NFPA 5000™

Building Construction and Safety Code™

2003 Edition

NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 5000™

Building Construction and Safety Code™

2003 Edition

This first edition of *NFPA 5000, Building Construction and Safety Code*, was prepared by the Committee on the Building Code, and acted on by NFPA at its May Association Technical Meeting held May 19–23, 2002, in Minneapolis, MN. It was issued by the Standards Council on July 19, 2002, with an effective date of August 8, 2002.

This edition of *NFPA 5000* was approved as an American National Standard on July 19, 2002.

Origin and Development of *NFPA 5000*

This inaugural edition of *NFPA 5000*™, *Building Construction and Safety Code*™, is the first model building code developed through full and open consensus-based procedures accredited by the American National Standards Institute. It is the culmination of NFPA's more than 100 years of experience in developing voluntary consensus-based codes and standards related to the built environment. From the *Life Safety Code*® to the *National Electrical Code*® to sprinkler installation fuel gas, and myriad other installation standards, NFPA codes and standards, as well as the codes and standards of other consensus-based standards development organizations, have addressed almost every aspect of the built environment. A significant gap in the code regime for the built environment, however, had been the lack of an open consensus-based model building code. In March 2000, the NFPA undertook to close this gap when the NFPA Standards Council formally established a Building Code Project to commence the development of *NFPA 5000*.

In developing the building code, NFPA's Building Code Project endeavored to be responsive to the needs of the enforcement, user, and design communities and to be consistent with the other principles of code development that NFPA adheres to. *NFPA 5000* also established a set of goals and objectives that work to deliver a safe, usable, and functional building at the end of the design process.

Beyond these elements, *NFPA 5000* has also established a basic philosophy of referencing and recognizing design-related codes and standards developed by other organizations under the procedures of the American National Standards Institute (ANSI), reflecting the highest quality and most technically sound documents for given areas. *NFPA 5000* has taken those documents and referenced and incorporated them in order to keep the *Code* in lockstep with such requirements. In general terms, the process by which many of the requirements in the *Code* were established is based on a reliance on the expertise in other ANSI codes and standards, including many from the NFPA *National Fire Codes*® set, and on the expertise of the NFPA Technical Committees for the building code project in incorporating the use of such documents and developing supplemental requirements.

In addition to fire, a design hazard that has always been, and will always be a major component of any building code, NFPA's other codes and standards address many of the subject areas that comprise a building code. *NFPA 5000* applies NFPA's collection of consensus codes and standards and adds requirements for other design provisions.

NFPA *101*®, *Life Safety Code*®, was a fundamental starting point for the content as well as the format and arrangement of *NFPA 5000*. Since 1913, NFPA *101* has set the standard for the minimum level of life safety from fire events for building occupants in the United States. Beyond these elements, *NFPA 5000* has taken great care to establish a clear set of goals and objectives for specifying the expected outcome for occupants based upon the *Code* requirements. These goals and objectives also extend to the expected outcome for a building, its contents, and its mission, when applicable. These goals and objectives are also critical in allowing those affected by codes to exercise the performance-based design approach, which is integral to the *Code* itself.

NFPA 5000 also covers a range of subjects, including allowable building heights and areas based upon occupancy and construction; protection schemes for vertical openings; means of egress; and the rehabilitation of existing buildings.

Another primary section of the *Code* provides specific requirements for individual occupancies. These requirements set up applicable criteria from the core chapters and establish any supplemental provisions that can be unique to a particular occupancy. These chapters largely mimic and replicate the occupancies that have been established by other NFPA codes and standards for many years. Structural design provisions are established in the next set of six chapters. The basis for these criteria was derived from numerous sources, including the Amerian Society of Civil Engineers (ASCE) and the Federal Emergency Management Agency (FEMA). The all-hazard design provisions for *NFPA 5000* are rounded out with the use of criteria that include elements for a range of design loads and natural hazards.

The materials allowed by *NFPA 5000* for use for construction purposes are described in the next group of chapters. For the most part, these requirements make reference to industry and engineering standards for particular materials. Many of the material specifications and standards used form the basis for the construction industry in the United States and are thus compatible for use in building codes throughout the country.

The last section of the *Code* governs a broad range of building systems and features. The criteria consist of everything concerning the interior environment, from energy efficiency to mechanical, electrical, and plumbing systems. In addition, the requirements for conveying systems, such as elevators and escalators, and the application and use of specific fire protection systems are also covered by this section.

NFPA 5000 is a key document in the collection of integrated consensus codes for the built environment known as the *Comprehensive Consensus Codes*™ (C3) set, which is currently being developed by NFPA and its partners. The first of its kind, C3 is the result of model code and standard developers bringing their expertise together to form one fully integrated, consensus-based code set. As a result of the coordinated efforts of NFPA, the International Association of Plumbing and Mechanical Officials (IAPMO), the Western Fire Chiefs Association (WFCA), and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), C3 will offer the only complete set of ANSI-approved model codes, integrated for public safety.

In addition to *NFPA 5000,* the C3 set includes: NFPA 70, *National Electrical Code* (NEC®); NFPA *101*, *Life Safety Code;* NFPA 1, *Uniform Fire Code*™ (which integrates NFPA 1, *Fire Prevention Code,*™ with the *Uniform Fire Code*); IAPMO's *Uniform Plumbing Code*™; NFPA 58, *Liquefied Petroleum Gas Code*; NFPA 54, *National Fuel Gas Code*; IAPMO's *Uniform Mechanical Code*™; NFPA 30, *Flammable and Combustible Liquids Code*; NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*; and ASHRAE standards 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, and 90.2, *Energy-Efficient Design of New Low-Rise Residential Buildings* (which will eventually be incorporated into the proposed NFPA 900).

The C3 set will provide numerous benefits for adopting jurisdictions and other users of codes. C3 offers a seamless system of code support and service from the best providers in the field. This combination will enhance ease of use and ensure consistencies in content, making C3 codes easy to reference, read, and apply.

The publication of *NFPA 5000* marks an historic point in NFPA's existence, representing a major step forward in the delivery of consensus codes and related support services.

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These lists represent the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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Rep. TC Structures and Construction

Robert E. Solomon, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents or portions of documents on the design and construction of every building or structure, including structural design methods and techniques, as well as the design of integrated building systems for health, safety, comfort, and convenience.

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(Chapter 16)

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(Alt. to R. Gerdes)
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Jonathan Humble, American Iron and Steel Institute, CT [M]
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Vern T. Lewis, Church of Jesus Christ of Latter-day Saints, UT [U]
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Stephen V. Skalko, Portland Cement Association, GA [M]
(Alt. to J. J. Messersmith, Jr.)

Ron Coté, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and on the nonemergency and emergency movement of people in assembly occupancies, tents, and membrane structures.

Technical Committee on Board and Care Facilities (BLD-BCF)
(Chapter 26)

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U.S. Department of Veterans Affairs, NY [U]

Gregory E. Harrington, *Nonvoting Secretary*
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Rep. American Hotel & Motel Association
Warren D. Bonisch, Schirmer Engineering Corporation, TX [SE]
Harry L. Bradley, Maryland State Fire Marshals Office, MD [E]
Rep. International Fire Marshals Association
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Thomas W. Gardner, Gage-Babcock & Associates, VA [U]
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Gregory E. Harrington, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and on the emergency movement of people, in residential board and care facilities.

Technical Committee on Building Materials (BLD-MAT)
(Chapters 41–48)

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Bonnie E. Manley, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on the application of various building materials that are used in the construction of buildings, structures, and related facilities.

Technical Committee on Building Service and Fire Protection Equipment (BLD-BSF)
(Chapter 55)

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David P. Klein, U.S. Department of Veterans Affairs, MD [U]
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Greg Gottlieb, Hauppauge Fire District, NY [C]
(Alt. to J. M. Jardin)
Claudia Hagood, Klinker and Associates, Inc., MD [SE]
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(Voting Alt. to NAHB Rep.)

Gregory E. Harrington, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on the application of fire protection systems including detection, alarm, and suppression, and the life safety impact of various building systems.

Technical Committee on Building Systems (BLD-SYS)
(Chapters 12, 49–54, Annex B)

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Building Owners & Managers Association International, MD [U]

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NFPA, MA

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William Ambrefe, City of Beverly, MA [E]
Brian D. Black, Eastern Paralyzed Veterans Association, NY [C]
Dennis W. Bradshaw, Ralph Gerdes Consultants, LLC, IN [SE]
Sidney L. Cavanaugh, United Association of Journeymen/Apprentices of Plumbing /Pipe Fitters, CA [L]
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Rep. Air Conditioning Contractors of America
Raymond N. Hansen, U.S. Air Force, FL [U]
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A. Hal Key, City of Mesa Fire Department, AZ [E]
David A. Linville, Mercedes Benz U.S. International Inc., AL [U]
Joseph V. McElvaney, Jr., City of Phoenix, AZ [E]
Richard A. Morris, National Association of Home Builders, DC [U]
John Munroe, Reid Crowther & Partners Limited, Canada [SE]
Jim Pauley, Square D Company, KY [M]
Francis W. Peri, Communications Design Corporation, MD [IM]
Rep. Association of Cabling Professionals
Michael J. Reeser, Santa Rosa Fire Equipment Service Inc., CA [IM]
Rep. California Automatic Fire Alarm Association Inc.
John A. Rickard, Pi Architects & Engineers, Inc., TX [SE]
Stephen Rondinelli, The RJA Group, Inc., CO [SE]
Earl Russell, City of Las Vegas, NV [E]
Shelley Siegel, Accessible Interiors' Network, Inc., FL [SE]
Rep. American Society of Interior Designers
Robert Van Becelaere, Ruskin Manufacturing Division, MO [M]
Rep. American Society of Mechanical Engineers
Mark Wales, Mark Wales Consulting, LA [SE]
Rep. American Institute of Architects
William A. Webb, Performance Technology Consulting, Limited, IL [SE]

Alternates

Shane M. Clary, Bay Alarm Company, CA [IM]
(Alt. to M. J. Reeser)
David Cook, Ralph Gerdes Consultants, IN [SE]
(Alt. to D. W. Bradshaw)
Laurence K. Oleck, Jr., The RJA Group, Inc., FL [SE]
(Alt. to S. Rondinelli)
John S. Ritterpusch, National Association of Home Builders, DC [U]
(Alt. to R. A. Morris)
Clifford Smith, Spectra Performance Group, Limited, OH [M]
(Alt. to P. Hays)
Jack Wells, Pass & Seymour/Legrand, NY [M]
(Alt. to J. Pauley)

Allan Fraser, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on the application of various building systems and features that relate to convenience, health, comfort, and access to a building.

Technical Committee on Detention and Correctional Occupancies (BLD-DET)
(Chapters 13, 14, 21)

Thomas W. Jaeger, *Chair*
Gage-Babcock & Associates Inc., VA [SE]

Ron Coté, *Nonvoting Secretary*
NFPA, MA

James R. Ambrose, Code Consultants, Inc., MO [SE]
Kevin Bailey, Folger Adam Security Inc., IL [M]
Rep. Builders Hardware Manufacturers Association
David L. Bondor, St. Paul Fire & Marine, TX [I]
Rep. American Society of Safety Engineers
Peter J. Collins, U.S. Department of Justice, DC [U]
Michael DiMascio, Solutions Engineering Inc., MA [SE]
Randy Gaw, Correctional Service of Canada, Canada [E]
Patrick G. Gordon, Philadelphia Prison System, PA [U]
Larry E. Harrison, Office of the Illinois State Fire Marshals, IL [E]

Kenneth E. Isman, National Fire Sprinkler Association, NY [M]
William E. Koffel, Koffel Associates, Inc., MD [SE]
Roger L. McDaniel, Florida Department of Corrections, FL [U]
E. Eugene Miller, Washington, DC [SE]
Jerry Nealy, Cumulus Fibres, Inc., NC [M]
Rep. Institutional Bedding Manufacturers Association
Robert R. Perry, Robert Perry Associates, Inc., IL [M]
Rep. Door & Hardware Institute
Kenneth J. Schwartz, Schirmer Engineering Corporation, IL [SE]
Wayne S. Smith, Texas State Fire Marshal, TX [E]
Rep. International Fire Marshals Association
David W. Spence, Corrections Corporation of America, TN [U]

Alternates

A. Larry Iseminger, Jr., Maryland State Fire Marshals Office, MD [E]
(Alt. to W. S. Smith)
Kevin Kelly, National Fire Sprinkler Association, NY [M]
(Alt. to K. E. Isman)
Fred G. Kerley, Office of the Illinois State Fire Marshal, IL [E]
(Alt. to L. E. Harrison)
Michael Tierney, Builders Hardware Manufacturers Association, CT [M]
(Alt. to K. Bailey)
Ralph R. Winter, Code Consultants, Inc., MO [SE]
(Alt. to J. R. Ambrose)

Ron Coté, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and on the emergency movement of people in detention and correctional occupancies.

Technical Committee on Educational and Day-Care Occupancies (BLD-END)
(Chapters 17, 18)

Catherine L. Stashak, *Chair*
Schirmer Engineering Corporation, IL [SE]

Ron Coté, *Nonvoting Secretary*
NFPA, MA

Scott R. Bartlett, Simplex Time Recorder Company, MA [M]
Samuel S. Dannaway, S. S. Dannaway Associates, Inc., HI [SE]
Victor L. Dubrowski, Code Consultants, Inc., MO [SE]
Stephen E. Duffin, Zurich Services Corporation, IL [I]
Gene B. Endthoff, National Fire Sprinkler Association, IL [M]
Douglas R. Freels, Performance Design Technologies, TN [SE]
Vern L. Martindale, Church of Jesus Christ of Latter-day Saints, UT [U]
Erin A. M. Oneisom, U.S. Air Force, AE [U]
Michael L. Sinsigalli, Windsor Locks Fire Department, CT [E]
Aleksy L. Szachnowicz, Anne Arundel County Public Schools, MD [U]
Robert T. Trotter, Franklin Fire Department, TN [E]
Ralph J. Warburton, University of Miami, FL [SE]
Kenneth Wood, Office of the Illinois State Fire Marshal, IL [E]

Alternates

Kevin Kelly, National Fire Sprinkler Association, NY [M]
(Alt. to G. B. Endthoff)
Amy J. McGarry, Code Consultants, Inc., MO [SE]
(Alt. to V. L. Dubrowski)
Roger B. Rudy, Performance Design Technologies, LLC, TN [SE]
(Alt. to D. R. Freels)
Fred K. Walker, U.S. Air Force, FL [U]
(Alt. to E. A. M. Oneisom)

Ron Coté, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and on the emergency movement of people in educational occupancies and day-care occupancies.

Technical Committee on Fire Protection Features (BLD-FIR)
(Chapter 8)

John W. McCormick, *Chair*
Code Consultants, Inc., MO [SE]

Walter P. Sterling, *Nonvoting Secretary*
NFPA, MA

Carl F. Baldassarra, Schirmer Engineering Corporation, IL [SE]
John F. Bender, Maryland Office of State Fire Marshal, MD [E]
Rep. International Fire Marshals Association
Robert M. Berhinig, Underwriters Laboratories Inc., IL [RT]
Edward K. Budnick, Hughes Associates, Inc., MD [SE]
Gregory J. Cahanin, St. Petersburg, FL [U]
Rep. Louisiana State Firemen's Association
Eric H. Cote, The RJA Group, Inc., MA [SE]
Brian L. Eklow, Conti Group, Safety & Loss Prevention, IL [I]
Gene B. Endthoff, National Fire Sprinkler Association, IL [M]
Sam W. Francis, American Forest & Paper Association, PA [M]
Ralph Gerdes, Ralph Gerdes Consultants, LLC, IN [SE]
Donald Murray Goff, Hillsborough County Fire Rescue, FL [E]
Rep. Florida Fire Marshals & Inspectors Association
Miles J. Haber, Monument Construction Inc., MD [U]
Rep. National Association of Home Builders
Wayne D. Holmes, HSB Professional Loss Control, CT [I]
Jonathan Humble, American Iron and Steel Institute, CT [M]
Ignacy A. Kapalczynski, Connecticut Department of Public Safety, CT [E]
Marshall A. Klein, Marshall A. Klein & Associates, Inc., MD [SE]
William E. Koffel, Koffel Associates, Inc., MD [M]
Rep. Glazing Industry Code Committee
Vickie Lovell, Intecode Inc., (ICI), FL [M]
Rep. Air Movement and Control Association/International FireStop Council
Joseph J. Messersmith, Jr., Portland Cement Association, VA [M]
Kurt A. Roeper, Ingersoll Rand Security and Safety, OH [M]
Rep. Steel Door Institute
Kathleen Taraba, Rolling Plains Construction, Inc., CO [IM]
Rep. Firestop Contractors International Association
Kenneth Wood, Office of the Illinois State Fire Marshal, IL [E]

Alternates

Donald W. Belles, Koffel Associates, Inc., TN [M]
(Alt. to W. E. Koffel)
Joseph A. Brooks, Air Movement and Control Association International, Inc., IL [M]
(Alt. to V. Lovell)
David Cook, Ralph Gerdes Consultants, IN [SE]
(Alt. to R. Gerdes)
John F. Devlin, Schirmer Engineering Corporation, VA [SE]
(Alt. to C. F. Baldassarra)
Jack Gump, HSB Professional Loss Control, TN [I]
(Alt. to W. D. Holmes)
David M. Hammerman, Marshall A. Klein & Associates, Inc., MD [SE]
(Alt. to M. A. Klein)
Mark Kluver, Portland Cement Association, CA [M]
(Alt. to J. J. Messersmith, Jr.)
David A. Lewis, Code Consultants, Inc., MO [SE]
(Alt. to J. W. McCormick)
Jeffrey A. Maddox, The RJA Group, Inc., CA [SE]
(Alt. to E. H. Cote)
Eric Rosenbaum, Hughes Associates, Inc., MD [SE]
(Alt. to E. K. Budnick)
David P. Tyree, American Forest & Paper Association, CO [M]
(Alt. to S. W. Francis)
Robert J. Wills, American Iron and Steel Institute, AL [M]
(Alt. to J. Humble)

Nonvoting

Michael Earl Dillon, Dillon Consulting Engineers, Inc., CA
Rep. TC on Air Conditioning

Walter P. Sterling, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on construction compartmentation, including the performance of assemblies, openings, and penetrations, as related to the protection of life and property from fire and other circumstances capable of producing similar consequences.

Technical Committee on Fundamentals (BLD-FUN)
(Chapters 1–6, 15)

Morgan J. Hurley, *Chair*
Society of Fire Protection Engineers, MD [U]

Ron Coté, *Nonvoting Secretary*
NFPA, MA

Thomas H. Allen, Smoke Guard Corporation, ID [U]
Rep. American Institute of Architects
Wayne G. Carson, Carson Associates, Inc., VA [SE]
James E. Churchill, Schirmer Engineering Corporation, CA [I]
Barbara Ebstein, Vinick Associates, Inc., CT [U]
Rep. American Society of Interior Designers
Ben Greene, City of Englewood, CO [E]
Norman E. Groner, Santa Cruz, CA [SE]
Howard Hopper, Underwriters Laboratories Inc., CA [RT]
David P. Klein, U.S. Department of Veterans Affairs, MD [U]
James A. Landmesser, U.S. Department of Energy, TN [E]
James K. Lathrop, Koffel Associates, Inc., CT [SE]
David H. MacKinnon, Canadian Steel Construction Council, Canada [M]
Rep. American Iron and Steel Institute
Richard A. Morris, National Association of Home Builders, DC [U]
Jake Pauls, Jake Pauls Consulting Services in Building Use & Safety, MD [C]
Rep. American Public Health Association
Milosh T. Puchovsky, Arup Fire, MA [SE]
Stephen V. Skalko, Portland Cement Association, GA [M]
Jeffrey B. Stone, American Forest & Paper Association, FL [M]
Amal Tamim, W.R. Grace & Company-Conn, MA [M]
John M. Watts, Jr., Fire Safety Institute, VT [SE]
Jay Woodward, International Conference of Building Officials, MO [E]

Alternates

Eugene A. Cable, U.S. Department of Veterans Affairs, NY [U]
(Alt. to D. P. Klein)
Robert M. Carasitti, Schirmer Engineering Corporation, MA [I]
(Alt. to J. E. Churchill)
Robert J. Eugene, Underwriters Laboratories Inc., WA [RT]
(Alt. to H. Hopper)
Mark Kluver, Portland Cement Association, CA [M]
(Alt. to S. V. Skalko)
Kimberly A. Marks, The Marks Design Group, Inc., TX [U]
(Alt. to B. Ebstein)
Rodney A. McPhee, Canadian Wood Council, Canada [M]
(Alt. to J. B. Stone)
Rick Thornberry, The Code Consortium, Inc., CA [M]
(Alt. to A. Tamim)
Robert J. Wills, American Iron and Steel Institute, AL [M]
(Alt. to D. H. MacKinnon)

Nonvoting

Carol A. Caldwell, Caldwell Consulting, Limited, New Zealand
Pichaya Chantranuwat, Fusion Consultants Company, Limited, Thailand [SE]

Ron Coté, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on the basic goals, objectives, performance requirements, and definitions for protection of human life and property from fire, earthquake, flood, wind, and other circumstances capable of producing similar consequences and on the nonemergency and emergency movement of people.

Technical Committee on Furnishings and Contents (BLD-FUR)
(Chapter 10)

William E. Fitch, *Chair*
Omega Point Laboratories Inc., TX [RT]

Steven E. Younis, *Nonvoting Secretary*
NFPA, MA

Patty K. Adair, American Textile Manufacturers Institute, DC [M]
Alastair J. M. Aikman, National Research Council of Canada, Canada [RT]
Vytenis Babrauskas, Fire Science and Technology Inc., WA [SE]
Lisa Bonneville, Bonneville Design, MA [U]
Rep. American Society of Interior Designers
Eugene A. Cable, U.S. Department of Veterans Affairs, NY [U]
Frederic B. Clarke, Benjamin Clarke Associates, Inc., VA [SE]
Paul Dillon, Southern Polytechnic State University, GA [M]
Pravinray D. Gandhi, Underwriters Laboratories Inc., IL [RT]
Marcelo M. Hirschler, GBH International, CA [SE]
E. Ken McIntosh, Carpet and Rug Institute, GA [M]
T. Hugh Talley, Hugh Talley Company, TN [M]
Rep. American Furniture Manufacturers Association

Alternates

Donald W. Belles, Koffel Associates, Inc., TN [M]
(Alt. to E. K. McIntosh)
Raman B. Chauhan, National Research Council, Canada [RT]
(Alt. to J. M. Aikman)
James V. Ryan, Potomac, MD [SE]
(Alt. to F. B. Clarke)
David T. Sheppard, Underwriters Laboratories Inc., IL [RT]
(Alt. to P. D. Gandhi)
Shelley Siegel, Accessible Interiors' Network, Inc., FL [U]
(Alt. to L. Bonneville)

Nonvoting

Hammad Malik, U.S. Consumer Product Safety Commission, MD [C]
(Alt. to U.S.CPSC Rep.)

Steven E. Younis, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on limiting the impact of furnishings and building contents effect on protection of human life and property from fire and other circumstances capable of producing similar consequences and on the emergency movement of people.

Technical Committee on Health Care Occupancies (BLD-HEA)
(Chapters 19, 20)

Daniel J. O'Connor, *Chair*
Schirmer Engineering Corporation, IL [SE]

Ron Coté, *Nonvoting Secretary*
NFPA, MA

James R. Ambrose, Code Consultants, Inc., MO [SE]
William N. Brooks, Eichleay Engineers, Inc., PA [SE]
Kenneth E. Bush, Maryland State Fire Marshals Office, MD [E]
Rep. International Fire Marshals Association
Wayne G. Carson, Carson Associates, Inc., VA [SE]
Michael Crowley, The RJA Group, Inc., TX [SE]
Douglas S. Erickson, American Society for Healthcare Engineering, VI [U]
Kenneth S. Faulstich, U.S. Department of Veterans Affairs, DC [U]
John E. Fishbeck, Joint Commission on Accreditation of Healthcare Organizations, IL [E]
Curt Fogel, Vaaler Insurance, Inc., ND [I]
Antonio Freire, Axa Courtage, France [I]
Donald W. Harris, California Office of Health Planning & Development, CA [E]
Anthony Perry Hill, U.S. Oncology, TX [U]
Rep. American Society of Safety Engineers
Thomas W. Jaeger, Gage-Babcock & Associates Inc., VA [U]
Rep. American Health Care Association
Ronald K. Mengel, System Sensor, IL [M]
Rep. National Electrical Manufacturers Association
John I. Mills, Beery, Rio & Associates, VA [SE]
Kirby W. Perry, Kirby W. Perry Architects & Associates Inc., TX [SE]
Rep. American Institute of Architects
Peter P. Petresky, Pennsylvania Department of Health, PA [E]
Rep. Association of Health Facility Survey Agencies
Brian Prediger, U.S. Army, MD [U]
Thomas A. Salamone, Health Care & Life Safety Concepts, NY [I]
Rep. Kemper Insurance Companies
David M. Sine, David M Sine & Associates, TX [U]
Rep. National Association of Psychiatric Health Systems
Richard D. Strub, Life Care Centers of America, TN [U]
Rep. NFPA Health Care Section
Mayer D. Zimmerman, U.S. Department of Health and Human Services, MD [E]

Alternates

James H. Antell, The RJA Group, Inc., IL [SE]
(Alt. to M. Crowley)
John F. Deubler, Schirmer Engineering Corporation, VA [SE]
(Alt. to D. G. O'Connor)
Lori Drexler, Code Consultants, Inc., MO [SE]
(Alt. to J. R. Ambrose)
J. Richard Fruth, Hayes Large Architects, PA [SE]
(Alt. to K. W. Perry)
Thomas W. Gardner, Gage-Babcock & Associates, VA [SE]
(Alt. to T. W. Jaeger)
Philip R. Jose, U.S. Department of Veterans Affairs, NY [U]
(Alt. to K. S. Faulstich)
William E. Koffel, Koffel Associates, Inc., MD [U]
(Alt. to D. S. Erickson)
John S. Taylor, St. Vincent's Hospital, AL [U]
(Alt. to R. D. Strub)

Nonvoting

Pichaya Chantranuwat, Fusion Consultants Company, Limited, Thailand [SE]

Ron Coté, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and on the emergency movement of people, in health care occupancies.

Technical Committee on Industrial, Storage, and Miscellaneous Occupancies (BLD-IND)
(Chapters 29–31, 33, 34)

Wayne D. Holmes, *Chair*
HSB Professional Loss Control, CT [I]

Walter P. Sterling, *Nonvoting Secretary*
NFPA, MA

Raymond E. Arnston, Rayden Research LLC, WI [SE]
Donald C. Birchler, FP&C Consultants Inc., MO [SE]
Howard M. Bucci, U.S. Department of Energy, WA [U]
John F. Farney, Jr., Sargent & Lundy Engineers, IL [SE]
Larry L. Fluer, Fluer, Inc., CA [M]
Rep. Compressed Gas Association
Larry N. Garrett, Delphi Automotive Systems Corporation, IN [U]
Rep. NFPA Industrial Fire Protection Section
James Golinveaux, Tyco Fire Products, RI [M]
Rep. American Fire Sprinkler Association, Inc.
Dale A. Harshbarger, Hebron Fire Protection District, KY [E]
Bruce W. Hisley, Fairfield, PA [E]
Rep. International Fire Marshals Association
Jonathan Humble, American Iron and Steel Institute, CT [M]
Ronald Keefer, Menlo Park Fire Protection District, CA [E]
Marshall A. Klein, Marshall A. Klein & Associates, Inc., MD [U]
Rep. Automotive Oil Change Association
Patrick A. McLaughlin, McLaughlin & Associates, CA [U]
Rep. Semiconductor Industry Association
Jeffrey M. Shapiro, International Code Consultants, TX [M]
Rep. The Chlorine Institute
Stephen V. Skalko, Portland Cement Association, GA [M]
Robert L. Smith, Jr., Westinghouse Savannah River Company, SC [U]
David C. Tabar, The Sherwin-Williams Company, OH [U]
Gregory W. Thomas, Liberty Mutual Group, CT [I]
Rep. Alliance of American Insurers
Robert Bruce Wallace, Royal Insurance Company, CA [I]
Rep. American Insurance Services Group
Carl Dewayne Wren, Austin Fire Department, TX [E]

Alternates

Clarence D. (Dale) Eggen, U.S. Department of Energy, WA [U]
(Alt. to H. M. Bucci)
Jack Gump, HSB Professional Loss Control, TN [I]
(Alt. to W. D. Holmes)
David M. Hammerman, Marshall A. Klein & Associates, Inc., MD [U]
(Alt. to M. A. Klein)
Roland J. Huggins, American Fire Sprinkler Association, Inc., TX [M]
(Alt. to J. Golinveaux)
Mark Kluver, Portland Cement Association, CA [M]
(Alt. to S. V. Skalko)
William E. Koffel, Koffel Associates, Inc., MD [U]
(Alt. to P. A. McLaughlin)
Michael E. Lyden, The Chlorine Institute, Inc., DC [M]
(Alt. to J. M. Shapiro)
Roger A. Smith, Compressed Gas Association, Inc., VA [M]
(Alt. to L. L. Fluer)
Robert J. Wills, American Iron and Steel Institute, AL [M]
(Alt. to J. Humble)

Walter P. Sterling, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and on the emergency movement of people, in industrial and storage occupancies, special structures, windowless and underground buildings, and high-rise buildings.

Technical Committee on Means of Egress (BLD-MEA)
(Chapter 11)

William E. Koffel, *Chair*
Koffel Associates, Inc., MD [SE]

Ron Coté, *Nonvoting Secretary*
NFPA, MA

John L. Barrios, Department of Business and Community Services, FL [E]
Rep. Southern Building Code Congress International Inc./International Code Council, Inc.
John L. Bryan, Frederick, MD [SE]
Kenneth E. Bush, Maryland State Fire Marshals Office, MD [E]
Rep. International Fire Marshals Association
Davie J. Camp, Dover Elevator Systems, Inc., TN [M]
Rep. National Elevator Industry Inc.
Steven Di Pilla, ACE USA Risk Control Services, NJ [I]
Joshua W. Elvove, U.S. Department of Veterans Affairs, CO [U]
Gene B. Endthoff, National Fire Sprinkler Association, IL [M]
Philip C. Favro, Philip C. Favro & Associates, CA [SE]
Edward L. Fixen, Schirmer Engineering Corporation, CA [SE]
Dave Frable, U.S. General Services Administration, IL [U]

Rita C. Guest, Carson Guest, Inc., GA [U]
Rep. American Society of Interior Designers
Billy G. Helton, Lithonia Emergency Systems, GA [M]
Rep. National Electrical Manufacturers Association
Lawrence J. McGinty, U.S. Central Intelligence Agency, DC [U]
Wayne Menuz, Underwriters Laboratories Inc., CA [RT]
Jake Pauls, Jake Pauls Consulting Services in Building Use & Safety, MD [C]
Rep. American Public Health Association
Robert R. Perry, Robert Perry Associates Inc., IL [M]
Rep. Door & Hardware Institute
Eric Rosenbaum, Hughes Associates, Inc., MD [SE]
John A. Sharry, Lawrence Livermore National Laboratory, CA [U]
Leslie Strull, The RJA Group, Inc., IL [SE]
Michael Tierney, Builders Hardware Manufacturers Association, CT [M]
Michael D. Tomy, Heery International Inc., GA [SE]
Rep. American Institute of Architects
Joseph H. Versteeg, Versteeg Associates, CT [E]
Rep. Fairfield Connecticut Fire Marshal's Office
David L. Wismer, Department of Licenses & Inspections, PA [E]
Jay Woodward, International Conference of Building Officials, MO [E]

Alternates

John R. Battles, Southern Building Code Congress International, AL [E]
(Alt. to J. L. Barrios)
Charles H. Berry, Baltimore VA Medical Center, MD [U]
(Alt. to J. W. Elvove)
Warren D. Bonisch, Schirmer Engineering Corporation, TX [SE]
(Alt. to E. L. Fixen)
Edward A. Donoghue, Edward A. Donoghue Associates, Inc., NY [M]
(Alt. to D. J. Camp)
Barbara Ebstein, Vinick Associates, Inc., CT [U]
(Alt. to R. Guest)
David A. Gilda, Builders Hardware Manufacturers Association, CT [M]
(Alt. to M. Tierney)
Miles J. Haber, Monument Construction Inc., MD [U]
(Vot. Alt. to NAHB Rep.)
James K. Lathrop, Koffel Associates, Inc., CT [SE]
(Alt. to W. E. Koffel)
R. T. Leicht, Delaware Fire Marshal's Office, DE [E]
(Alt. to K. E. Bush)
James A. Milke, University of Maryland, MD [SE]
(Alt. to J. L. Bryan)
Ronald H. Minter, Thomas & Betts, TN [M]
(Alt. to B. G. Helton)
Harold E. Nelson, Hughes Associates, Inc., VA [SE]
(Alt. to E. R. Rosenbaum)
Roy W. Schwarzenberg, U.S. Central Intelligence Agency, DC [U]
(Alt. to L. J. McGinty)
Michael S. Shulman, Underwriters Laboratories Inc., CA [RT]
(Alt. to W. Menuz)

Nonvoting

Pichaya Chantranuwat, Fusion Consultants Company, Limited, Thailand [SE]

Ron Coté, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on the general requirements for safe egress for protection of human life from fire and other circumstances capable of producing similar consequences and on the nonemergency and emergency movement of people.

Technical Committee on Mercantile and Business Occupancies (BLD-MER)
(Chapters 27, 28)

Ed Schultz, *Chair*
Code Consultants, Inc., MO [SE]

Walter P. Sterling, *Nonvoting Secretary*
NFPA, MA

David M. Banwarth, David M. Banwarth Associates, LLC, MD [SE]
E. Joseph Bocci, U.S. Department of the Treasury, DC [U]
Kenneth E. Bush, Maryland State Fire Marshals Office, MD [E]
Rep. International Fire Marshals Association
Douglas S. Erickson, American Society for Healthcare Engineering, VI [U]
Sam W. Francis, American Forest & Paper Association, PA [M]
Douglas R. Freels, Performance Design Technologies, TN [SE]
Daniel J. Gauvin, Simplex Time Recorder Company, MA [M]
Rep. National Electrical Manufacturers Association
Darrell W. Harguth, Fire Equipment Manufacturers' Association, Inc., CA [M]
William Hiotaky, The Taubman Company, MI [U]
Wayne D. Holmes, HSB Professional Loss Control, CT [I]
Jonathan Humble, American Iron and Steel Institute, CT [M]
Brian L. Marburger, Kemper Insurance Companies, IL [I]
Rep. American Insurance Services Group
Richard V. Moon, Insurance Services Office, NY [I]
Lawrence G. Perry, Building Owners & Managers Association International, MD [U]
Sheldon S. Rucinski, Schirmer Engineering Corporation, IL [SE]
David C. Tabar, The Sherwin-Williams Company, OH [U]
Richard P. Thornberry, The Code Consortium, Inc., CA [SE]
William J. Tomes, TVA Fire and Life Safety, GA [U]
Rep. The Home Depot

Alternates

Travey D. Bellamy, TVA Fire and Life Safety, GA [U]
(Alt. to W. J. Tomes)
Darryl Thomas Brown, Performance Design Technologies, TN [SE]
(Alt. to D. R. Freels)
Lawrence G. Danielkiewicz, The Taubman Company, MI [U]
(Alt. to W. Hiotaky)
Jack Gump, HSB Professional Loss Control, TN [I]
(Alt. to W. D. Holmes)
Michael J. Laderoute, MJL Associates, Inc., VA [M]
(Alt. to D. W. Harguth)
Gene A. LaValle, Interlogix, GA [M]
(Alt. to D. J. Gauvin)
Patrick A. McLaughlin, McLaughlin & Associates, RI [U]
(Alt. to D. C. Tabar)
Richard R. Osman, Schirmer Engineering Corporation, IL [SE]
(Alt. to S. S. Rucinski)
Dennis L. Pitts, American Forest & Paper Association, TX [M]
(Alt. to S. W. Francis)
Terry Schultz, Code Consultants, Inc., MO [SE]
(Alt. to E. Schultz)
Robert J. Wills, American Iron and Steel Institute, AL [M]
(Alt. to J. Humble)
Dale Woodin, American Society for Healthcare Engineering, IL [U]
(Alt. to D. S. Erickson)

Walter P. Sterling, NFPA Staff Liaison

Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and for the emergency movement of people, in mercantile and business occupancies.

Technical Committee on Residential Occupancies (BLD-RES)

(Chapters 22–25)

James K. Lathrop, *Chair*
Koffel Associates, Inc., CT [SE]

Gregory E. Harrington, *Nonvoting Secretary*
NFPA, MA

Warren D. Bonisch, Schirmer Engineering Corporation, TX [SE]
H. Wayne Boyd, U.S. Safety & Engineering Corporation, CA [M]
Harry L. Bradley, Maryland State Fire Marshals Office, MD [E]
Rep. International Fire Marshals Association
Phillip A. Brown, American Fire Sprinkler Association, Inc., TX [IM]
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Committee Scope: This Committee shall have primary responsibility for documents on protection of human life and property from fire and other circumstances capable of producing similar consequences, and on the emergency movement of people, in hotels, dormitories, apartments, lodging and rooming houses, and one- and two-family dwellings.

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Committee Scope: This Committee shall have primary responsibility for documents on the selection and design of building construction types, structural design systems and assemblies, construction techniques and methodologies, and for the protection of human life and property from fire and environmental loads.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, Annex D lists the complete title and edition of the source documents for both mandatory and nonmandatory extracts. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the appropriate technical committee.

Information on referenced publications can be found in Chapter 2 and Annex D.

Chapter 1 Administration

1.1* Scope.

1.1.1 The *Code* addresses those construction, protection, and occupancy features necessary to minimize danger to life and property.

1.1.2 *Code* Title. The provisions of this document shall constitute and be known as *NFPA 5000, Building Construction and Safety Code*, hereinafter referred to as "this *Code*" or "the *Code*."

1.2* Purpose. The purpose of the *Code* is to provide minimum design regulations to safeguard life, health, property, and public welfare and to minimize injuries by regulating and controlling the permitting, design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within the jurisdiction and certain equipment specifically regulated herein.

1.3 Application.

1.3.1 Buildings and Structures. The provisions of the *Code* shall apply to the construction, alteration, repair, equipment, use and occupancy, maintenance, relocation, and demolition of every building or structure, or any appurtenances connected or attached to such buildings or structures within the jurisdiction.

1.3.2 References to Requirements of Other Codes or Standards. Where the requirements of a referenced code or standard differ from the requirements of this *Code*, the requirements of this *Code* shall govern.

1.3.3 Moved Buildings and Structures. The provisions of the *Code* shall apply to buildings and structures moved into or within the jurisdiction.

1.3.4 Existing Buildings and Structures. The provisions of this *Code* shall apply to existing buildings where any one of the following conditions applies:

(1) A change of use or occupancy classification occurs.
(2) A repair, renovation, modification, reconstruction, or addition is made.
(3) The building or structure is relocated.
(4) The building is considered an unsafe building or a fire hazard.

1.4 Retroactivity (Reserved).

1.5 Equivalency.

1.5.1 General. Nothing in this *Code* shall be intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this *Code*. Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency. The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction (AHJ).

1.5.2 Approval of Alternatives. Alternative systems, methods, or devices approved as equivalent by the authority having jurisdiction shall be recognized as being in compliance with this *Code*.

1.5.3 Permitted Alternatives. The provisions of this *Code* shall not be construed to prevent the use of construction systems, materials, or methods of design, or interpolations, calculations, evaluations, or similar evidence based on test data acceptable to the authority having jurisdiction, as alternatives to the standards and provisions set forth in this *Code*. Such alternatives shall be permitted to be offered for approval, and their consideration shall be as provided in 1.5.2 through 1.5.8.

1.5.4 Standards. Construction systems, materials, or methods of design referred to in this *Code* shall be considered as standards of quality and strength. New or alternative construction systems, materials, or methods of design shall be at least equal to, and shall meet the intent of, these standards for the corresponding use intended.

1.5.5 Systems, Materials, and Methods. Any person desiring to use construction systems, materials, or methods of design not specifically mentioned in this *Code* shall file with the authority having jurisdiction a request for permission to use such systems, materials, or methods. Where alternative construction systems or materials are requested, the request shall be submitted with documentation, in writing, that supports claims of the sufficiency of such construction systems or materials. If a test installation is proposed, a description of the location and purpose of the test also shall be submitted.

1.5.6 Approval. The authority having jurisdiction shall approve alternative construction systems, materials, or methods of design when it is substantiated that the standards of this *Code* are at least equaled. If, in the opinion of the authority having jurisdiction, the standards of this *Code* are not equaled by the alternative requested, approval for permanent work shall be refused. Consideration shall be given to test or prototype installations.

1.5.7 Tests.

1.5.7.1 Whenever there is insufficient evidence of compliance with the requirements of this *Code,* evidence that any material or method of construction does not conform to the requirements of this *Code*, or insufficient evidence to substantiate claims for alternative construction systems, materials, or methods of construction, the authority having jurisdiction shall be permitted to require tests for proof of compliance to be made by an approved agency at the expense of the owner or the owner's agent.

1.5.7.2 Test methods shall be as specified by this *Code* for the material in question. If there are not appropriate test methods specified in this *Code*, the authority having jurisdiction is authorized to accept an applicable test procedure from another recognized source.

1.5.7.3 Copies of the results of all tests shall be retained for not less than 2 years after the acceptance of the building or structure.

1.5.8 Appeal. Any person whose request for use of alternative systems and materials or methods of design has been refused by the authority having jurisdiction shall be permitted to appeal to the board of appeals.

1.6 Units.

1.6.1 SI Units. Metric units in this *Code* are in accordance with the modernized metric system known as the International System of Units (SI).

1.6.2 Primary and Equivalent Values. If a value for a measurement as given in this *Code* is followed by an equivalent value in other units, the first stated value shall be regarded as the requirement. A given equivalent value might be approximate.

1.7 Enforcement.

1.7.1 Organization.

1.7.1.1 Creation of Department of Building and Safety. There is hereby created in the jurisdiction a department of building and safety that shall be under the control of the director of building and safety, who shall also bear the title of authority having jurisdiction.

1.7.1.2 Delegation of Authority. The authority having jurisdiction is hereby empowered to delegate authority and assignments to subordinate employees working under his/her authority. Such employees shall have the authority to carry out duties and assignments, as delegated by the authority having jurisdiction.

1.7.1.3 Right of Entry.

1.7.1.3.1 Whenever necessary to make an inspection to enforce any of the provisions of this *Code*, or whenever the authority having jurisdiction or his/her authorized representative has reason to believe that there exists in any building, or upon any premises, a condition that makes such building or premises unsafe, as defined in 1.7.5.3.1.1 of this *Code*, the authority having jurisdiction or his/her authorized representative shall be authorized to enter such building or premises at reasonable times to inspect the same, or to perform any duty imposed on the authority having jurisdiction by this *Code* under the following conditions:

(1) If such building or premises be occupied, the official shall first present proper credentials and request entry.
(2) If such building or premises be unoccupied, the official shall first make a reasonable effort to locate the owner or other persons having charge or control of the building or premises and request entry, and, if such entry is refused, the authority having jurisdiction or his/her authorized representative shall have recourse to remedy provided by law to secure entry.

1.7.1.3.2 No owner or occupant or other person having charge, care, or control of any building or premises shall fail or neglect, after proper request is made as herein provided, to permit entry therein by the authority having jurisdiction or his/her authorized representative for the purpose of inspection and examination as provided by this *Code*.

1.7.1.4 Stop-Work Orders. Whenever any work is being done contrary to provisions of this *Code*, the authority having jurisdiction is hereby authorized to order such work stopped. Such work shall immediately stop until authorized by the authority having jurisdiction to proceed.

1.7.1.5 Unlawful Occupancy. Whenever any building or part thereof is being used or occupied contrary to the provisions of this *Code*, the authority having jurisdiction is hereby authorized to order such use or occupancy discontinued and the building or part thereof vacated. Such order shall be in writing, served on the person(s) using or causing to be used such building or parts thereof. Within a 30-day period after receipt of notice or order, such building or part thereof shall be made to comply with the requirements of this *Code*; however, in the event of an emergency, 1.7.5.3.7 and 1.7.5.3.8 shall apply.

1.7.1.6 Concealed Work. The authority having jurisdiction is hereby authorized to order parts of any building or structure to be exposed for inspection when the building or part thereof is in an unsafe or a dangerous condition, or when there is willful or negligent concealment of a violation of this *Code* or when work subject to a required inspection has been covered prior to the required inspection. All costs incurred in making concealed work available for inspection shall be borne by the owner of the building or structure.

1.7.2 Approvals by Other Authorities Having Jurisdiction. The authority having jurisdiction shall have the authority to require that the laws, rules, and regulations of all other regulatory agencies having jurisdiction shall be met before a building permit is issued to an applicant. The authority having jurisdiction shall have the authority to require evidence in writing to show that other regulatory agencies having jurisdiction over the design, construction, alteration, repair, equipment, maintenance, and relocation of buildings and structures in the jurisdiction have approved the proposed construction. The authority having jurisdiction shall not be held responsible for enforcement of the regulations of such other regulatory agencies unless he/she is specifically authorized to enforce that agency's regulations.

1.7.3 Board of Appeals.

1.7.3.1 Creation of Board of Appeals.

1.7.3.1.1 There is hereby established a board to be designated the board of appeals, consisting of at least five members qualified by training and experience to rule on matters relating to building, who shall be appointed by the chief appointing authority of the jurisdiction. The board shall select one of its members to serve as chair, and the authority having jurisdiction shall be an ex officio member without vote and shall act as secretary to the board.

1.7.3.1.2 Whenever the authority having jurisdiction shall reject or refuse to approve the manner of proposed construction, and to assist in determining the suitability of alternative materials and methods of construction, the owner of such building or structure or his/her duly authorized agent shall be permitted to request an appeal from the decision of the authority having jurisdiction by means of the board of appeals.

1.7.3.2 Term of Office. The chief appointing authority of the jurisdiction shall appoint one member of the board of appeals for a term of 1 year, two members for a term of 2 years, and two

members for a term of 3 years, and thereafter, they shall be appointed for a term of 3 years. The chief appointing authority shall fill vacancies for an unexpired term. Absence of a member from three consecutive meetings of the board, unless excused, shall render such member liable for immediate removal from office by the chief appointing authority.

1.7.3.3 Quorum. Two-thirds, but not less than four members, of the board of appeals shall constitute a quorum. In varying the application of any provision of this *Code*, or in modifying an order of the authority having jurisdiction, a majority vote shall be required.

1.7.3.4 Meetings and Records. Meetings of the board shall be held at the call of the chair and at such other times as the board determines. All hearings before the board shall be open to the public. The board shall keep minutes of its proceedings showing the vote of each member on every question, or if the member is absent or fails to vote, indicating such actions. The board shall also keep records of its examinations and other official actions. Minutes and records of the board shall be public records.

1.7.3.5 Procedures. The board shall establish rules and regulations for its own procedures consistent with the provisions of this *Code*.

1.7.3.6 Appeals. An appeal of the decision of the authority having jurisdiction shall be filed within 30 days from the date of the decision being appealed by filing with the authority having jurisdiction and the board of appeals a notice of appeal, specifying the grounds thereof. In the case of a building or structure that, in the opinion of the authority having jurisdiction, is unsafe or dangerous, the authority having jurisdiction shall be permitted to limit the time for such appeal to a shorter period. The authority having jurisdiction shall forthwith transmit to the board all the papers on which action appealed from was taken and shall schedule a public hearing thereon.

1.7.3.7 Authority of the Board.

1.7.3.7.1 The board of appeals shall provide for reasonable interpretation of the provisions of this *Code* and rule on appeals from decisions of the authority having jurisdiction. The ruling of the appeals board shall ensure that the intent of the *Code* is complied with and public safety is secured.

1.7.3.7.2 The board shall be permitted to grant modifications, through the procedures outlined for equivalency in Section 1.5 of this *Code*, to encourage the development of new technologies, methods, and materials.

1.7.3.7.3 A decision of the board to modify the application of any provision of this *Code*, or to modify an order of the authority having jurisdiction, shall be in writing and shall specify the manner in which such variation or modification is made, the conditions upon which it is made, and the reasons therefor.

1.7.3.8 Decisions.

1.7.3.8.1 The board shall reach a decision on every matter before it without unreasonable or unnecessary delay. Every decision of the board shall be entered in the minutes of such meeting. Every decision shall be promptly filed in the office of the authority having jurisdiction and shall be open for public inspection. A certified copy shall be sent by mail or messenger to the appellant, and a copy shall be publicly posted in the office of the authority having jurisdiction for 2 weeks after filing. The decision of the board shall be final, subject to such remedy as any aggrieved party might have through legal, equity, or other avenues of appeal or petition.

1.7.3.8.2 If a decision of the board reverses or modifies a refusal, order, or disallowance of the authority having jurisdiction, or varies the application of any provision of this *Code*, the authority having jurisdiction shall take action immediately in accordance with such decision.

1.7.4 Liability.

1.7.4.1 Any officer, employee, or member of the board of appeals charged with the enforcement or interpretation of this *Code*, acting for the applicable governing body in the discharge of his/her duties, shall not thereby render himself/herself personally liable. Further, all such persons shall be relieved from all personal liability for any damage they accrue to persons or property as a result of any act required or permitted in the discharge of their duties. Any suit brought against any officer or employee because of such act performed in the course of enforcement of any provision of this *Code* shall be defended by the legal counsel of the jurisdiction until the termination of the proceedings.

1.7.4.2 This *Code* shall not be construed to relieve from, or lessen the responsibility of, any person owning, operating, or controlling any building or structure for any damages to persons or property caused by defects. Further, the *Code* enforcement agency or its parent jurisdiction shall not be held as assuming any such liability by reason of the inspections authorized by this *Code* or any permits or certificates issued under this *Code*.

1.7.5 Compliance of Buildings and Structures.

1.7.5.1 Alterations or Change of Occupancy Classification. Alterations or change of occupancy classification shall be in accordance with Chapter 15.

1.7.5.2 Maintenance of Buildings and Property.

1.7.5.2.1 Buildings. The requirements contained in this *Code* for maintenance of buildings shall apply to all buildings and structures in existence on the date of enactment of this *Code* and those hereafter erected. All buildings and structures and all parts thereof shall be maintained in a safe condition, and all devices and safeguards required by this *Code* shall be maintained in operating condition. The requirements of this paragraph shall not be construed as permitting the removal or nonmaintenance of existing devices or safeguards, unless authorized by the authority having jurisdiction.

1.7.5.2.2 Existing Installations. Buildings in existence at the time of the adoption of this *Code* shall be permitted to have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of this *Code*, provided such continued use is not dangerous to life.

1.7.5.3 Unsafe Buildings and Fire Hazards.

1.7.5.3.1 Descriptions.

1.7.5.3.1.1 Description of Unsafe Building. All buildings that are, or that hereafter become, as follows shall be considered unsafe buildings:

(1) Unsanitary
(2) Deficient in means of egress
(3) A hazard from fire or natural or man-made threats
(4) Dangerous to human life or public welfare by reason of illegal or improper use, occupancy, or maintenance

(5) Noncompliant with the provisions of applicable codes
(6) Significantly damaged by fire or explosion or other natural or man-made cause
(7) Incomplete buildings for which building permits have expired
(8) The falling away, hanging loose, or loosening of any siding, block, or other building material, structural member, appurtenance, or part thereof of a building; or the deterioration of the structure or structural parts of a building, a partially destroyed building, or any part of a building when caused by deterioration or overstressing
(9) The existence of unsanitary conditions by reason of inadequate or malfunctioning sanitary facilities or waste disposal systems

1.7.5.3.1.2 Description of Building as a Fire Hazard. A building shall be deemed to be a fire hazard and unsafe under the following conditions:

(1) When vacant and unguarded and open to unauthorized entry at door or window
(2) When there is an accumulation of combustible dust, debris, or materials therein deemed to be a hazard by the authority having jurisdiction
(3) When the building does not provide the exits or fire protection required herein for the most recent occupancy
(4) When electrical or mechanical installations or systems create a hazardous condition

1.7.5.3.2 Authority of the Authority Having Jurisdiction Regarding Unsafe Buildings or Buildings that Are a Fire Hazard. All buildings deemed to be unsafe or to be a fire hazard by the authority having jurisdiction, based on 1.7.5.3.1, are hereby declared to be public nuisances and shall be demolished and removed from the premises concerned or shall be made safe and sanitary in a manner acceptable to the authority having jurisdiction and as provided in Section 1.7 and by other applicable laws, rules, and regulations of the jurisdiction.

1.7.5.3.3 Inspection of Unsafe Buildings. The authority having jurisdiction, on his/her own initiative, or as a result of reports filed with the department of building and safety, shall examine or cause to be examined every building appearing to be or reported to be unsafe, and, if such is found to be an unsafe building as defined in 1.7.5.3.1.1, the authority having jurisdiction shall post the property on which the building is located and shall furnish the owner of such building with a written notice of violation. The manner of posting and furnishing written notice shall be as provided in 1.7.5.3.4 and 1.7.5.3.5, inclusive.

1.7.5.3.4 Notice of Violation. At least 14 days prior to posting a noncomplying building, the authority having jurisdiction shall give the owner of the premises written notice by certified mail, addressed to the owner's last known address. If proof of service by certified mail is not completed by signed return receipt, a copy of the written notice shall be affixed to the structure concerned, and such procedure shall be considered proper service, and the time for compliance stipulated in the notice shall commence with the date on which such notice is so affixed. This written notice shall state the defects that constitute a violation of this *Code* and prescribe the action to be taken by the owner of the building to comply with the *Code* and the time within which compliance must be accomplished. Such time shall be reasonable under the circumstances of the case, subject to reasonable extension when requested in writing, for reasons that the authority having jurisdiction considers as justifying an extension of time. All extensions of time shall be by written approval of the authority having jurisdiction. In addition, this written notice shall explain the right of appeal of the decision of the authority having jurisdiction to the board of appeals and shall state that, unless there is compliance with the instructions in the notice of violation or an appeal is filed, a public hearing before the board of appeals will be initiated by the authority having jurisdiction after the time period for compliance has expired.

1.7.5.3.5 Recording of Notice of Violation.

1.7.5.3.5.1 If the owner of the property has not complied with the requirements as stated in the notice of violation within the time specified, the authority having jurisdiction shall file an appropriate instrument in the office of the clerk of the circuit court, to be recorded in the public records of the jurisdiction in which the violation occurred, indicating that violations of this *Code*, and of 1.7.5.3.4 thereof, exist upon the property involved.

1.7.5.3.5.2 The recording of the notice of violation shall constitute legal notice to all concerned, as well as to any subsequent purchasers, transferees, grantees, mortgagees, lessees, and all persons claiming or acquiring interest in the property.

1.7.5.3.5.3 When the violation specified in the notice of violation has been corrected and the filing fees incurred have been paid, the authority having jurisdiction shall file a certificate attesting that the violation has been corrected.

1.7.5.3.6 Posting Notice of Violation. The authority having jurisdiction shall post a signed notice in a conspicuous location on the building that has been determined to be unsafe, but not before 14 days after the notice of violation provided in 1.7.5.3.4 has been served. The posted notice shall be dated and shall read as follows:

> UNSAFE BUILDING — This building is unsafe based on the provisions of 1.7.5.3 of the *Building Construction and Safety Code*. This building shall be vacated and shall not be occupied. Action to repair or remove this building shall be taken by the owner as prescribed by written notice previously served. THIS NOTICE SHALL NOT BE REMOVED EXCEPT BY THE AUTHORITY HAVING JURISDICTION.

1.7.5.3.7 Emergency Action.

1.7.5.3.7.1 When, in the opinion of the authority having jurisdiction, an imminent danger exists, the authority having jurisdiction shall be authorized to order the occupants to vacate, or temporarily close for use or occupancy, the rights-of-way, sidewalks, streets, or adjacent buildings or nearby areas. The authority having jurisdiction shall have the authority to institute such other temporary safeguards as deemed necessary. The authority having jurisdiction shall be authorized to employ the necessary labor and materials to perform the required work. The authority having jurisdiction shall promptly notify the local emergency services of buildings posted as unsafe and ordered to be vacated. The authority having jurisdiction shall also notify the emergency services when unsafe conditions have been remedied and the building is safe for occupancy and use.

1.7.5.3.7.2 Costs incurred in the performance of emergency work shall be paid by the governmental authority having jurisdiction. Upon recording in the public records of the county in which such emergency work was completed, a

certificate, executed by the authority having jurisdiction, certifying the amount expended and the reasons therefor shall be issued, and the cost shall become a lien against the property on which such emergency work was required.

1.7.5.3.8 Appeal and Review. The owner of, or anyone having an interest in, a building that has been determined to be unsafe, concerning which a notice of violation has been served by the authority having jurisdiction as stated in the notice of violation, shall be permitted to appeal to the board of appeals, and such appeal shall be filed in accordance with the provisions of 1.7.3.6 and 1.7.3.7 prior to the expiration of the time allowed for compliance specified in such notice. In no case shall the appeal period be less than 15 days.

1.7.6 Building Permits, Plans and Specifications, and Inspections.

1.7.6.1 Permits.

1.7.6.1.1 Permits Required.

1.7.6.1.1.1 No person, firm, or corporation shall erect, construct, enlarge, alter, repair, relocate, improve, convert, or demolish any building, structure, or part thereof in the jurisdiction, or cause the same to be done, without first obtaining from the authority having jurisdiction a separate building permit for the work to be accomplished for each such building, structure, or temporary structure. Permits shall not be required for the following:

(1) Painting, papering, tiling, carpeting, cabinets, counter tops, and similar finish work
(2) Temporary motion picture, television, and theater stage sets and scenery
(3) Window awnings supported by an exterior wall for one- and two-family residential use
(4) One-story detached accessory structures used as tool and storage sheds or playhouses or for other similar uses, provided the floor area does not exceed 120 ft^2 (7.5 m^2)
(5) Fences not over 6 ft (1830 mm) high
(6) Movable cases, counters, and partitions not over 6 ft (1830 mm) high

1.7.6.1.1.2 Separate permits shall be required for plumbing, air-conditioning, heating, and ventilating systems; elevators, escalators, and transporting assemblies; and gas, sprinkler, roofing, electrical, and show/ride installations.

1.7.6.1.1.3 Special building permits for temporary structures placed in flood hazard areas shall comply with 39.15.

1.7.6.1.1.4 A previously issued lawful permit shall be valid on the terms of the *Code* under which it was issued, provided that no such permit shall be subject to the limitations specified in 1.7.6.1.

1.7.6.1.2 Other Jurisdictions. Permits required for work to be accomplished under the jurisdiction of other departments shall be issued only on presentation of written proof of compliance with 1.7.2 of this *Code*.

1.7.6.2 Applications.

1.7.6.2.1 Application Requirements. To obtain a permit, the applicant shall first file an application therefor in writing on a form supplied for that purpose by the department of building and safety. Such application shall include the following:

(1) Identification and description of the work to be covered by the permit for which application is made
(2) Description of the land on which the proposed work is to be done by lot, block, tract, and street address, or similar description that will locate specifically the proposed building or work
(3) Indication of the use or occupancy of all parts of the building
(4) Plans and specifications as required in 1.7.6.3
(5) Valuation of the proposed work
(6) Signature of the permittee or his/her authorized agent
(7) Provision of other information as required by the authority having jurisdiction

1.7.6.2.2 Surveyor's Certificate Requirements. Application for permit for new construction and additions shall be accompanied by a registered land surveyor's certificate and plan in duplicate on which shall be indicated clearly the following:

(1) Property corner stakes
(2) Property line dimensions
(3) Existing structures and their location
(4) Existing rights-of-way
(5) Sidewalks
(6) Easements
(7) Street zoning and property zoning of record
(8) Critical elevations and building setbacks required by law
(9) General block plan
(10) Other pertinent survey data

1.7.6.2.3 Waiver of Surveyor's Certificate Requirement. The authority having jurisdiction shall be granted authority to waive the requirements for such survey when property line stakes are known to be in place and when the work contemplated is minor and is clearly within building lines.

1.7.6.2.4 Requirements for Relocation of Buildings. Application for permit for relocating a building within the jurisdiction shall be submitted in the form that the authority having jurisdiction requests. The application shall be accompanied by plans or other data that, in the opinion of the authority having jurisdiction, are necessary to show compliance with this *Code* and the zoning and other regulations of the jurisdiction. A physical examination of the structure shall be made by the authority having jurisdiction before it issues a permit for relocation. *(See also 1.7.6.6.)*

1.7.6.2.5 Requirements for Demolition of Buildings and Structures. Application for permits for the work of demolition of buildings or structures shall be accepted only from persons or firms qualified to do the work. The qualifications of persons or firms permitted to demolish a building or structure shall be in accordance with a special ordinance of the jurisdiction providing for qualification and certification of construction tradespeople.

1.7.6.3 Plans and Specifications.

1.7.6.3.1 Plans and Specifications Requirements.

1.7.6.3.1.1 Each application for a permit shall be accompanied by two sets of plans, specifications, and calculations when required by the authority having jurisdiction.

1.7.6.3.1.2 The authority having jurisdiction shall be permitted to issue a permit without plans, specifications, and calculations for small or finish work.

1.7.6.3.1.3 The construction documents shall be prepared by a registered design professional where required by statutes of the jurisdiction in which the construction site is located.

1.7.6.3.1.4 Plans shall be drawn to scale, shall be identified by name of designer and owner on every sheet, and shall be mechanically reproduced prints on substantial paper or cloth. A plot plan shall show all occupied and unoccupied parts of the lot or lots. The use, name, and occupancy of all parts of the building shall be shown, including all foundations, wall sections, floor plans, elevations, and structural details. Mechanical, plumbing, electrical, fire sprinkler, and alarm details shall be shown on the plans and represent the designs for those disciplines, along with such other information to show clearly the nature, character, and location of the proposed work.

1.7.6.3.1.5 Plans for all buildings shall indicate required fire-resistance-rated construction and how the required structural and fire resistance integrity will be maintained where a penetration of a required fire-resistant wall, floor, or partition will be made for electrical, gas, mechanical, plumbing and communications conduits, pipes, and systems and also indicate in sufficient detail how the fire integrity will be maintained where required fire-resistant floors intersect the exterior walls.

1.7.6.3.1.6 The classification of fire-resistance-rated floor and roof construction shall be identified on the plans as restrained or unrestrained. Only where a registered design professional has furnished documentation satisfactory to the authority having jurisdiction verifying that the construction is restrained as specified in 8.2.1.2 shall the construction be considered restrained.

1.7.6.3.1.7 The construction documents and shop drawings submitted to the authority having jurisdiction shall contain sufficient detail for evaluation of the protected hazards and the effectiveness of the system. The shop drawings for the installation of fire protection systems shall be submitted for review and approval prior to the installation of a fire protection system.

1.7.6.3.1.8 For high-rise buildings, covered mall buildings, and buildings containing atriums, the construction documents shall include a description of the fire protection systems in the building. This description shall include the basic concepts used for suppression, alarm, notification, egress, compartmentation, smoke control, and other related systems, as well as the coordination of those systems. Upon completion of the project, a copy of the approved documentation shall be maintained at the site.

1.7.6.3.2 Examination of Plans.

1.7.6.3.2.1 The authority having jurisdiction shall examine all plans and applications for permits and amendments thereto for their compliance with this *Code*. If the applications or the plans do not conform to the requirements of all pertinent laws, the authority having jurisdiction shall reject such application for a building permit in writing, stating the reasons therefor. Plans that are rejected shall be returned for corrections. If, upon examination, the application, plans, and specifications are found to comply with the requirements of this *Code*, the plans shall be signed by the authority having jurisdiction or its deputy and shall be stamped "approved."

1.7.6.3.2.2 When practical difficulties are involved in carrying out the requirements of this *Code*, the authority having jurisdiction shall be permitted to grant modifications for individual cases. Such permission shall require, first, a finding that a special individual reason makes strict compliance impractical and, second, that the modification is in conformance with the intent and purpose of the *Code*. Fire protection and structural integrity shall not be lessened.

1.7.6.3.3 Partial Approval.

1.7.6.3.3.1 Pending the completion of checking of plans and specifications, and on payment of the fee required, the authority having jurisdiction at its discretion shall be permitted to authorize the issuance of a temporary permit for site preparation, excavation, construction, and foundation, structural, or show/ride installations or any combination thereof. The holder of such temporary permit shall proceed at his/her own risk and without assurance that a completion permit will be granted.

1.7.6.3.3.2 Whenever there is a delay in approval of plans under similar special circumstances, the authority having jurisdiction shall be permitted to allow the builder to place tool sheds, materials, batterboards, and construction equipment on the site prior to actual construction, or to permit exploratory uncovering of concealed structural elements of existing buildings for design information, pending completion of plans for proposed alterations.

1.7.6.3.3.3 The drawings for each phase shall be complete in themselves so that review and inspection can properly be made. Preliminary plans of the total building shall be submitted with the working drawings, and with sufficient detail, so that proper evaluation can be made. Areas and items not included in the phase to be permitted shall be shown as not included.

1.7.6.3.4 Approved Plans.

1.7.6.3.4.1 The authority having jurisdiction shall retain one set of the approved plans, specifications, and computations. The other set shall be kept at the building site, open to inspection at all times when the offices of the jurisdiction are open.

1.7.6.3.4.2 After permit issuance, all changes and deviations from the approved plans shall be submitted to the authority having jurisdiction for approval.

1.7.6.3.4.3 Approved plans and amendments thereto that are retained by the authority having jurisdiction shall become public record, provided that they shall be considered as confidential records of their author, that they shall be open to the public only for inspection, and that the authority having jurisdiction shall permit bona fide owners or designers employed by such owners to inspect the plans when not available from their author. Upon written application, the authority having jurisdiction shall permit the plans to be copied by the owner in the event of the author's death or the inability of the author to supply copies of the plans.

1.7.6.3.4.4 At the time a certificate of occupancy is issued, an updated set of plans and specifications shall be submitted, and a permit fee shall be paid to reflect increased costs.

1.7.6.3.5 Multitenant Buildings. Buildings that are to be completed in phases due to occupancy by tenants shall be permitted to be completed by the owner to a "rough-in" status. The individual tenant area shall then have a permit issued, and, upon completion of all work, a certificate of occupancy shall be issued for that area only. The authority having jurisdiction shall approve the certificate of occupancy by stages before starting construction and shall be permitted to require special conditions to provide safety during the completion.

1.7.6.3.5.1 Buildings that will later be occupied by multiple tenants (lessees) shall be permitted to have certain areas constructed to an unfinished rough-in condition without affecting the certificate of occupancy issued for the finished portions of

the buildings. Future construction to accommodate individual tenants shall be approved upon submittals of acceptable plans and specifications for permit purposes. Certificates of occupancy shall be granted on a case-by-case basis when *Code* compliance has been achieved.

1.7.6.3.5.2 Construction in individual tenant areas shall require special safety and fire protection measures to assure the safety of the building occupants during construction operations.

1.7.6.4 Permit Fees.

1.7.6.4.1 Fee Requirements. Any person requiring a building permit, in addition to filing an application therefor and before such permit is issued, shall pay such permit fee and plan check fee as required by the jurisdiction.

1.7.6.4.2 Basis of Permit Fee. The jurisdiction shall establish a fee schedule listing all applicable fees and the method of their calculation. The authority having jurisdiction shall be permitted to require an estimate of cost and other descriptive data as a basis for determining the permit fee.

1.7.6.4.3 Temporary Structures. A special building permit that remains in effect for a limited time shall be obtained before the erection of temporary structures such as construction sheds, seats, canopies, tents, and fences used in construction work or for temporary purposes such as reviewing stands. Such structures shall be completely removed upon the expiration of the time limit stated in the permit.

1.7.6.5 Conditions of Permit.

1.7.6.5.1 Permit Card. When plans, specifications, and application for permit have been approved and the required fee has been paid, the authority having jurisdiction will issue a permit for the work. With each permit, the authority having jurisdiction shall issue a weather-resistant permit card bearing the legal description of the property, the nature of the work being done, the names of the owner and builder or contractor, and other pertinent information. The permit card shall be posted and maintained in legible condition in a conspicuous place within 200 ft (60 m) of the construction area during the entire time period the work authorized by the permit is in progress.

1.7.6.5.2 Compliance with the *Code*.

1.7.6.5.2.1 Issuing or granting of a permit or approval of plans and specifications by the authority having jurisdiction shall not be construed to be a permit for, or an approval of, any violations of any of the provisions of this *Code*. No permit presuming to give authority to violate or cancel any of the provisions of this *Code* shall be valid, except insofar as the performance of the work that it authorizes is lawful.

1.7.6.5.2.2 When plans and specifications have been approved, the issuance of a permit shall not prevent the authority having jurisdiction from thereafter requiring correction of errors in such plans and specifications, or from preventing building operations being carried on thereunder in violation of this *Code* or of any other regulations of the jurisdiction applicable thereto. Compliance with this *Code* is the responsibility of the owner or his/her authorized agent.

1.7.6.5.3 Time Limitation.

1.7.6.5.3.1 Permits shall expire if the work authorized by such permit is not commenced within 6 months from the date of the permit, or, if after commencing, the work is suspended or abandoned for a period of 6 months at any time during construction operations. The authority having jurisdiction shall be permitted to extend such permit for a period of 90 days from the date of expiration if the work has not commenced, or for a period of 90 days from the date of the last recorded inspection if written application for such extension is received and approved by the authority having jurisdiction prior to the date of expiration of the initial permit, and provided that the proposed work complies with all requirements of the *Code* in effect at the time of such renewal.

1.7.6.5.3.2 A previously issued lawful permit shall be valid under the terms of the *Code* under which it was issued, provided that such permit shall be subject to the limitations specified in 1.7.6.5.3.

1.7.6.5.3.3 Before the work for which a building permit has become void can be recommended, a new permit shall be required. The work for which the new permit is issued shall conform to the provisions of this *Code* at the time of reissuance of the permit. The fee shall be based on the amount of work remaining to be done.

1.7.6.5.4 Revocation of Permit.

1.7.6.5.4.1 The authority having jurisdiction shall be hereby granted authority to revoke a permit or approval issued under the provisions of this *Code* when any false statement or misrepresentation of fact is made in the application or on the plans on which the permit or approval was based.

1.7.6.5.4.2 Whenever the work for which a permit has been issued is not being performed in conformity with plans, specifications, or descriptions, or approved plans are not being kept at the site, the authority having jurisdiction shall notify the contractor or owner or his/her agent in writing that the permit is suspended. Written notice shall be mailed or given to the permit holder or permit holder's agent, and it shall be unlawful for any person or persons to perform any work in or about the building or structure, except work required for correction of the violations. If, in the judgment of the authority having jurisdiction, there is imminent danger that requires immediate action, the permit can be revoked or suspended verbally, and written notice shall be served later.

1.7.6.5.4.3 When a permit has been suspended, it shall not be reinstated until all violations have been corrected. Written notice of reinstatement shall be given to the permit holder when requested.

1.7.6.6 Inspection.

1.7.6.6.1 Inspection Requirements.

1.7.6.6.1.1 Before issuing a permit, the authority having jurisdiction shall be permitted to inspect any building or structure for which an application has been received for a permit to enlarge, alter, repair, relocate, demolish, or change the occupancy thereof. The authority having jurisdiction shall inspect all buildings and structures from time to time during the work for which a permit was issued and on completion of the work. The authority having jurisdiction shall cause to be kept a record of every inspection and of all violations of this *Code* and of the correction and disposition of such violations.

1.7.6.6.1.2 Before a permit for moving a building or structure within or into the jurisdiction is issued, such building or structure shall be inspected by the authority having jurisdiction. The authority having jurisdiction shall ascertain that the building being relocated complies with the requirements of

this *Code* and all other applicable laws or regulations of the jurisdiction.

1.7.6.6.1.3 All construction or work for which a permit is required shall be subject to mandatory inspections by the authority having jurisdiction as prescribed in 1.7.6.6.3, and certain types of construction shall have special engineering inspections as specified in Chapter 40. Prior to issuance of a certificate of occupancy, a final inspection shall be made by the authority having jurisdiction of all construction or work for which a permit has been issued.

1.7.6.6.1.4 When considered necessary by the authority having jurisdiction, it shall make an inspection of materials or assemblies at the place of manufacture or fabrication. A record shall be maintained of every such inspection and of all violations of this *Code* noted during the inspection.

1.7.6.6.1.5 The authority having jurisdiction shall make or cause to be made the inspections required in 1.7.6.6.1. Written reports of inspectors employed by approved inspection services shall be permitted, provided that, after investigation, the authority having jurisdiction is satisfied as to the qualifications and reliability of the inspection service. No certificate called for by any of these requirements shall be based on such reports, unless the reports are in writing and are certified by the officer of the agency who made the inspection. Reports issued by inspection services engaged by the owner, designer, or contractor of a building shall be promptly forwarded to the authority having jurisdiction for its information and records.

1.7.6.6.1.6 Work requiring a building permit shall not be commenced until the permit holder or his/her agent shall have posted the building permit card in accordance with the requirements of 1.7.6.1.1. This permit card shall be maintained in such position by the permit holder until the certificate of occupancy has been issued by the authority having jurisdiction.

1.7.6.6.2 Inspection of Structural Units. Where a building or part thereof is a structural unit, the integral parts of which have been built or assembled prior to incorporation into the building, such building or part thereof shall conform to the requirements of this *Code*. Inspections shall be made by the authority having jurisdiction as required in this *Code* for the materials and types of construction used in the prefabricated assemblies. The inspection shall be permitted to be waived during prefabrication if the approved agency certifies to the compliance of the construction with this *Code* and supplies evidence of such compliance in writing by a registered design professional or an approved agency or laboratory.

1.7.6.6.3 Mandatory Inspections.

1.7.6.6.3.1 Work requiring mandatory inspections shall not be covered or concealed in any manner without first obtaining the approval of the authority having jurisdiction.

1.7.6.6.3.2 Work shall not be done on any part of a building or structure beyond the stage of work indicated in each of the successive mandatory inspections until inspection has been completed and written approval has been given by the authority having jurisdiction or its deputy.

1.7.6.6.3.3 The permit holder or permit holder's agent shall notify the authority having jurisdiction of the time when a given stage of construction will be ready for inspection. The authority having jurisdiction shall then make such called inspection and other inspection as necessary, and it either shall approve in writing on the permit card that stage of the construction as completed or shall notify the permit holder or permit holder's agent specifically wherein the work fails to comply with the provisions of this *Code*.

1.7.6.6.3.4 Inspections shall be conducted for each building element as described in 1.7.6.6.3.4(A) through 1.7.6.6.3.4(P).

(A) Foundations. Inspections for foundations shall be conducted when the excavation for footings is complete and footing forms and required anchorage and reinforcing steel are in place but before concrete is placed.

(B) Reinforcing Steel. Inspections of reinforcing steel shall be conducted after all reinforcing steel is in place and forms are braced but before the concrete is placed. Reinforcing steel in walls shall be inspected after the steel is in place, with one side of wall forms in place and braced, but before the concrete is placed.

(C)* Lowest Floor. Inspections for the lowest floor for buildings and structures located wholly or partly within the flood hazard area established by 39.4.2 shall be made after the lowest floor level is set. No further vertical construction shall take place until the lowest floor inspection has been completed and the lowest floor elevation has been approved by the authority having jurisdiction. An elevation certificate identifying the lowest floor elevation, as required by 39.12.3.1.3 or 39.12.3.2.3, shall be submitted to the authority having jurisdiction immediately after the floor level is set. The lowest floor inspection shall be in addition to other flood-related special inspections in 1.7.6.6.3.3(N)(5).

(D) Framing. Inspections for framing shall be made at each floor level after all floor, wall, roof framing, and fire blocking are complete, after welds and clip connections are made, and after all pipes, chimneys, vents, ductwork, rough plumbing, and rough electrical work are in place.

(E) Insulation. Inspections for insulation shall be made before lathing, wallboard, or other finishes are applied.

(F) Lathing and Wallboard. Inspections for lathing and wallboard shall be conducted when supports, backing, lath, or wallboard, or any combination thereof, are in place and ready for plaster and other finish work and all plastering materials are delivered on the job, but before any finish is applied and before wallboard joints and fasteners are taped and finished.

(G) Roofing. Inspections for roofing shall be conducted after the anchor sheet or anchor sheets are on and secured and before the installation of capsheet or other finish course.

(H) Masonry. Inspections for masonry shall be conducted after units are set and reinforcing steel is placed and prior to grouting.

(I) Structural Steel. Inspections for structural steel shall be conducted when structural steel members and required connections are complete, but before concealing any members or connections.

(J) Electrical Systems. Inspections for electrical systems shall be made in accordance with the requirements of Chapter 52.

(K) Mechanical Systems. Inspections for mechanical systems shall be made in accordance with the requirements of Chapter 14.

(L) Plumbing Systems. Inspections for plumbing systems shall be made in accordance with the requirements of Chapter 53.

(M) Fire Protection Systems. Inspections for fire protection systems shall be in accordance with applicable standards.

(N) Special Inspections. Special inspections shall be made immediately after completion and at such intervals during the progress of the work as required by the authority having jurisdiction and as follows:

(1) Inspections for elevators and conveying systems shall be made in accordance with the requirements of ASME A17.1, *Safety Code for Elevators and Escalators*, ASME A18.1, *Safety Standard for Platform Lifts and Stairway Chairlifts*, and ASME B20.1, *Safety Standard for Conveyors and Related Equipment*.
(2) Inspections for swimming pools shall be made in accordance with the requirements of this *Code*.
(3) Inspections for signs shall be made in accordance with the requirements of this *Code*.
(4) Inspections shall be made to confirm that stairways, except those used in the means of escape, comply with 11.2.2.3.5 and 11.2.2.3.6 of this *Code* before the installation of carpeting and after the installation of carpeting, provided that measurements made after the installation of carpeting are made to the uncompressed walking surface of the carpet.
(5) For buildings and structures located wholly or partly within the flood hazard area established by 39.4.2, inspections shall be made to determine the lowest elevation of machinery and equipment servicing the building, adjacent grade elevations, and flood-opening information. An elevation certificate identifying this information, as required by 39.12.3.1.3 or 39.12.3.2.3, shall be submitted to the authority having jurisdiction before a certificate of occupancy is issued.

(O) Other Inspections. Other inspections shall be permitted. Prefabricated assemblies shall be permitted to be inspected at the place of manufacture.

(P) Final Inspection. A final inspection shall be made when the building or structure is completed and is ready for use or occupancy.

1.7.6.6.3.5 Requests for final inspections shall be made to the office of the authority having jurisdiction, and a reasonable time shall be allowed for such inspection to be made. Rejection or refusal to approve the work for reasons of incompleteness, violation of the provisions of this *Code*, or inadequacy of the construction shall nullify the request for final inspection. The work shall be made to comply with the *Code*, and the request for inspection shall be repeated as required herein.

1.7.6.6.4 Inspection Reports. The authority having jurisdiction shall keep a record of all inspections made, results, plans filed, surveys made, and certificates of occupancy issued.

1.7.6.7 Cleanup of Site. Upon completion of the proposed work, the permit holder shall clear the site of rubbish, debris, construction sheds, or materials of construction. In the event that there has been damage to public property, or that rubbish, debris, construction sheds, or materials of construction have been left at the site, the authority having jurisdiction shall refuse to make final inspection and shall notify the permit holder to correct the condition of violation within 5 days. For failure to comply with such notice after such period of 5 days, the permit holder shall be subject to the penalties specified herein. The authority having jurisdiction shall have the cleanup work done and the public property restored, in which event the costs shall become a lien against the property on which the permit was issued.

1.7.6.8 Certificate of Occupancy.

1.7.6.8.1 Certificate Requirements.

1.7.6.8.1.1 No building hereafter erected, altered, enlarged, or relocated or for which a change of occupancy has been made, shall be used in whole or in part until a certificate of occupancy has been issued by the authority having jurisdiction certifying that the building and occupancy are in accordance with the provisions of this *Code* and all other laws and regulations applying thereto. When the building or part thereof complies with the provisions of all pertinent laws and regulations, the authority having jurisdiction shall issue the certificate of occupancy for the building or part thereof. A certificate of occupancy for places of assembly shall indicate thereon, and make record of, the number of persons for whom such certificate is issued. In all manufacturing, commercial, storage, or warehouse occupancies, the design live loads shall be plainly posted.

1.7.6.8.1.2 When, in the opinion of the authority having jurisdiction, any building altered or enlarged, or both, is in compliance with this *Code*, the owner shall be issued a letter affirming compliance in lieu of a certificate of occupancy.

1.7.6.8.2 Existing Occupancy. The authorized occupancy of any structure existing on the date of adoption of this *Code* shall be permitted to continue without change, except as is specifically covered in this *Code* or as is deemed necessary by the authority having jurisdiction for the general safety and welfare of the occupants and public.

1.7.6.8.3 Revocation of Certificate. The authority having jurisdiction shall be authorized to revoke a certificate of occupancy for any building occupied in whole or in part for any use not authorized in this *Code*, or in other laws and regulations of the jurisdiction, or for any building that is changed in occupancy to a classification not complying with this *Code*, or for any building where the live load is imposed on any floor, or where the number of persons permitted to assemble therein or thereon exceeds those authorized in said certificate of occupancy, or for any violation of a condition of a certificate of occupancy as set forth in 1.7.6.8.6. Continued use of the building or structure after the revocation of said certificate shall be in violation of this *Code*.

1.7.6.8.4 Temporary Certificate of Occupancy. A temporary certificate of occupancy shall be permitted to be issued by the authority having jurisdiction for the use of parts of a building prior to completion of the entire building.

1.7.6.8.5 Connection of Services. It shall be unlawful for a public service corporation or agency to begin utility service to a building or structure, except temporary service for use during building construction or testing operations, or both, until approved by the authority having jurisdiction.

1.7.6.8.6 Conditions of Certificate of Occupancy. Certificate of occupancy shall be conditioned upon the following:

(1) The completed project meets the conditions of the construction permit, the approved drawings including all amendments, and all prior approvals.
(2) All required fees have been paid.
(3) All necessary inspections have been completed, and the completed project meets the requirements of this *Code*.
(4) All violations have been corrected, and any assessed penalties have been paid.
(5) All protective devices and equipment required to be installed by this *Code* will continue to be operational as required by this *Code*.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this *Code* and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02169-9101.

NFPA 1, *Fire Prevention Code,* 2000 edition. [Chapter 14] 14.5, [Chapter 34] 34.1.1 Exceptions (4) and (7), Table 34.1.3.1, 34.1.3.2 Exception, 34.1.3.2.2.2 Exception, 34.1.3.2.2.3 Exception, 34.1.3.2.2.4 Exception, 34.1.3.2.3.1, Table 34.1.3.2.3.1 footnote (b), 34.1.3.2.3.4 Exception, 34.1.3.2.3.6 Exception, 34.2.2, 34.2.5(2), 34.3.2.6.8, 34.3.2.6.10, 34.3.2.8.1, 34.3.2.8.2, 34.3.2.10, 34.3.4.4.1 Exception, 34.3.5.4 Exception, 34.3.6.1(A), 34.3.7.1, 34.3.7.1.2.1, 34.3.7.2.4.1(C), 34.3.7.3.1.1, 34.3.7.3.4.5(B).

NFPA 10, *Standard for Portable Fire Extinguishers,* 2002 edition. [Chapter 55] 55.6.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam Systems,* 2002 edition. [Chapter 55] Table 55.5.1.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2000 edition. [Chapter 55] Table 55.5.1.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 1997 edition. [Chapter 55] Table 55.5.1.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2002 edition. [Chapter 7] 7.1.5.2.1.2(B), 7.4.3.6.2, 7.4.3.6.3, 7.6.2.2, 7.6.3.2.1, 7.6.3.3(1), 7.6.3.4, 7.6.3.7(2), 7.6.3.8, 7.6.3.9(2), [Chapter 8] 8.12.5.2(2), [Chapter 11] 11.2.2.5.2 Exception No. 2(a), [Chapter 15] 15.4.2.9.1(2), [Chapter 16] 16.4.5.6, 16.4.5.10, [Chapter 19] 19.3.5.5, [Chapter 24] 24.3.5.6, [Chapter 25] 25.3.5.7, [Chapter 27] 27.3.1(3), 27.4.4.5.10.2(2), 27.4.5.3(1), 27.4.5.5(1), [Chapter 32] 32.3.5.2, 32.3.5.3, [Chapter 34] Table 34.1.3.1 footnote (f), Table 34.1.3.2.3.1 footnote (a) and (c), [Chapter 37] 37.1.3.1(4), 37.1.4.1, [Chapter 55] 55.3.1.1(1), 55.3.3, 55.4.3.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,* 2002 edition. [Chapter 7] 7.1.5.2.1.2(B), [Chapter 15] 15.6.2.5.4 Exception No. 6, [Chapter 55] 55.3.1.1(3).

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,* 2002 edition. [Chapter 7] 7.1.5.2.1.2(B), 7.5.2, 7.6.2.3.2, [Chapter 11] 11.2.2.5.2 Exception No. 2(a), [Chapter 15] 15.6.2.5.4 Exception No. 6, [Chapter 37] 37.1.4.1, [Chapter 55] 55.3.1.1(2).

NFPA 14, *Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems,* 2000 edition. [Chapter 15] 15.6.2.5.5, [Chapter 16] 16.4.5.10, [Chapter 55] 55.1, 55.4.2, 55.4.3.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 2001 edition. [Chapter 55] Table 55.5.1.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems,* 1999 edition. [Chapter 55] Table 55.5.1.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2002 edition. [Chapter 55] Table 55.5.1.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems,* 2002 edition. [Chapter 55] Table 55.5.1.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2002 edition. [Chapter 55] 55.8, 55.9.

NFPA 30, *Flammable and Combustible Liquids Code,* 2000 edition. [Chapter 6] 6.4.2.25, [Chapter 27] 27.4.5.3(2), 27.4.5.5(2), [Chapter 34] 34.1.1 Exceptions (10), (11), (12), 34.3.2.6.1 Exception No. 1, 34.3.4.2 Exception No. 1 and No. 2, 34.3.5.2 Exception No. 1 and No. 2.

NFPA 30A, *Code for Motor Fuel Dispersing Facilities and Repair Garages,* 2000 edition. [Chapter 6] 6.4.2.46, [Chapter 30] 30.8.3.2(A)(1), 30.8.3.2(B).

NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products,* 2002 edition. [Chapter 6] 6.4.2.3, [Chapter 27] 27.4.5.3(3), 27.4.5.5(3), [Chapter 34] 34.1.1 Exception (9).

NFPA 31, *Standard for the Installation of Oil-Burning Equipment,* 2001 edition. [Chapter 6] 6.4.2.48, [Chapter 32] 32.3.6.6(1), 32.11(1), [Chapter 34] Table 34.1.3.1 footnote (c), [Chapter 50] 50.1(2).

NFPA 32, *Standard for Drycleaning Plants,* 2000 edition. [Chapter 6] 6.4.2.19, [Chapter 34] 34.1.1 Exception (3).

NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials,* 2000 edition. [Chapter 6] 6.4.2.61, [Chapter 34] 34.1.1 Exception (1).

NFPA 34, *Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids,* 2000 edition. [Chapter 6] 6.4.2.18, [Chapter 34] 34.1.1 Exception (1).

NFPA 35, *Standard for the Manufacture of Organic Coatings,* 1999 edition. [Chapter 6] 6.4.2.49.

NFPA 36, *Standard for Solvent Extraction Plants,* 2001 edition. [Chapter 6] 6.4.2.2(3), 6.4.2.60.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines,* 2002 edition. [Chapter 6] 6.4.2.14.

NFPA 40, *Standard for the Storage and Handling of Cellulose Nitrate Film,* 2001 edition. [Chapter 6] 6.4.2.9, [Chapter 16] 16.4.6.1.

NFPA 42, *Code for the Storage of Pyroxylin Plastic,* 2002 edition. [Chapter 6] 6.4.2.57.

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals,* 2000 edition. [Chapter 6] 6.4.2.3.3, [Chapter 17] 17.3.2.3, [Chapter 49] 49.2.3.

NFPA 50, *Standard for Bulk Oxygen Systems at Consumer Sites,* 2001 edition. [Chapter 6] 6.4.2.54.

NFPA 50A, *Standard for Gaseous Hydrogen Systems at Consumer Sites,* 1999 edition. [Chapter 6] 6.4.2.29.

NFPA 50B, *Standard for Liquefied Hydrogen Systems at Consumer Sites,* 1999 edition. [Chapter 6] 6.4.2.30.

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes,* 2002 edition. [Chapter 6] 6.4.2.53.

NFPA 51A, *Standard for Acetylene Cylinder Charging Plants,* 2001 edition. [Chapter 6] 6.4.2.1, 6.4.2.53.

NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code,* 2002 edition. [Chapter 6] 6.4.2.10, [Chapter 30] 30.8.3.2(A)(3).

NFPA 54/ANSI 223.1, *National Fuel Gas Code,* 2002 edition. [Chapter 17] 17.5.2.3, [Chapter 18] 18.5.2.3, [Chapter 32] 32.2.1.5.1, 32.3.6.6(2), 32.11(2), [Chapter 34] 34.1.1, [Chapter 50] 50.1(1), [Chapter 51] Table 51.3.2.11, [Chapter 53] 53.1(1).

NFPA 55, *Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders,* 1998 edition. [Chapter 6] 6.4.2.16, [Chapter 34] 34.3.2.8.2, 34.3.6.1(A).

NFPA 57, *Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code,* 2002 edition. [Chapter 6] 6.4.2.36, [Chapter 30] 30.8.3.2(A)(3).

NFPA 58, *Liquefied Petroleum Gas Code,* 2001 edition. [Chapter 6] 6.4.2.38, [Chapter 30] 30.8.3.2(A)(2), [Chapter 34] 34.1.1, 34.1.3.2.1.5 Exception No. 2, 34.1.3.2.2.5 Exception No. 2, 34.1.3.2.3.7 Exception (2), 34.1.3.2.4.5 Exception No. 2,

34.1.3.2.5.5 Exception No. 2, 34.1.3.2.6.5 Exception No. 2 [Chapter 53] 53.1(2).

NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG,*), 2001 edition. [Chapter 6] 6.4.2.37.

NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities,* 2002 edition. [Chapter 6] 6.4.2.2.

NFPA 69, *Standard on Explosion Prevention Systems,* 2002 edition. [Chapter 34] Table 34.3.2.7 footnote (1).

NFPA 70, *National Electrical Code®,* 2002 edition. [Chapter 11] 11.9.2.4, [Chapter 14] 14.4, [Chapter 15] 15.3.5 Exceptions No. 1, 2, 3, 4, 6, 15.5.5.1 Exception, 15.5.5.3.1, 15.5.5.3.2.4, 15.5.5.3.2.7, 15.5.5.3.3, 15.5.5.4, 15.7.2.4.1, 15.7.2.4.2, 15.7.3.10, [Chapter 16] 16.4.3.4, [Chapter 21] 21.5.1.2, [Chapter 32] 32.2.1.3, 32.3.6.1, 32.6.2, [Chapter 33] 33.2.4.2(A), [Chapter 34] 34.3.2.8.2, [Chapter 52] 52.1.

NFPA 72®, National Fire Alarm Code®, 2002 edition. [Chapter 8] 8.7.4, 8.10.5.6, 8.11.6.7.1, 8.11.6.7.2, [Chapter 11] 11.2.1.8.2(3), 11.2.1.9.2(4), [Chapter 12] 12.5.1, [Chapter 15] 15.3.5 Exception No. 1, 3, 4, 6, [Chapter 16] 16.6.2.5.4 [Chapter 17] 17.3.4.2.3.1(1), [Chapter 21] 21.3.4.1.2, 21.3.7.9(1), [Chapter 26] 26.3.3.4.8.1, [Chapter 33] 33.2.1.2(1), [Chapter 34] 34.3.7.3.5(C), [Chapter 55] 55.2.1.2, 55.2.2.3, 55.2.2.4.1, 55.2.2.6.1, 55.2.2.6.2, 55.2.3.4, 55.2.3.5, 55.2.3.6.3(1), 55.2.3.9, 55.2.4.2, 55.2.5.5, 55.3.2.1.

NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment,* 1999 edition. [Chapter 6] 6.4.2.17.

NFPA 80, *Standard for Fire Doors and Fire Windows,* 1999 edition. [Chapter 8] 8.7.1, 8.7.5.1, 8.7.6.2, 8.7.6.3, 8.10.3.4, [Chapter 11] 11.2.1.14 (5), [Chapter 19] 19.3.6.3.1, 19.3.6.3.6.

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C23, *Round Poles and Posts Used in Building Construction — Preservative Treatment by Pressure Processes,* 2000. [Chapter 45] 45.5.11.1(1)

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C28, *Standard for Preservative Treatment of Structural Glued Laminated Members and Lamination Before Gluing of Southern Pine, Coastal Douglas Fir, Hemfir, and Western Hemlock by Pressure Processes,* 1999. [Chapter 45] 45.5.11.1(1)

C31, *Lumber Used Out of Contact with the Ground and Continuously Protected from Liquid Water—Treatment by Pressure Processes,* 2000. [Chapter 45] 45.5.11.1(1)

C33, *Standard for Preservative Treatment of Structural Composite Lumber by Pressure Processes,* 2000. [Chapter 45] 45.5.11.1(1)

M4, *Standard for the Care of Preservative-Treated Wood Products,* 2001. [Chapter 45] 45.5.11.1(1)

P1/P13, *Standard for Creosote Preservative,* 2001. [Chapter 45] 45.5.11.1(2)

P2, *Standard for Creosote Solutions,* 2001. [Chapter 45] 45.5.11.1(2)

P5, *Standard for Waterborne Preservatives,* 2000. [Chapter 45] 45.5.11.1(2)

P8, *Standard for Oil-borne Preservatives,* 2000. [Chapter 45] 45.5.11.1(2)

P9, *Standards for Solvents and Formulations for Organic Preservative Systems,* 2001. [Chapter 45] 45.5.11.1(2)

2.3.16 BHMA Publication. Builders Hardware Manufacturers Association, 355 Lexington Avenue, 17th Floor, New York, NY 10017-6603.

BHMA/ANSI A156.19, *American National Standard for Power Assist and Low Energy Power Operated Doors*, 1997. [Chapter 11] 11.2.1.9.2(6)

2.3.17 CGSB Publications. Canadian General Standards Board, CGSB Sales Centre, Ottawa, Canada K1A 1G6.

37-GP-52M, *Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric,* 1984. [Chapter 38] Table 38.1.3.1

CAN/CGSB-37.54, *Polyvinyl Chloride Roofing and Waterproofing Membrane,* 1995. [Chapter 38] Table 38.1.3.1

37-GP-56M, *Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing,* 1985. [Chapter 38] Table 38.1.3.1

2.3.18 DASMA Publication. Door & Access Systems Manufacturers Association, International, 1300 Summer Avenue, Cleveland, OH 44115-2851.

ANSI/DASMA 107, *Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation,* 1997. [Chapter 48] 48.3.3.4(7)(d)

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ANSI/EIMA 99A, *Exterior Insulation and Finish Systems (EIFS),* 2001. [Chapter 37] 37.5.2, 37.5.4.1, [Chapter 40] 40.4.2

2.3.20 FM Global, FMRC Publications. Factory Mutual Research Corporation, Standards Laboratories Department, 1151 Boston-Providence Turnpike, Norwood, MA 02062.

FM 4411, *Insulated Wall Constructions,* 1974. [Chapter 48] 48.7.6.5.3(4)

FM 4435, *Test Standard for Roof Perimeter Flashing,* 2002. [Chapter 38] 38.4.2.2

FM 4450, *Test Standard for Class I Insulated Steel Deck Roofs,* 1989. [Chapter 38] 38.3.2(1), [Chapter 48] 48.3.2.3(3), 48.3.3.4(5)(b)(i)

FM 4470, *Approval Standard for Class I Roof Covers,* 1986. [Chapter 38] 38.3.2(2), Table 38.4.2.1, 38.5.2.1(1), 38.5.2.2(1)

FM 4471, *Approval Standard for Class 1 Panel Roofs,* 1995. [Chapter 38] Table 38.4.2.1

FM 4473, *Test Standard for Specification Test Protocol for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls,* 2000. [Chapter 38] 38.5.2.1(3), 38.5.2.2(3)

FM 4880, *Approval Standard for Class 1 Insulated Wall or Wall & Roof/Ceiling Panels; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems,* 1994. [Chapter 37] 37.4.4.1(2)(c), [Chapter 48] 48.3.3.2(2), 48.4.4.1(3)

2.3.21 FRSA/NTRMA Publication. Florida Roofing, Sheet Metal and Air Conditioning Contractors Association, 4111 Metric Drive, Winter Park, FL 32792.

07320/1, *Concrete and Clay Roof Tile Installation Manual,* third edition, 1998. [Chapter 38] 38.4.3.1

2.3.22 GA Publications. Gypsum Association, 810 First St., NE, #510, Washington, DC 20062.

GA-216, *Application and Finishing of Gypsum Board,* 2000. [Chapter 47] 47.2.3.1

GA-600, *Fire Resistance Design Manual,* 2000. [Chapter 47] 47.2.1.3.2

2.3.23 HPVA Publication. Hardwood Plywood and Veneer Association, P.O. Box 2789, Reston, VA 20195.

ANSI/HPVA HP-1, *American National Standard for Hardwood and Decorative Plywood,* 2000. [Chapter 45] 45.5.13, 45.5.14.2

2.3.24 IAPMO Publications. International Association of Plumbing and Mechanical Officials, 20001 Walnut Drive South, Walnut, CA 91789.

UMC, *Uniform Mechanical Code,* 2000. [Chapter 32] 32.2.1.5.2, [Chapter 34] 34.1.1 Exception 4, 34.3.2.6.2, 34.2.6.8, 34.3.2.6.9, 34.3.7.3.8.1, [Chapter 50] 50.1(a), [Chapter 54] 54.7.2(C)

UPC, *Uniform Plumbing Code,* 2000. [Chapter 34] 34.3.2.9.3(I), [Chapter 36] 36.8.3.2, [Chapter 38] 38.11.2.3, 38.11.2.4, 38.11.4, [Chapter 53] 53.1(4)

2.3.25 ICC Publications. International Code Council, 5203 Leesburg Pike, Suite 600, Falls Church, VA 22041.

CRHA, *Code Requirements for Housing Accessibility,* 2000. [Chapter 12] 12.20.1

ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities,* 1998. [Chapter 3] 3.3.4, 3.3.33.1, [Chapter 11] 11.2.2.6.1, 11.2.12.3.6, 11.10.1.3, 11.10.8.2, [Chapter 12] 12.1.2, 12.1.3, 12.3.5.2.4, 12.5, 12.7.2.5.2, 12.7.4.8, 12.7.6, 12.7.7, 12.7.8, 12.7.8.2, 12.8.3, 12.7.10.2, 12.12.3, 12.13.1.1, 12.13.2.1, 12.13.3.1, 12.13.3.3.1.1, 12.13.3.3.2, 12.17.4, 12.20.1, 12.23.4, 12.24.3, 12.25, 12.26.1, 12.26.2.1, 12.26.2.2, 12.26.2.4, 12.26.2.5, 12.26.2.6, 12.26.2.7, 12.26.2.7.1.2, 12.26.2.7.1.5, 12.26.2.7.2, 12.27.2.1, 12.27.2.2, 12.27.2.3, 12.27.4.1, 12.27.4.2, 12.28.3 Exception, 12.28.5.1, 12.28.5.2, 12.29.2.1, 12.29.2.2, 12.29.2.3, 12.29.2.4, 12.29.2.5, [Chapter 55] 55.2.3.5

IRC, *International Residential Code*, 2000, as modified by the 2001 and 2002 supplements. [Chapter 35] 35.1.2.3(6)

2.3.26 NAAMM Publication. National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, IL 60603.

ANSI/NAAMM FP 1001, *Guide Specifications for Design of Metal Flagpoles Manual,* 1997. [Chapter 35] 35.9.1.3.2(1)

2.3.27 NCMA Publication. National Concrete Masonry Association, 13750 Sunrise Valley Drive, Herndon, VA 20171.

Design Manual for Segmented Retaining Walls, 2000. [Chapter 36] 36.9.5

2.3.28 NFRC Publications. National Fenestration Rating Council, 1300 Spoons Street, Suite 500, Silver Spring, MD 20910.

NFRC 100, *Procedure for Determining Fenestration Product U-factors*, 1997. [Chapter 51] 51.3.2.5

NFRC 200, *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Nominal Incidence*, 2002. [Chapter 51] 51.3.2.5

2.3.29 NSPI Publications. National Spa and Pool Institute, 211 Eisenhower Avenue, Alexandria, VA 22314.

ANSI/NSPI-1, *Standard for Public Swimming Pools,* 1991. [Chapter 32] 32.8.3.4(1), 32.8.4.2

ANSI/NSPI-2, *Standard for Public Spas,* 1999. [Chapter 32] 32.8.3.4(2)

ANSI/NSPI-3, *Standard for Permanently Installed Residential Spas,* 1999. [Chapter 32] 32.8.3.4(3)

ANSI/NSPI-4, *Standard for Aboveground/Onground Residential Swimming Pools,* 1999. [Chapter 32] 32.8.3.4(4)

ANSI/NSPI-5, *Standard for Residential Inground Swimming Pools,* 1995. [Chapter 32] 32.8.3.4(5)

ANSI/NSPI-6, *Standard for Residential Potable Spas,* 1999. [Chapter 32] 32.8.3.4(6)

ANSI/NSPI-8, *Model Barrier Code for Residential Swimming Pools, Spas, and Hot Tubs,* 1996. [Chapter 32] 32.8.4.1

2.3.30 NWWDA Publications. National Wood Window and Door Association, 1400 E. Touhy Avenue, Des Plaines, IL 60018.

ANSI/NWWDA IS-2, *Industry Standard for Wood Window Units*, 1987. [Chapter 51] Table 51.3.2.6.1

ANSI/NWWDA IS-3, *Industry Standard for Wood Sliding Patio Doors*, 1998. [Chapter 51] Table 51.3.2.6.1

2.3.31 PCA Publication. Portland Cement Association, 5420 Old Orchard Road, Skokie, IL, 60077-1083.

PCA EB118, *Prescriptive Method for Insulating Concrete Forms in Residential Construction*, May 1998. [Chapter 35] 35.1.2.3(1), [Chapter 41] 41.2(1), 41.2(2)

2.3.32 PTI Publication. Post-Tensioning Institute, 1717 W. Northern Ave., Suite 114, Phoenix, AZ 85021-7540.

Design and Construction of Post-Tensioned Slabs-on-Ground, 1996. [Chapter 36] 36.4.1.4

2.3.33 RMI Publication. Rack Manufacturers Institute, 8720 Red Oak Blvd., Suite 201, Charlotte, NC 28217.

Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks, 1997. [Chapter 44] 44.5.1, 44.5.2

2.3.34 SAE Publication. Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J78, *Standard for Steel Self-Drilling Tapping Screws,* 1998. [Chapter 44] 44.8.1.2.2(4)

2.3.35 SBCCI Publication. Southern Building Code Congress International, Inc., 900 Montclair Road, Birmingham, AL 35213-1206.

SSTD-10, *Standard for Hurricane-Resistant Construction,* 1999. [Chapter 35] 35.1.2.3(5)

2.3.36 SJI Publications. Steel Joist Institute, 3127 10th Ave., North Ext., Myrtle Beach, SC 29577-6760.

Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, 1994. [Chapter 35] 35.1.2.8.3(6)

Standard Specifications for Longspan Steel Joists, LH Series and Deep Longspan Steel Joists, DLH Series, 1994. [Chapter 44] 44.3.1(2)

Standard Specification for Joist Girders, 1994. [Chapter 44] 44.3.1(3)

Standard Specifications for Open Web Steel Joists, K Series, 1994. [Chapter 44] 44.3.1(1)

2.3.37 SPC Publication. Southern Pine Council, P.O. Box 641700, Kenner, LA 70064-1700.

Permanent Wood Foundations: Design & Construction Guide, 2000. [Chapter 45] 45.6.8.7, 45.6.9.6.16

2.3.38 SPRI Publications. SPRI, 200 Reservoir Street, Suite 309A, Needham, MA 02494.

ANSI/SPRI ES-1, *Wind Design Guide for Edge Systems Used with Low Slope Roofing Systems,* 1998. [Chapter 38] 38.4.2.2

ANSI/SPRI RP-4, *Wind Design Standard for Ballasted Single-Ply Roofing Systems,* 1997. [Chapter 38] 38.4.3.2

2.3.39 TIA Publication. Telecommunications Industry Association, 2500 Wilson Blvd., Suite 300, Arlington, VA.

ANSI/TIA/EIA-222-F, *Structural Standards for Steel Antenna Towers and Antenna Structures,* 1996. [Chapter 35] 35.9.1.3.2(3)

2.3.40 TPI Publication. Truss Plate Institute, Inc., 583 D'Onofrio Drive, Suite 200, Madison, WI 53719.

ANSI/TPI 1, *National Design Standard for Metal Plate Connected Wood Truss Construction,* 1995. [Chapter 45] 45.5.16.1

2.3.41 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 10C, *Positive Pressure Fire Tests of Door Assemblies*, 2001. [Chapter 8] 8.7.5.2(B)

UL 217, *Standard for Single and Multiple Station Smoke Alarms,* 1997. [Chapter 15] 15.6.2.6.1.2 Exception No. 2

UL 263, *Standard for Fire Tests of Building Construction and Materials,* 1997. [Chapter 8] 8.2.1.2

UL 555, *Standard for Fire Dampers,* 1999. [Chapter 8] 8.8.8.2, 8.11.6.2

UL 555C, *Standard for Ceiling Dampers,* 1996. [Chapter 8] 8.8.8.6

UL 555S, *Standard for Leakage Rated Dampers for Use in Smoke Control Systems,* 1999. [Chapter 8] 8.10.5.2, 8.11.6.2

UL 580, *Standard for Tests for Uplift Resistance of Roof Assemblies,* 1994. [Chapter 38] Table 38.4.2.1

UL 924, *Standard for Emergency Lighting and Power Equipment,* 1995. [Chapter 11] 11.10.7.1

UL 1040, *Standard for Fire Test of Insulated Wall Construction,* 1996. [Chapter 37] 37.4.4.1(2)(b), [Chapter 48] 48.3.3.2(3), 48.4.4.1(2)

UL 1256, *Standard for Safety for Fire Test of Roof Deck Constructions,* 1998. [Chapter 38] 38.3.2(3), [Chapter 48] 48.3.2.3(3), 48.3.3.4(5)(b)(ii)

UL 1286, *Standard for Office Furnishings,* 2001. [Chapter 28] 28.3.7.1(2)

UL 1479, *Standard for Safety for Fire Tests of Through-Penetration Fire Stops,* 1994. [Chapter 8] 8.8.2, 8.8.7.1

UL 1715, *Standard for Safety for Fire Test of Interior Finish Material,* 1997. [Chapter 37] 37.4.4.1(2)(d), [Chapter 48] 48.3.3.2(1), 48.4.4.1(1)

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UL 1820, *Standard for Safety for Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics,* 1997. [Chapter 7] 7.2.3.2.16(1)(b)

UL 1887, *Standard for Safety for Fire Test of Plastic Sprinkler Pipe for Flame and Smoke Characteristics,* 1996. [Chapter 7] 7.2.3.2.16(1)(c)

UL 1897, *Standard for Safety for Uplift Tests for Roof Covering Systems,* 1998. [Chapter 38] Table 38.4.2.1

UL 1975, *Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes,* 1996. [Chapter 27] 27.4.4.11(6), 27.4.4.12(1)

UL 2024, *Standard for Optical Fiber Cable Raceway,* 1995. [Chapter 7] 7.2.3.2.16(1)(d)

UL 2043, *Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces,* 1996. [Chapter 7] 7.2.3.2.16(3)

UL 2079, *Standard for Tests for Fire Resistance of Building Joint Systems,* 1998. [Chapter 8] 8.9.2, 8.9.2.2, 8.12.1.3(2)

UL 2218, *Standard for Impact Resistance of Prepared Roof Covering Materials,* 1998. [Chapter 38] 38.5.2.1(2), 38.5.2.2(2)

CAN/ULC S102.2, *Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies,* 1988. [Chapter 8] 8.16.5

2.3.42 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Federal Specification UUB-790a, *Specification for Building Paper, Vegetable Fiber: Kraft, Waterproofed, Water Repellent, and Fiber Resistant,* 1992. [Chapter 37] 37.3.1.2, [Chapter 47] 47.4.1.3.2

Public Law 100-12, 42 U.S.C. 6295, *National Appliance Energy Conservation Act of 1987.* [Chapter 51] Table 51.3.2.15.1

USDOC PS 1, *U.S. Product Standard for Construction and Industrial Plywood,* 1995. [Chapter 44] 44.8.1.2.2(3), [Chapter 45] 45.5.7.1, 45.5.14.1

USDOC PS 2, *Performance Standard for Wood-based Structural-Use Panels,* 1992. [Chapter 44] 44.8.1.2.2(3), [Chapter 45] 45.5.7.1, 45.5.14.1

USDOC PS 20, *American Softwood Lumber Standard,* 1999. [Chapter 3] 3.3.329, 3.3.362, [Chapter 45] 45.2.4, 45.2.5, 45.5.2, 45.5.2(1), 45.5.3.2

CPSC, 16 CFR 1201, *Safety Standard for Architectural Glazing Materials.* [Chapter 46] 46.5.1(1), 46.5.1(2), 46.5.1.3.2, 46.6.1(3), 46.7.2.1, 46.7.3

CPSC, 16 CFR 1209, *Interim Safety Standard for Cellulose Insulation,* 1979. [Chapter 8] 8.16.6

CPSC, 16 CFR 1404, *Cellulose Insulation,* 1979. [Chapter 8] 8.16.6

40 CFR 18, *Transportation, Manufacture, Distribution, and Storage of Explosive Materials.* [Chapter 34] Table 34.3.3.3

10 CFR 430, *Test Procedure and Certification and Enforcement Requirements for Plumbing Products and Residential Appliances.* [Chapter 51] Table 51.3.2.13, Table 51.3.2.15.1

2.3.43 WRI/CRSI Publication. Wire Reinforcement Institute, 301 E. Sandusky Street, Findlay, OH 45839-0450.

Design of Slab-on-Ground Foundations, 1996. [Chapter 36] 36.4.1.4

Chapter 3 Definitions

3.1 General. The following terms, for the purposes of this *Code*, shall have the meanings given in this chapter, if not otherwise modified by another chapter. Words used in the present tense shall include the future; words used in the masculine gender shall include the feminine and neuter; the singular number shall include the plural, and the plural number shall include the singular. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Webster's Third New International Dictionary of the English Language, Unabridged*, shall be a source for ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

3.2.3* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.5* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.6 Shall. Indicates a mandatory requirement.

3.2.7 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Accessible (Accessibility). A site, building, facility, or portion thereof that complies with this *Code.*

3.3.2 Accessible Area of Refuge. See 3.3.33.1.

3.3.3 Accessible Means of Egress. See 3.3.343.1.

3.3.4 Accessible Route (Accessibility). A continuous unobstructed path that complies with this *Code* and ICC/ANSI A117.1.

3.3.5 Accessory Building. See 3.3.58.1.

3.3.6 Accreditation Body. An approved, third-party organization that is independent of the grading and inspection agencies, and the lumber mills, and that initially accredits and subsequently monitors, on a continuing basis, the competency and performance of a grading or inspection agency related to carrying out specific tasks.

3.3.7 Active Sub-slab Depressurization System. See 3.3.536.3.1.

3.3.8 Actual Start of Construction (Flood Resistance). See 3.3.520.1.

3.3.9 Addition. An increase in building area, aggregate floor area, height, or number of stories of a structure. [**ASCE 7:**9.2.1]

3.3.10 Adjusted Shear Resistance. See 3.3.462.1.

3.3.11 Aerosol. A product that is dispensed from an aerosol container by a propellant.

3.3.12 Aerosol Container. See 3.3.98.1.

3.3.13 Agent. A qualified company or individual assigned to execute the specific tests, inspections, or observations required by the quality assurance program.

3.3.14 Agricultural Building. See 3.3.58.2.

3.3.15 Agricultural Dust. See 3.3.145.1.

3.3.16 Aircraft Engine Test Facility. See 3.3.176.2.

3.3.17 Air-Inflated Structure. See 3.3.530.2.

3.3.18 Air-Right Structure. See 3.3.530.3.

3.3.19 Air-Supported Structure. See 3.3.530.4.

3.3.20* Aisle. An unenclosed path of travel that forms part of the exit access and provides an open and unobstructed path of egress travel to another aisle, a corridor, a vomitory, or an exit.

3.3.21* Aisle Accessway. The initial portion of an exit access that leads to an aisle.

3.3.22 Alarm.

3.3.22.1 ***Single-Station Alarm.*** A detector comprising an assembly that incorporates a sensor, control components, and an alarm notification appliance in one unit operated from a power source either located in the unit or obtained at the point of installation. [**72:**1.4]

3.3.22.2 ***Smoke Alarm.*** A single- or multiple-station alarm responsive to smoke. [**72:**1.4]

3.3.23 Alley. Public space or thoroughfare less than 20 ft (6.1 m) wide, but not less than 10 ft (3 m) wide, that has been deeded or dedicated to the public for permanent public use.

3.3.24 Allowable Stress Design. A method of proportioning structural members such that elastically computed stresses produced in the members by nominal loads do not exceed specified allowable stresses (also called working stress design). **[ASCE 7:**1.2]

3.3.25 Alteration.

3.3.25.1 ***Alter/Alteration.*** A modification, replacement, or other physical change to an existing facility.

3.3.25.2* ***Alteration (Accessibility).*** A change to a building or facility that affects or could affect the accessibility of the building or facility or part thereof.

3.3.26 Alternative Calculation Procedure. A calculation procedure that differs from the procedure originally employed by the design team but that provides predictions for the same variables of interest.

3.3.27 Aluminum Composite Material (ACM). See 3.3.340.1.

3.3.28 Ambulatory Health Care Occupancy. See 3.3.371.6.1.

3.3.29 Analysis.

3.3.29.1 ***Sensitivity Analysis.*** An analysis performed to determine the degree to which a predicted output will vary given a specified change in an input parameter, usually in relation to models.

3.3.29.2 ***Uncertainty Analysis.*** An analysis performed to determine the degree to which a predicted value will vary.

3.3.30 Anchor Building. See 3.3.58.3.

3.3.31 Apartment Building. See 3.3.58.4.

3.3.32 Area.

3.3.32.1 ***Assembly Area (Accessibility).*** A room or space accommodating a group of individuals for recreational, educational, political, social, civic, religious, or amusement purposes, or for the consumption of food and drink.

3.3.32.2 ***Building Area.*** The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building areas if such areas are included within the horizontal projection of the roof or floor above.

3.3.32.3 ***Control Area.*** A building or portion of a building within which hazardous materials are allowed to be stored, dispensed, used, or handled in quantities not exceeding the maximum allowable quantities (MAQ).

3.3.32.4 ***Detention and Correctional Residential Housing Area.*** Sleeping areas and any contiguous day room, group activity space, or other common space for customary access of residents.

3.3.32.5* ***Fabrication Area (Fab Area).*** An area within a semiconductor fabrication facility and related research and development areas in which there are processes using hazardous production materials.

3.3.32.6 ***Fire Area.*** The aggregate gross floor area contained within firewalls, fire barriers, or exterior walls of a building.

3.3.32.7 ***Flood Hazard Area.*** The greater of either (1) the special flood hazard area shown on the flood insurance rate map or (2) the area subject to flooding during the design flood and shown on a jurisdiction's flood hazard map, or otherwise legally designated.

3.3.32.7.1 ***Special Flood Hazard Area.*** The land area subject to flooding by the base flood, and depicted on the flood insurance rate map or other flood hazard map as Zone A, Zone AE, Zone A1-30, Zone A99, Zone AO, Zone AR, Zone AH, Zone V, Zone VE, Zone V1-30, or Zone VO.

3.3.32.8 ***Floor Area.***

3.3.32.8.1* ***Gross Floor Area.*** The floor area within the inside perimeter of the outside walls of the building under consideration with no deduction for hallways, stairs, closets, thickness of interior walls, columns, or other features.

3.3.32.8.2 ***Net Floor Area.*** The floor area within the inside perimeter of the outside walls, or the outside walls and fire walls of the building under consideration with deductions for hallways, stairs, closets, thickness of interior walls, columns, or other features.

3.3.32.9 ***Gross Leasable Area.*** The total floor area designated for tenant occupancy and exclusive use. The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls. All tenant areas, including areas used for storage, shall be included in calculating gross leasable area.

3.3.32.10* ***Hazardous Area.*** An area of a structure or building that poses a degree of hazard greater than that normal to the general occupancy of the building or structure.

3.3.32.11 ***Living Area.*** Any normally occupiable space in a residential occupancy, other than sleeping rooms or rooms that are intended for combination sleeping/living, bathrooms, toilet compartments, kitchens, closets, halls, storage or utility spaces, and similar areas.

3.3.32.12 ***Work Area.***

3.3.32.12.1* ***Employee Work Area (Accessibility).*** All or any portion of a space used only by employees and used only for work.

3.3.32.12.2* ***Rehabilitation Work Area.*** That portion of a building affected by any renovation, modification, or reconstruction work as initially intended by the owner and indicated as such in the permit.

3.3.33* Area of Refuge. An area that is either (1) a story in a building where the building is protected throughout by an approved, supervised automatic sprinkler system and has not less than two accessible rooms or spaces separated from each other by smoke-resisting partitions; or (2) a space located in a path of travel leading to a public way that is protected from the effects of fire, either by means of separation from other spaces in the same building or by virtue of location, thereby permitting a delay in egress travel from any level.

3.3.33.1 ***Accessible Area of Refuge.*** An area of refuge that complies with the accessible route requirements of ICC/ANSI A117.1.

3.3.34 Assembly.

3.3.34.1 ***Door Assembly.*** Any combination of a door, frame, hardware, and other accessories that is placed in an opening in a wall that is intended primarily for access or for human entrance or exit.

3.3.34.1.1 ***Fire Door Assembly.*** Any combination of a fire door, a frame, hardware, and other accessories that together provide a specific degree of fire protection to the opening [**80:**1.4].

3.3.34.1.2 ***Floor Fire Door Assembly.*** A combination of a fire door, a frame, hardware, and other accessories installed in a horizontal plane, which together provide a specific degree of fire protection to a through-opening in a fire-rated floor.

3.3.34.2 ***Fire Window Assembly.*** A window or glass block assembly having a fire rating.

3.3.34.3 ***Roof Assembly.*** The component(s) above the roof structural framing including the roof deck, vapor barrier, insulation, roof cover, coatings, toppings, or any combination thereof.

3.3.35 Assembly Area. See 3.3.32.1.

3.3.36 Assembly Occupancy. See 3.3.371.1.

3.3.37 Atmosphere.

3.3.37.1 ***Common Atmosphere.*** The atmosphere that exists between rooms, spaces, or areas within a building that are not separated by an approved smoke barrier.

3.3.37.2 ***Separate Atmosphere.*** The atmosphere that exists between rooms, spaces, or areas that are separated by an approved smoke barrier.

3.3.38* Atrium. A large-volume space created by a floor opening or a series of floor openings connecting two or more stories that is covered at the top of the series of openings and is used for purposes other than an enclosed stairway; an elevator hoistway; an escalator opening; or as a utility shaft used for plumbing, electrical, air-conditioning, or communications facilities.

3.3.39 Attic/Attic Story. See 3.3.523.1.

3.3.40 Automatic. That which provides a function without the necessity of human intervention.

3.3.41 Automatic-Closing Door. See 3.3.138.1.

3.3.42 Automatic Fire Extinguishing System. See 3.3.536.1.

3.3.43 Balcony (Exterior). An exterior floor projecting from, and supported by, a structure without additional independent supports.

3.3.44* Barricade. The effective screening of a building containing explosive materials from the magazine or another building, a railway, or a highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosive materials to the eaveline of any magazine or other building or to a point 12 ft (3.7 m) above the center of a railway or highway shall pass through such barrier.

3.3.45 Barrier.

3.3.45.1* ***Fire Barrier.*** A continuous membrane or a membrane with discontinuities created by protected openings with a specified fire protection rating, where such membrane is designed and constructed with a specified fire resistance rating to limit the spread of fire, that also restricts the movement of smoke.

3.3.45.2* ***Smoke Barrier.*** A continuous membrane, or a membrane with discontinuities created by protected openings, where such membrane is designed and constructed to restrict the movement of smoke.

3.3.45.3* ***Thermal Barrier.*** A material that limits the average temperature rise of an unexposed surface to not more than 250°F (139°C) for a specified fire exposure complying with the standard time-temperature curve of NFPA 251.

3.3.46 Base Flood. See 3.3.210.1.

3.3.47 Base Flood Elevation (BFE). See 3.3.213.1.

3.3.48 Basement. Story of a building wholly below grade or partly below and partly above grade, located so that the vertical distance from grade to the floor below is greater than the vertical distance from grade to the floor above.

3.3.48.1 ***Basement (Flood Resistance).*** For all matters related to flood-resistant design and construction, the portion of a building having its floor below ground level on all sides.

3.3.49 Basic Wind Speed ***(V).*** Three-second gust speed at 33 ft (10 m) above the ground in Exposure C (see ASCE 7, Section 6.5.6.3) as determined in accordance with ASCE 7, Section 6.5.4. **[ASCE 7:**6.2]

3.3.50 Bay Window. See 3.3.577.1.

3.3.51 Bearing Wall. See 3.3.566.1.

3.3.52* Birth Center. A facility in which low-risk births are expected following normal, uncomplicated pregnancies, and in which professional midwifery care is provided to women during pregnancy, birth, and postpartum.

3.3.53 Bleachers. A grandstand in which the seats are not provided with backrests.

3.3.54 Board and Care. See 3.3.371.12.

3.3.55 Boiler. A closed vessel in which water is heated, steam is generated, or steam is superheated, or in which any combination thereof takes place by the application of heat from combustible fuels, in a self-contained or attached furnace.

3.3.56 Boiler Room. See 3.3.470.1.

3.3.57 Boiling Point. See 3.3.417.1.

3.3.58* Buildings. Structures, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy. [**ASCE 7:**1.2]

3.3.58.1 ***Accessory Building.*** Any building or structure used incidentally to another building or structure.

3.3.58.2 ***Agricultural Building.*** A building located on agricultural property used for sheltering farm implements, hay, grain, livestock, or other farm produce or equipment in which there is no human habitation and that is not used by the public.

3.3.58.3 ***Anchor Building.*** A building housing assembly, business, and mercantile occupancies other than bulk merchandise retail having low or ordinary hazard contents and having direct access to a mall building, but having all required means of egress independent of the mall.

3.3.58.4* ***Apartment Building.*** A building or portion thereof containing three or more dwelling units with independent cooking and bathroom facilities.

3.3.58.5 ***Bulk Merchandising Retail Building.*** A building in which the sales area includes the storage of combustible materials on pallets, in solid piles, or in racks in excess of 12 ft (3.7 m) in storage height.

3.3.58.6 ***Detached Building.*** A separate building that is separated from other structures or uses as required by this *Code* for a freestanding structure.

3.3.58.7* ***Existing Building.*** A building erected or officially authorized prior to the effective date of the adoption of this edition of the *Code* by the agency or jurisdiction.

3.3.58.7.1 ***Existing Building (Flood Resistance).*** For all matters related to flood-resistant design and construction, a building for which the *start of construction* commenced before the effective date of the jurisdiction's first floodplain management ordinance, code, or standard.

3.3.58.8* ***Flexible Plan and Open Plan Educational or Day-Care Building.*** A building or portion of a building designed for multiple teaching stations.

3.3.58.9* ***High-Rise Building.*** A building greater than 75 ft (23 m) in height where the building height is measured from the lowest level of fire department vehicle access to the floor of the highest occupiable story.

3.3.58.10* ***Historic Building.*** A building or facility deemed to have historical, architectural, or cultural significance by a local, regional, or national jurisdiction.

3.3.58.10.1 ***Historic Building (Flood Resistance).*** A building or structure that is (1) listed or preliminarily determined to be eligible for listing in the National Register of Historic Places, or (2) determined by the secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district, or (3) designated as historic under a state or local historic preservation program approved by the U.S. Department of Interior.

3.3.58.11* ***Mall Building.*** A single building enclosing a number of tenants and occupancies wherein two or more tenants have a main entrance into one or more malls. For the purpose of this chapter, anchor buildings shall not be considered as a part of the mall building.

3.3.58.12 ***Private Building.*** Any building or that portion of a building that is normally not frequented by, and not open to, the public.

3.3.58.13 ***Public Building.*** A building or part of a building that is not a private building.

3.3.58.14* ***Special Amusement Building.*** A building that is temporary, permanent, or mobile that contains a device or system that conveys passengers or provides a walkway along, around, or over a course in any direction as a form of amusement arranged so that the egress path is not readily apparent due to visual or audio distractions or an intentionally confounded egress path; or is not readily available due to the mode of conveyance through the building or structure.

3.3.59 Building Area. See 3.3.32.2.

3.3.60 Building Height. See 3.3.271.1.

3.3.61 Bulk Merchandising Retail Building. See 3.3.58.5.

3.3.62 Bulkhead. (1) The exterior walls of a store building that support show windows; (2) a structure above the roof of a building, enclosing elevator machinery, tanks, stairs, or the like, or the part of a shaft extending above the roof; (3) a retaining structure intended to withstand lateral pressure; or (4) a vertical structural wall, usually of stone, timber, metal, concrete, or synthetic material, constructed along, and generally parallel to, the shoreline to retain earth as an extension of the upland, and often to provide suitable water depth at the waterside face.

3.3.63 Business Occupancy. See 3.3.371.2.

3.3.64 Canopy. Any fixed roof-like structure that is self-supporting in whole or in part, but having no sidewalls or curtains other than valances not exceeding 18 in. (457 mm) in depth.

3.3.65 Categories of Work. The nature and extent of construction work undertaken in an existing building.

3.3.66 Cavity Wall. See 3.3.566.2.

3.3.67 Ceiling Radiation Damper. See 3.3.110.1.

3.3.68 Ceiling Limit. See 3.3.307.1.

3.3.69 Cellular or Foamed Plastic. See 3.3.412.1.

3.3.70 Change of Use. See 3.3.560.2.

3.3.71 Children's Use (Accessibility). See 3.3.560.3.

3.3.72 Chimney. One or more passageways, vertical or nearly so, for conveying flue gases to the outside atmosphere.

3.3.73 Circulation Path (Accessibility). An exterior or interior way of passage from one place to another for pedestrians including, but not limited to, walks, hallways, courtyards, stairways, and stair landings.

3.3.74 Cleanroom. A room in which the concentration of airborne particles is controlled to specified limits, including areas below the raised floor and above the ceiling grid if these areas are part of the air path and within the rated construction.

3.3.75 Closed System (Use). See 3.3.560.1.1.

3.3.76 Coal Preparation Plant. See 3.3.410.1.

3.3.77 Combination Fire/Smoke Damper. See 3.3.110.2.

3.3.78 Combustible Dusts. See 3.3.145.2.

3.3.79 Combustible Fiber. Any material in a fibrous or shredded form that will readily ignite when heat sources are present.

3.3.80 Combustible Liquids. See 3.3.313.1.

3.3.81 Combustible (Material). See 3.3.340.2.

3.3.82 Combustion. A chemical process that involves oxidation sufficient to produce light or heat.

3.3.83 Common Atmosphere. See 3.3.37.1.

3.3.84* Common Path of Travel. The portion of exit access that must be traversed before two separate and distinct paths of travel to two exits are available.

3.3.85 Common Use (Accessibility). See 3.3.560.4.

3.3.86 Compartment.

3.3.86.1* *Fire Compartment.* A space within a building that is enclosed by fire barriers on all sides, including the top and bottom.

3.3.86.2* *Smoke Compartment.* A space within a building enclosed by smoke barriers on all sides, including the top and bottom.

3.3.87 Complex Rehabilitation Project Involving Multiple Codes. A rehabilitation project or portion thereof that involves two or more construction codes and either (1) is an addition, a change of occupancy, or a reconstruction; or (2) is in any category of work and involves the installation of sprinklers.

3.3.88 Component. A part or element of an architectural, electrical, mechanical, or structural system. **[ASCE 7:**9.2.1]

3.3.89 Components and Cladding. Elements of the building envelope that do not qualify as part of the main wind-force resisting system. [**ASCE 7:**6.2]

3.3.90 Composite Wood Structural Panel. See 3.3.389.3.1.

3.3.91 Compressed Gas. See 3.3.235.1.

3.3.92 Compressed Gas Container. See 3.3.98.2.

3.3.93 Concrete.

3.3.93.1 *Plain Concrete.* Concrete that either is unreinforced or contains less reinforcement than the minimum amount specified in ACI 318 for reinforced concrete. [**ASCE 7:**9.2.1].

3.3.93.2 *Reinforced Concrete.* Concrete reinforced with no less than the minimum amount required by ACI 318, prestressed or nonprestressed, and designed on the assumption that the two materials act together in resisting forces. [**ASCE 7:**9.2.1]

3.3.94 Construction. Work or operations necessary or incidental to land clearing, grading, excavation, and filling; or erection, demolition, assembling, installing, or equipping of buildings or structures; or alterations incidental thereto, or to the finished product of construction operations.

3.3.95 Construction Design.

3.3.95.1 *Construction Documents (Structural Design).* The written, graphic, electronic, and pictorial documents describing the design, locations, and physical characteristics of the project required to verify compliance with ASCE 7 and this *Code*. **[ASCE 7:**9.2.1]

3.3.95.2 *Construction Documents (Quality Assurance).* The plans, specifications, approved shop drawings, and all other documents that describe the design of a construction project for which a building permit has been issued by the authority having jurisdiction.

3.3.96 Construction Type. The combination of materials used in the construction of a building or structure, based on the varying degrees of fire resistance and combustibility.

3.3.97 Consumer Fireworks, 1.4G. See 3.3.200.1.

3.3.98 Container.

3.3.98.1 *Aerosol Container.* A metal can, up to a maximum size of 33.8 fl ounces (1000 mL), or a glass or plastic bottle, up to a maximum size of 4 fl ounces (118 mL), that is designed to dispense an aerosol.

3.3.98.2 *Compressed Gas Container.* A pressure vessel designed to hold compressed gases at pressures greater than 1 atmosphere at 68°F (20°C) that includes cylinders, containers, and tanks.

3.3.99 Contents and Furnishings. Objects, goods, or products placed inside a structure for functional, operational, or decorative reasons, excluding parts of the building structure, building service equipment, and items meeting the definition of interior finish.

3.3.100 Continuous Gas-Detection System. See 3.3.536.2.

3.3.101 Contractor. One who contracts on predetermined terms to provide labor and materials and who is responsible for performance of a construction job in accordance with construction documents.

3.3.102 Control Area. See 3.3.32.3.

3.3.103 Corrosion Resistance. See 3.3.462.2.

3.3.104 Corrosive Material. See 3.3.340.3.

3.3.105 Court. An open, uncovered, unoccupied space, unobstructed to the sky, bounded on three or more sides by exterior building walls.

3.3.105.1 *Enclosed Court.* A court bounded on all sides by the exterior walls of a building or by the exterior walls and lot lines on which walls are permitted.

3.3.105.2 *Food Court.* A public seating area located in a mall that serves adjacent food preparation tenant spaces.

3.3.106* Critical Radiant Flux. The level of incident radiant heat energy on a floor-covering system at the most distant flameout point.

3.3.107 Cross Slope (Accessibility). The slope that is perpendicular to the direction of travel.

3.3.108 Cryogenic Fluid. A refrigerated gas having a boiling point below –130°F (–90°C) at atmospheric pressure.

3.3.109 Dalle Glass. See 3.3.239.1.

3.3.110 Damper.

3.3.110.1 ***Ceiling Radiation Damper.*** A listed device installed in a ceiling membrane of a fire resistance–rated floor-ceiling or roof-ceiling assembly to automatically limit the radiative heat transfer through an air inlet/outlet opening.

3.3.110.2 ***Combination Fire/Smoke Damper.*** A device that meets both the fire damper and smoke damper requirements.

3.3.110.3* ***Fire Damper.*** A device, installed in an air-distribution system, that is designed to close automatically upon detection of heat to interrupt migratory airflow and to restrict the passage of flame.

3.3.110.4 ***Smoke Damper.*** A device within an air-distribution system to control the movement of smoke.

3.3.111 Dangerous. That situation where the stresses in any member, the condition of the building or any of its components or elements or attachments, or other condition results in an overload exceeding 150 percent of the stress allowed for the member or material.

3.3.112 Dash-bond Coat (of plaster). A thick, wet mixture of aggregate and portland cement mixed in proportions of two parts aggregate to one part portland or plastic cement, dashed onto a monolithic surface to improve the mechanical key for subsequent plaster coats.

3.3.113 Data Conversion. The process of developing the input data set for the assessment method of choice.

3.3.114 Day-Care Home. See 3.3.280.1.

3.3.115 Day-Care Occupancy. See 3.3.371.3.

3.3.116 Dead Load. See 3.3.317.1.

3.3.117 Deck. An exterior floor supported on at least two opposing sides by an adjacent structure and/or posts, piers, or other independent supports.

3.3.118 Decorative Glass. See 3.3.239.2.

3.3.119 Deflagration. Propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium.

3.3.120 Demolition. Dismantling or razing of all or part of a building and all operations incidental thereto.

3.3.121 Depressurization System. See 3.3.536.3.

3.3.122 Design Earthquake. The earthquake effects that are two-thirds of the corresponding maximum considered earthquake. [**ASCE 7:**9.2.1]

3.3.123 Design Fire Scenario. See 3.3.194.1.

3.3.124 Design Flood. See 3.3.210.2.

3.3.125 Design Flood Elevation (DFE). See 3.3.213.2.

3.3.126 Design Pressure ***(p).*** Equivalent static pressure to be used in the determination of wind loads for buildings. [**ASCE 7:**6.2]

3.3.127 Design Specification. See 3.3.513.1.

3.3.128 Design Strength. The product of the nominal strength and a resistance factor, Φ. [**ASCE 7:**1.2]

3.3.129 Design Team. A group of stakeholders including, but not limited to, representatives of the architect, client, and any pertinent engineers and other designers.

3.3.130 Detached Building. See 3.3.58.6.

3.3.131 Detention and Correctional Occupancy. See 3.3.371.4.

3.3.132 Detention and Correctional Residential Housing Area. See 3.3.32.4.

3.3.133 Detonation (Detonatable). Propagation of a combustion zone at a velocity that is greater than the speed of sound in the unreacted medium.

3.3.134* Development. Any man-made changes to improved or unimproved real estate.

3.3.134.1 ***Development (Flood Resistance).*** Any man-made changes to improved or unimproved real estate including, but not limited to, buildings or other structures, temporary or permanent storage of materials, mining, dredging, filling, grading, paving, excavation, drilling, or other land-disturbing activities.

3.3.135 Device.

3.3.135.1 ***Multiple Station Alarm Device.*** Two or more single-station alarm devices that can be interconnected so that actuation of one causes all integral audible alarms to operate; or one single-station alarm device having connections to other detectors or to a manual fire alarm box. [**72:**1.4]

3.3.135.2* ***Special Industrial Explosive Device (SIED).*** An explosive power pack containing an explosive charge in the form of a cartridge or construction device.

3.3.136 Dispensing. The pouring or transferring of a material from a container, tank, or similar vessel whereby vapors, dusts, fumes, mists, or gases could be liberated to the atmosphere.

3.3.137 Display Fireworks, 1.3G. See 3.3.200.2.

3.3.138 Door.

3.3.138.1 ***Automatic-Closing Door.*** Doors that normally are open but that close when the automatic-closing device is activated.

3.3.138.2 ***Elevator Lobby Door.*** A door between an elevator lobby and another building space other than the elevator shaft.

3.3.138.3 ***Fire Door.*** The door component of a fire door assembly [**80:**1.4].

3.3.139 Door Assembly. See 3.3.34.1.

3.3.140* Dormitory. A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities.

3.3.141 Draft Stop. A continuous membrane used to subdivide a concealed space to resist the passage of smoke and heat.

3.3.142 Drycleaning Plant. See 3.3.410.2.

3.3.143 Dry Floodproofing. A combination of design modifications that results in a building or structure, including the attendant utility and sanitary facilities, being watertight, with walls substantially impermeable to the passage of water, and with structural components having the capacity to resist loads and load combinations associated with the design flood.

3.3.144 Dumbwaiter. See ANSI/ASME A17.1.

3.3.145 Dust.

3.3.145.1 ***Agricultural Dust.*** Any finely divided solid agricultural material 420 microns or smaller in diameter (material passing a U.S. No. 40 standard sieve) that presents a fire or explosion hazard when dispersed and ignited in air. [**61:**1.4]

3.3.145.2 ***Combustible Dust.*** Any finely divided solid material that is 420 microns or smaller in diameter (material passing through a U.S. No. 40 Standard sieve) that presents a fire or deflagration hazard.

3.3.146 Dwelling Unit. One or more rooms arranged for the use of one or more individuals living together, providing complete, independent living facilities, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

3.3.146.1 ***One- and Two-Family Dwelling Unit.*** A building that contains not more than two dwelling units with independent cooking and bathroom facilities.

3.3.146.2 ***One-Family Dwelling Unit.*** A building that consists solely of one dwelling unit with independent cooking and bathroom facilities.

3.3.146.3 ***Two-Family Dwelling Unit.*** A building that consists solely of two dwelling units with independent cooking and bathroom facilities.

3.3.147 Educational Occupancy. See 3.3.371.5.

3.3.148* Electroluminescent. Refers to a light-emitting capacitor in which alternating current excites phosphor atoms placed between electrically conductive surfaces and produces light.

3.3.149 Element.

3.3.149.1 ***Element (Accessibility).*** An architectural or mechanical component of a building, facility, space, or site.

3.3.149.2 ***Load-Bearing Element.*** Any column, girder, beam, joist, truss, rafter, wall, floor, or roof sheathing that supports any vertical load in addition to its own weight, or any lateral load.

3.3.149.3 ***Structural Element.*** The columns and girders, beams, trusses, joists, braced frames, moment-resistant frames, and vertical and lateral resisting elements, and other framing members that are designed to carry any portion of the dead or live load and lateral forces, that are essential to the stability of the building or structure.

3.3.150 Elevator. See Chapter 54.

3.3.151 Elevator Evacuation System. See 3.3.536.4.

3.3.152 Elevator Lobby. See 3.3.321.1.

3.3.153 Elevator Lobby Door. See 3.3.138.2.

3.3.154 Emergency Alarm System. See 3.3.536.5.

3.3.155 Employee Work Area (Accessibility). See 3.3.32.12.1.

3.3.156 Enclosed Court. See 3.3.105.1.

3.3.157 Enclosure.

3.3.157.1* ***Exhausted Enclosure.*** An appliance or piece of equipment that consists of a top, a back, and two sides providing a means of local exhaust for capturing gases, fumes, vapors, and mists.

3.3.157.2* ***Smokeproof Enclosure.*** A stair enclosure designed to limit the movement of products of combustion produced by a fire.

3.3.158 Entrance.

3.3.158.1 ***Public Entrance (Accessibility).*** An entrance that is not a service entrance or a restricted entrance.

3.3.158.2 ***Restricted Entrance (Accessibility).*** An entrance that is made available for common use on a controlled basis, but not public use, and that is not a service entrance.

3.3.158.3 ***Service Entrance (Accessibility).*** An entrance intended primarily for delivery of goods or services. *(See also 3.3.158.1 and 3.3.158.2.)*

3.3.159* Equipment or Fixture. Any plumbing, heating, electrical, ventilating, air-conditioning, refrigerating, and fire protection equipment, and elevators, dumb waiters, escalators, boilers, pressure vessels, and other mechanical facilities or installations that are related to building services.

3.3.160 Escalator. See Chapter 54.

3.3.161 Essential Facility. See 3.3.176.3.

3.3.162 Exhausted Enclosure. See 3.3.157.1.

3.3.163 Exhibit. A space or portable structure used for the display of products or services.

3.3.164* Existing. That which is already in existence on the date this edition of the *Code* goes into effect.

3.3.165 Existing Building. See 3.3.58.7.

3.3.166 Existing Building (Flood Resistance). See 3.3.58.7.1.

3.3.167* Exit. That portion of a means of egress that is separated from all other spaces of a building or structure by construction or equipment as required to provide a protected way of travel to the exit discharge.

3.3.167.1* ***Horizontal Exit.*** A way of passage from one building to an area of refuge in another building on approximately the same level, or a way of passage through or around a fire barrier to an area of refuge on approximately the same level in the same building that affords safety from fire and smoke originating from the area of incidence and areas communicating therewith.

3.3.168 Exit Access. That portion of a means of egress that leads to an exit.

3.3.169 Exit Discharge. That portion of a means of egress between the termination of an exit and a public way.

3.3.169.1 ***Level of Exit Discharge.*** (1) The lowest story from which not less than 50 percent of the required number of exits and not less than 50 percent of the required egress capacity from such a story discharge directly outside at grade; (2) the story with the smallest elevation change

needed to reach grade where no story has 50 percent or more of the required number of exits and 50 percent or more of the required egress capacity from such a story discharge directly outside at grade.

3.3.169.1.1 ***Primary Level of Exit Discharge.*** The lowest story whose floor is level with or above finished ground level on the exterior wall line for 50 percent or more of its perimeter.

3.3.170 Explosive Material. See 3.3.340.4.

3.3.171* Exposure Fire. A fire that starts at a location that is remote from the area being protected and grows to expose that which is being protected.

3.3.172 Exterior Surface. See 3.3.534.1.

3.3.173 Externally Illuminated. See 3.3.287.1.

3.3.174 Fabricator. The entity performing off-site manufacture or assembly, or both, of construction components or systems.

3.3.175 Fabrication Area (Fab Area). See 3.3.32.5.

3.3.176 Facility.

3.3.176.1 ***Facility (Accessibility).*** All or any portion of buildings, structures, site improvements, elements, and pedestrian or vehicular routes located on a site.

3.3.176.2 ***Aircraft Engine Test Facility.*** An integrated system of building(s), structure(s), space, and services used to test aircraft engines contained within a test cell or on a test stand. [**423:**1.3]

3.3.176.3 ***Essential Facilities.*** Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from wind, snow, or earthquakes. **[ASCE 7:**1.2]

3.3.176.4 ***Functionally Dependent Facility (Flood Resistance).*** For all matters related to flood-resistant design and construction, any facility that cannot be used for its intended purpose unless it is located or carried out in close proximity to water. *Functionally Dependent Facility* shall include docking or port facilities necessary for the loading or unloading of cargo or passengers, shipbuilding, or ship repair, but shall not include long-term storage, manufacture, sales, or service facilities.

3.3.176.5 ***Health Care Facilities.*** Buildings or portions of buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. Health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers. [**99:**2.2]

3.3.176.6 ***Hypobaric Facility.*** A facility that is designed to provide an oxygen-enriched atmosphere in which the concentration of oxygen exceeds 23.5 percent by volume, and a pressure less than 760 mm Hg.

3.3.176.7* ***Limited Care Facility.*** A building or portion of a building used on a 24-hour basis for the housing of four or more persons who are incapable of self-preservation because of age; physical limitations due to accident or illness; or limitations such as mental retardation/developmental disability, mental illness, or chemical dependency.

3.3.176.8 ***Self-Service Storage Facility (Accessibility).*** Real property designed and used for the purpose of renting or leasing individual storage spaces to customers for the purpose of storing and removing personal property on a self-service basis.

3.3.176.9 ***Temporary Facilities.*** Buildings or other structures that are to be in service for a limited time and have a limited exposure period for environmental loadings. **[ASCE 7:**1.2]

3.3.177 Facility (Accessibility). See 3.3.176.1.

3.3.178 Factored Load. See 3.3.317.2.

3.3.179 Fence. A freestanding wall, balustrade, or railing having a height of not less than 3 ft (1 m), erected to divide property, to serve as a barrier or guard, or for decoration.

3.3.180 Festival Seating. See 3.3.474.1.

3.3.181* Fiberboard. A fibrous, homogeneous panel made from lignocellulosic fibers and having a density of less than 31 lb/ft^3 (497 kg/m^3) but more than 10 lb/ft^3 (160 kg/m^3).

3.3.182 Fire Area. See 3.3.32.6.

3.3.183 Fire Barrier. See 3.3.45.1.

3.3.184 Fire Barrier Wall. See 3.3.566.5.

3.3.185 Fire Compartment. See 3.3.86.1.

3.3.186 Fire Damper. See 3.3.110.3.

3.3.187 Fire Door. See 3.3.138.3.

3.3.188 Fire Door Assembly. See 3.3.34.1.1.

3.3.189 Fire Exit Hardware. A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel and provides fire protection where used as part of a fire door assembly.

3.3.190* Fire Model. A structured approach to predicting one or more effects of a fire.

3.3.191 Fire Protection Rating. See 3.3.444.1.

3.3.192 Fire Resistance Rating. See 3.3.444.2.

3.3.193 Fire Retardant–Treated Wood. See 3.3.578.1.

3.3.194* Fire Scenario. A set of conditions that defines the development of fire, the spread of combustion products throughout a building or portion of a building, the reactions of people to fire, and the effects of combustion products.

3.3.194.1 ***Design Fire Scenario.*** A fire scenario used for evaluation of a proposed design.

3.3.195 Fire Wall. See 3.3.566.4.

3.3.196 Fire Window. See 3.3.577.2.

3.3.197 Fire Window Assembly. See 3.3.34.2.

3.3.198 Fireblock. A material, barrier, or construction installed in concealed spaces to prevent the extension of fire for an unspecified period of time.

3.3.199 Firestop. A specific system, device, or construction consisting of the materials that fill the openings around penetrating items such as cables, cable trays, conduits, ducts, pipes, and their means of support through the wall or floor openings to prevent the spread of fire.

3.3.200* Fireworks. Any composition or device for the purpose of producing a visible or an audible effect by combustion, deflagration, or detonation, and that meets the definition of Consumer Fireworks, 1.4G, or Display Fireworks, 1.3G, as set forth in this *Code*. Exception No. 1: Toy caps for use in toy pistols, toy canes, toy guns, and novelties and trick noisemakers shall not be

considered as fireworks. *(See Appendix C of NFPA 1124.)* Exception No. 2: Model rockets and model rocket motors designed, sold, and used for the purpose of propelling recoverable aero models shall not be considered as fireworks. [**1124:**1.4]

3.3.200.1* ***Consumer Fireworks, 1.4G.*** *(Formerly known as Class C, Common Fireworks.)* Any small fireworks device designed primarily to produce visible effects by combustion that complies with the construction, chemical composition, and labeling regulations of the U.S. Consumer Product Safety Commission, as set forth in Title 16, CFR, Parts 1500 and 1507. Some small devices designed to produce audible effects are included, such as whistling devices, ground devices containing 0.8 gr (50 mg) or less of explosive composition (salute powder), and aerial devices containing 2 gr (130 mg) or less of explosive composition (salute powder) per explosive unit.

3.3.200.2* ***Display Fireworks, 1.3G.*** *(Formerly known as Class B, Special Fireworks.)* Large fireworks articles designed to produce visible or audible effects for entertainment purposes by combustion, deflagration, or detonation. This term includes, but is not limited to, salutes containing more than 2 gr (130 mg) of explosive composition (salute powder), aerial shells containing more than 60 g (2.1 oz) of total pyrotechnic and explosive composition, and other display pieces that exceed the limits for classification as consumer fireworks, 1.4G.

3.3.201* Flame Spread. The propagation of flame over a surface.

3.3.202 Flammable Gas. See 3.3.235.2.

3.3.203 Flammable Gas — Liquefied. See 3.3.235.2.1.

3.3.204 Flammable Liquid. See 3.3.313.2.

3.3.205* Flammable Solid. A solid substance, other than one defined as a blasting agent or explosive, that is liable to cause fire through friction or as a result of retained heat from manufacture, that has an ignition temperature below 212°F (100°C), or that burns so vigorously or persistently when ignited that it creates a serious hazard.

3.3.206 Flammable Vapors. A concentration of constituents in air that exceeds 25 percent of its lower flammable limit (LFL).

3.3.207 Flash Point. See 3.3.417.2.

3.3.208* Flashover. A stage in the development of a contained fire in which all exposed surfaces reach ignition temperatures more or less simultaneously and fire spreads rapidly throughout the space.

3.3.209 Flexible Plan and Open Plan Educational or Day-Care Building. See 3.3.58.8.

3.3.210 Flood. A general and temporary condition of partial or complete inundation of normally dry land by either (1) the overflow of inland or tidal waters, or (2) the rapid accumulation of surface waters from any source.

3.3.210.1 ***Base Flood.*** The flood having a 1 percent chance of being equaled or exceeded in any given year.

3.3.210.2 ***Design Flood.*** The greater of either (1) the base flood or (2) the flood so designated by the jurisdiction as its regulatory flood, with a 1 percent chance, or less, of being equaled or exceeded in any given year.

3.3.211 Flood Boundary Floodway Map (FBFM). See 3.3.335.1.

3.3.212 Flood Damage–Resistant Material. See 3.3.340.5.

3.3.213 Flood Elevation.

3.3.213.1 ***Base Flood Elevation (BFE).*** The elevation of the base flood, including wave height, relative to the datum specified on a jurisdiction's flood hazard map.

3.3.213.2 ***Design Flood Elevation (DFE).*** The elevation of the design flood, including wave height, relative to the datum specified on a jurisdiction's flood hazard map.

3.3.214 Flood Boundary and Floodway Map (FBFM). See 3.3.335.1.

3.3.215 Flood Hazard Area. See 3.3.32.7.

3.3.216 Flood Hazard Boundary Map (FHBM). See 3.3.335.2.

3.3.217 Flood Hazard Map. See 3.3.335.3.

3.3.218 Flood Insurance Rate Map (FIRM). See 3.3.335.4.

3.3.219 Flood Insurance Study. An official report provided to a jurisdiction by the Federal Emergency Management Agency, which accompanies the flood insurance rate map and flood boundary and floodway map, and provides the water surface elevation of the base flood, along with supporting technical data.

3.3.220 Floodway *(Also known as Regulatory Floodway).* The channel of a river, creek, or other watercourse, and the adjacent land area, that must be reserved in order to pass the base flood discharge without cumulatively raising the water surface elevation more than a designated height.

3.3.221 Floor.

3.3.221.1 ***Lowest Floor (Flood Resistance).*** For all matters related to flood-resistant design and construction, the floor of the lowest enclosed area of a building or structure. An unfinished or flood-resistant enclosure used solely for vehicle parking, building access, or limited storage shall not be considered the lowest floor, provided the enclosed area is not constructed so as to render the building or structure in violation of the flood-related provisions of Chapter 39.

3.3.221.2* ***Street Floor.*** A story or floor level accessible from the street or from outside a building at ground level, with the floor level at the main entrance located not more than three risers above or below ground level and arranged and utilized to qualify as the main floor.

3.3.222 Floor Area. See 3.3.32.8.

3.3.223 Floor Fire Door Assembly. See 3.3.34.1.2.

3.3.224 Foam Plastic Insulation. A cellular plastic, used for thermal insulating or acoustical applications, having a density of 20 lb/ft^3 (320 kg/m^3) or less, containing open or closed cells, and formed by a foaming agent.

3.3.225 Folding and Telescopic Seating. See 3.3.474.2.

3.3.226 Food Court. See 3.3.105.2.

3.3.227 Footing. Part of the foundation of a structure that spreads and transmits the load direct to the soil or to piles.

3.3.228 Foundation Wall. See 3.3.566.6.

3.3.229 Foyer. Area or space within a building, located between the main entrance and the occupied areas of a building, or, when used in connection with a theater, the area between the lobby and the main floor.

3.3.230 Fuel Gas. See 3.3.235.3.

3.3.231 Fuel Load. See 3.3.317.3.

3.3.232 Functionally Dependent Facility (Flood Resistance). See 3.3.176.4.

3.3.233 Gallery. That part of the seating area of a theater or assembly room located above a balcony and having a seating capacity of more than 10.

3.3.234 Garage. A building or portion of a building in which one or more self-propelled vehicles carrying volatile flammable liquid for fuel or power are kept for use, sale, storage, rental, repair, exhibition, or demonstrating purposes, and all that portion of a building that is on or below the floor or floors in which such vehicles are kept and that is not separated therefrom by suitable cutoffs.

3.3.234.1 ***Parking Garage.*** Garage used solely for parking motor vehicles.

3.3.234.2 ***Private Garage.*** A building or part thereof not over 1000 ft^2 (93 m^2) in area, in which only motor vehicles used by the owner or tenants of the building are stored or kept.

3.3.234.3 ***Repair Garage.*** A building, structure, or portions thereof wherein major repair or painting or body and fender work is performed on motorized vehicles or automobiles, and includes associated floor space used for offices, parking, and showrooms.

3.3.235 Gas.

3.3.235.1* ***Compressed Gas.*** A material, or mixture of materials, that (1) is a gas at 68°F (20°C) or less at 14.7 psia (101.3 kPa) of pressure, and (2) has a boiling point of 68°F (20°C) or less at 14.7 psia (101.3 kPa) that is either liquefied, nonliquefied, or in solution, except those gases that have no other health or physical hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (282.5 kPa) at 68° (20°C).

3.3.235.2 ***Flammable Gas.*** A material that is a gas at 68°F (20°C) or less at 14.7 psia (101.3 kPa) of pressure that (1) is ignitable at 14.7 psia (101.3 kPa) when a mixture of 13 percent or less by volume with air, or (2) has a flammable range at 14.7 psia (101.3 kPa) with air of at least 12 percent, regardless of lower limit. The limits shall be determined at 14.7 psia (101.3 kPa) of pressure and a temperature of 68°F (20°C) in accordance with nationally recognized standards.

3.3.235.2.1 ***Flammable Gas — Liquefied.*** A liquefied compressed gas that under the charged pressure is partially liquid at a temperature of 68°F (20°C) and that is flammable.

3.3.235.3 ***Fuel Gas.*** Natural gas, manufactured gas, liquefied petroleum gas (LP-Gas) in the vapor phase only, liquefied petroleum gas-air mixtures, and mixtures of these gases, plus gas-air mixtures within the flammable range, with the fuel gas or the flammable component of a mixture being a commercially distributed product.

3.3.235.4 ***Liquefied Petroleum Gas.*** Any material having a vapor pressure not exceeding that allowed for commercial propane composed predominantly of the following hydrocarbons, either by themselves or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylenes.

3.3.235.5 ***Oxidizing Gas.*** A gas that can support and accelerate combustion of other materials.

3.3.236* Gas Cabinet. A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use.

3.3.237 Gas Room. See 3.3.470.2.

3.3.238 General Industrial Occupancy. See 3.3.371.7.1.

3.3.239 Glass.

3.3.239.1 ***Dalle Glass.*** A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

3.3.239.2 ***Decorative Glass.*** A carved, leaded, or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture, or other design qualities or components cannot be removed without destroying the glazing material; and whose surface, or assembly into which it is incorporated, is divided into segments.

3.3.240 Glass Fiber Reinforced Plastic. See 3.3.412.2.

3.3.241 Glazing. Glass or transparent or translucent plastic sheet used in windows, doors, skylights, or curtain walls. [**ASCE 7:**6.2]

3.3.241.1 ***Plastic Glazing.*** Plastic panels or lenses that are glazed or set in a frame or sash and that are not mechanically fastened to a structural member of the structure.

3.3.241.2 ***Sloped Glazing.*** Any installation of glass or other transparent, translucent, or opaque glazing material installed at a slope of 15 degrees or more from the vertical plane, including glazing materials in skylights, roofs, and sloped walls.

3.3.242 Goal. A nonspecific overall outcome to be achieved that is measured on a qualitative basis.

3.3.243 Grade (Ground Level). A reference plane representing the average of finished ground level adjoining the building at all exterior walls. When the finished ground level slopes down from the exterior walls, the reference plane is established by the lowest points within the area between the building and the lot line or, when the lot line is more than 6 ft (1.8 m) from the building, between the building and a point 6 ft (1.8 m) from the building.

3.3.243.1* ***Grade (Ground Level, Flood Resistance).*** For all matters related to flood-resistant design and construction, the elevation of the natural or graded ground surface, or fill, adjacent to the walls of a building or structure.

3.3.244* Grandstand. A structure that provides tiered or stepped seating.

3.3.245 Gridiron. The structural framing over a stage supporting equipment for hanging or flying scenery and other stage effects.

3.3.246 Gross Floor Area. See 3.3.32.8.1.

3.3.247 Gross Leasable Area. See 3.3.32.9.

3.3.248 Guard. A vertical protective barrier erected along exposed edges of stairways, balconies, and similar areas.

3.3.249 Guest. Person hiring or occupying a room for living or sleeping, not included in a family.

3.3.250 Guest Room. See 3.3.470.3.

3.3.251 Guest Suite. An accommodation with two or more contiguous rooms comprising a compartment, with or without doors between such rooms, that provides living, sleeping, sanitary, and storage facilities.

3.3.252 Gypsum Base for Veneer Plaster. A gypsum board used as the base for application of a gypsum veneer plaster.

3.3.253 Gypsum Board. The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing.

3.3.254 Gypsum Lath. A gypsum board used as the base for application of gypsum plaster.

3.3.255 Gypsum Panel Products. The general name for a family of sheet products consisting essentially of gypsum.

3.3.256 Gypsum Plaster. See 3.3.411.1.

3.3.257 Gypsum Veneer Plaster. See 3.3.411.2.

3.3.258 Gypsum Wallboard. A gypsum board used primarily as an interior surfacing for building structures.

3.3.259 Habitable Room. See 3.3.470.4.

3.3.260 Handling. The deliberate movement of material by any means to a point of storage or use.

3.3.261 Handrail. A bar, pipe, or similar member designed to furnish persons with a handhold.

3.3.262 Hardboard. A fibrous-felted, homogeneous panel made from lignocellulosic fibers consolidated under heat and pressure in a hot press to a density not less than 31 lb/ft^3 (497 kg/m^3).

3.3.263 Hazardous Area. See 3.3.32.10.

3.3.264 Hazardous Material. See 3.3.340.6.

3.3.265 Hazardous Production Material (HPM). See 3.3.340.7.

3.3.266 Hazardous Production Material (HPM) Room. See 3.3.470.5.

3.3.267 Health Care Facilities. See 3.3.176.5.

3.3.268 Health Care Occupancy. See 3.3.371.6.

3.3.269 Health Hazard Material. See 3.3.340.8.

3.3.270* Heat Release Rate (HRR). The rate at which heat energy is generated by burning.

3.3.271 Height.

3.3.271.1 ***Building Height.*** The vertical distance from the grade to the average elevation of the highest roof surface.

3.3.271.2 ***Story Height.*** The vertical distance from the upper surface of a floor and upper surface of the floor or roof next above.

3.3.271.3 ***Wall Height.*** The vertical distance to the top of the wall measured from the foundation wall or from a girder or other immediate support of such wall.

3.3.272* Heliport. An identifiable area located on land, on water, or on a structure, that also includes any existing buildings or facilities thereon, used or intended to be used for landing and takeoff of helicopters.

3.3.273 Helistop. A heliport where no refueling, maintenance, repair, or storage of helicopters is permitted.

3.3.274 High Explosive Material. See 3.3.340.4.1.

3.3.275 High Velocity Wave Action (Flood Resistance). Condition present during the base flood where wave heights are greater than or equal to 3 ft (0.9 m) or where wave run-up elevations exceed 3 ft (0.9 m) above grade. Areas subject to high velocity wave action are designated on the flood insurance rate map or flood hazard map as Zone V, Zone VE, Zone VO, or Zone V1-30.

3.3.276 Highly Toxic Material. See 3.3.340.18.1.

3.3.277 High-Rise Building. See 3.3.58.9.

3.3.278 Historic Building. See 3.3.58.10.

3.3.279 Historic Building (Flood Resistance). See 3.3.58.10.1.

3.3.280 Home.

3.3.280.1* *Day-Care Home.* A building or portion of a building in which more than 3 but not more than 12 clients receive care, maintenance, and supervision, by other than their relative(s) or legal guardians(s), for less than 24 hours per day.

3.3.280.2 ***Manufactured Home.*** A structure, transportable in one or more sections, that is 8 body-ft (2.4 body-m) or more in width or 40 body-ft (12.2 body-m) or more in length in the traveling mode or, when erected on site, is 320 ft^2 (29.7 m^2) or more; which is built on a chassis and designed to be used as a dwelling, with or without a permanent foundation, when connected to the required utilities, including the plumbing, heating, air-conditioning, and electrical systems contained therein. Calculations used to determine the number of square feet in a structure are based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. [**501:**1.2.14]

3.3.280.2.1 ***Manufactured Home (Flood Resistance).*** For all matters related to installation or erection in flood hazard areas: (1) a structure, transportable in one or more sections, built on a chassis and designed to be used as a dwelling with or without a permanent foundation, when connected to the required utilities, and constructed to the Federal Manufactured Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development; (2) a mobile home, park trailer, travel trailer, and similar transportable structure that is placed on a site for 180 consecutive days or longer.

3.3.280.3 ***Nursing Home.*** A building or portion of a building used on a 24-hour basis for the housing and nursing care of four or more persons who, because of mental or physical incapacity, might be unable to provide for their own needs and safety without the assistance of another person.

3.3.281 Horizontal Exit. See 3.3.167.1.

3.3.282 Horizontal Separation. The width of the permanent open space as measured horizontally between a building exterior wall and the adjacent property line or the centerline of a facing street, alley, or public way.

3.3.283 Hospital. A building or portion thereof used on a 24-hour basis for the medical, psychiatric, obstetrical, or surgical care of four or more inpatients.

3.3.284* Hot Tub. A spa constructed of wood, with sides and bottoms formed separately, and the whole shaped to join together by pressure from the surrounding hoops, bands, or rods.

3.3.285* Hotel. A building or groups of buildings under the same management in which there are sleeping accommodations for more than 16 persons and primarily used by transients for lodging with or without meals.

3.3.286 Hypobaric Facility. See 3.3.176.6.

3.3.287 Illuminated.

3.3.287.1* *Externally Illuminated.* Refers to an illumination source that is contained outside of the device or sign legend area that is to be illuminated.

3.3.287.2* *Internally Illuminated.* Refers to an illumination source that is contained inside the device or legend that is illuminated.

3.3.288 Importance Factor *(I).* A factor that accounts for the degree of hazard to human life and damage to property. [**ASCE 7:**6.2]

3.3.289 Imminent Danger. Any conditions or practices in any occupancy or structure that pose a danger that could reasonably be expected to cause death, serious physical harm, or serious property loss.

3.3.290 Incapacitation. A condition under which humans do not function adequately and become unable to escape untenable conditions.

3.3.291 Incompatible Material. See 3.3.340.9.

3.3.292 Industrial Occupancy. See 3.3.371.7.

3.3.293 Input Data Specification. See 3.3.513.2.

3.3.294* Interior Finish. The exposed surfaces of walls, ceilings, and floors within buildings.

3.3.294.1 *Interior Ceiling Finish.* The interior finish of ceilings.

3.3.294.2* *Interior Floor Finish.* The interior finish of floors, ramps, stair treads and risers, and other walking surfaces.

3.3.294.3 *Interior Wall Finish.* The interior finish of columns, fixed or movable walls, and fixed or movable partitions.

3.3.295 Interior Surface. See 3.3.534.2.

3.3.296 Internally Illuminated. See 3.3.287.2.

3.3.297 Joint. A linear opening in or between adjacent assemblies that is designed to allow independent movement of the building.

3.3.298 Jurisdiction. Legally constituted governmental unit that has adopted this *Code* by law or ordinance.

3.3.299 Legitimate Stage. See 3.3.516.1.

3.3.300 Level of Exit Discharge. See 3.3.169.1.

3.3.301 Life Safety Evaluation. A written review dealing with the adequacy of life safety features relative to fire, storm, collapse, crowd behavior, and other related safety considerations.

3.3.302 Light-Diffusing System. See 3.3.536.6.

3.3.303 Light-Transmitting Plastic. See 3.3.412.3.

3.3.304 Light-Transmitting Plastic Panel. See 3.3.389.1.

3.3.305 Light-Transmitting Plastic Roof Panel. See 3.3.389.1.1.

3.3.306 Light-Transmitting Plastic Wall Panel. See 3.3.389.1.2.

3.3.307 Limit.

3.3.307.1* *Ceiling Limit.* The maximum concentration of an airborne contaminant to which one may be exposed.

3.3.307.2* *Lower Flammable Limit (LFL).* The concentration of a combustible material in air below which ignition will not occur.

3.3.307.3* *Permissible Exposure Limit (PEL).* The maximum permitted 8-hour, time-weighted average concentration of an airborne contaminant.

3.3.308 Limited Access Structure. See 3.3.530.5.

3.3.309 Limited Care Facility. See 3.3.176.7.

3.3.310 Limited Combustible (Material). See 3.3.340.10.

3.3.311 Limited State. A condition beyond which a structure or member becomes unfit for service and is judged either to be no longer useful for its intended function (serviceability limited state) or to be unsafe (strength limit state). **[ASCE 7:**1.2]

3.3.312 Liquefied Petroleum Gas. See 3.3.235.4.

3.3.313 Liquid. A material that has a melting point that is equal to or less than 68°F (20°C) and a boiling point that is greater than 68°F (20°C) at 14.7 psia (101.3 kPa). When not otherwise identified, the term *liquid* shall mean both flammable and combustible liquids.

3.3.313.1* *Combustible Liquid.* A liquid having a flash point at or above 100°F (37.8°C).

3.3.313.2* *Flammable Liquid.* A liquid having a closed-cup flash point not exceeding 100°F (37.8°C).

3.3.314 Liquid Storage Room. See 3.3.470.6.

3.3.315 Live Load. See 3.3.317.4.

3.3.316 Living Area. See 3.3.32.11.

3.3.317 Loads. Forces or other actions that result from the weight of all building materials, occupants and their possessions, environmental effects, differential movement, and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude. All other loads are variable loads. *(See also 3.3.361, Nominal Load.)* **[ASCE 7:**1.2]

3.3.317.1 *Dead Loads.* Dead loads consist of the weight of all materials of construction incorporated into the building including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items, and fixed service equipment including the weight of cranes. **[ASCE 7:**3.1]

3.3.317.2 *Factored Load.* The product of the nominal load and a load factor. [**ASCE 7:**1.2]

3.3.317.3* *Fuel Load.* The total quantity of combustible contents of a building, space, or fire area.

3.3.317.4 *Live Loads.* Live loads are those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood

load, or dead load. Live loads on a roof are those produced (1) during maintenance by workers, equipment, and materials; and (2) during the life of the structure by movable objects such as planters and by people. **[ASCE 7:**4.1]

3.3.317.5 ***Nominal Loads.*** The magnitudes of the loads specified in ASCE 7, Sections 3 through 9 (dead, live, soil, wind, snow, rain, flood and earthquake). **[ASCE 7:**1.2]

3.3.317.6 ***Occupant Load.*** The total number of persons that might occupy a building or portion thereof at any one time.

3.3.318 Load-Bearing Element. See 3.3.149.2.

3.3.319 Load Effects. Forces and deformations produced in structural members by the applied loads. [**ASCE 7:**1.2]

3.3.320 Load Factor. A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the load into a load effect, and for the probability that more than one extreme load will occur simultaneously. **[ASCE 7:**1.2]

3.3.321 Lobby. An enclosed vestibule directly accessible from the main entrance of a theater, hotel, apartment house, or similar building with an occupant load of 10 or more.

3.3.321.1 ***Elevator Lobby.*** A space from which people directly enter an elevator car(s) and into which people directly enter upon leaving an elevator car(s).

3.3.322 Lodging or Rooming House. A building or portion thereof that does not qualify as a one- or two-family dwelling, that provides sleeping accommodations for a total of 16 or fewer people on a transient or permanent basis, without personal care services, with or without meals, but without separate cooking facilities for individual occupants.

3.3.323 Lot. Smallest parcel of land considered as a unit.

3.3.324 Low Explosive Material. See 3.3.340.4.2.

3.3.325 Lower Flammable Limit (LFL). See 3.3.307.2.

3.3.326 Lowest Floor (Flood Resistance). See 3.3.221.1.

3.3.327 LP Fuel. See 3.3.235.3.

3.3.328 LP Gas. See 3.3.235.4.

3.3.329 Lumber (Grade). The classification of lumber in regard to strength and utility in accordance with USDOC PS 20 and the grading rules of an approved lumber rules-writing agency.

3.3.330 Mall. A roofed or covered common pedestrian area within a mall building that serves as access for two or more tenants and does not exceed three levels that are open to each other.

3.3.331 Mall Building. See 3.3.58.11.

3.3.332 Manufactured Home. See 3.3.280.2.

3.3.333 Manufactured Home (Flood Resistance). See 3.3.280.2.1.

3.3.334 Manufactured Home Park or Subdivision (Flood Resistance). A parcel, or contiguous parcels, of land divided into two or more manufactured home lots.

3.3.335 Map.

3.3.335.1 ***Flood Boundary and Floodway Map (FBFM).*** An official map of a jurisdiction on which the Federal Emergency Management Agency has delineated flood hazard zones and floodway boundaries for the jurisdiction.

3.3.335.2 ***Flood Hazard Boundary Map (FHBM).*** An official map of a jurisdiction, on which FEMA has delineated special flood hazard areas for the jurisdiction.

3.3.335.3 ***Flood Hazard Map.*** A map delineating the flood hazard area and adopted by a jurisdiction.

3.3.335.4 ***Flood Insurance Rate Map (FIRM).*** An official map of a jurisdiction on which FEMA has delineated special flood hazard areas and risk premium zones applicable to the jurisdiction. The term *flood insurance rate map* shall include the flood boundary and floodway map, and the flood hazard boundary map.

3.3.336 Marine Terminal. See 3.3.545.1.

3.3.337 Marquee. Permanent roofed structure attached to and supported by a building.

3.3.338 Masonry. Built-up unit of construction or combination of materials such as clay, shale, concrete, glass, gypsum, tile, or stone set in mortar.

3.3.339 Masonry Bonded Hollow Wall. See 3.3.566.9.

3.3.340 Material.

3.3.340.1 ***Aluminum Composite Material (ACM).*** A factory-manufactured panel consisting of aluminum skins bonded to both faces of a plastic core.

3.3.340.2 ***Combustible (Material).*** A material that, in the form in which it is used and under the conditions anticipated, will ignite and burn; a material that does not meet the definition of noncombustible or limited-combustible.

3.3.340.3* ***Corrosive Material.*** A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact.

3.3.340.4* ***Explosive Material.*** Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion.

3.3.340.4.1 ***High Explosive (Material).*** Explosive material, such as dynamite, that can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

3.3.340.4.2* ***Low Explosive (Material).*** Explosive material that will burn or deflagrate when ignited.

3.3.340.5 ***Flood Damage–Resistant Material.*** Any construction material capable of direct and prolonged contact with floodwaters without sustaining any damage that requires more than cosmetic repairs.

3.3.340.6 ***Hazardous Material.*** A chemical or substance that is classified as a physical hazard material or a health hazard material, whether the chemical or substance is in usable or waste condition. *(See also Health Hazard Material and Physical Hazard Material.)*

3.3.340.7 ***Hazardous Production Material (HPM).*** A solid, liquid, or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or reactivity of Class 3 or Class 4 as ranked by NFPA 704 and that is used directly in research, laboratory, or production processes that have as their end product materials that are not hazardous.

3.3.340.8 ***Health Hazard Material.*** A chemical or substance classified as a toxic, highly toxic, or corrosive material in accordance with definitions set forth in this *Code*.

3.3.340.9 ***Incompatible Material.*** Materials that, when in contact with each other, have the potential to react in a manner that generates heat, fumes, gases, or by-products that are hazardous to life or property.

3.3.340.10* ***Limited-Combustible (Material).*** Refers to a building construction material not complying with the definition of *noncombustible material (see 3.3.340.11)* that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), where tested in accordance with NFPA 259 and includes (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of ⅛ in. (3.2 mm) that has a flame spread index not greater than 50; and (2) materials, in the form and thickness used, other than as described in (1), having neither a flame spread index greater than 25 nor evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion. [**220:**2.1]

3.3.340.11 ***Noncombustible Material.*** A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors, when subjected to fire or heat. Materials that are reported as passing ASTM E 136 are considered noncombustible materials.

3.3.340.12 ***Physical Hazard Material.*** A chemical or substance classified as a combustible liquid, combustible fiber, explosive, flammable cryogen, flammable gas, flammable liquid, flammable solid, organic peroxide, oxidizer, oxidizing cryogen, pyrophoric, unstable (reactive), or water-reactive material.

3.3.340.13 ***Pyrophoric Material.*** A chemical with an autoignition temperature in air at or below 130°F (54.4°C).

3.3.340.14 ***Solid Material.*** A material that has a melting point, decomposes, or sublimes at a temperature greater than 68°F (20°C).

3.3.340.15 ***Sprayed Fire-Resistive Material.*** A cementitious or fibrous material that is spray-applied to structural elements, walls, floors, and roofs to provide fire-resistive protection.

3.3.340.16 ***Thermoplastic Material.*** Plastic material capable of being repeatedly softened by heating and hardened by cooling and, that in the softened state, can be repeatedly shaped by molding or forming.

3.3.340.17 ***Thermoset Material.*** Plastic material that, after having been cured by heat or other means, is substantially infusible and cannot be softened and formed.

3.3.340.18 ***Toxic Material.*** A material that produces a lethal dose or a lethal concentration within any of the following categories: (1) a chemical or substance that has a median lethal dose (LD_{50}) of more than 50 mg/kg but not more than 500 mg/kg of body weight when administered orally to albino rats weighing between 200 g and 300 g each; (2) a chemical or substance that has a median lethal dose (LD_{50}) of more than 200 mg/kg but not more than 1000 mg/kg of body weight when administered by continuous contact for 24 hours, or less if death occurs within 24 hours, with the bare skin of albino rabbits weighing between 2 kg and 3 kg each; (3) a chemical or substance that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million but not more than 2000 parts per million by volume of gas or vapor, or more than 2 mg/L but not more than 20 mg/L, of mist, fume, or dust when administered by continuous inhalation for 1 hour, or less if death occurs within 1 hour, to albino rats weighing between 200 g and 300 g each.

3.3.340.18.1* ***Highly Toxic Material.*** A material that produces a lethal dose or lethal concentration that falls within any of the following categories: (1) a chemical that has a median lethal dose (LD_{50}) of 50 mg/kg or less of body weight when administered orally to albino rats weighing between 200 g and 300 g each; (2) a chemical that has a median lethal dose (LD_{50}) of 200 mg/kg or less of body weight when administered by continuous contact for 24 hours, or less if death occurs within 24 hours, with the bare skin of albino rabbits weighing between 2 kg and 3 kg each; (3) a chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 mg/L or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour, or less if death occurs within 1 hour, to albino rats weighing between 200 g and 300 g each.

3.3.340.19* ***Unstable (Reactive) Material.*** A material that, in the pure state or as commercially produced, will vigorously polymerize, decompose or condense, become self-reactive, or otherwise undergo a violent chemical change under conditions of shock, pressure, or temperature.

3.3.340.20* ***Water-Reactive Material.*** A material that explodes; violently reacts; produces flammable, toxic, or other hazardous gases; or evolves enough heat to cause self-ignition or ignition of nearby combustibles upon exposure to water or moisture.

3.3.340.21 ***Weathered-Membrane Material.*** Membrane material that has been subjected to a minimum of 3000 hours in a weatherometer in accordance with ASTM G 155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials,* or approved equivalent.

3.3.341* Materials and Methods Requirements. Those requirements of applicable codes that specify material standards, details of installation and connection, joints, penetrations, and continuity of any element, component, or system in the building.

3.3.342 Maximum Considered Earthquake Ground Motion. The most severe earthquake effects considered by these Standards as defined in ASCE 7, Section 9.4.1. [**ASCE 7:**9.2.1]

3.3.343* Means of Egress. A continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of three separate and distinct parts: (1) the exit access, (2) the exit, and (3) the exit discharge.

3.3.343.1 ***Accessible Means of Egress.*** A means of egress that provides an accessible route to an area of refuge, a horizontal exit, or a public way.

3.3.344 Means of Escape. A way out of a building or structure that does not conform to the strict definition of *means of egress* but does provide an alternate way out.

3.3.345 Membrane. For the purposes of membrane structures, a thin, flexible, water-impervious material capable of being supported by an air pressure of 1.5 in. water column (38 mm).

3.3.346 Membrane Penetration. See 3.3.397.1.

3.3.347 Membrane Structure. See 3.3.530.6.

3.3.348 Mercantile Occupancy. See 3.3.371.8.

3.3.349 Metal Composite Panel Wall. See 3.3.566.10.

3.3.350 Mezzanine. An intermediate level between the floor and the ceiling of any room or space.

3.3.350.1 ***Mezzanine (Accessibility).*** That portion of a story that is an intermediate floor level placed within the story and having occupiable space above and below its floor.

3.3.351 Mixed Occupancy. See 3.3.371.9.

3.3.352 Modification. The reconfiguration of any space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.

3.3.353 Moist Curing. A method for the retention of moisture for hydration of portland cement plaster.

3.3.354 Motor Freight Terminal. See 3.3.545.2.

3.3.355 Multilevel Play Structure. See 3.3.530.7.

3.3.356 Multiple Occupancy. See 3.3.371.10.

3.3.357 Multiple Station Alarm Device. See 3.3.135.1.

3.3.358 Multipurpose Assembly Occupancy. See 3.3.371.1.1.

3.3.359 Net Floor Area. See 3.3.32.8.2.

3.3.360 Nominal Dimension.

3.3.360.1* ***Nominal Dimension (Masonry).*** A specified dimension plus an allowance for the joints with which the units are to be laid.

3.3.360.2 ***Nominal Dimension (Metal).*** A specified dimension or weight plus or minus the specified manufacturing tolerance for the material or product.

3.3.361 Nominal Load. See 3.3.317.5.

3.3.362 Nominal Size (Lumber). The commercial size designation of width and depth, in standard sawn lumber and glued laminated lumber grades, meeting the requirements of USDOC PS 20 for sawn lumber and AF&PA NDS for glued laminated lumber.

3.3.363 Nonbearing Wall. See 3.3.566.11.

3.3.364 Noncombustible Material. See 3.3.340.11.

3.3.365 Nonconforming. Not conforming to the requirements of this *Code*.

3.3.366 Normal Temperature and Pressure (NTP). A temperature of 70°F (21.1°C) and a pressure of 1 atmosphere [14.7 psia (101.3 kPa)].

3.3.367 NTP. See 3.3.366.

3.3.368* Number of Stories. The story count starting with the primary level of exit discharge and ending with the highest occupiable level.

3.3.369 Nursing Home. See 3.3.280.3.

3.3.370* Objective. A requirement that needs to be met to achieve a goal.

3.3.371 Occupancy. The purpose for which a building or other structure, or part thereof, is used or intended to be used. [**ASCE 7:**1.2]

3.3.371.1* ***Assembly Occupancy.*** An occupancy (1) used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or (2) used as a special amusement building, regardless of occupant load.

3.3.371.1.1 ***Multipurpose Assembly Occupancy.*** An assembly room designed to accommodate temporarily any of several possible assembly uses.

3.3.371.2* ***Business Occupancy.*** An occupancy used for account and record keeping or the transaction of business other than mercantile.

3.3.371.3* ***Day-Care Occupancy.*** An occupancy in which four or more clients receive care, maintenance, and supervision, by other than their relatives or legal guardians, for less than 24 hours per day.

3.3.371.4* ***Detention and Correctional Occupancy.*** An occupancy used to house four or more persons under varied degrees of restraint or security where such occupants are mostly incapable of self-preservation because of security measures not under the occupants' control.

3.3.371.5* ***Educational Occupancy.*** An occupancy used for educational purposes through the twelfth grade by six or more persons for 4 or more hours per day or more than 12 hours per week.

3.3.371.6* ***Health Care Occupancy.*** An occupancy used for purposes of medical or other treatment or care of four or more persons where such occupants are mostly incapable of self-preservation due to age, physical or mental disability, or because of security measures not under the occupants' control.

3.3.371.6.1 ***Ambulatory Health Care Occupancy.*** A building or portion thereof used to provide services or treatment simultaneously to four or more patients that (1) provides, on an outpatient basis, treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others; or (2) provides, on an outpatient basis, anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

3.3.371.7* ***Industrial Occupancy.*** An occupancy in which products are manufactured or in which processing, assembling, mixing, packaging, finishing, decorating, or repair operations are conducted.

3.3.371.7.1* ***General Industrial Occupancy.*** An industrial occupancy in which ordinary and low hazard industrial operations are conducted in buildings of conventional design suitable for various types of industrial processes.

3.3.371.7.2 ***Special-Purpose Industrial Occupancy.*** An industrial occupancy in which ordinary and low hazard industrial operations are conducted in buildings designed for, and suitable only for, particular types of operations, characterized by a relatively low density of employee population, with much of the area occupied by machinery or equipment.

3.3.371.8* ***Mercantile Occupancy.*** An occupancy used for the display and sale of merchandise.

3.3.371.9 ***Mixed Occupancy.*** A multiple occupancy where the occupancies are intermingled.

3.3.371.10* ***Multiple Occupancy.*** A building or structure in which two or more classes of occupancy exist.

3.3.371.11* ***Residential Occupancy.*** An occupancy that provides sleeping accommodations for purposes other than health care or detention and correctional.

3.3.371.12* ***Residential Board and Care Occupancy.*** A building or portion thereof that is used for lodging and boarding of four or more residents, not related by blood or marriage to the owners or operators, for the purpose of providing personal care services.

3.3.371.13 ***Separated Occupancy.*** A multiple occupancy where the occupancies are separated by fire resistance–rated assemblies.

3.3.371.14* ***Storage Occupancy.*** An occupancy used primarily for the storage or sheltering of goods, merchandise, products, vehicles, or animals.

3.3.372 Occupancy Importance Factor *(I).* A factor assigned to each structure according to its Seismic Use Group as prescribed in ASCE 7, Section 9.1.4. [**ASCE 7:**9.2.1]

3.3.373 Occupant Characteristics. The abilities or behaviors of people before and during a fire.

3.3.374 Occupant Load. See 3.3.317.6.

3.3.375 Occupiable (Accessibility). A room or enclosed space designed for human occupancy.

3.3.376 Occupiable Story. See 3.3.523.3.

3.3.377 One- and Two-Family Dwelling. See 3.3.146.1.

3.3.378 One-Family Dwelling. See 3.3.146.2.

3.3.379 Open-Air Mercantile Operation. An operation conducted outside of all structures, with the operations area devoid of all walls and roofs except for small, individual, weather canopies.

3.3.380 Openings. Apertures or holes in the building envelope that allow air to flow through the building envelope and which are designed as "open" during design winds as defined by ASCE 7. [**ASCE 7:**6.2]

3.3.381 Open Parking Structure. See 3.3.530.9.

3.3.382 Open Structure. See 3.3.530.8.

3.3.383 Operable Part (Accessibility). A component of an element used to insert or withdraw objects, or to activate, deactivate, or adjust the element.

3.3.384* Organic Peroxide. An organic compound that contains the bivalent -0-0- structure and that might be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical.

3.3.385 Oriented Strand Board (OSB) Wood Structural Panel. See 3.3.389.3.2.

3.3.386* Outside Stair. A stair with not less than one side open to the outer air.

3.3.387* Oxidizer. A material, other than a blasting agent or explosive, that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials.

3.3.388 Oxidizing Gas. See 3.3.235.5.

3.3.389 Panel.

3.3.389.1 ***Light-Transmitting Plastic Panel.***

3.3.389.1.1* ***Light-Transmitting Plastic Roof Panel.*** A structural plastic panel in the plane of the roof, fastened to roof members, that transmits light into the structure.

3.3.389.1.2* ***Light-Transmitting Plastic Wall Panel.*** A plastic panel fastened to structural wall members that transmits light into the structure.

3.3.389.2 ***Wall Panel.*** Nonbearing wall built between columns and piers wholly supported at each story.

3.3.389.3 ***Wood Structural Panel.*** A panel manufactured from veneers; or wood strands or wafers; or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems, including composite panels, oriented strand board, and plywood.

3.3.389.3.1 ***Composite Wood Structural Panel.*** A structural panel that is made of layers of veneer and wood-based material.

3.3.389.3.2 ***Oriented Strand Board (OSB) Wood Structural Panel.*** A mat-formed wood structural panel product composed of thin, rectangular wood strands or wafers arranged in oriented layers and bonded with waterproof adhesive.

3.3.389.3.3 ***Plywood Wood Structural Panel.*** A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers.

3.3.390 Panic Hardware. A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel.

3.3.391 Parapet. That part of a wall entirely above the roofline.

3.3.392 Parking Garage. See 3.3.234.1.

3.3.393 Partial Height Partition. See 3.3.395.1.

3.3.394* Particleboard. A generic term for a panel primarily composed of cellulosic materials, generally in the form of discrete pieces or particles, as distinguished from fibers, that are combined with synthetic resin or other suitable bonding system by a process in which the interparticle bond is created by the bonding system under heat and pressure.

3.3.395* Partition. A nonstructural interior wall that spans horizontally or vertically from support to support. The supports may be the basic building frame, subsidiary structural members, or other portions of the partition system. [**ASCE 7:**9.2.1]

3.3.395.1 ***Partial Height Partition.*** A partition with a height not greater than 72 in. (1830 mm).

3.3.395.2* ***Smoke Partition.*** A continuous membrane that is designed to form a barrier to limit the transfer of smoke.

3.3.396 Passive Sub-slab Depressurization System. See 3.3.531.

3.3.397 Penetration.

3.3.397.1* ***Membrane Penetration.*** An opening for penetrations made through one side of a fire resistance–rated assembly.

3.3.397.2* ***Through-Penetration.*** An opening for penetrations that pass through both sides of a vertical or horizontal fire resistance–rated assembly.

3.3.398* Penthouse. Enclosed structure other than a roof structure located on a roof, extending not more than 12 ft (3.7 m) above a roof.

3.3.399* Performance Criteria. Threshold values on measurement scales that are based on quantified performance objectives.

3.3.400 Permanent. Any object that is intended to remain in place for more than 180 days. *(See also 3.3.530.11.)*

3.3.401 Permissible Exposure Limit (PEL). See 3.3.307.3.

3.3.402 Permit. A document issued by the authority having jurisdiction for the purpose of authorizing performance of a specified activity.

3.3.403 Person. Any individual, firm, partnership, corporation, company, association, or joint-stock association, including any trustee, receiver, assignee, or personal representative thereof.

3.3.404* Personal Care. The care of residents who do not require chronic or convalescent medical or nursing care.

3.3.405* Photoluminescent. Having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed.

3.3.406 Physical Hazard Material. See 3.3.340.12.

3.3.407 Pictogram (Accessibility). A pictorial symbol that represents activities, facilities, or concepts.

3.3.408 Pinrail. A rail on or above a stage through which belaying pins are inserted and to which lines are fastened.

3.3.409 Plain Concrete. See 3.3.93.1.

3.3.410 Plant.

3.3.410.1* *Coal Preparation Plant.* A facility designed to prepare coal for shipment, including coal mine surface buildings and structures, housing, and supporting coal-processing and coal-handling equipment.

3.3.410.2 *Drycleaning Plant.* A plant in which dry cleaning and associated operations are conducted, including the office, receiving area, and storage rooms. [**32:**1.4]

3.3.411 Plaster.

3.3.411.1 *Gypsum Plaster.* The generic name for a family of powdered cementitious products consisting primarily of calcined gypsum with additives to modify physical characteristics, and having the ability, when mixed with water, to produce a plastic mortar or slurry that can be formed to the desired shape by various methods and subsequently sets to a hard, rigid mass.

3.3.411.2 *Gypsum Veneer Plaster.* A calcined gypsum plaster specially manufactured to provide high strength, hardness, and abrasion resistance when applied in thin coats over a gypsum base for veneer plasters.

3.3.411.3 *Portland Cement Plaster.* A plaster mix in which portland cement or combinations of portland and masonry cements or portland cement and lime are the principal cementitious materials mixed with aggregate.

3.3.412* Plastic. Any of a wide range of natural or synthetic organic materials of high molecular weight that can be formed by pressure, heat, extrusion, and other methods into desired shapes.

3.3.412.1* *Cellular or Foamed Plastic.* A heterogeneous system comprised of not less than two phases, one of which is a continuous, polymeric, organic material, and the second of which is deliberately introduced for the purpose of distributing gas in voids throughout the material.

3.3.412.2 *Glass Fiber Reinforced Plastic.* Plastic material containing not less than 20 percent by weight glass fiber that impart some mechanical properties superior to those of the base resin.

3.3.412.3 *Light-Transmitting Plastic.* Plastic material that is used to transmit light into structures.

3.3.413 Plastic Glazing. See 3.3.241.1.

3.3.414* Platform. The raised area within a building used for the presentation of music, plays, or other entertainment.

3.3.414.1 *Temporary Platform.* A platform erected within an area for not more than 30 days.

3.3.415 Plenum. A compartment or chamber to which one or more air ducts are connected and that forms part of the air-distribution system.

3.3.416 Plywood Wood Structural Panel. See 3.3.389.3.3.

3.3.417 Point.

3.3.417.1* *Boiling Point.* The temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure. For purposes of defining the boiling point, atmospheric pressure shall be considered to be 14.7 psia (760 mm Hg). For mixtures that do not have a constant boiling point, the 20 percent evaporated point of a distillation performed in accordance with ASTM D 86 shall be considered to be the boiling point.

3.3.417.2 *Flash Point.* The minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid within the vessel as specified by appropriate test procedure and apparatus as follows: (1) the flash point of a liquid having a viscosity less than 45 SUS at 100°F (37.8°C) and a flash point below 200°F (93°C) shall be determined in accordance with ASTM D 56; (2) the flash point of a liquid having a viscosity of 45 SUS or more at 100°F (37.8°C) or a flash point of 200°F (93°C) or higher shall be determined in accordance with ASTM D 93; (3) as an alternate, ASTM D 3278 may be used for paints, enamels, lacquers, varnishes, and related products and their components having flash points between 32°F (0°C) and 230°F (110°C) and having a viscosity lower than 150 stokes at 77°F (25°C); (4) as an alternate, ASTM D 3828 may be used for materials other than those for which specific Setaflash Methods exist.

3.3.418 Pool.

3.3.418.1 *Public Pool.* Any pool that is not a residential pool.

3.3.418.2 *Residential Pool.* A swimming pool that is intended for noncommercial use by not more than three owner families and their guests.

3.3.418.3 *Swimming Pool.* Any constructed pool intended for swimming or diving, permanent or nonportable, that is over 24 in. (610 mm) in depth, has a surface area exceeding 250 ft^2 (23 m^2) or a volume over 3250 gal (12,300 L).

3.3.419 Portable Spa. See 3.3.507.1.

3.3.420 Portland Cement Plaster. See 3.3.411.3.

3.3.421 Prefabricated. Fabricated prior to erection or installation on or in a building or on a foundation.

3.3.422 Preservative-treated Wood. See 3.3.578.2.

3.3.423 Primary Level of Exit Discharge. See 3.3.169.1.1.

3.3.424 Private Building. See 3.3.58.12.

3.3.425 Private Garage. See 3.3.234.2.

3.3.426 Private Party Tent. See 3.3.544.1.

3.3.427 Production Studio. A building, a portion of a building, or a group of buildings designed and constructed for use by the entertainment industry for the purpose of motion picture, television, or commercial productions, or broadcasting television programs utilizing a soundstage. [**140:**2.2]

3.3.428 Professional Engineer. A person licensed to practice engineering in a jurisdiction, subject to all laws and limitations imposed by the jurisdiction.

3.3.429 Property Line. Line dividing one lot from another, or from a street or other public space.

3.3.430* Proposed Design. A design developed by a design team and submitted to the authority having jurisdiction for approval.

3.3.431 Proscenium Wall. See 3.3.566.13.

3.3.432 Public Building. See 3.3.58.13.

3.3.433 Public Entrance (Accessibility). See 3.3.158.1.

3.3.434 Public Pool. See 3.3.418.1.

3.3.435 Public Spa. See 3.3.507.2.

3.3.436 Public Use (Accessibility). See 3.3.560.5.

3.3.437 Public Way. See 3.3.572.1.

3.3.438 Pyrophoric Material. See 3.3.340.13.

3.3.439 Quality Assurance. The tests, inspections, and observations of construction to the extent that they provide evidence and documentation to the responsible registered design professional (RDP) and authority having jurisdiction that the work is being constructed in accordance with the registered design professional's design.

3.3.440 Quality Assurance Plan. A written procedure of the tests, inspections, and observations to be performed.

3.3.441 Quality Assurance Program. A predefined set of periodic observations, tests, and other procedures that provide an independent record to the owner, authority having jurisdiction, and RDP that the construction is in general conformance with the approved design documents.

3.3.442 Quality Control. The operational procedures provided by contractors to ensure compliance with construction documents.

3.3.443* Ramp. A walking surface that has a slope steeper than 1 in 20.

3.3.444 Rating.

3.3.444.1 ***Fire Protection Rating.*** The designation indicating the duration of the fire test exposure to which a fire door assembly or fire window assembly was exposed and for which it met all the acceptance criteria as determined in accordance with NFPA 252, or NFPA 257, respectively.

3.3.444.2 ***Fire Resistance Rating.*** The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as determined by the tests, or methods based on tests, prescribed by this *Code*.

3.3.445 Reconstruction. The reconfiguration of a space that affects an exit, or a corridor shared by more than a single tenant; or reconfiguration of space such that the rehabilitation work area is not permitted to be occupied because existing means of egress and fire protection systems, or their equivalent, are not in place or continuously maintained.

3.3.446* Recreational Vehicle. A vehicle that is built on a single chassis, 400 ft^2 (37 m^2) or less when measured at the largest horizontal projection, designed to be self-propelled or permanently towable by a light-duty truck, and designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

3.3.447 Registered Architect. A person licensed to practice architecture in a jurisdiction, subject to all laws and limitations imposed by the jurisdiction.

3.3.448 Registered Design Professional (RDP). An individual who is registered or licensed to practice his/her respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

3.3.449 Regular Stage. See 3.3.516.2.

3.3.450 Regulatory Floodway. See 3.3.220.

3.3.451 Rehabilitation Work Area. See 3.3.32.12.2.

3.3.452 Reinforced Concrete. See 3.3.93.2.

3.3.453 Renovation. The change, strengthening, or addition of load-bearing elements; the refinishing, replacement, bracing, strengthening, upgrading of existing materials, elements, equipment or fixtures, or both, without reconfiguration of spaces.

3.3.454 Repair. The patching, restoration, or painting of materials, elements, equipment, or fixtures for the purposes of maintaining such materials, elements, equipment, or fixtures in good or sound condition.

3.3.455 Repair Garage. See 3.3.234.3.

3.3.456 Required. Required by this *Code*.

3.3.457 Residential Board and Care Occupancy. See 3.3.371.12.

3.3.458 Residential Board and Care Resident. A person who receives personal care and resides in a residential board and care facility.

3.3.459 Residential Occupancy. See 3.3.371.11.

3.3.460 Residential Pool. See 3.3.418.2.

3.3.461 Residential Spa. See 3.3.507.3.

3.3.462 Resistance.

3.3.462.1 ***Adjusted Shear Resistance.*** The unadjusted shear resistance multiplied by the shear resistance adjustment factors.

3.3.462.2 ***Corrosion Resistance.*** The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

3.3.463 Resistance Factor. A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure (also called *strength reduction factor*). [**ASCE 7:**1.2]

3.3.464 Restricted Entrance (Accessibility). See 3.3.158.2.

3.3.465 Retaining Wall. See 3.3.566.14.

3.3.466 Roof Assembly. See 3.3.34.3.

3.3.467 Roof Covering. The membrane, which may also be the roof assembly, that resists fire and provides weather protection to the building against water infiltration, wind, and impact.

3.3.468 Roof Structure. See 3.3.530.12.

3.3.469 Rooftop Landing Pad. The entire load-bearing surface intended for the landing, takeoff, and parking of helicopters. [**418:**1.3]

3.3.470 Room.

3.3.470.1 ***Boiler Room.*** Any room with a boiler of 5 horsepower or greater.

3.3.470.2 ***Gas Room.*** A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

3.3.470.3 ***Guest Room.*** An accommodation combining living, sleeping, sanitary, and storage facilities within a compartment.

3.3.470.4 ***Habitable Room.*** A room in a residential occupancy used for living, sleeping, cooking, and eating, but excluding bath, storage and service area, and corridors.

3.3.470.5 ***Hazardous Material Production (HPM) Room.*** A room used in conjunction with or serving a semiconductor fabrication facility classified as a Group H occupancy, where HPM is stored or used and that is classified as a Group H occupancy.

3.3.470.6 ***Liquid Storage Room.*** A room used for the storage of flammable or combustible liquids in a closed condition that satisfies the requirements of this *Code* for high hazard Level 3 contents.

3.3.471 Safety Factor. A factor applied to a predicted value to ensure that a sufficient safety margin is maintained.

3.3.472 Safety Margin. The difference between a predicted value and the actual value where a fault condition is expected.

3.3.473 Sally Port (Security Vestibule). A compartment provided with two or more doors where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door at a time.

3.3.474 Seating.

3.3.474.1* ***Festival Seating.*** A form of audience/spectator accommodation in which no seating, other than a floor or ground surface, is provided for the audience/spectators gathered to observe a performance.

3.3.474.2 ***Folding and Telescopic Seating.*** A structure that is used for tiered seating of persons and whose overall shape and size can be reduced, without being dismantled, for purposes of moving or storing.

3.3.474.3 ***Smoke-Protected Assembly Seating.*** Seating served by means of egress that is not subject to smoke accumulation within or under the structure.

3.3.475 Seismic Design Category. A classification assigned to a structure based on its Seismic Use Group and the severity of the design earthquake ground motion at the site as defined in ASCE 7, Sections 9.4.1 and 9.4.2. [**ASCE 7:**9.2.1]

3.3.476 Seismic Forces. The assumed forces prescribed herein, related to the response of the structure to earthquake motions, to be used in the design of the structure and its components. [**ASCE 7:**9.2.1]

3.3.477 Seismic Use Group. A classification assigned to a structure based on its use as defined in ASCE 7, Section 9.1.3. [**ASCE 7:**9.2.1]

3.3.478 Self-Closing. Equipped with an approved device that ensures closing after opening.

3.3.479* Self-Luminous. Illuminated by a self-contained power source and operated independently of external power sources.

3.3.480* Self-Preservation (Day-Care Occupancy). The ability of a client to evacuate a day-care occupancy without direct intervention by a staff member.

3.3.481 Self-Service Storage Facility. See 3.3.176.8.

3.3.482 Sensitivity Analysis. See 3.3.29.1.

3.3.483 Separate Atmosphere. See 3.3.37.2.

3.3.484 Separated Occupancy. See 3.3.371.13.

3.3.485 Service Corridor. A fully enclosed passage used for transporting HPM and for purposes other than required means of egress.

3.3.486 Service Entrance. See 3.3.158.3.

3.3.487 Severe Mobility Impairment. The ability to move to stairs but without the ability to use the stairs.

3.3.488 Shaft. An enclosed space extending through one or more stories and connecting vertical openings through two or more successive floors of a building or through floors and roof.

3.3.489 Shear Wall. See 3.3.566.15.

3.3.490 Sign.

3.3.490.1 ***Sign (Accessibility).*** An architectural element composed of displayed text or numbers or symbolic, tactile, or pictorial information.

3.3.491 Single-Station Alarm. See 3.3.22.1.

3.3.492 Site (Accessibility). A parcel of land bounded by a property line or a designated portion of a public right-of-way.

3.3.493 Site Class. A classification assigned to a site based on the types of soils present and their engineering properties as defined in Section 9.4.1.2 of ASCE 7. [**ASCE 7:**9.2.1]

3.3.494 Skywalk Bridge. Any elevated bridge-like structure connecting two buildings and primarily designed for pedestrian use.

3.3.495 Sloped Glazing. See 3.3.241.2.

3.3.496 Smoke Alarm. See 3.3.22.2.

3.3.497 Smoke Barrier. See 3.3.45.2.

3.3.498 Smoke Compartment. See 3.3.86.2.

3.3.499 Smoke Damper. See 3.3.110.4.

3.3.500 Smoke Detector. A device that detects visible or invisible particles of combustion. [**72:**1.4]

3.3.501 Smoke Partition. See 3.3.395.2.

3.3.502 Smokeproof Enclosure. See 3.3.157.2.

3.3.503 Smoke-Protected Assembly Seating. See 3.3.474.3.

3.3.504 Solid Masonry Unit. Masonry units whose net cross-sectional area in every plane parallel to the bearing surface is 75 percent or more of its gross cross-sectional area measured in the same plane.

3.3.505 Solid Material. See 3.3.340.14.

3.3.506 Soundstage. A building or a portion of a building, usually insulated from outside noise and natural light, used by the entertainment industry for the purpose of motion picture, television, or commercial productions. [**140:**2.2]

3.3.507 Spa. A hydrotherapy unit, including, but not limited to, a therapeutic or hydrotherapy pool, whirlpool, or hot tub, with a maximum water depth of 4 ft (1.2 m) that might have a therapeutic use but is not drained, cleaned, or refilled for each individual use.

3.3.507.1 ***Portable Spa.*** A spa that is not permanent and in which the water circulating equipment can be either an integral or nonintegral part of the product.

3.3.507.2 ***Public Spa.*** Any spa which is intended to be used for bathing and is operated by an owner, licensee, or concessionaire, regardless of whether a fee is charged for use.

3.3.507.3* ***Residential Spa.*** A permanent spa in which the water heating and water circulation equipment is not an integral part of the product.

3.3.508 Space. (Accessibility). A definable area, such as a room, toilet room, hall, assembly area, entrance, storage room, alcove, courtyard, or lobby.

3.3.509 Special Amusement Building. See 3.3.58.14.

3.3.510 Special Flood Hazard Area. See 3.3.32.7.1.

3.3.511 Special Industrial Explosive Device (SIED). See 3.3.135.2.

3.3.512 Special-Purpose Industrial Occupancy. See 3.3.371.7.2.

3.3.513 Specification.

3.3.513.1* ***Design Specification.*** A building characteristic and other conditions that are under the control of the design team.

3.3.513.2 ***Input Data Specification.*** Information required by the verification method.

3.3.514 Sprayed Fire-Resistive Material. See 3.3.340.15.

3.3.515 Staff (Residential Board and Care). Persons who provide personal care services, supervision, or assistance.

3.3.516 Stage. A space within a building used for entertainment and utilizing drops or scenery or other stage effects.

3.3.516.1 ***Legitimate Stage.*** A stage with a height greater than 50 ft (15 m) measured from the lowest point on the stage floor to the highest point of the roof or floor deck above.

3.3.516.2 ***Regular Stage.*** A stage with a height of 50 ft (15 m) or less measured from the lowest point on the stage floor to the highest point of the deck above.

3.3.517 Stairway. One or more flights of stairs and the landings and platforms connecting them, forming a continuous and uninterrupted passage from one story to another in a building or structure.

3.3.518 Stakeholder. An individual, or representative of same, having an interest in the successful completion of a project.

3.3.519 Standpipe System. See 3.3.536.8.

3.3.520 Start of Construction (Flood Resistance). For all matters related to flood-resistant design and construction, the date of permit issuance for new construction or substantial improvements to an existing structure, provided the actual start of construction, repair, reconstruction, rehabilitation, addition placement, or other improvement is within 180 days after the date of issuance.

3.3.520.1* ***Actual Start of Construction (Flood Resistance).*** For all matters related to flood-resistant design and construction, the first placement of permanent construction of a building (including a manufactured home) on a site, such as the pouring of a slab or footings, installation of pilings, or construction of columns. Permanent construction does not include land preparation (such as clearing, excavation, grading, or filling); or the installation of streets and walkways; or the excavation for a basement, footings, piers, or foundations; or the erection of temporary forms; or the installation of accessory buildings such as garages or sheds not occupied as dwelling units and not part of the main building. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of the building, whether or not that alteration affects the exterior dimensions of the building.

3.3.521 Storage (Material). The keeping, retention, or leaving of hazardous materials in closed containers, tanks, cylinders, or similar vessels; or vessels supplying operations through closed connections to the vessel.

3.3.522 Storage Occupancy. See 3.3.371.14.

3.3.523 Story. The portion of a building located between the upper surface of a floor and the upper surface of the floor or roof next above.

3.3.523.1 ***Attic/Attic Story.*** The space between the ceiling of the top habitable story and the roof that may be used for storage or habitation.

3.3.523.2 ***First Story Above Grade.*** Any story having its finished floor surface entirely above grade, except that a basement shall be considered as a first story above grade where the finished surface of the floor above the basement is (1) more than 6 ft (1830 mm) above grade or (2) more than 6 ft (1830 mm) above the finished ground level for more than 50 percent of the total building perimeter, or (3) more than 12 ft (3660 mm) above the finished ground level at any point.

3.3.523.3* ***Occupiable Story.*** A story occupied by people on a regular basis.

3.3.524 Story Height. See 3.3.271.2.

3.3.525 Street. A public thoroughfare that has been dedicated for vehicular use by the public and can be used for access by fire department vehicles.

3.3.526 Strength.

3.3.526.1 ***Nominal Strength.*** (1) In general, the capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths

and dimensions and formulas derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions. (2) For the purposes of earthquake loading, strength of a member or cross section calculated in accordance with the requirements and assumptions of the strength design methods of ASCE 7 (or the referenced standards) before application of any strength reduction factors. **[ASCE 7:**1.2 & 9.2.1]

3.3.526.2 ***Required Strength.*** Strength of a member, cross section, or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by ASCE 7. **[ASCE 7:**9.2.1]

3.3.526.3 ***Strength Design.*** A method of proportioning structural members such that the computed forces produced in the members by the factored loads do not exceed the member design strength (also called *load and resistance factor design*). **[ASCE 7:**1.2]

3.3.527 Structural Element. See 3.3.149.3.

3.3.528 Structural Frame. Frame composed of individual members of a building or structure required to transmit loads to the ground.

3.3.529 Structural Glued Laminated Timber. Any member comprising an assembly of laminations of lumber in which the grain of all laminations is approximately parallel longitudinally, and in which the laminations are bonded with adhesives.

3.3.530* Structure. That which is built or constructed and limited to buildings and nonbuilding structures as defined herein. [**ASCE 7:**9.2.1]

3.3.530.1 ***Structure (Flood Resistance).*** For all matters related to flood-resistant design and construction, a walled and roofed building, a gas or liquid storage tank that is principally above ground, as well as a manufactured home.

3.3.530.2 ***Air-Inflated Structure.*** A structure whose shape is maintained by air pressure in cells or tubes forming all or part of the enclosure of the usable area and in which the occupants are not within the pressurized area used to support the structure.

3.3.530.3 ***Air-Right Structure.*** A structure other than a skywalk bridge that is built over a roadway using the roadway's air rights.

3.3.530.4* ***Air-Supported Structure.*** A structure where shape is maintained by air pressure and in which occupants are within the elevated pressure area.

3.3.530.5 ***Limited Access Structure.*** A structure or portion of a structure lacking emergency openings.

3.3.530.6 ***Membrane Structure.*** A building or portion of a building incorporating an air-inflated, air-supported, tensioned-membrane structure; a membrane roof; or a membrane-covered rigid frame to protect habitable or usable space.

3.3.530.7 ***Multilevel Play Structure.*** A structure that consists of tubes, slides, crawling areas, and jumping areas that is located within a building and is used for climbing and entertainment, generally by children.

3.3.530.8* ***Open Structure.*** A structure that supports equipment and operations not enclosed within building walls.

3.3.530.9 ***Open Parking Structure.*** A parking structure that, at each parking level, has wall openings open to the atmosphere, for an area of not less than 1.4 ft^2 (0.13 m^2) for each linear foot (0.3 m) of its exterior perimeter. Such openings are distributed over 40 percent of the building perimeter or uniformly over two opposing sides. Interior wall lines and column lines are at least 20 percent open, with openings distributed to provide ventilation.

3.3.530.10 ***Other Structures.*** Structures, other than buildings, for which loads are specified in ASCE 7. [**ASCE 7:**1.2]

3.3.530.11 ***Permanent Structure.*** A building or structure that is intended to remain in place for a period of more than 180 consecutive days.

3.3.530.12 ***Roof Structure.*** Structure above the roof of any part of a building enclosing a stairway, a tank, elevator machinery, service equipment, or part of a shaft extending above the roof, not housing living or recreational accommodations.

3.3.530.13 ***Temporary Structure.*** A building or structure not meeting the definition of *permanent structure. (See also Permanent Structure.)*

3.3.530.14 ***Tensioned-Membrane Structure.*** A membrane structure incorporating a membrane and a structural support system such as arches, columns and cables, or beams wherein the stresses developed in the tensioned membrane interact with those in the structural support so that the entire assembly acts together to resist the applied loads.

3.3.530.15* ***Underground Structure.*** A structure or portions of a structure in which the floor level is below the level of exit discharge.

3.3.530.16 ***Water-Surrounded Structure.*** A structure fully surrounded by water.

3.3.531 Sub-membrane Depressurization System. See 3.3.536.3.3.

3.3.532 Substantial Damage (Flood Resistance). For buildings and structures located wholly or partly within the flood hazard area, damage of any origin whereby the cost of restoring the building or structure to its pre-damage condition would equal or exceed 50 percent of the market value of the building or structure.

3.3.533 Substantial Improvement (Flood Resistance). For buildings and structures located wholly or partly within the flood hazard area: (1) any repair, addition, reconstruction, rehabilitation, or improvement of the building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the alteration is started; or (2) if a building or structure has sustained substantial damage, any repairs or reconstruction regardless of the actual work performed. *Substantial improvement* shall not include the following: (1) any project or improvement of a building or structure required to correct existing health, sanitary, or safety code violations identified by the authority having jurisdiction, and that are the minimum necessary to assure safe living conditions; (2) any alteration of a historic building or structure, provided that the alteration will not preclude the continued designation as a historic building or structure.

3.3.534 Surfaces.

3.3.534.1 ***Exterior Surface.*** A weather-exposed surface.

3.3.534.2 ***Interior Surface.*** A surface other than a weather-exposed surface.

3.3.534.3* ***Weather-Exposed Surface.*** The surface of walls, ceilings, roofs, soffits, and similar surfaces exposed to the weather.

3.3.535 Swimming Pool. See 3.3.418.3.

3.3.536 System.

3.3.536.1 ***Automatic Fire Extinguishing System.*** Any system that is designed and installed to detect a fire and subsequently discharge an extinguishing agent without human intervention.

3.3.536.2 ***Continuous Gas-Detection System.*** A gas detection system where the instrument is maintained in continuous operation and the interval between sampling of any point does not exceed 30 minutes.

3.3.536.3 ***Depressurization System.***

3.3.536.3.1 ***Active Sub-slab Depressurization System.*** A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.

3.3.536.3.2 ***Passive Sub-slab Depressurization System.*** A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a vent pipe routed through the conditioned space of a building and connecting the sub-slab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.

3.3.536.3.3 ***Sub-membrane Depressurization System.*** A system designed to achieve lower sub-membrane air pressure relative to crawl space air pressure by use of a vent drawing air from beneath the soil-gas retarder membrane.

3.3.536.4 ***Elevator Evacuation System.*** A system, including a vertical series of elevator lobbies and associated elevator lobby doors, an elevator shaft(s), and a machine room(s), that provides protection from fire effects for elevator passengers, people waiting to use elevators, and elevator equipment so that elevators can be used safely for egress.

3.3.536.5 ***Emergency Alarm System.*** A system to provide indication and warning of emergency situations involving hazardous materials and summon appropriate aid.

3.3.536.6* ***Light-Diffusing System.*** Panels, grids, baffles, or lenses made with light-transmitting plastics, positioned below independently mounted electrical light sources, skylights, or light-transmitting roof panels.

3.3.536.7 ***Open System Use.*** See 3.3.560.1.2.

3.3.536.8 ***Standpipe System.*** An arrangement of piping, valves, hose connections, and allied equipment installed in a building or structure, with the hose connections located in such a manner that water can be discharged in streams or spray patterns through attached hose and nozzles, for the purpose of extinguishing a fire, thereby protecting a building or structure and its contents in addition to protecting the occupants. This is accomplished by means of connections to water supply systems or by means of pumps, tanks, and other equipment necessary to provide an adequate supply of water to the hose connections. [**14:**1.4.28]

3.3.537 Tactile (Accessibility). Describes an object that can be perceived by using the sense of touch.

3.3.538 Tank. A structure above grade that encloses a volume that either holds bulk solids or liquids or simulates that.

3.3.539 Technically Infeasible. A change to a building that has little likelihood of being accomplished because the existing structural conditions require the removal or alteration of a load-bearing member that is an essential part of the structural frame, or because other existing physical or site constraints prohibit modification or addition of elements, spaces, or features that are in full and strict compliance with applicable requirements.

3.3.539.1 ***Technically Infeasible (Accessibility).*** With respect to an alteration of a building or a facility, a change to a building that has little likelihood of being accomplished because existing structural conditions would require removing or altering a load-bearing member that is an essential part of the structural frame, or because other existing physical or site constraints prohibit modification or addition of elements, spaces, or features that are in full and strict compliance that the minimum requirement for alterations and that are necessary to provide accessibility.

3.3.540 Temporary Facility. See 3.3.176.9.

3.3.541 Temporary. Any object that is in place for a period of 180 consecutive days or less. *(See also 3.3.530.13.)*

3.3.542 Temporary Platform. See 3.3.414.1.

3.3.543 Tensioned-Membrane Structure. See 3.3.530.14.

3.3.544* Tent. A temporary structure, the covering of which is made of pliable material that achieves its support by mechanical means such as beams, columns, poles, or arches, or by rope or cables, or both.

3.3.544.1 ***Private Party Tent.*** A tent erected in the yard of a private residence for entertainment, recreation, dining, a reception, or similar function.

3.3.545 Terminal.

3.3.545.1 ***Marine Terminal.*** A facility comprising one or more berths, slips, piers, wharves, loading and unloading areas, warehouses, and storage yards used for transfer of people and/or cargo between waterborne carriers and land. [**307:**2.1]

3.3.545.2* ***Motor Freight Terminal.*** The area where the overall operation of freight transfer, vehicle repair and service, truck parking, and administrative functions are performed.

3.3.546 Thermal Barrier. See 3.3.45.3.

3.3.547 Thermoplastic Material. See 3.3.340.16.

3.3.548 Thermoset Material. See 3.3.340.17.

3.3.549 Through-Penetration. See 3.3.397.2.

3.3.550 Tower. An enclosed independent structure or portion of a building with elevated levels for support of equipment or occupied for observation, control, operation, signaling, or similar limited use.

3.3.551 Townhouse. A single-family dwelling constructed in attached groups of three or more units in which each unit extends from the foundation to the roof and has open space on at least two sides.

3.3.552 Toxic Material. See 3.3.340.18.

3.3.553 Two-Family Dwelling. See 3.3.146.3.

3.3.554 Type I (Segmented) Shear Wall. See 3.3.566.11.1.

3.3.555 Type II (Perforated) Shear Wall. See 3.3.566.11.2.

3.3.556* Type II Shear Wall Segment. A section of shear wall with full-height sheathing and that meets required aspect ratio limits.

3.3.557 Uncertainty Analysis. See 3.3.29.2.

3.3.558 Underground Structure. See 3.3.530.15.

3.3.559 Unstable (Reactive) Material. See 3.3.340.19.

3.3.560 Use.

3.3.560.1 ***Use (Material).*** Placing a solid, liquid, or gaseous material into action or keeping a solid or liquid material in an open vessel.

3.3.560.1.1* ***Closed System Use (Material).*** A solid or liquid hazardous material in a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations, and all uses of compressed gases.

3.3.560.1.2* ***Open System Use (Material).*** Use of a solid or liquid hazardous material in a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations.

3.3.560.2* ***Change of Use.*** A change in the purpose or level of activity within a structure that involves a change in application of the requirements of the building code.

3.3.560.3 ***Children's Use (Accessibility).*** Spaces and elements specifically designed for use primarily by people 12 years old and younger.

3.3.560.4* ***Common Use (Accessibility).*** Interior or exterior rooms, spaces, or elements that are made available for the use of a restricted group of people.

3.3.560.5* ***Public Use (Accessibility).*** Interior or exterior rooms, spaces, or elements that are made available to the public.

3.3.561 Variance (Flood Resistance). A grant of relief from a provision or provisions of this *Code*, which permits construction in a manner that would otherwise be prohibited.

3.3.562 Vehicular Way (Accessibility). See 3.3.572.2.

3.3.563 Veneered Wall. See 3.3.566.16.

3.3.564 Verification Method. A procedure or process used to demonstrate *or* confirm that the proposed design meets the specified criteria.

3.3.565 Vertical Opening. An opening through a floor or roof.

3.3.566 Wall.

3.3.566.1 ***Bearing Wall.*** Any wall meeting either of the following classifications: (1) any metal or wood stud wall that supports more than 100 lb/linear ft (1400 N/linear m) of vertical load in addition to its own weight or (2) any concrete or masonry wall that supports more than 200 lb/linear ft (2900 N/linear m) of vertical load in addition to its own weight. [**ASCE 7:**9.2.1]

3.3.566.1.1 ***Bearing Wall System.*** A structural system with bearing walls providing support for all or major portions of the vertical loads. Shear walls or braced frames provide seismic force resistance. [**ASCE 7:**9.2.1]

3.3.566.2 ***Cavity Wall.*** A wall built of masonry units or of plain concrete, or a combination of these materials arranged to provide an air space within the wall and in which the inner and outer wythes of the wall are tied together with metal ties.

3.3.566.3 ***Cripple Wall.*** Short stud wall, less than 8 ft (2.4 m) in height, between the foundation and the lowest framed floors with studs not less than 14 in. (35 mm) long—also known as a knee wall. Cripple walls can occur in both engineered structures and conventional construction. [**ASCE 7:**9.2.1]

3.3.566.4* ***Fire Wall.*** A wall separating buildings or subdividing a building to prevent the spread of fire and having a fire resistance rating and structural stability. [**221:**1.3]

3.3.566.5 ***Fire Barrier Wall.*** A wall, other than a fire wall, that has a fire resistance rating.

3.3.566.6 ***Foundation Wall.*** A wall below the floor nearest grade that serves as a structural support for a wall, pier, column, or other structural part of a building or structure, or a basement wall that resists lateral soil load.

3.3.566.7 ***Light Framed Wall.*** A wall with wood or steel studs. [**ASCE 7:**9.2.1]

3.3.566.8 ***Light-Framed Wood Shear Wall.*** A wall constructed with wood studs and sheathed with material rated for shear resistance. [**ASCE 7:**9.2.1]

3.3.566.9 ***Masonry Bonded Hollow Wall.*** A wall built of masonry units arranged to provide an air space within the wall, in which the inner and outer wythes of the wall are tied together with masonry units.

3.3.566.10 ***Metal Composite Panel Wall.*** Nonbearing wall built between columns and piers wholly supported at each story and comprised of an exterior and interior metal panel housing a foam or other insulating material.

3.3.566.11 ***Nonbearing Wall.*** A wall that is not a bearing wall. [**ASCE 7:**9.2.1]

3.3.566.12 ***Nonstructural Wall.*** All walls other than bearing walls or shear walls. [**ASCE 7:**9.2.1]

3.3.566.13 ***Proscenium Wall.*** The wall that separates the stage from the auditorium or house.

3.3.566.14 ***Retaining Wall.*** A wall that is not laterally supported at the top, and is designed to resist lateral soil load.

3.3.566.15 ***Shear Wall.*** A wall, bearing or nonbearing, designed to resist lateral seismic forces acting in the plane of the wall (sometimes referred to as a vertical diaphragm).

3.3.566.15.1 ***Type I (Segmented) Shear Wall.*** A wall designed to resist inplane lateral forces that is fully sheathed and that is provided with hold-down anchors at each end of the wall segment.

3.3.566.15.2* ***Type II (Perforated) Shear Wall.*** A wall designed to resist inplane lateral forces that is sheathed with wood structural panel or sheet steel that contains openings, but that has not been specifically designed and detailed for force transfer around wall openings.

3.3.566.16 ***Veneered Wall.*** A wall having a facing of masonry, plastic, glass, or other material securely attached to the backing but not bonded to exert a common reaction under load.

3.3.567 Wall Height. See 3.3.271.3.

3.3.568 Wall Panel. See 3.3.389.2.

3.3.569 Water-Reactive Material. See 3.3.340.20.

3.3.570 Water-Surrounded Structure. See 3.3.530.16.

3.3.571 Water Vapor Retarder. Material or construction that adequately impedes the transmission of water vapor under specified conditions. Water vapor retards have a water vapor permeance of less than 1.0 perm when tested in accordance with ASTM E 96.

3.3.572 Way.

3.3.572.1 ***Public Way.*** A street, alley, or other similar parcel of land essentially open to the outside air deeded, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width and height of not less than 10 ft (3 m).

3.3.572.2 ***Vehicular Way (Accessibility).*** A route intended for vehicular traffic, such as a street, driveway, or parking lot.

3.3.573 Weather-Exposed Surfaces. See 3.3.534.3.

3.3.574 Weathered-Membrane Material. See 3.3.340.21.

3.3.575 Wildland/Urban Interface. An area where improved property and wildland fuels meet at a well-defined boundary. [**1144:**2.1]

3.3.576 Wildland/Urban Intermix. An area where improved property and wildland fuels meet with no clearly defined boundary. [**1144:**2.1]

3.3.577 Window.

3.3.577.1 ***Bay Window.*** A window assembly whose maximum horizontal projection is no more than 2 ft (610 mm) from the plane of an exterior wall and is elevated above the floor level of the home, or a window supported on a foundation extending beyond the main walls of a building.

3.3.577.2 ***Fire Window.*** A window assembly rated in accordance with NFPA 257 and installed in accordance with NFPA 80.

3.3.578 Wood.

3.3.578.1 ***Fire Retardant–Treated Wood.*** A wood product impregnated with chemical by a pressure process or other means during manufacture, which is tested in accordance with NFPA 255, has a listed flame spread of 25 or less, and shows no evidence of significant progressive combustion when the test is continued for an additional 20-minute period; nor does the flame front progress more than 10.5 ft (3.2 m) beyond the centerline of the burners at any time during the test.

3.3.578.2 ***Preservative-treated Wood.*** Wood impregnated under pressure with compounds that reduce their susceptibility to deterioration caused by fungi, insects, or marine borers.

3.3.579 Wood Structural Panel. See 3.3.389.3.

3.3.580 Work Area. See 3.3.32.12.

3.3.581* Workstation. A defined space or independent, principal piece of equipment using hazardous chemicals within a cleanroom, or clean zone, where a specific function, a laboratory procedure, or a research activity occurs.

3.3.582 Written Notice. A notification in writing delivered in person to the individual or parties intended, or delivered at, or sent by certified or registered mail to, the last residential or business address of legal record.

3.3.583 Yard. An open, unoccupied space, other than a court, unobstructed from the ground to the sky on the lot on which a building is situated.

Chapter 4 General

4.1* Goals and Objectives.

4.1.1* Goals. The primary goals of this *Code* are safety, health, building usability, and public welfare, including property protection as it relates to the primary goals.

4.1.2* Objectives. To achieve the goals stated in 4.1.1, the goals and objectives of 4.1.3 through 4.1.6 shall be satisfied.

4.1.3 Safety. The intent of the safety goal of this *Code* is to reduce the probability of injury or death from fire, structural failure, and building use.

4.1.3.1 Safety from Fire.

4.1.3.1.1* Safety from Fire Goal. The fire safety goal of this *Code* is as follows:

(1) To provide an environment for the occupants inside or near a building that is reasonably safe from fire and similar emergencies
(2) To provide reasonable safety for fire fighters and emergency responders during search and rescue operations

4.1.3.1.2 Safety from Fire Objectives.

4.1.3.1.2.1 Buildings shall be designed and constructed to protect occupants not intimate with the initial fire development for the time needed to evacuate, relocate, or defend in place.

4.1.3.1.2.2* Buildings shall be designed and constructed to provide reasonable safety for fire fighters and emergency responders during search and rescue operations.

4.1.3.1.2.3 Buildings shall be designed and constructed to reasonably protect adjacent persons and buildings from injury, death, or substantial damage as a result of a fire.

4.1.3.1.2.4 Buildings shall be designed and constructed to provide reasonable access to the building for emergency responders.

4.1.3.2 Safety from Structural Failure.

4.1.3.2.1* Safety from Structural Failure Goals. The safety from structural failure goals of this *Code* are to provide a high confidence of a low probability of structural failure resulting in local or global collapse, or the creation of falling debris hazards that could threaten life under any load or combination of loads that the structure could reasonably be anticipated to experience, and to provide a high confidence that the structure will be capable of resisting regularly occurring loads and combinations of loads without significant damage or degradation.

4.1.3.2.2 Safety from Structural Failure Objectives.

4.1.3.2.2.1* Buildings shall be designed and constructed to withstand the dead weight of the building and its contents together with the live, impact, soil and hydrostatic pressure, rain, flood, snow, and ice loads specified in Chapter 35, as well as loads due to earthquake and wind that are expected to regularly affect the building, without damage or excessive deformation or deflection.

4.1.3.2.2.2* Buildings and their components shall be designed and constructed such that there is a low likelihood of failure under the extreme levels of live, earthquake, rain, flood, ice, impact, soil and hydrostatic pressure, snow, and wind loads that are anticipated to occur during the building life.

4.1.3.2.2.3 Buildings and building components shall be designed and constructed to reasonably protect pedestrians and persons in adjacent buildings or structures from injury or death as a result of a structural failure.

4.1.3.3 Safety During Building Use.

4.1.3.3.1* Safety During Building Use Goal. The safety during building use goal of this *Code* is to provide an environment for the occupants of the building that is reasonably safe during the normal use of the building.

4.1.3.3.2 Safety During Building Use Objectives.

4.1.3.3.2.1 Buildings shall be designed and constructed to reduce the probability of death or injury to occupants from falls during normal use.

4.1.3.3.2.2 Buildings shall be designed and constructed to provide for reasonably safe crowd movement during emergency and nonemergency conditions.

4.1.3.3.2.3 Buildings shall be designed and constructed to provide reasonable safety for occupants and workers during construction and demolition.

4.1.3.3.2.4 Buildings shall be designed and constructed to provide reasonable notification to occupants of emergency situations.

4.1.3.3.2.5 Buildings shall be designed and constructed to provide reasonable signage to identify hazards, means of egress, and other building safety features.

4.1.3.3.2.6 Buildings shall be designed and constructed to provide reasonable safety from occupants coming in contact with glazing or similar frangible construction materials during normal use of the building.

4.1.3.4 Safety from Hazardous Materials. Facilities containing high-hazard contents shall have the goal of protecting people and property from the consequences of unauthorized discharges, fires, and explosions involving hazardous materials. Designs shall minimize the risk of such events and shall minimize the consequences of such events if they occur.

4.1.4 Health. The intent of the health goal of this *Code* is to reduce the probability of an illness or injury caused by the indoor environment, vibrations and noise, surface water, release of hazardous materials, uncontrolled moisture, inadequate light, or inadequate sanitation facilities.

4.1.4.1 Interior Environment.

4.1.4.1.1* Interior Environment Goal. The interior environment goal of this *Code* is to provide an environment for occupants of the building that is reasonably safe from contaminants in the interior environment during normal use of the building.

4.1.4.1.2 Interior Environment Objectives.

4.1.4.1.2.1 Buildings shall be designed and constructed to reduce the probability of levels of airborne contaminants in the interior air that could cause illness or injury to the occupants.

4.1.4.1.2.2 Buildings shall be designed and constructed to provide reasonable levels of air, temperature, and moisture to reduce the probability of illness for occupants.

4.1.4.2 Surface Water Entry.

4.1.4.2.1 Surface Water Entry Goal. The surface water entry goal of this *Code* is to prevent surface water from unreasonably affecting the health and safety of occupants.

4.1.4.2.2 Surface Water Entry Objective. Buildings shall be designed and constructed to prevent surface water from entering or accumulating, unless the building is specifically designed and constructed to accommodate surface water entry.

4.1.4.3 Control of Contaminants.

4.1.4.3.1 Control of Contaminants Goal. The control of contaminants goal of this *Code* is to provide an environment for the occupants of the building that is as follows:

(1) Reasonably safe from substances that could constitute a hazard to the health of the occupants
(2) Reasonably free of unwanted odors and uncontrolled moisture

4.1.4.3.2 Control of Contaminants Objective. Buildings shall be designed and constructed to reduce concentrations of contaminants, unwanted odors, and uncontrolled moisture, during normal use of the building, to quantities that do not unreasonably affect the health and safety of, or irritate a substantial portion of, the occupants.

4.1.4.4 Lighting.

4.1.4.4.1 Lighting Goal. The lighting goal of this *Code* is to provide an environment for the occupants of the building that offers reasonable illumination, either natural, artificial, or both, to reduce the probability of an illness or injury.

4.1.4.4.2 Lighting Objectives.

4.1.4.4.2.1 Buildings shall be designed and constructed to provide natural or artificial light in all spaces of the building at reasonable levels to reduce the probability of illness or injury to occupants.

4.1.4.4.2.2 Habitable spaces in buildings shall be designed and constructed to provide reasonable levels of natural light to reduce the probability of illness or injury to occupants.

4.1.4.5 Sanitation.

4.1.4.5.1* Sanitation Goal. The sanitation goal of this *Code* is to reduce the probability of illness caused by insufficient sanitation or personal hygiene facilities.

4.1.4.5.2 Sanitation Objective. Buildings shall be designed and constructed with reasonable sanitary facilities for personal hygiene so as to reduce the probability of illness for occupants of the building.

4.1.4.6 Uncontrolled Moisture.

4.1.4.6.1 Uncontrolled Moisture Goal. The uncontrolled moisture goal of this *Code* is to provide an interior environ-

ment reasonably free of moisture that adversely affects the health of the occupants.

4.1.4.6.2 Uncontrolled Moisture Objectives.

4.1.4.6.2.1 Buildings shall be designed and constructed to control precipitation entering the exterior envelope of the building to quantities that do not unreasonably affect the health of the occupants.

4.1.4.6.2.2 Buildings shall be designed and constructed to control water vapor entering the exterior envelope of the building or concealed spaces within the building to quantities that do not unreasonably affect the health of the occupants.

4.1.4.6.2.3 Buildings shall be designed and constructed to control moisture or leaks occurring within the building to quantities that do not unreasonably affect the health of the occupants.

4.1.5 Usability Goal. The intent of the usability goal of this *Code* is to reduce the probability that all potential occupants of a building are unreasonably impeded in the access to, or the reasonable use of, a building, consistent with its normal function, and that the building is capable of functioning at the level for which it was designed.

4.1.5.1 Accessibility.

4.1.5.1.1 Accessibility Goal. The intent of the accessibility goal of this *Code* is to ensure that all persons, including those with physical or sensory limitations, have reasonable access to a building and the facilities it contains.

4.1.5.1.2 Accessibility Objective. Buildings shall be designed and constructed to provide reasonable access to the building and its facilities for all persons, including those with physical or sensory limitations.

4.1.5.2 Barrier-Free Use.

4.1.5.2.1 Barrier-Free Use Goal. The intent of the barrier-free use goal of this *Code* is to ensure that all persons, including those with physical or sensory limitations, are not unreasonably impeded from circulation within a building and have reasonable use of facilities within a building.

4.1.5.2.2 Barrier-Free Use Objectives.

4.1.5.2.2.1 Buildings shall be designed and constructed to provide reasonable circulation within the building for all persons, including those with physical or sensory limitations.

4.1.5.2.2.2 Buildings shall be designed and constructed to provide reasonable use of facilities within the building for all persons, including those with physical or sensory limitations.

4.1.5.3 Function.

4.1.5.3.1* Function Goal. The intent of the function goal of this *Code* is to ensure that a building and its systems, features, and construction, throughout its life, provide reasonable capability of operation to satisfy the other goals of this *Code*.

4.1.5.3.2* Function Objective. Buildings shall be designed and constructed to provide reasonable assurance that its systems, features, and construction are capable of performing their intended use to satisfy the objectives of this *Code*.

4.1.6* Public Welfare. The intent of the public welfare goal of this *Code* is to ensure that the design, construction, and operation of the building is consistent with the reasonable expectations of society with respect to energy efficiency, cultural heritage preservation, mission continuity, and environment.

4.1.6.1 Energy Efficiency.

4.1.6.1.1 Energy Efficiency Goal. The energy efficiency goal of this *Code* is to ensure that a building, in its design, construction, and operation, utilizes energy efficiently.

4.1.6.1.2 Energy Efficiency Objective. Buildings shall be designed and constructed to be reasonably efficient in the use of energy from depletable sources.

4.1.6.2 Cultural Heritage.

4.1.6.2.1 Cultural Heritage Goal. The cultural heritage goal of this *Code* is to ensure that reasonable care in design and construction is provided to preserve the original quality or character of a historic building, structure, or site.

4.1.6.2.2 Cultural Heritage Objective. Buildings shall be designed and constructed to reasonably preserve the original quality or character of a historic building, structure, or site.

4.1.6.3 Mission Continuity.

4.1.6.3.1* Mission Continuity Goal. The mission continuity goal of this *Code* is to maintain a high probability that the building continues to perform the function for which it is intended following a fire, an earthquake, a flood, and other internal or external events.

4.1.6.3.2* Mission Continuity Objective. Buildings that provide a public welfare role for a community shall be designed and constructed to provide reasonable assurance of continued function following a fire, an earthquake, a flood, and other internal or external events.

4.1.6.4 Environment.

4.1.6.4.1 Environment Goal. The environment goal of this *Code* is to ensure that a building, in its design and construction, does not impact the environment in an unreasonably negative manner.

4.1.6.4.2* Environment Objective. Buildings shall be designed and constructed to reasonably ensure that the probability of harm to the external environment surrounding the building is minimized.

4.2* Assumption — Single Fire Source. The fire protection methods of this *Code* assume that multiple simultaneous fire incidents will not occur. This assumption shall not preclude the evaluation of multiple design fire scenarios as required by Section 5.5 for performance-based designs.

4.3 Building Design and Life Safety Compliance Options.

4.3.1 Options. Building design meeting the goals and objectives of Section 4.1 shall be provided in accordance with either of the following:

(1) The prescriptive-based provisions of 4.3.2
(2) The performance-based provisions of 4.3.3

4.3.2 Prescriptive-Based Option.

4.3.2.1 A prescriptive-based building design shall be in accordance with Chapter 1 through Chapter 4 and Chapter 6 through Chapter 55 of this *Code*.

4.3.2.2 Where specific requirements contained in Chapter 15 through Chapter 55 differ from general requirements contained in Chapter 1 through Chapter 4 and Chapter 6 through Chapter 14, the requirements of Chapter 15 through Chapter 55 shall govern.

4.3.3 Performance-Based Option.

4.3.3.1 A performance-based building design shall be in accordance with Chapter 1 through Chapter 5 of this *Code*.

4.3.3.2 Prescriptive requirements shall be permitted to be used as part of the performance approach, if they, in conjunction with the performance features, meet the overall goals and objectives of this *Code*.

4.4 Fundamental Fire and Life Safety Requirements.

4.4.1 Multiple Safeguards. The design of every building or structure intended for human occupancy shall be such that reliance for property protection and safety to life does not depend solely on any single safeguard. An additional safeguard(s) shall be provided for property protection and life safety in case any single safeguard is ineffective due to inappropriate human actions, building failure, or system failure.

4.4.2 Appropriateness of Safeguards. Every building or structure shall be provided with means of egress and other fire and life safety safeguards of the kinds, numbers, locations, and capacities appropriate to the individual building or structure, with due regard to the following:

(1) Character of the occupancy, including fire load
(2) Capabilities of the occupants
(3) Number of persons exposed
(4) Fire protection available
(5) Height and type of construction of the building or structure
(6) Other factors necessary to provide occupants with a reasonable degree of safety
(7) Other factors necessary to protect the building and contents from unacceptable damage

4.4.3 Means of Egress.

4.4.3.1 Number of Means of Egress. Two means of egress, as a minimum, shall be provided in every building or structure, section, and area where size, occupancy, and arrangement endanger occupants attempting to use a single means of egress that is blocked by fire or smoke. The two means of egress shall be arranged to minimize the possibility that both might be rendered impassable by the same emergency condition.

4.4.3.2 Unobstructed Egress. In every occupied building or structure, means of egress from all parts of the building shall be maintained free and unobstructed. No lock or fastening shall be permitted that prevents free escape from the inside of any building other than in health care occupancies and detention and correctional occupancies, where staff are continually on duty and effective provisions are made to remove occupants in case of fire or other emergency. Means of egress shall be accessible to the extent necessary to ensure reasonable safety for occupants with impaired mobility.

4.4.3.3 Awareness of Egress System. Every exit shall be clearly visible, or the route to reach every exit shall be conspicuously indicated. Each means of egress, in its entirety, shall be arranged or marked so that the way to a place of safety is indicated in a clear manner.

4.4.3.4 Lighting. Where artificial illumination is needed in a building or structure, egress facilities shall be included in the lighting design.

4.4.4* Occupant Notification. In every building or structure of such size, arrangement, or occupancy that a fire itself might not provide adequate occupant warning, fire alarm facilities shall be provided where necessary to warn occupants of the existence of fire.

4.4.5 Vertical Openings. Every vertical opening between the floors of a building shall be suitably enclosed or protected, as necessary, to provide the following:

(1) Reasonable safety to occupants while using the means of egress by preventing spread of fire, smoke, or fumes through vertical openings from floor to floor to allow occupants to complete their use of the means of egress
(2) Limitation of damage to the building and its contents

4.4.6 System Design/Installation. Any fire protection system, building service equipment, feature of protection, or safeguard provided for fire and life safety shall be designed, installed, and approved in accordance with applicable NFPA codes and standards.

4.4.7 Limiting Fire Spread.

4.4.7.1 Interior Finishes. The interior surfaces of the building shall not contribute to an unacceptable rate and magnitude of fire spread and generation of heat and smoke.

4.4.7.2 Concealed Spaces. The construction of concealed spaces shall not contribute to an unacceptable rate of the spread of fire, hot gases, and smoke to areas of the building remote from the fire source and shall limit their spread beyond the immediate area of the origin of the fire.

4.4.7.3 Compartmentation. The building shall be compartmented, as appropriate, by walls and floors, including their associated openings with proper closures, to limit the spread of fire, hot gases, and smoke to an acceptable area beyond the immediate area of fire origin.

4.4.8 Structural Integrity. The building's structural members and assemblies shall be provided with the appropriate degree of fire resistance to limit structural damage to an acceptable level and to limit damage to the building and its contents and to adjacent buildings and property.

4.4.9 Maintenance. Whenever or wherever any device, equipment, system, condition, arrangement, or level of protection, or any other feature, is required for compliance with the provisions of this *Code*, such device, equipment, system, condition, arrangement, level of protection, or other feature shall thereafter be maintained, unless the *Code* exempts such maintenance.

4.5 General Requirements.

4.5.1 Authority Having Jurisdiction.

4.5.1.1 The authority having jurisdiction shall determine whether the provisions of this *Code* are met.

4.5.1.2 Where it is evident that a reasonable degree of safety is provided, any requirement shall be permitted to be modified if its application would be hazardous under normal occupancy conditions in the judgment of the authority having jurisdiction.

4.5.2 Historic Buildings. See Chapter 15.

4.5.3 Provisions in Excess of *Code* Requirements. Nothing in this *Code* shall be construed to prohibit a superior type of building construction, an additional means of egress, or an otherwise safer condition than that specified by the minimum requirements of this *Code*.

4.5.4 Conditions for Occupancy.

4.5.4.1 No new construction or existing building shall be occupied in whole or in part in violation of the provisions of this *Code,* unless the following conditions exist:

(1) A plan of correction has been approved.
(2) The occupancy classification remains the same.
(3) No serious life safety hazard exists, as judged by the authority having jurisdiction.

4.5.4.2 Where compliance with this *Code* is effected by means of a performance-based design, the owner shall annually certify compliance with the conditions and limitations of the design by submitting a warrant of fitness acceptable to the authority having jurisdiction. The warrant of fitness shall attest that the building features, systems, and use have been inspected and confirmed as still consistent with design specifications outlined in the documentation required by Section 5.8 and that they continue to satisfy the goals and objectives specified in Section 4.1. *(See Chapter 5.)*

4.5.5 Construction, Repair, and Improvement Operations.

4.5.5.1 Buildings or portions of buildings shall be permitted to be occupied during construction, repair, or alteration, or during construction of additions, where required means of egress, required fire protection features, and other health and safety features necessary for the protection of occupants and the general public are in place and continuously maintained for the portion occupied or where alternative life safety measures and building protection measures acceptable to the authority having jurisdiction are in place.

4.5.5.2 In buildings under construction, adequate escape facilities shall be maintained at all times for the use of construction workers. Escape facilities shall consist of doors, walkways, stairs, ramps, fire escapes, ladders, or other approved means or devices arranged in accordance with the general principles of the *Code,* insofar as they can reasonably be applied to buildings under construction.

4.5.5.3 Flammable or explosive substances or equipment for repairs or alterations shall be permitted in a building while the building is occupied if the condition of use and safeguards provided do not create any additional danger or impediment to egress beyond the conditions normally permitted in the building.

4.5.6* Changes of Use. Changes of use, including change of occupancy, shall be in accordance with Chapter 15.

4.5.7 Wildland/Urban Interface or Wildland/Urban Intermix. Buildings or structures located in a wildland/urban interface or wildland/urban intermix shall comply with this *Code* and NFPA 1144, *Standard for the Protection of Life and Property from Wildfire.*

4.5.8 Maintenance and Testing.

4.5.8.1 Whenever or wherever any device, equipment, system, condition, arrangement, or level of protection, or any other feature, is required for compliance with the provisions of this *Code*, such device, equipment, system, condition, arrangement, level of protection, or other feature shall thereafter be continuously maintained in accordance with applicable NFPA requirements or requirements developed as part of a performance-based design, or as directed by the authority having jurisdiction.

4.5.8.2 Equipment requiring periodic testing or operation to ensure its maintenance shall be tested or operated as specified elsewhere in this *Code* or as directed by the authority having jurisdiction.

4.5.8.3 Maintenance and testing shall be under the supervision of a responsible person who shall ensure that testing and maintenance are made at specified intervals in accordance with applicable NFPA standards or as directed by the authority having jurisdiction.

4.5.9 Buildings and Structures in Flood Hazard Areas. The provisions of Chapter 39 of this *Code* shall apply to new and existing buildings and structures located wholly or partly within flood hazard areas.

4.6 Roof Access.

4.6.1 Structures shall provide means of access to the roof in accordance with Section 4.6 in cases where the roof is flat or the roof has a pitch less than 3 in 12, and the structure either is four or more stories in height or the roof is 40 ft (12 m) or more above grade for more than 50 percent of the building perimeter.

4.6.2 Where required by 4.6.1, at least one means of access to the roof shall be provided. Additional access shall be provided at the rate of one access for each 100,000 ft^2 (9300 m^2) of roof area.

4.6.3 Where roof access is required, at least one means of access shall be provided by stairs complying with 11.2.2.3. Additional roof access using ladders in accordance with 11.2.9 shall be permitted.

4.6.4* Where roof access is required, such access shall be provided with a door that is readily operable from both sides by fire department personnel.

Chapter 5 Performance-Based Option

5.1* General Requirements.

5.1.1 Application. The requirements of this chapter shall apply to buildings designed to the performance-based option permitted by Section 4.3.

5.1.2 Goals and Objectives. The performance-based design shall meet the goals and objectives of Section 4.1.

5.1.3* Independent Review. The authority having jurisdiction shall be permitted to require an approved, independent third party to review the proposed design and provide an evaluation of the design to the authority having jurisdiction at the expense of the owner.

5.1.4 Sources of Data. Data sources shall be identified and documented for each input data requirement that must be met using a source other than a design scenario, an assumption, or a building design specification. The degree of conservatism reflected in such data shall be specified, and a justification for the source shall be provided.

5.1.5 Final Determination. The authority having jurisdiction shall make the final determination as to whether the performance objectives have been met.

5.1.6* Maintenance of Design Features.

5.1.6.1 The design features required for the building to continue to meet the performance goals and objectives of this

Code shall be maintained for the life of the building. Such performance goals and objectives shall include complying with all documented assumptions and design specifications. Any variations shall require the approval of the authority having jurisdiction prior to the actual change.

5.1.6.2 Whenever or wherever any device, equipment, system, condition, arrangement, level of protection, or other feature is required to meet the goals, objectives, or performance criteria of this *Code*, approved procedures for the operation and maintenance of such device, equipment, system, condition, arrangement, level of protection, or other feature shall be prepared, and an approved system of inspection, maintenance, and testing shall be included in an operations and maintenance manual developed as part of the performance-based design or as directed by the authority having jurisdiction.

5.1.7 Special Definitions. See Section 3.3.

5.2 Performance Criteria.

5.2.1 General. To achieve the goals and objectives of Section 4.1, a building design shall meet the performance criteria in Section 5.2.

5.2.2* Safety from Fire.

5.2.2.1 Equipment and fixtures in a building shall be designed and installed to reasonably prevent the ignition of construction materials and building contents.

5.2.2.2* Buildings shall be designed and constructed to reasonably prevent the spread of fire beyond the compartment of fire origin.

5.2.2.3 Buildings shall be designed and constructed to reasonably prevent structural failure under fire conditions for a time sufficient to protect the occupants.

5.2.2.4 Means shall be provided to evacuate, relocate, or defend in place occupants of buildings for a time sufficient to prevent them from exposure to instantaneous or cumulative untenable conditions from smoke, heat, or flames.

5.2.2.5* Buildings shall be designed and constructed to reasonably prevent structural failure under fire conditions for a time sufficient to enable fire fighters and emergency responders to conduct search and rescue operations.

5.2.2.6* Buildings shall be designed and constructed to reasonably prevent fire spread to adjacent buildings and structures for a time sufficient for emergency responders to arrive on-site and establish fire suppression operations.

5.2.2.7 Access shall be provided to enable fire apparatus to reach the principal building entrance for fire department use and to reach the fire emergency equipment provided for the building.

5.2.3 Safety from Structural Failure.

5.2.3.1* General. Buildings shall be designed and constructed to withstand combinations of dead, live, impact, soil and hydrostatic pressure, rain, flood, wind, ice, snow, and earthquake loads at the serviceability performance level and immediate occupancy performance level without collapse as specified in 5.5.3 for the structural design scenarios.

5.2.3.2* Serviceability Performance. The serviceability level of performance shall be a state in which structural elements and nonstructural components shall not sustain detrimental cracking or yielding, or degradation in strength, stiffness, or fire resistance requiring repair. Structures shall not experience permanent deformation or deflection or deformation or deflection that is troubling to occupants or disruptive of building function. Nonstructural components and permanent fixtures and features shall not become displaced or dislodged.

5.2.3.3* Immediate Occupancy Performance. The immediate occupancy level of performance shall be a state in which minor, repairable cracking, yielding, and permanent deformation of the structure and nonstructural elements shall be permitted to occur. However, the structure shall not sustain such degradation in configuration, stiffness, strength, or fire resistance that it is unsafe for continued occupancy.

5.2.3.4* Collapse Prevention Performance. Buildings shall be designed and constructed to reasonably prevent structural failure under extreme loads to enable emergency responders to effect occupant rescue and evacuate the building.

5.2.4 Safety During Building Use.

5.2.4.1 Measures shall be provided to prevent falls in locations where an occupant could fall 30 in. (760 mm) or more during normal use of a building.

5.2.4.2 Stairs shall be designed and constructed in such a manner as to reasonably prevent falls by occupants.

5.2.4.3 In assembly occupancy buildings with occupant loads greater than 1000, measures shall be provided to reasonably prevent injury or death during the movement of crowds in emergency and nonemergency conditions.

5.2.4.4 During construction and demolition, measures shall be taken to ensure the safety of occupants and workers from fire and other hazards in the building undergoing construction or demolition and in adjacent buildings that could be impacted by a hazard in the building undergoing construction or demolition.

5.2.4.5* Measures shall be provided to alert occupants to the presence of a fire or other emergency condition to provide sufficient time for occupants to evacuate, relocate, or defend in place.

5.2.4.6 Signs shall be provided inside and outside buildings to identify means of egress, exits, emergency safety features, potential hazards, and features intended for the safety and for the amenity of occupants with physical or sensory limitations.

5.2.4.7 Glass or other similar frangible construction material shall be installed in such a manner that, if occupants come into contact with such material, one of the following occurs:

(1) The material resists impact without breaking.
(2) The material breaks in such a manner that it does not cause injury.
(3) The material is protected from occupant impact.

5.2.5 Surface Water Entry. Buildings shall be designed and constructed to ensure that surface water will not enter or accumulate during the design flood, unless the building is designed to accommodate such surface water entry.

5.2.6 Control of Contaminants.

5.2.6.1* Buildings shall limit, or shall be provided with systems to reduce, concentrations in the building of contaminants, unwanted odors, and excess moisture, to quantities that do not unreasonably affect the health and safety or irritate a substantial portion of the occupants during normal use of the building.

5.2.6.2* Strong concentrations of pollutants, odors, and moisture shall be eliminated or collected at their point of origin and exhausted from the building; mild concentrations shall be diluted with outdoor air by natural or mechanical means.

5.2.7 Function. Building, construction, facilities and equipment required by this *Code* shall be designed, constructed, and installed in a manner that minimizes the risk of failure, when required, during the occupancy of the building.

5.2.8 Cultural Heritage.

5.2.8.1 Additions, alterations, and renovations in culturally significant buildings and structures shall be undertaken so as to preserve their original quality or character and so that, if the additions, alterations, or renovations were removed in the future, the essential form and integrity of the original building or structure would be essentially unchanged.

5.2.8.2* For historic buildings or structures located in whole or in part in flood hazard areas established by 39.4.2, work on the building or structure shall be permitted, provided the following provisions are met:

(1) The proposed work does not preclude the continued designation as a historic building or structure.
(2) A variance to the flood provisions of this *Code* is granted by the board of appeals.

5.2.9 Mission Continuity. Buildings that perform a community public welfare role shall incorporate means appropriate to their function and importance to ensure their continued operation following a fire or other natural or man-made disaster.

5.2.10 Environment. Buildings shall be designed and constructed so that, during their construction and operation, damage to the environment from waste gases, solids, or liquids from the building is reduced to the greatest extent possible.

5.2.11 Uncontrolled Moisture.

5.2.11.1 The exterior envelope of the building shall be designed to control the entry of precipitation into the building.

5.2.11.2 The exterior walls, attics, crawl spaces, and other concealed or enclosed building elements that comprise the building envelope shall be designed to control the accumulation of water vapor or its condensation in such quantities and physical state that contact of water vapor or its condensation with the building insulation or building materials will not result in conditions that adversely affect the health of the building occupants.

5.2.11.3 Building materials located in areas within the building that are subject to exposure from water discharges or leaks in quantities and durations that cause exterior moisture to accumulate for extended periods of time, thus resulting in conditions that adversely affect the health of the building occupants, shall be designed to control penetration of, or direct contact with, water or shall be protected from such exposure.

5.3 Retained Prescriptive Requirements. The design shall comply with the requirements of Section 5.3 in addition to the performance criteria of Section 5.2 and the methods of Section 5.4 through Section 5.8.

5.3.1 Systems and Features. All fire protection systems and features of the building shall comply with applicable NFPA standards for those systems and features.

5.3.2 Means of Egress. Means of egress shall comply with the following:

(1) Changes in level in means of egress — 11.1.7
(2) Guards — 11.1.8
(3) Doors — 11.2.1
(4) Stairs — 11.2.2, other than the provisions of 11.2.2.5.1, 11.2.2.5.2, 11.2.2.7.2, 11.2.2.7.3, and 11.2.2.7.4
(5) Ramps — 11.2.5, other than the provisions of 11.2.5.3.1, 11.2.5.5, and 11.2.5.6.1
(6) Fire escape ladders — 11.2.9
(7) Alternating tread devices — 11.2.11
(8) Capacity of means of egress — Section 11.3, other than the provisions of 11.3.3 and 11.3.4
(9) Impediments to egress — 11.5.2
(10) Illumination of means of egress — Section 11.8
(11) Emergency lighting — Section 11.9
(12) Marking of means of egress — Section 11.10

5.3.3 Equivalency. Equivalent designs for the features covered in the retained prescriptive requirements mandated by Section 5.3 shall be addressed in accordance with the equivalency provisions of Section 1.5.

5.3.4 Accessibility. Accessibility shall comply with Chapter 12.

5.3.5 Building Environment.

(A) Interior Environment. The interior environment shall comply with Section 49.2.

(B) Lighting. Lighting shall comply with Section 49.3.

(C) Sound Transmission. Sound transmission shall comply with Section 49.4.

(D) Indoor Space Dimensions. Indoor space dimensions shall comply with Section 49.5.

(E) Access to Attics. Access to attics shall be in accordance with Section 49.6.

(F) Heating and Cooling Design Conditions. Heating and cooling design conditions shall comply with Section 49.7.

(G) Special Interior Requirements. Interior environments shall comply with Section 49.8.

5.3.6 Energy Efficiency. Energy efficiency shall comply with Chapter 51.

5.3.7 Quality Assurance During Construction. Quality assurance during construction shall comply with Chapter 40.

5.3.8 Plumbing Systems. Plumbing systems shall comply with Chapter 53.

5.3.9 Electrical Systems Electrical systems shall comply with Chapter 52.

5.3.10 Flood-Resistant Construction. Construction shall be in accordance with Chapter 39.

5.4* Performance-Based Design Characteristics and Assumptions.

5.4.1 General.

5.4.1.1 Design characteristics and assumptions used in the performance-based design shall be clearly stated and shown to be realistic and sustainable.

5.4.1.2 Each design characteristic and assumption used in the design shall be accurately translated into input data specifications, as appropriate for the calculation method or model to be used.

5.4.1.3 Design characteristics and assumptions that the design analyses do not explicitly address or incorporate and that are, therefore, omitted from input data specifications shall be identified, and a sensitivity analysis of the consequences of that omission shall be performed.

5.4.1.4 Design characteristics and assumptions modified in input data specifications, due to limitations in test methods or other data-generation procedures, shall be identified, and a sensitivity analysis of the consequences of the modification shall be performed.

5.4.1.5* The design shall not include mutually inconsistent characteristics, assumptions, or statements of conditions.

5.4.2 Building Characteristics and Assumptions.

5.4.2.1* Characteristics of the building or its contents, equipment, layout, or operations that are not inherent in the design specifications, but that affect occupant or building behavior or the rate of hazard development, shall be explicitly identified.

5.4.2.2* The performance of building systems and features shall reflect the documented performance and reliability of the components of those systems or features, unless design specifications are incorporated to modify the expected performance.

5.4.3 Occupant Characteristics and Assumptions.

5.4.3.1* General. The selection of occupant characteristics to be used in the design calculations shall be approved by the authority having jurisdiction and shall provide an accurate reflection of the expected population of building users.

5.4.3.2 Occupant Profile. Occupant characteristics shall represent the normal occupant profile, unless design specifications are used to modify the expected occupant features.

5.4.3.3* Response Characteristics. The basic response characteristics of sensibility, reactivity, mobility, and susceptibility shall be considered. Such consideration shall include the expected distribution of characteristics of a population appropriate to the use of the building. The source of data for these characteristics shall be documented.

5.4.3.4 Location. It shall be assumed that, in every normally occupied room or area, at least one person shall be located at the most remote point from the exits.

5.4.3.5* Number of Occupants. The design shall be based on the maximum number of people that every occupied room or area is expected to contain. Where success or failure of the design is contingent on the number of occupants not exceeding a certain number, operational controls shall be used to ensure that a greater number of occupants could not be expected to be present.

5.4.3.6* Staff Assistance. In those occupancies where staff assistance is required to ensure the safety of other occupants, such trained assistance shall be provided. The ability of trained employees to be included as part of the building safety system shall be identified and documented.

5.4.4 Emergency Response Personnel Characteristics and Assumptions.

5.4.4.1 Nongovernmental emergency response personnel shall not be relied upon in the performance design, unless they are under the continuous and direct control of the building owner or occupant. Emergency response personnel of the governmental agency legally responsible for providing emergency responders to the local jurisdiction shall be permitted to be relied upon in the performance design when approved by the governmental agency.

5.4.4.2 Design characteristics and assumptions related to the availability, speed of response, effectiveness, roles, and other characteristics of emergency response personnel shall be specified, estimated, or characterized sufficiently for evaluation of the design.

5.4.5 Other Characteristics and Assumptions.

5.4.5.1* Post-Construction Conditions. Design characteristics or assumptions related to activities during the life of the building that affect the ability of the building to meet the stated goals, objectives, and performance criteria of this *Code* shall be specified, estimated, or characterized sufficiently to evaluate the design.

5.4.5.2 Off-Site Conditions. Design characteristics or assumptions related to resources or conditions outside the property being designed that affect the ability of the building to meet the stated goals, objectives, and performance criteria of this *Code* shall be specified, estimated, or characterized sufficiently for evaluation of the design.

5.4.5.3* Special Provisions. Additional provisions not covered by the design characteristics and assumptions provided in Section 5.4 but that are required for the design to comply with the goals, objectives, or performance criteria of this *Code* shall be documented.

5.4.5.4 Single Fire Source. It is assumed that a single fire source shall be utilized to evaluate the protection measures provided in this *Code*.

5.5* Design Scenarios.

5.5.1 General.

5.5.1.1 The proposed design shall be considered to meet the goals and objectives if it achieves the performance criteria for each required design scenario. The authority having jurisdiction shall approve the parameters involved with design scenarios.

5.5.1.2* Design scenarios shall be evaluated for each required scenario using a method acceptable to the authority having jurisdiction and appropriate for the conditions. Each scenario shall be as challenging and realistic as any that could realistically occur in the building.

5.5.1.3* Scenarios selected as design scenarios shall include, but shall not be limited to, those specified in 5.5.2 through 5.5.4. Design fire scenarios demonstrated by the design team to the satisfaction of the authority having jurisdiction as inappropriate for the building use and conditions shall not be required to be evaluated fully. Fire Design Scenario 8 shall not be required to be applied to fire protection systems for which both the level of reliability and the design performance in the absence of the system are acceptable to the authority having jurisdiction.

5.5.1.4 Each design scenario used in the performance-based design proposal shall be translated into input data specifications, as appropriate for the calculation method or model.

5.5.1.5 Any design scenario specifications that the design analyses do not explicitly address or incorporate and that are, therefore, omitted from input data specifications shall be identified, and a sensitivity analysis of the consequences of that omission shall be performed.

5.5.1.6 Any design scenario specifications modified in input data specifications, due to limitations in test methods or other data-generation procedures, shall be identified, and a sensitivity analysis of the consequences of the modification shall be performed.

5.5.2 Required Design Scenarios — Fire.

5.5.2.1* Fire Design Scenario 1. Fire Design Scenario 1, which is an occupancy-specific design scenario representative of a typical fire for the occupancy, shall explicitly specify the following:

(1) Occupant activities
(2) Number and location of occupants
(3) Room size
(4) Furnishings and contents
(5) Fuel properties and ignition sources
(6) Ventilation conditions
(7) First item ignited and its location

5.5.2.2* Fire Design Scenario 2. Fire Design Scenario 2, which is an ultrafast-developing fire in the primary means of egress, with interior doors open at the start of the fire, shall address the concern regarding a reduction in the number of available means of egress.

5.5.2.3* Fire Design Scenario 3. Fire Design Scenario 3, which is a fire that starts in a normally unoccupied room that can potentially endanger a large number of occupants in a large room or other area, shall address the concern regarding a fire starting in a normally unoccupied room and migrating into the space that can, potentially, hold the greatest number of occupants in the building.

5.5.2.4* Fire Design Scenario 4. Fire Design Scenario 4, which is a fire that originates in a concealed wall space or ceiling space adjacent to a large, occupied room, shall address the concern regarding a fire originating in a concealed space that does not have either a detection system or suppression system and then spreading into the room within the building that can, potentially, hold the greatest number of occupants.

5.5.2.5* Fire Design Scenario 5. Fire Design Scenario 5, which is a slow-developing fire, shielded from fire protection systems, in close proximity to a high occupancy area, shall address the concern regarding a relatively small ignition source causing a significant fire.

5.5.2.6* Fire Design Scenario 6. Fire Design Scenario 6, which is the most severe fire resulting from the largest possible fuel load characteristic of the normal operation of the building, shall address the concern regarding a rapid-developing fire with occupants present.

5.5.2.7* Fire Design Scenario 7. Fire Design Scenario 7, which is an outside exposure fire, shall address the concern regarding a fire starting at a location remote from the area of concern and either spreading into the area, blocking escape from the area, or developing untenable conditions within the area.

5.5.2.8* Fire Design Scenario 8. Fire Design Scenario 8, which is a fire originating in ordinary combustibles in a room or area with each passive or active fire protection system or fire protection feature independently rendered ineffective, shall address the concern regarding each fire protection system or fire protection feature, considered individually, being unreliable or becoming unavailable. This scenario shall not be required to be applied to fire protection systems or fire protection features for which both the level of reliability and the design performance in the absence of the system or feature are acceptable to the authority having jurisdiction.

5.5.3 Required Design Scenarios — Structural.

5.5.3.1 Serviceability Scenario. Buildings shall be designed and constructed to provide serviceability performance, as presented in 5.2.3.2, under dead load and in combination with live, impact, soil and hydrostatic pressure, rain, flood, wind, ice, snow, and earthquake loads having the mean recurrence intervals indicated in Table 5.5.3.1. The following combinations of load shall be considered, or, alternatively, the loads and load combinations specified in ASCE-7, *Minimum Design Loads for Buildings and Other Structures,* shall be permitted to be used:

(1) Dead
(2) Dead and floor live and impact
(3) Dead and floor live and roof live or snow or rain
(4) Dead and floor live and wind or earthquake
(5) Dead and wind or earthquake
(6) In hurricane-prone regions, dead and wind and flood
(7) In other areas, dead and flood

Table 5.5.3.1 Serviceability Level Mean Recurrence Intervals for Transient Loads (yr)

	Occupancy Category[2]			
Load Type[1]	I	II	III	IV
Live	50	50	50	50
Snow	50	50	100	100
Wind	NA	10	20	20
Earthquake	NA	25	50	100
Flood	100	100	100	100

Note: NA = not applicable.
[1] Loading includes deflection and vibration.
[2] Occupancy categories are as defined in ASCE-7.

5.5.3.1.1 The effects of soil and hydrostatic pressure shall be considered concurrently with dead loads in the above load combinations specified in 5.5.3.1(1) through 5.5.3.1(7).

5.5.3.1.2 Seventy-five percent of the effects of floor live and wind loads, or floor live and earthquake loads, shall be permitted to be used when considered in combination.

5.5.3.2 Immediate Occupancy Scenario. Buildings and their nonstructural components shall be designed and constructed to provide the immediate occupancy performance level, as presented in 5.2.3.3, under dead load in combination with live loads having the mean recurrence intervals indicated in Table 5.5.3.1 and earthquake loads having the mean recurrence intervals indicated in Table 5.5.3.2. Building cladding systems shall be designed to provide immediate occupancy performance under dead load in combination with the wind loads indicated in Table 5.5.3.2. The following load combinations shall be used:

(1) Dead and floor live and earthquake
(2) Dead and wind or earthquake

5.5.3.2.1 The effects of soil and hydrostatic pressure shall be considered concurrently with dead loads in the above load combinations specified in 5.5.3.2.

Table 5.5.3.2 Immediate Occupancy Level Mean Recurrence Intervals for Transient Loads (yr)

Load Type[1]	Occupancy Category[2]			
	I	II	III	IV
Wind[3]	25	50	100	100
Earthquake	NA	50	100	200
Flood[4]	NA	100	100	100

Note: NA = not applicable.
[1] Loading includes deflection and vibration.
[2] Occupancy categories are as defined in ASCE-7.
[3] In hurricane-prone areas, wind speed is based on both hurricane simulation techniques and 500-yr wind speed records.
[4] In hurricane-prone areas, flood height is determined in conjunction with the hurricane wind surge.

5.5.3.2.2 Seventy-five percent of the effects of floor live and wind loads, or floor live and earthquake loads, shall be permitted to be used when considered in combination.

5.5.3.3 Collapse Prevention Scenario. Buildings shall be designed and constructed to resist collapse, and their components shall be designed to resist failure as presented in 5.2.3.4 under dead load in combination with live loading having the mean recurrence intervals indicated in Table 5.5.3.1, in combination with ground motion intensities having the fraction of maximum considered earthquake (MCE) intensity indicated in Table 5.5.3.3. The following combinations of load shall be considered:

(1) Dead and floor live and earthquake
(2) Dead and earthquake

Table 5.5.3.3 Collapse Prevention Level Minimum Intensities for Earthquake Shaking (multiple of MCE acceleration)

Component	Occupancy Category*			
	I	II	III	IV
Structure and structural components	0.67	1.0	1.25	1.5
Nonstructural components	0.67	0.67	0.83	1.0

Note: Maximum considered earthquake (MCE) shaking is as defined in ASCE-7.
*Occupancy categories are as defined in ASCE-7.

5.5.3.3.1 The effects of soil and hydrostatic pressure shall be considered concurrently with dead loads in the load combinations specified in 5.5.3.3.

5.5.3.3.2 Seventy-five percent of the effects of floor live and earthquake loads shall be permitted to be used when considered in combination.

5.5.4 Required Design Scenarios — Safety During Building Use.

5.5.4.1* Building Use Design Scenario 1. Building Use Design Scenario 1, which is an event in which the maximum occupant load is in the assembly occupancy building and an emergency event occurs blocking the principal exit/entrance to the building, shall address the concern of occupants having to take alternative exit routes under crowded conditions.

5.5.4.2 Building Use Design Scenario 2. Building Use Design Scenario 2, which is a fire in an area of a building undergoing construction or demolition while the remainder of the building is occupied and in which the normal fire suppression system in the area has been taken out of service, shall address the concern regarding the inoperability of certain building fire safety features during construction and demolition in a partially occupied building.

5.6 Evaluation of Proposed Designs.

5.6.1 General. A proposed design's performance shall be assessed relative to each performance objective in Section 4.1 and each applicable scenario in Section 5.5, with the assessment conducted through the use of appropriate calculation methods. The authority having jurisdiction shall approve the choice of assessment methods.

5.6.2 Use. The design professional shall use the assessment methods to demonstrate that the proposed design will achieve the goals and objectives for each scenario, as measured by the performance criteria in light of the safety margins and uncertainty analysis, given the assumptions.

5.6.3 Input Data.

5.6.3.1 Data. Input data for computer fire models shall be obtained in accordance with ASTM E 1591, *Standard Guide for Obtaining Data for Deterministic Fire Models.* Data for use in analytical models that are not computer-based fire models shall be obtained using appropriate measurement, recording, and storage techniques to ensure the applicability of the data to the analytical method being used.

5.6.3.2 Data Requirements. A complete listing of input data requirements for all models, engineering methods, and other calculation or verification methods required or proposed as part of the performance-based design shall be provided.

5.6.3.3 Uncertainty and Conservatism of Data. Uncertainty in input data shall be analyzed and, as determined appropriate by the authority having jurisdiction, addressed through the use of conservative values.

5.6.4 Output Data. The assessment methods used shall accurately and appropriately produce the required output data from input data based on the design specifications, assumptions, and scenarios.

5.6.5 Validity. Evidence shall be provided confirming that the assessment methods are valid and appropriate for the proposed building, use, and conditions.

5.7* Safety Factors. Approved safety factors shall be included in the design methods and calculations to reflect uncertainty in the assumptions, data, and other factors associated with the performance-based design.

5.8 Documentation Requirements.

5.8.1* General. All aspects of the design, including those described in 5.8.2 through 5.8.14, shall be documented. The format and content of the documentation shall be acceptable to the authority having jurisdiction.

5.8.2* Technical References and Resources. The authority having jurisdiction shall be provided with sufficient documentation to support the validity, accuracy, relevance, and precision of the

proposed methods. The engineering standards, calculation methods, and other forms of scientific information provided shall be appropriate for the particular application and methodologies used.

5.8.3 Building Design Specifications. All details of the proposed building design that affect the ability of the building to meet the stated goals and objectives shall be documented.

5.8.4 Performance Criteria. Performance criteria, with sources, shall be documented.

5.8.5 Occupant Characteristics. Assumptions about occupant characteristics shall be documented.

5.8.6 Design Scenarios. Descriptions of design hazards scenarios shall be documented.

5.8.7 Input Data. Input data to models and assessment methods, including sensitivity analysis, shall be documented.

5.8.8 Output Data. Output data from models and assessment methods, including sensitivity analysis, shall be documented.

5.8.9 Safety Factors. The safety factors utilized shall be documented.

5.8.10 Prescriptive Requirements. Retained prescriptive requirements shall be documented.

5.8.11* Modeling Features.

5.8.11.1 Assumptions made by the model user and the description of the models and methods used, including known limitations, shall be documented.

5.8.11.2 Documentation shall be provided verifying that the assessment methods have been used validly and appropriately to address the design specifications, assumptions, and scenarios.

5.8.12 Evidence of Modeler Capability. The design team's relevant experience with the models, test methods, databases, and other assessment methods used in the performance-based design proposal shall be documented.

5.8.13 Performance Evaluation. The performance evaluation summary shall be documented.

5.8.14 Use of Performance-Based Design Option. Design proposals shall include documentation that provides anyone involved in ownership or management of the building with notification of the following:

(1) The building was approved as a performance-based design with certain specified design criteria and assumptions.
(2) Any remodeling, modification, renovation, change in use, or change in the established assumptions is to be reevaluated and reapproved.

Chapter 6 Classification of Occupancy, Classification of Hazard of Contents, and Special Operations

6.1 Classification of Occupancy.

6.1.1 General.

6.1.1.1 Occupancy Classification.

6.1.1.1.1 The occupancy of a building or structure, or portion of a building or structure, shall be classified in accordance with 6.1.2 through 6.1.13.

6.1.1.1.2 Occupancy classification shall be subject to the ruling of the authority having jurisdiction where there is a question of proper classification in any individual case.

6.1.1.2 Special Structures. Occupancies in special structures shall conform to the requirements of the specific occupancy chapter, Chapter 16 through Chapter 30, except as modified by Chapter 31.

6.1.1.3 Structures in Flood Hazard Areas. For buildings and structures located wholly or partly within the flood hazard area established in 39.4.2, the additional requirements of 39.11.1.2 shall be met.

6.1.2 Assembly. For requirements, see Chapter 16.

6.1.2.1* Definition — Assembly Occupancy. An occupancy (1) used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or (2) used as a special amusement building, regardless of occupant load.

6.1.2.2 Other (Reserved).

6.1.3 Educational. For requirements, see Chapter 17.

6.1.3.1* Definition — Educational Occupancy. An occupancy used for educational purposes through the twelfth grade by six or more persons for 4 or more hours per day or more than 12 hours per week.

6.1.3.2 Other Occupancies. Other occupancies associated with educational institutions shall be in accordance with the appropriate parts of this *Code*.

6.1.3.3 Incidental Instruction. In cases where instruction is incidental to some other occupancy, the section of this *Code* governing such other occupancy shall apply.

6.1.4 Day Care. For requirements, see Chapter 18.

6.1.4.1* Definition — Day-Care Occupancy. An occupancy in which four or more clients receive care, maintenance, and supervision, by other than their relatives or legal guardians, for less than 24 hours per day.

6.1.4.2 Other (Reserved).

6.1.5 Health Care. For requirements, see Chapter 19.

6.1.5.1* Definition — Health Care Occupancy. An occupancy used for purposes of medical or other treatment or care of four or more persons where such occupants are mostly incapable of self-preservation due to age, physical or mental disability, or because of security measures not under the occupants' control.

6.1.5.2 Other (Reserved).

6.1.6 Ambulatory Health Care. For requirements, see Chapter 20.

6.1.6.1 Definition — Ambulatory Health Care Occupancy. A building or portion thereof used to provide services or treatment simultaneously to four or more patients that (1) provides, on an outpatient basis, treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others; or (2) provides, on an outpatient basis, anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others.

6.1.6.2 Other (Reserved).

6.1.7 Detention and Correctional. For requirements, see Chapter 21.

6.1.7.1* Definition — Detention and Correctional Occupancy. An occupancy used to house four or more persons under varied degrees of restraint or security where such occupants are mostly incapable of self-preservation because of security measures not under the occupants' control.

6.1.7.2* Nonresidential Uses. Within detention and correctional facilities, uses other than residential housing shall be in accordance with the appropriate chapter of the *Code*.

6.1.8 Residential.

6.1.8.1* Definition — Residential Occupancy. An occupancy that provides sleeping accommodations for purposes other than health care or detention and correctional.

6.1.8.1.1* Definition — One- and Two-Family Dwelling. A building that contains not more than two dwelling units with independent cooking and bathroom facilities. *(For requirements, see Chapter 22.)*

6.1.8.1.2 Definition — Lodging or Rooming House. A building or portion thereof that does not qualify as a one- or two-family dwelling, that provides sleeping accommodations for a total of 16 or fewer people on a transient or permanent basis, without personal care services, with or without meals, but without separate cooking facilities for individual occupants. *(For requirements, see Chapter 23.)*

6.1.8.1.3* Definition — Hotel. A building or groups of buildings under the same management in which there are sleeping accommodations for more than 16 persons and primarily used by transients for lodging with or without meals. *(For requirements, see Chapter 24.)*

6.1.8.1.4* Definition — Dormitory. A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room or a series of closely associated rooms under joint occupancy and single management, with or without meals, but without individual cooking facilities. *(For requirements, see Chapter 24.)*

6.1.8.1.5 Definition — Apartment Building. A building or portion thereof containing three or more dwelling units with independent cooking and bathroom facilities. *(For requirements, see Chapter 25.)*

6.1.8.2 Other (Reserved).

6.1.9 Residential Board and Care. For requirements, see Chapter 26.

6.1.9.1* Definition — Residential Board and Care Occupancy. A building or portion thereof that is used for lodging and boarding of four or more residents, not related by blood or marriage to the owners or operators, for the purpose of providing personal care services.

6.1.9.2 Other (Reserved).

6.1.10 Mercantile. For requirements, see Chapter 27.

6.1.10.1* Definition — Mercantile Occupancy. An occupancy used for the display and sale of merchandise.

6.1.10.2 Other (Reserved).

6.1.11 Business. For requirements, see Chapter 28.

6.1.11.1* Definition — Business Occupancy. An occupancy used for account and record keeping or the transaction of business other than mercantile.

6.1.11.2 Other (Reserved).

6.1.12 Industrial. For requirements, see Chapter 29.

6.1.12.1* Definition — Industrial Occupancy. An occupancy in which products are manufactured or in which processing, assembling, mixing, packaging, finishing, decorating, or repair operations are conducted.

6.1.12.2 Other (Reserved).

6.1.13 Storage. For requirements, see Chapter 30.

6.1.13.1* Definition — Storage Occupancy. An occupancy used primarily for the storage or sheltering of goods, merchandise, products, vehicles, or animals.

6.1.13.2 Other (Reserved).

6.2 Multiple Occupancies.

6.2.1 General.

6.2.1.1 Multiple occupancies, as defined in 6.2.2.1, shall comply with the requirements of the following:

(1) Subsection 6.2.1
(2) Subsection 6.2.3, mixed occupancy requirements, or 6.2.4, separated occupancy requirements

6.2.1.2* Where incidental to another occupancy, areas used as follows shall be permitted to be considered part of the predominant occupancy and shall be subject to the provisions of the *Code* that apply to the predominant occupancy:

(1) Mercantile, business, industrial, or storage use
(2) *Nonresidential use with an occupant load fewer than that established by Section 6.1 for the occupancy threshold

6.2.1.3 Each occupancy shall not exceed the area limitations or be located at a height greater than that permitted for such occupancy and the type of construction being used.

6.2.1.4 Where minor accessory uses do not occupy more than 25 percent of the area of any floor of a building, nor more than the basic area permitted for the occupancy by 7.4.2 for such minor use, for the purpose of determining permitted area, the principal use of the building shall determine the occupancy classification.

6.2.1.5 The following accessory occupancies shall not be required to be separated from the primary occupancy as required in 6.2.4:

(1) An area used solely as a public dining room having an occupant load of not more than 300 persons and accessory to a retail sales area
(2) An assembly room not over 750 ft^2 (70 m^2), where not accessory to an occupancy with high-hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3
(3) Administrative, clerical, or other office rooms that, in the aggregate, are not more than 25 percent of the principal occupancy where not accessory to an occupancy with high-hazard contents, but are not more than the basic area permitted for the occupancy and type of construction
(4) A private garage separated from one- and two-family dwelling units by minimum ½-in. (12.7-mm) gypsum board applied to the garage side that complies with the following:

(a) Door openings between the garage and the dwelling unit shall be equipped with either solid wood doors not less than 1⅜ in. (35 mm) thick or solid or honeycomb core steel doors not less than 1⅜ inches (35 mm) thick.
(b) Ducts penetrating the walls or ceilings separating the garage from the dwelling shall be constructed of a minimum No. 26-gauge (0.48-mm) steel and shall have no openings into the garage.

6.2.2 Definitions.

6.2.2.1 Multiple Occupancy. A building or structure in which two or more classes of occupancy exist.

6.2.2.2 Mixed Occupancy. A multiple occupancy where the occupancies are intermingled.

6.2.2.3 Separated Occupancy. A multiple occupancy where the occupancies are separated by fire resistance–rated assemblies.

6.2.3 Mixed Occupancies.

6.2.3.1 Each portion of the building shall be classified as to its use in accordance with Section 6.1.

6.2.3.2 The means of egress facilities, type of construction, protection, and other safeguards in the building shall comply with the most restrictive fire and life safety requirements of the occupancies involved.

6.2.3.3 The type of construction required for the building shall be determined by applying the Section 7.4 height and area limitations for each of the occupancies to the entire building.

6.2.3.4 The most restrictive type of construction determined in 6.2.3.3 shall apply to the entire building.

6.2.3.5 The most restrictive, applicable, high-rise building provisions and fire protection system requirements shall apply to all portions of the building.

6.2.4 Separated Occupancies.

6.2.4.1 Where separated occupancies are provided, each part of the building comprising a distinct occupancy, as described in this chapter, shall be completely separated from other occupancies by fire-resistive assemblies as specified in 6.2.4.2 through 6.2.4.4 and Table 6.2.4.1.

Table 6.2.4.1 Required Fire Resistance–Rated Separations for Separated Occupancies (hr)[a]

	Assembly ≤300	Assembly >300 to ≤ 1000	Assembly >1000	Educational	Day-Care > 12 Clients	Day-Care Homes	Health Care	Ambulatory Health Care	Detention & Correctional	One- & Two-Family Dwellings	Lodging & Rooming Houses
Assembly ≤300		0	0	2	2	2	2[b]	2	2[b]	2	2
Assembly >300 to ≤1000			0	2	2	2	2[b]	2	2[b]	2	2
Assembly >1000				2	2	2	2[b]	2	2[b]	2	2
Educational					2	2	2[b]	2	2[b]	2	2
Day Care >12 Clients						1	2[b]	2	2[b]	2	2
Day-Care Homes							2[b]	2	2[b]	2	2
Health Care								2[b]	2[b]	2[b]	2[b]
Ambulatory Health Care									2[b]	2	2
Detention & Correctional										2[b]	2[b]
One- & Two-Family Dwellings											1

	Hotels & Dormitories	Apartment Buildings	Board & Care, Small	Board & Care, Large	Mercantile	Mercantile, Covered Mall	Mercantile, Bulk Retail	Business	Industrial, Low Hazard	Industrial	Storage, Low Hazard	Storage
Assembly ≤300	2	2	2	2	2	2	3	1	2	3	2	3
Assembly >300 to ≤1000	2	2	2	2	2	2	3	2	2	3	2	3
Assembly >1000	2	2	2	2	2	2	3	2	2	3	2	3
Educational	2	2	2	2	2	2	3	2	3	3	2	3
Day Care >12 Clients	2	2	2	2	2	2	3	2	3	3	2	3
Day-Care Homes	2	2	2	2	2	2	3	2	3	3	2	3
Health Care	2[b]	2[b]	2[b]	2[b]	2[b]	2[b]	3	2[b]	2[b]	3	2[b]	3
Ambulatory Health Care	2	2	2	2	2	2	3	1	2	3	2	3

(continues)

Table 6.2.4.1 *Continued*

	Hotels & Dormitories	Apartment Buildings	Board & Care, Small	Board & Care, Large	Mercantile	Mercantile, Covered Mall	Mercantile, Bulk Retail	Business	Industrial, Low Hazard	Industrial	Storage, Low Hazard	Storage
Detention & Correctional	2[b]	2[b]	2[b]	2[b]	2[b]	2[b]	3	3	2[b]	3	2[b]	3
One- & Two-Family Dwellings	2	2	1	2	2	2	3	2	2	3	2	3
Lodging & Rooming Houses	2	2	2	2	2	2	3	2	2	3	2	3
Hotels & Dormitories		2	2	2	2	2	3	2	2	3	2	3
Apartment Buildings			2	2	2	2	3	2	2	3	2	3
Board & Care, Small				1	2	2	3	2	3	3	2	3
Board & Care, Large					2	2	3	2	3	3	2	3
Mercantile						0	3	2	2	2	2	2
Mercantile, Covered Mall							3	2	3	3	2	3
Mercantile, Bulk Retail								2	3	3	2	2
Business									2	2	2	2
Industrial, Low Hazard										0	1	2
Industrial											1	2
Storage, Low Hazard												1
Storage												

[a] The fire resistance rating shall be permitted to be reduced by 1 hour, but in no case to less than 1 hour, where the building is protected throughout by an approved automatic sprinkler system in accordance with Section 55.3.
[b] The 1-hour reduction due to the presence of sprinklers in accordance with footnote a is not permitted.

6.2.4.2 Occupancy separations shall meet the requirements of Chapter 8.

6.2.4.3 Occupancy separations shall be vertical, horizontal, or both or, when necessary, of such other form as required to provide complete separation between occupancy divisions in the building.

6.2.4.4 Where the occupancy separation is horizontal, structural members supporting the separation shall be protected by an equivalent fire-resistive construction.

6.3 Hazard of Contents.

6.3.1 General.

6.3.1.1 For the purpose of this *Code*, the hazard of contents shall be the relative danger of the start and spread of fire, the danger of smoke or gases generated, and the potential of an explosion or other occurrence to endanger the lives and safety of the occupants of the building or structure or to cause damage to the building or its contents.

6.3.1.2 Hazard of contents shall be determined by the authority having jurisdiction on the basis of the character of the contents and the processes or operations conducted in the building or structure.

6.3.1.3 For the purpose of this *Code*, where different degrees of hazard of contents exist in different parts of a building or structure, the most hazardous shall govern the classification, unless hazardous areas are separated or protected as specified in the applicable sections of Chapter 16 through Chapter 31.

6.3.2 Classification of Hazard of Contents.

6.3.2.1* General. The hazard of contents of any building or structure shall be classified as low, ordinary, or high in accordance with 6.3.2.2, 6.3.2.3, and 6.3.2.4.

6.3.2.2* Low Hazard. Low hazard contents shall be classified as those of such low combustibility that no self-propagating fire therein can occur.

6.3.2.3* Ordinary Hazard. Ordinary hazard contents shall be classified as those that are likely to burn with moderate rapidity or to give off a considerable volume of smoke.

6.3.2.4 High Hazard.

6.3.2.4.1 General. High hazard contents shall include materials defined as hazardous material in Chapter 3, whether stored, used, or handled.

6.3.2.4.1.1 High hazard contents shall include those materials defined as hazardous material and classified in accordance with 6.3.2.4.2 through 6.3.2.4.6, whether stored, used, or handled.

6.3.2.4.1.2* Occupancies in which high hazard contents are stored, used, or handled shall also comply with Chapter 34.

6.3.2.4.2 High Hazard Level 1 Contents. High hazard Level 1 contents shall include materials that present a detonation hazard including, but not limited to, the following:

(1) Explosives
(2) Unclassified detonable organic peroxides
(3) Class 4 oxidizers
(4) Detonable pyrophoric materials
(5) Class 3 detonable and Class 4 unstable (reactive) materials

6.3.2.4.3 High Hazard Level 2 Contents. High hazard Level 2 contents shall include materials that present a deflagration hazard or a hazard from accelerated burning including, but not limited to, the following:

(1) Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103.3 kPa)
(2) Combustible dusts stored, used, or generated in a manner creating a severe fire or explosion hazard
(3) Flammable gases and flammable cryogenic liquids
(4) Class I organic peroxides
(5) Class 3 solid or liquid oxidizers that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103.3 kPa)
(6) Nondetonable pyrophoric materials
(7) Class 3 nondetonable unstable (reactive) materials
(8) Class 3 water-reactive materials

6.3.2.4.4 High Hazard Level 3 Contents. High hazard Level 3 contents shall include materials that readily support combustion or present a physical hazard including, but not limited to, the following:

(1) Level 2 and Level 3 aerosols
(2) Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103.4 kPa)
(3) Classification 1.4G consumer fireworks
(4) Flammable solids, other than dusts classified as high hazard Level 2, stored, used, or generated in a manner creating a high fire hazard
(5) Class II and Class III organic peroxides
(6) Class 2 solid or liquid oxidizers
(7) Class 3 solid or liquid oxidizers that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103.4 kPa)
(8) Oxidizing gases and oxidizing cryogenic liquids
(9) Class 2 unstable (reactive) materials
(10) Class 2 water-reactive materials

6.3.2.4.5 High Hazard Level 4 Contents. High hazard Level 4 contents shall include materials that are acute health hazards including, but not limited to, the following:

(1) Corrosives
(2) Highly toxic materials
(3) Toxic materials

6.3.2.4.6 High Hazard Level 5 Contents. High hazard Level 5 contents shall include hazardous production materials (HPM) used in the fabrication of semiconductors or semiconductor research and development.

6.4 Special Operations.

6.4.1 General.

6.4.1.1 In addition to the requirements in this *Code*, buildings or structures in which the operations specified in 6.4.2 are conducted, or in which materials are manufactured, stored, sold, or handled, shall also comply with applicable construction requirements in the standards and codes in 6.4.2.

6.4.1.2 When conflicts exist between this *Code* and the referenced documents, the provisions of 1.3.2 shall apply.

6.4.2 Specific Operations.

6.4.2.1 Acetylene Cylinder Charging Plants. Buildings and structures in plants that are engaged in the generation and compression of acetylene and in the charging of acetylene cylinders, either as their sole operation or in conjunction with facilities for charging other compressed gas cylinders, shall be constructed in accordance with NFPA 51A, *Standard for Acetylene Cylinder Charging Plants*.

6.4.2.2 Agricultural and Food Products Facilities. Buildings and structures associated with the production, storage, and handling of agricultural and food products that are subject to the accumulation of agricultural dust shall be constructed in accordance with NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities*, and include the following:

(1) All facilities that handle, process, use, blend, mill, receive, load, ship, package, store, or unload dry agricultural bulk materials, or their by-products or dusts, that include grains, oilseeds, agricultural seeds, legumes, sugar, flour, spices, feeds, and other related materials
(2) All facilities designed for manufacturing and handling starch, including drying, grinding, conveying, processing, packaging, and storage of dry or modified starch, and for handling the dry products and dusts generated from these processes
(3) Seed preparation and meal-handling systems of oilseed processing plants not covered by NFPA 36, *Standard for Solvent Extraction Plants*. [**61:**1.1.1]

6.4.2.3 Aerosol Manufacture and Storage. Building and structures in which aerosol products are manufactured, stored, and displayed shall be constructed in accordance with NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*.

6.4.2.4 Aircraft Engine Test Facilities. Buildings and structures in which aircraft engines are tested within a test cell or on a test stand shall be constructed in accordance with NFPA 423, *Standard for Construction and Protection of Aircraft Engine Test Facilities*.

6.4.2.5 Aircraft Hangers. Aircraft hangers and mezzanines, tool rooms, and other enclosures within aircraft storage and servicing areas shall be constructed in accordance with NFPA 409, *Standard on Aircraft Hangars*.

6.4.2.6 Airport Terminal Buildings. Airport terminal buildings and aircraft loading walkways between the terminal building and aircraft shall be constructed in accordance with NFPA 415, *Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways*.

6.4.2.7 Aluminum Powder Facilities. Buildings used for the manufacture, packing, or loading for shipment of aluminum powders shall be constructed in accordance with NFPA 484, *Standard for Combustible Metals*.

6.4.2.8 Ammonium Nitrate Storage. Buildings in which ammonium nitrate is stored shall be constructed in accordance with NFPA 490, *Code for the Storage of Ammonium Nitrate*.

6.4.2.9 Cellulose Nitrate Motion Picture Film Storage. Buildings in which cellulose nitrate motion picture film is stored

shall be constructed in accordance with NFPA 40, *Standard for the Storage and Handling of Cellulose Nitrate Film.*

6.4.2.10 Buildings Housing Compressed Natural Gas (CNG) Vehicular Fuel Systems. Buildings and structures used for compressing, storing, and dispensing of CNG as an engine fuel in fleet- and public-dispensing operations shall be constructed in accordance with NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code.*

6.4.2.11 Buildings with Cleanrooms. Buildings in semiconductor fabrication facilities that contain cleanrooms shall be constructed in accordance with NFPA 318, *Standard for the Protection of Semiconductor Fabrication Facilities.*

6.4.2.12 Coal Preparation Plants. Surface buildings, structures, and housing provided as part of a plant designed to prepare coal for shipment, including the separation, crushing, screening, washing, drying, storage, and loadout of coal to make ready for market, shall be constructed in accordance with NFPA 120, *Standard for Coal Preparation Plants.*

6.4.2.13 Combustible Particulate Solids Facilities. Buildings and structures in all phases of the manufacture, processing, blending, repackaging, and handling of combustible particulate solids, where the materials present a fire or explosion hazard, shall be constructed in accordance with NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids.*

6.4.2.14 Buildings Housing Combustion Engines and Gas Turbines. Buildings and rooms in which stationary combustion engines and gas turbines are installed shall be constructed in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.*

6.4.2.15 Commercial Cooking Operations. Buildings in which public and private cooking operations are performed, except for single-family residential occupancies, shall be constructed in accordance with NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.*

6.4.2.16 Compressed and Liquefied Gas Facilities. Buildings in which compressed and liquefied gases are stored, used, or handled shall be constructed in accordance with NFPA 55, *Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders.*

6.4.2.17 Data Processing Facilities. Buildings in which electronic computer/data processing equipment and computer areas are located shall be constructed in accordance with NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment.*

6.4.2.18 Dipping and Coating Process Facilities Using Flammable or Combustible Liquids. Buildings in which articles or materials are passed through tanks, vats, containers, or process equipment that contains flammable or combustible liquids including, but not limited to, dipping, roll coating, flow coating, curtain coating, and cleaning shall be constructed in accordance with NFPA 34, *Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids.*

6.4.2.19 Dry Cleaning Plants. Dry cleaning plants shall be constructed in accordance with NFPA 32, *Standard for Drycleaning Plants.*

6.4.2.20 Emergency Communications Centers. Buildings used as public emergency communications centers and emergency response facilities shall be constructed in accordance with NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.*

6.4.2.21 Ethylene Oxide Facilities. Buildings and structures that house ethylene oxide storage, dispensing, and use shall be constructed in accordance with NFPA 560, *Standard for the Storage, Handling, and Use of Ethylene Oxide for Sterilization and Fumigation.*

6.4.2.22 Particulate Exhaust Systems Facilities. Buildings and structures containing exhaust systems for air conveying of vapors, gases, mists, and noncombustible particulate solids shall be constructed in accordance with NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.*

6.4.2.23 Facilities for Explosives Manufacturing, Storage, and Sale. Buildings in which explosives are manufactured, stored, or sold shall be constructed in accordance with NFPA 495, *Explosive Materials Code.*

6.4.2.24 Fireworks and Pyrotechnic Devices Facilities. Buildings in which fireworks and pyrotechnic devices are manufactured or stored, and magazines in which these products are stored, shall be constructed in accordance with NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles.*

6.4.2.25 Flammable and Combustible Liquids Facilities. Buildings or structures in which flammable and combustible liquids, including waste liquids, are stored, handled, or used shall be constructed in accordance with NFPA 30, *Flammable and Combustible Liquids Code.*

6.4.2.26 Grandstands. Grandstands and folding and telescoping seating shall only be permitted in or near buildings in accordance with NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures.*

6.4.2.27 Health Care Facilities. Buildings in which medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided including, but not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers shall be constructed in accordance with NFPA 99, *Standard for Health Care Facilities.*

6.4.2.28 Heliports. When permitted by the authority having jurisdiction, rooftop heliports and rooftop landing pads shall be constructed in accordance with NFPA 418, *Standard for Heliports.* Fueling systems associated with rooftop heliports shall be constructed in accordance with NFPA 407, *Standard for Aircraft Fuel Servicing.*

6.4.2.29 Facilities Housing Gaseous Hydrogen Systems. Buildings and structures in consumer premises with a gaseous hydrogen system with a storage capacity of more than 400 scf (11 m^3) shall be constructed in accordance with NFPA 50A, *Standard for Gaseous Hydrogen Systems at Consumer Sites.*

6.4.2.30 Facilities Housing Liquefied Hydrogen Systems. Buildings and structures in consumer premises with a liquefied hydrogen system with a storage capacity of more than 39.6 gal (150 L) shall be constructed in accordance with NFPA 50B, *Standard for Liquefied Hydrogen Systems at Consumer Sites.*

6.4.2.31 Hypobaric Facilities. Buildings in which hypobaric facilities and chambers are located shall be constructed in accordance with NFPA 99B, *Standard for Hypobaric Facilities.*

6.4.2.32 Facilities Housing Incinerators and Waste Handling Systems. Buildings containing incinerators, waste handling chutes, conveying systems, storage rooms, or compactors shall

be constructed in accordance with NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment.*

6.4.2.33 Laboratories Using Chemicals. Buildings in which chemicals are handled or stored, and in which laboratory-scale operations are conducted, shall be constructed in accordance with NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals.*

6.4.2.34 Facilities Housing Linen Handling Systems. Buildings containing linen and laundry chutes and conveying systems shall be constructed in accordance with NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment.*

6.4.2.35 Lithium Storage, Processing, and Handling Facilities. Buildings intended for the storage, handling, processing, or use of lithium shall be constructed in accordance with NFPA 484, *Standard for Combustible Metals.*

6.4.2.36 Liquefied Natural Gas (LNG) Fueling Facilities. Buildings associated with LNG fueling operations shall be constructed in accordance with NFPA 57, *Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code.*

6.4.2.37 Liquefied Natural Gas (LNG) Production Facilities. Buildings and structures associated with the production and related storage and handling of LNG shall be constructed in accordance with NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG).*

6.4.2.38 Liquefied Petroleum Gas Distribution Facilities. Buildings or structures housing liquefied petroleum gas distribution facilities shall be constructed in accordance with NFPA 58, *Liquefied Petroleum Gas Code.*

6.4.2.39 Magnesium Storage, Handling, and Processing Facilities. Buildings in which magnesium solids and powders are stored, handled, or processed, including mills, foundries, production plants, and storage facilities, shall be constructed in accordance with NFPA 484, *Standard for Combustible Metals.*

6.4.2.40 Marinas and Boatyards. Buildings and structures used for the construction, repair, storage, hauling, launching, or fueling of vessels shall be constructed in accordance with NFPA 303, *Fire Protection Standard for Marinas and Boatyards*, if fire on a dock would pose an immediate threat to such facilities, or if a fire at such a facility would pose an immediate threat to a dock area.

6.4.2.41 Marine Terminals, Piers, and Wharves. Buildings and structures provided as part of a marine terminal shall be constructed in accordance with NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves.*

6.4.2.42 Membrane Structures. Membrane structures provided as part of a building or structure shall comply with NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures.*

6.4.2.43 Model Rocket Motor Manufacturing Facilities. Buildings in which model rocket motors are manufactured, and associated storage buildings and magazines, shall be constructed in accordance with NFPA 1125, *Code for the Manufacture of Model Rocket and High Power Rocket Motors.*

6.4.2.44 Motion Picture and Television Production Facilities. Buildings and structures used as soundstages and production studios in the motion picture and television industry shall be constructed in accordance with NFPA 140, *Standard on Motion Picture and Television Production Studio Soundstages and Approved Production Facilities.*

6.4.2.45 (Reserved)

6.4.2.46 Motor Fuel Dispensing Facilities and Repair Garages. Motor fuel dispensing facilities, marine/motor fuel dispensing facilities, motor fuel dispensing facilities located inside buildings, fleet vehicle motor fuel dispensing facilities, and repair garages shall be constructed in accordance with NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages.*

6.4.2.47 Nuclear Power Plants. Nuclear power plant buildings and structures shall be constructed in accordance with NFPA 804, *Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants*, or NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*, as applicable.

6.4.2.48 Facilities Housing Oil-Burning Equipment. Rooms in buildings containing an oil-fuel storage tank shall be constructed in accordance with NFPA 31, *Standard for the Installation of Oil-Burning Equipment.*

6.4.2.49 Organic Coating Manufacturing Facilities. Buildings and structures in which flammable and combustible liquids are used to manufacture organic coatings for automotive, industrial, institutional, household, marine, printing, transportation, and other applications shall be constructed in accordance with NFPA 35, *Standard for the Manufacture of Organic Coatings.*

6.4.2.50 Organic Peroxide Storage. Buildings and structures in which organic peroxide formulations are stored shall be constructed in accordance with NFPA 432, *Code for the Storage of Organic Peroxide Formulations.*

6.4.2.51 Facilities for Mercantile Sales of Oxidizers. Buildings and structures in which liquid and solid oxidizers are sold shall be constructed in accordance with NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers.*

6.4.2.52 Facilities for Storage of Oxidizers. Buildings and structures in which liquid and solid oxidizers are stored shall be constructed in accordance with NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers.*

6.4.2.53 Oxygen–Fuel Gas Systems Facilities. Buildings and structures in which oxygen–fuel gas welding and cutting systems are used for welding or cutting, gaseous fuels are generated from flammable liquids, or calcium carbide is stored shall be constructed in accordance with NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes.*

6.4.2.54 Bulk Oxygen Systems Facilities. Buildings and structures in consumer premises with a bulk oxygen system with a storage capacity of more than 20,000 ft^3 (566 m^3) of oxygen at normal temperature and pressure (NTP) shall be constructed in accordance with NFPA 50, *Standard for Bulk Oxygen Systems at Consumer Sites.*

6.4.2.55 Parking Structures. Open, enclosed, basement, and underground parking structures, other than those provided with one- and two-family dwellings, shall be constructed in accordance with NFPA 88A, *Standard for Parking Structures.*

6.4.2.56 Pesticide Storage. Buildings in which pesticides are stored shall be constructed in accordance with NFPA 434, *Code for the Storage of Pesticides.*

6.4.2.57 Pyroxylin Plastic Storage. Buildings in which pyroxylin plastics are stored in the form of raw material, unfinished and finished products, or scrap shall be constructed in accordance with NFPA 42, *Code for the Storage of Pyroxylin Plastic*.

6.4.2.58 Racetrack Facilities. Buildings and structures provided at racetracks, including those containing stalls for housing horses, human sleeping quarters, feed rooms, tack rooms, equipment storage rooms, blacksmith shops, kitchens, mechanical equipment rooms, and toilet facilities shall be constructed in accordance with NFPA 150, *Standard on Fire Safety in Racetrack Stables*.

6.4.2.59 Radioactive Materials Facilities. Buildings in which radioactive materials are stored, handled, or used in quantities and conditions requiring government oversight (for example, U.S. Nuclear Regulatory Commission or U.S. Department of Energy), or requiring a license to possess or use these materials, and all other locations in which such quantities or conditions exist shall be constructed in accordance with NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*.

6.4.2.60 Solvent Extraction Plants. Buildings and structures in which commercial-scale extraction processing of animal and vegetable oils and fats by the use of Class I flammable hydrocarbon liquids is conducted, and all buildings and structures within 100 ft (30 m) of such an extraction process, shall be constructed in accordance with NFPA 36.

6.4.2.61 Spray Application Facilities Using Flammable or Combustible Materials. Buildings in which flammable or combustible materials are sprayed or applied by fluidized bed application methods, either continuously or intermittently, shall be constructed in accordance with NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*.

6.4.2.62 Fuel Cell Power Plants. Buildings and structures in which stationary fuel cell power plants are installed shall be constructed in accordance with NFPA 853, *Standard for the Installation of Stationary Fuel Cell Power Plants*.

6.4.2.63 Sulfur Processing Facilities. Buildings and structures in which sulfur grinding or pulverizing machinery is located shall be constructed in accordance with NFPA 655, *Standard for Prevention of Sulfur Fires and Explosions*.

6.4.2.64 Titanium Production and Processing Facilities. Buildings housing titanium-reduction furnaces, boring and crushing facilities, refining operations, and titanium powder–drying operations shall be constructed in accordance with NFPA 484, *Standard for Combustible Metals*.

6.4.2.65 Wastewater Treatment Plants. Buildings and structures in wastewater treatment plants shall be constructed in accordance with NFPA 820, *Standard for Fire Protection in Wastewater Treatment and Collection Facilities*.

6.4.2.66 Wood Processing and Woodworking Facilities. Buildings and structures in facilities that handle, store, or process wood or wood products that produce or utilize finely divided wood particles or wood fibers shall be constructed in accordance with NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*. Such facilities shall include, but are not limited to, wood flour plants, woodworking plants, lumber mills, and composite board plants.

6.4.2.67 Zirconium Production and Processing Facilities. Buildings housing zirconium-reduction furnaces, boring and crushing facilities, refining operations, and zirconium powder–drying operations shall be constructed in accordance with NFPA 484, *Standard for Combustible Metals*.

Chapter 7 Construction Types and Height and Area Requirements

7.1 General.

7.1.1 Buildings. Buildings or parts of buildings classified in a specified occupancy group because of their use shall be limited to the types of construction specified in Section 7.2 and shall not exceed the height or area requirements specified in Section 7.4 through Section 7.6.

7.1.2 Mechanical, Plumbing, and Electrical Components. Combustible mechanical, plumbing, and electrical components installed in accordance with the applicable code shall be permitted in all types of construction.

7.1.3 Location and Property. Buildings or parts of buildings shall be subject to the requirements of Chapter 37 for protection of exterior walls and Section 7.3 for openings in exterior walls as determined by location on property.

7.1.4 Terminology. Where the term *limited-combustible* is used in this *Code*, it shall also include *noncombustible*.

7.1.5 Fire Department Access.

7.1.5.1 General. Fire department access roads shall be provided and maintained in accordance with 7.1.5.

7.1.5.2 Fire Apparatus Access Roads.

7.1.5.2.1 Required Access. Fire apparatus access roads shall be provided in accordance with 7.1.5.2 for every building or portion of a building hereafter constructed or relocated, unless otherwise permitted by the following:

(1) When there are not more than two one- and two-family dwellings or private garages, carports, sheds, and agricultural buildings, the requirements of 7.1.5.2.1 and 7.1.5.2.2 shall be permitted to be modified by the authority having jurisdiction.
(2) When access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the authority having jurisdiction is authorized to require additional fire protection.

7.1.5.2.1.1 Access to Buildings. A fire apparatus access road shall extend to within 50 ft (15 m) of a single exterior door providing access to the interior of the building.

7.1.5.2.1.2 Additional Requirements.

(A) Fire apparatus access roads shall be provided such that any portion of an exterior wall of the first story above grade of the building is located not more than 150 ft (46 m) from fire apparatus access roads as measured by an approved route around the exterior of the building.

(B) When buildings are protected with an approved automatic fire sprinkler system, installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*; NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes;* or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,* the distance shall be permitted to be increased to 450 ft (137 m).

7.1.5.2.2 Specifications.

7.1.5.2.2.1 Dimensions.

(A) Fire apparatus access roads shall have an unobstructed width of not less than 20 ft (6 m) and an unobstructed vertical clearance of not less than 13 ft 6 in. (4.1 m).

(B) When approved, vertical clearance shall be permitted to be reduced, provided such reduction does not impair access by fire apparatus and approved signs are installed and maintained indicating the established vertical clearance.

(C) Vertical clearances or widths shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

7.1.5.2.2.2 Surface. Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus and shall be provided with a surface so as to provide all-weather driving capabilities.

7.1.5.2.2.3 Turning Radius. The turning radius of a fire apparatus access road shall be as approved.

7.1.5.2.2.4 Dead Ends. Dead-end fire apparatus access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for turning fire apparatus around.

7.1.5.2.2.5 Bridges.

(A) When a bridge is required to be used as part of a fire apparatus access road, it shall be constructed and maintained in accordance with nationally recognized standards.

(B) The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

(C) Vehicle load limits shall be posted at both entrances to bridges when required by the authority having jurisdiction.

7.1.5.2.2.6 Grade.

(A) The gradient for a fire apparatus access road shall not exceed the maximum approved.

(B)* The angle of approach and departure for any means of fire lane access shall not exceed a 1-ft drop in 20 ft (0.3-m drop in 6 m) and the design limitations of the fire apparatus of the fire department subject to approval by the authority having jurisdiction.

7.1.5.2.2.7 Marking of Fire Apparatus Access Road or Fire Lane. When required by the authority having jurisdiction, approved signs or other approved notices shall be provided and maintained for fire apparatus access roads or fire lanes to identify such roads or prohibit the obstruction thereof, or both.

7.2 Construction Types.

7.2.1 General.

7.2.1.1 All buildings and parts of buildings hereafter constructed shall conform to the requirements for the specific types of construction as provided in this chapter and shall comply with the applicable requirements of other chapters and sections of this *Code*.

7.2.1.2 Except as permitted by other provisions of this *Code*, wherever two or more types of construction are used in the same building, the entire building shall be classified as the least type of construction in the building and shall be subject to the requirements for that type.

7.2.1.3 Requirements for specific materials, types of construction, and fire protection shall be minimum requirements, and any material, type of construction, or fire protection affording safety or a fire resistance rating equal to or greater than that provided in this *Code* shall be permitted. Materials shall be in accordance with all of the following except as modified by any special requirements in 7.2.3:

(1) Chapter 41, Concrete
(2) Chapter 42, Aluminum
(3) Chapter 43, Masonry
(4) Chapter 44, Steel
(5) Chapter 45, Wood
(6) Chapter 46, Glass and Glazing
(7) Chapter 47, Gypsum Board, Lath, and Plaster
(8) Chapter 48, Plastics

7.2.2* Types of Building Construction. All buildings and structures shall be classified according to their type of construction, which shall be based upon one of five basic types of construction designated by roman numerals as Type I, Type II, Type III, Type IV, and Type V, with fire resistance ratings not less than those specified in Table 7.2.2 and 7.2.3 through 7.2.6 and with fire resistance ratings meeting the requirements of 7.2.7.

7.2.3 Type I (442 or 332) and Type II (222, 111, or 000) Construction.

7.2.3.1 Type I and Type II Construction. Type I (442 or 332) and Type II (222, 111, or 000) construction shall be those types in which the structural members, including walls, columns, beams, girders, trusses, arches, floors, and roofs, are of approved noncombustible or limited-combustible materials.

7.2.3.2 Special Requirements—Type I and Type II Construction. The special requirements in 7.2.3.2.1 through 7.2.3.2.22 shall apply to Type I and Type II construction.

7.2.3.2.1 Wood Sleepers. Where wood sleepers are used for laying wood flooring on noncombustible floors, the furring space shall be filled with noncombustible or limited-combustible material or shall be fireblocked so that there will be no open space over 100 ft^2 (9 m^2) in area under the flooring.

7.2.3.2.2 Sleeper Space. The furring spaces created by sleepers in 7.2.3.2.1 shall be filled solidly under all permanent partitions to prevent spread of fire under the flooring.

7.2.3.2.3 Mezzanine Floors. Mezzanine floors shall be of noncombustible or limited-combustible construction with a 1-hour fire resistance rating.

7.2.3.2.4 Mezzanine Floors in Type II (000) Construction. Mezzanine floors in Type II(000) construction shall be permitted to be of nonrated construction.

7.2.3.2.5 Platforms. Permanent platforms shall be permitted to be constructed of noncombustible or limited-combustible materials.

7.2.3.2.6 Space Beneath Platforms. When the space beneath any permanent platform is used for storage or any other purpose other than equipment, wiring, or plumbing, the floor construction shall not be less than 1-hour fire resistance–rated construction.

7.2.3.2.7 Fire Retardant–Treated Wood Platforms. Fire retardant–treated wood shall be permitted for permanent platforms that are not more than 30 in. (760 mm) above the floor and do not occupy more than 50 percent of the floor area.

7.2.3.2.8 Fire Retardant–Treated Wood Platform Area. The maximum area of a platform constructed with fire retardant–treated wood shall be not more than 3000 ft^2 (278 m^2).

Table 7.2.2 Fire Resistance Ratings for Type I through Type V Construction (hr)

	Type I		Type II			Type III		Type IV	Type V	
	442	**332**	**222**	**111**	**000**	**211**	**200**	**2HH**	**111**	**000**
Exterior Bearing Walls[a]										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0[b]	2	2	2	1	0[b]
Supporting one floor only	4	3	2	1	0[b]	2	2	2	1	0[b]
Supporting a roof only	4	3	1	1	0[b]	2	2	2	1	0[b]
Interior Bearing Walls										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	2	1	0
Supporting one floor only	3	2	2	1	0	1	0	1	1	0
Supporting roofs only	3	2	1	1	0	1	0	1	1	0
Columns										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	H	1	0
Supporting one floor only	3	2	2	1	0	1	0	H	1	0
Supporting roofs only	3	2	1	1	0	1	0	H	1	0
Beams, Girders, Trusses, and Arches										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	H	1	0
Supporting one floor only	2	2	2	1	0	1	0	H	1	0
Supporting roofs only	2	2	1	1	0	1	0	H	1	0
Floor Construction	2	2	2	1	0	1	0	H	1	0
Roof Construction	2	1½	1	1	0	1	0	H	1	0
Interior Nonbearing Walls	0	0	0	0	0	0	0	0	0	0
Exterior Nonbearing Walls[c]	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]

Note: H = heavy timber members *(see text for requirements).*
[a]See 7.3.2.1.
[b]See Section 7.3.
[c]See 7.2.3.2.13, 7.2.4.2.3, and 7.2.5.6.8.

7.2.3.2.9 Roofs 20 ft (6 m) or More Above Any Floor. In all occupancies except hazardous mercantile, industrial, or storage occupancies with ordinary contents or high hazard contents, and any other occupancies with high hazard contents exceeding the maximum allowable quantities per control as set forth in 34.1.3, the fire protection of structural members shall not be required for the roof construction, including protection of roof framing and decking, when all parts of the roof construction are 20 ft (6 m) or more above any floor immediately below.

7.2.3.2.10 Fire Retardant–Treated Wood Roof.

7.2.3.2.10.1 Fire retardant–treated wood members shall be permitted to be used for unprotected members specified in 7.2.3.2.9.

7.2.3.2.10.2 Fire retardant–treated wood shall be permitted for roof construction, including girders and trusses, under the following conditions:

(1) In Type II buildings
(2) In Type I buildings of two stories or less
(3) In Type I buildings over two stories when the vertical distance from the floor to the roof is 20 ft (6 m) or more

7.2.3.2.11 Heavy Timber Structural Members. In all occupancies, heavy timber structural members shall be permitted to be used for the roof construction where a 1-hour or less fire resistance rating is required.

7.2.3.2.12 Interior Nonbearing Walls.

7.2.3.2.12.1 Interior nonbearing walls shall be constructed of noncombustible or limited-combustible materials.

7.2.3.2.12.2 Interior nonbearing walls required to have a fire resistance rating of 2 hours or less shall be permitted to be fire retardant–treated wood enclosed within noncombustible or limited-combustible materials, provided such walls are not used as shaft enclosures.

7.2.3.2.13 Exterior Nonbearing Walls. Nonbearing exterior walls shall be constructed of noncombustible materials, limited-combustible materials, or materials specified in 7.2.3.2.13.1 or 7.2.3.2.13.2.

7.2.3.2.13.1 Fire retardant-treated wood shall be permitted in exterior nonbearing walls when such walls are not required to have fire resistance ratings.

7.2.3.2.13.2 Exterior nonbearing walls tested in accordance with, and meeting the conditions of, acceptance of NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus,* shall be permitted.

7.2.3.2.14 Combustible Materials. Combustible materials shall be permitted in accordance with the following:

(1) Foam plastic insulation complying with Section 48.4
(2) Aluminum composite material complying with Section 37.4
(3) Thermal and acoustical insulation, other than foam plastic, complying with Chapter 51
(4) Interior floor finish and interior finish, trim, and millwork such as doors, door frames, window sashes, and window frames
(5) Light-transmitting plastic complying with Section 48.7 and Section 38.14
(6) Class A, Class B, or Class C roof coverings
(7) Blocking

7.2.3.2.15 Ceiling Plenum. The space between the top of the finished ceiling and the underside of the floor or roof above shall be permitted to be used to supply air to the occupied area or return and exhaust air from the occupied area, provided that the conditions of 7.2.3.2.16 through 7.2.3.2.21 are met.

7.2.3.2.16 Plenum Materials Combustibility. All materials exposed to the airflow shall be listed as noncombustible, limited-combustible, or fire retardant–treated wood and have a maximum smoke developed index of 50, unless otherwise permitted by the following:

(1) The following materials shall be permitted in the plenum where listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread of 5 ft (1.5 m) or less when tested in accordance with the specified test method:
   (a) Electrical wires and cables and optical fiber cables — NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*
   (b) Pneumatic tubing for control systems — UL 1820, *Standard for Safety for Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics*
   (c) Fire sprinkler piping — UL 1887, *Standard for Safety for Fire Test of Plastic Sprinkler Pipe for Flame and Smoke Characteristics*
   (d) Optical-fiber and communication raceways — UL 2024, *Standard for Optical Fiber Cable Raceway*
(2) Smoke detectors shall not be required to comply with 7.2.3.2.16.
(3) Loudspeakers and recessed lighting fixtures, including their assemblies and accessories, shall be permitted in the ceiling cavity plenum where listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested in accordance with UL 2043, *Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.*
(4) Pipe insulation and coverings, duct coverings, duct linings, vapor-retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems shall be permitted, provided that the following criteria are met:
   (a) The products specified in 7.2.3.2.16(4) shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50.
   (b) Where the products specified in 7.2.3.2.16(4) are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state.

7.2.3.2.17 Plenum Fire Stopping. The integrity of the fire stopping for penetrations shall be maintained.

7.2.3.2.18 Plenum Light Diffusers. Light diffusers, other than those made of metal or glass, used in air-handling light fixtures shall be listed and marked as follows:

Fixture Light Diffusers for Air-Handling Fixtures

7.2.3.2.19 Plenum Air Temperature. The temperature of air delivered to plenums shall not exceed 250°F (121°C).

7.2.3.2.20 Plenum Materials Exposure. Materials used in the construction of a plenum shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the plenum.

7.2.3.2.21 Ceiling Plenum Tested Assembly. Where the plenum is a part of a floor-ceiling or roof-ceiling assembly that has been tested or investigated and assigned a fire resistance rating of 1 hour or more, and the assembly contains air ducts and openings for air ducts, all the materials and the construction of the assembly, including the air duct materials and the size and protection of the openings, shall conform with the design of the fire resistance–rated assembly, as tested in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, or ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials.*

7.2.3.2.22 Raised Floor Plenum. The space between the top of the finished floor and the underside of a raised floor shall be permitted to be used to supply air to the occupied area, or return and exhaust air from the occupied area, provided that the conditions in 7.2.3.2.16 through 7.2.3.2.21 are met.

7.2.4 Type III (211 or 200) Construction.

7.2.4.1 Type III Construction. Type III (211 or 200) construction shall be that type in which exterior walls and structural members that are portions of exterior walls are of approved noncombustible or limited-combustible materials, and in which interior structural members, including walls, columns, beams, girders, trusses, arches, floors, and roofs, are entirely or partially of wood of smaller dimensions than required for Type IV construction or are of approved noncombustible, limited-combustible, or other approved combustible materials.

7.2.4.2 Special Requirements—Type III Construction. The special requirements in 7.2.4.2.1 through 7.2.4.2.3 shall apply to Type III construction.

7.2.4.2.1 Fire Retardant–Treated Wood. Approved fire retardant–treated wood framing shall be permitted within the assembly of exterior walls having a required fire resistance rating of 2 hours or less and a horizontal separation of not less than 5 ft (1.5 m), provided the fire resistance rating is maintained and the exposed outer and inner faces of such walls are constructed of limited-combustible or noncombustible materials.

7.2.4.2.2 Heavy Timber. Wood columns and arches conforming to heavy timber sizes shall be permitted where exterior walls are required to have a 1-hour fire resistance rating or less.

7.2.4.2.3 Exterior Nonbearing Walls. Exterior nonbearing walls tested in accordance with, and meeting the conditions of acceptance of, NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus,* shall be permitted.

7.2.5 Type IV (2HH) Construction.

7.2.5.1 Type IV Construction. Type IV (2HH) construction shall be that type in which exterior walls, and interior bearing walls and structural members that are portions of such walls, are of approved noncombustible or limited-combustible materials. Other interior structural members, including columns, beams, girders, trusses, arches, floors, and roofs, shall be of solid or laminated wood without concealed spaces and shall comply with the allowable dimensions of 7.2.5.5.

7.2.5.2 Exterior Wall Separation. Exterior walls greater than 30 ft (9.1 m) from the property line shall be permitted to be of heavy timber construction, provided the 2-hour rating as required by Table 7.2.2 is maintained and such walls contain no combustible concealed spaces.

7.2.5.3 Interior Columns, Arches, Beams, Girders, and Trusses. Interior columns, arches, beams, girders, and trusses of approved materials other than wood shall be permitted, provided they are protected to provide a fire resistance rating of not less than 1 hour.

7.2.5.4 Concealed Space. Certain concealed spaces shall be permitted in accordance with 7.2.5.5.3(D).

7.2.5.5 Type IV (2HH) Allowable Dimensions. All dimensions in 7.2.5.5 shall be considered nominal.

7.2.5.5.1 Columns.

(A) Wood columns supporting floor loads shall be not less than 8 in. (200 mm) in any dimension.

(B) Wood columns supporting only roof loads shall be not less than 6 in. (150 mm) in width and not less than 8 in. (200 mm) in depth.

7.2.5.5.2 Beams.

(A) Wood beams and girders supporting floor loads shall be not less than 6 in. (150 mm) in width and not less than 10 in. (250 mm) in depth.

(B) Wood beams and girders and other roof framing supporting roof loads only shall be not less than 4 in. (100 mm) in width and not less than 6 in. (150 mm) in depth.

7.2.5.5.3 Arches.

(A) Framed or glued laminated arches that spring from grade or the floor line and timber trusses that support floor loads shall be not less than 8 in. (200 mm) in width or depth.

(B) Framed or glued laminated arches for roof construction that spring from grade or the floor line and do not support floor loads shall have members not less than 6 in. (150 mm) in width and not less than 8 in. (200 mm) in depth for the lower half of the member height and not less than 6 in. (150 mm) in depth for the upper half of the member height.

(C) Framed or glued laminated arches for roof construction that spring from the top of walls or wall abutments, and timber trusses that do not support floor loads, shall have members not less than 4 in. (100 mm) in width and not less than 6 in. (150 mm) in depth.

(D) Spaced members shall be permitted to be composed of two or more pieces not less than 3 in. (75 mm) in thickness where blocked solidly throughout their intervening spaces or where such spaces are tightly closed by a continuous wood cover plate not less than 2 in. (50 mm) in thickness that is secured to the underside of the members.

7.2.5.5.4 Splice Plates. Splice plates shall be not less than 3 in. (75 mm) in thickness.

7.2.5.5.5 Floors. Floors shall be constructed of spline or tongue-and-groove plank not less than 3 in. (75 mm) in thickness that is covered with 1-in. (25-mm) tongue-and-groove flooring, laid crosswise or diagonally to the plank, or with ½-in. (12.5-mm) wood structural panel; or they shall be constructed of laminated planks not less than 4 in. (100 mm) in width, set close together on edge, spiked at intervals of 18 in. (460 mm), and covered with 1-in. (25-mm) tongue-and-groove flooring, laid crosswise or diagonally to the plank, or with ½-in. (12.5-mm) wood structural panel.

7.2.5.5.6 Roof Decks. Roof decks shall be constructed of spline or tongue-and-groove plank not less than 2 in. (50 mm) in thickness; or of laminated planks not less than 3 in. (75 mm) in width, set close together on edge, and laid as required for floors; or of 1⅛-in. (28.5-mm) thick interior wood structural panel (exterior glue); or of approved noncombustible or limited-combustible materials of equivalent fire durability.

7.2.5.6 Special Requirements—Type IV Construction. The special requirements in 7.2.5.6.1 through 7.2.5.6.8 shall apply to Type IV construction.

7.2.5.6.1 Structural Elements. Structural elements shall be of heavy timber members (sawn or glued-laminated) or of fire resistance-rated construction as set forth in Table 7.2.2 when materials other than heavy timber are used.

7.2.5.6.2 Columns, Arches, Beams, and Roof Decking. Where horizontal separation of 20 ft (6 m) or more is provided, wood columns, arches, beams, and roof decking conforming to the requirements for heavy timber in 7.2.5.5 shall be permitted to be used on the exterior of the building.

7.2.5.6.3 Partitions. Permanent partitions shall be permitted to be of solid wood construction formed by not less than two layers of matched boards of 1-in. (25-mm) nominal thickness or of 1-hour fire resistance–rated construction as set forth in Table 7.2.2.

7.2.5.6.4 Floors. Floors shall be permitted to be of heavy timber, masonry, concrete, wood, or steel and shall be constructed as required in Chapter 8.

7.2.5.6.5 Roofs. Roofs of 1-hour fire resistance–rated construction shall be permitted.

7.2.5.6.6 Stairways.

7.2.5.6.6.1 Stairways shall be permitted to be constructed with wood treads and risers of not less than 2-in. (50-mm) nominal thickness.

7.2.5.6.6.2 Where built-on, laminated or plank inclines are required for floors, stairways shall be permitted to be 1-in. (25-mm) nominal thickness or shall be permitted to be constructed as required for buildings of Type I or Type II construction.

7.2.5.6.7 Exterior Walls. Approved fire retardant–treated wood framing shall be permitted within the assembly of exterior walls having a required fire resistance rating of 2 hours or less and a horizontal separation of not less than 5 ft (1.5 m), provided the fire resistance rating is maintained and the exposed outer and inner faces of such walls are constructed of limited-combustible or noncombustible materials.

7.2.5.6.8 Exterior Nonbearing Walls. Exterior nonbearing walls tested in accordance with, and meeting the conditions of, acceptance of NFPA 285 shall be permitted.

7.2.6 Type V (111 or 000) Construction. Type V (111 or 000) construction shall be that type in which exterior walls, bearing walls, columns, beams, girders, trusses, arches, floors, and roofs are entirely or partially of wood or other approved material.

7.2.7 Fire Resistance Rating Requirements for Structural Elements.

7.2.7.1 Fire resistance protection shall be provided for structural elements as set forth in Chapter 7 and other chapters of this *Code*.

7.2.7.2 Structural elements shall meet the requirements of 7.2.7.2.1 and 7.2.7.2.2.

7.2.7.2.1 Structural elements including floors and bearing walls shall have a fire resistance rating not less than the fire resistance rating required for the structural element, bearing or nonbearing wall, floor, or roof they support.

7.2.7.2.2 Structural elements shall be required to have only the fire resistance rating required for the construction classification of the building, provided both of the following are met:

(1) Structural elements support nonbearing wall or partition assemblies having a required fire resistance rating of 1 hour or less
(2) Structural elements do not serve as exit enclosures or protection for vertical openings.

7.2.7.3 Structural elements required to have a fire resistance rating and that support more than two floors, one floor and roof, a bearing wall, or a nonbearing wall more than two stories high shall be individually protected on all sides for their full length with materials providing the required fire resistance rating.

7.2.7.4 Structural members, other than those specified in 7.2.7.3, required to have a fire resistance rating shall be protected by individual encasement, membrane or ceiling protection in accordance with Section 8.6 or a combination of both.

7.2.7.5 In addition to the requirements of 7.2.7.3 and 7.2.7.4, columns shall meet the following requirements:

(1) Where columns require a fire resistance rating, the entire column, including its connections to beams or girders, shall be individually protected.
(2) Where the column extends through a ceiling, the fire-resistive protection provided for the column shall be continuous from the top of the floor through the ceiling space to the top of the column.

7.2.7.6 The required thickness and construction of fire-resistive materials or assemblies enclosing trusses shall be based on one of the following:

(1) The results of full-scale tests or combinations of tests on truss components
(2) Approved calculations based on such tests to verify that the assembly is provided with the required fire resistance rating.

7.2.7.7 The fire resistance rating required for external structural members, defined as columns, trusses, girders, and beams located beyond the perimeter of the building floor area, shall be permitted to be calculated by using analytical methods in accordance with the provisions set forth in 8.2.3.

7.2.7.8 Structural elements within exterior walls or located along the exterior perimeter of a building or structure shall have a fire resistance rating as required by Table 7.2.2 for exterior bearing walls based on the type of construction.

7.2.7.9 Structural elements within an exterior wall located where openings are not permitted, or where protection of openings is required in accordance with 7.3.5, shall have a fire resistance rating based on protection against exterior fire exposure as required for exterior bearing walls or the structural element, whichever requires the greater fire resistance rating.

7.2.7.10 The edges of lugs, brackets, rivets, and bolt heads attached to structural elements shall be permitted to extend to within 1 in. (25.4 mm) of the surface of the fire-resistive protection.

7.2.7.11 Conduits, pipes, ducts, or other construction elements shall not be embedded within required fire-resistive protection of any structural member requiring individual encasement to achieve the required fire resistance rating.

7.2.7.12 Fire-resistive materials covering columns required to have a fire resistance rating, where exposed to impact damage by moving vehicles, handling of merchandise, or by other means, shall be protected from damage.

7.3 Exterior Walls.

7.3.1 General. Exterior walls shall be designed and constructed in accordance with Chapter 37 and Section 7.3.

7.3.2 Fire Resistance Rating of Exterior Walls.

7.3.2.1 Exterior walls shall have a fire resistance rating based on Table 7.2.2 and Table 7.3.2.1, whichever is greater.

7.3.2.2 The fire resistance rating requirements of Table 7.3.2.1 shall not apply to exterior walls of one- and two-family dwellings having a horizontal separation of more than 5 ft (1.5 m).

7.3.3 Continuity. Exterior walls required to be fire rated by Table 7.3.2.1 because of horizontal separation shall be continuous from the foundation to not less than 30 in. (760 mm) above the roof, except where otherwise permitted by 37.1.3.1.

7.3.4 Horizontal Separation.

7.3.4.1 Horizontal separation shall be measured at a 90-degree angle to the building face.

Table 7.3.2.1 Fire Resistance Ratings for Exterior Walls (hr)

Occupancy Classification	Horizontal Separation ft (m)				Opening Protectives
	0 to 5 (0 to 1.5)	>5 to ≤10 (>1.5 to ≤3)	>10 to ≤30 (>3 to ≤9)	>30 (>9)	
Assembly, educational, day care, health care, ambulatory health care, detection and correctional, residential, residential board and care, business, industrial, and storage occupancies with low hazard contents	1	1	0	0	See Table 7.3.5(a)
Mercantile and industrial and storage occupancies with ordinary hazard contents	2	1	0	0	See Table 7.3.5(b)
Industrial and storage occupancies with high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3	See Chapter 34 for minimum requirements				

7.3.4.2 Where two or more buildings are located on the same lot, the horizontal separation shall be measured from the building face to an imaginary line drawn between the exterior walls of the adjacent buildings. The imaginary line shall be placed at a distance from the facing exterior wall of the adjacent building that is equal to the horizontal separation applicable for that wall based on its fire resistance rating and protection of openings.

7.3.4.3 Where the exterior wall of a building is an irregular vertical shape, the following criteria shall be met:

(1) The horizontal separation shall be determined by measuring from a vertical plane that is located so that no portion of the exterior wall of the building is between such vertical plane and the line to which the horizontal separation is measured.
(2) The area of openings shall be determined from the projection of the openings in the exterior wall onto the vertical plane.

7.3.5 Opening Protectives. Where an exterior wall is required to have a fire resistance rating as determined by Table 7.3.2.1, the area of openings in exterior walls shall not exceed that permitted by this section and Table 7.3.5(a) or Table 7.3.5(b).

7.3.5.1 The area of unprotected openings in an exterior wall shall be the aggregate of unprotected openings expressed as a percentage of the area of the exterior wall.

7.3.5.2 When required by Table 7.3.2.1 to have a fire protection rating, penetrations shall comply with the requirements of Section 8.8.

7.3.5.3 The area of an exterior wall shall be calculated as the length, edge to edge, of the exterior wall multiplied by the measurement from the finished ground level to the uppermost ceiling.

7.3.5.4 The area of unprotected openings permitted by Table 7.3.5(a) and Table 7.3.5(b) shall be permitted to be doubled under either of the following conditions:

(1) Where the building is protected throughout with an approved, electrically supervised automatic sprinkler system in accordance with 55.3.1.1
(2) Where the openings are protected with fire window assembly or other listed opening protectives having a fire protection rating in accordance with Table 7.3.5.4.

Table 7.3.5.4 Minimum Fire Protection Ratings for Exterior Opening Protectives

Wall Fire Resistance Rating (hr)	Fire Protection Rating (hr)
2	1½
1	¾

7.4 Height and Area Limitations.

7.4.1 General. Except as modified in Section 7.4 through Section 7.6, the heights and areas of buildings, based on their intended occupancy and type of construction classification, shall not exceed the limits set forth in Table 7.4.1 where the values in Table 7.4.1 for sprinklered buildings apply to buildings protected throughout with an approved, electrically supervised automatic sprinkler system in accordance with 55.3.1.1(1).

7.4.1.1 Mixed Occupancies. Buildings with mixed occupancies complying with 6.2.3 shall have their required type of construction determined by applying the most restrictive type of construction to the entire building in accordance with Section 7.4 through Section 7.6 for each of the occupancies.

7.4.1.2 Separated Occupancies. Buildings with separated occupancies complying with 6.2.4 shall have their required type of construction determined in accordance with 7.4.1.2.1 and 7.4.1.2.2.

7.4.1.2.1 Each separated occupancy shall comply with the story and height limitations of Section 7.4 through Section 7.6 based on the location of the occupancy in the building.

7.4.1.2.2 For each story in the building, the sum of the ratios of the floor area of each separated occupancy divided by the allowable floor area as determined by Table 7.4.1, and as modified by 7.6.2, shall not exceed 1.0.

Table 7.3.5(a) Maximum Allowable Area of Unprotected Openings (percentage of exterior walls)

Horizontal Separation (ft)	Max. Area of Exposing Building Face (ft^2)																		
	100	**150**	**200**	**250**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1,000**	**1,500**	**2,000**	**2,500**	**3,500**	**5,000**	**10,000**	**20,000**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	9	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7
5	12	11	10	9	9	9	8	8	8	8	8	8	7	7	7	7	7	7	7
6	18	15	13	12	11	10	10	9	9	9	9	8	8	8	8	7	7	7	7
7	25	20	17	15	14	12	11	11	10	10	10	9	9	8	8	8	8	7	7
8	33	25	21	19	17	15	14	13	12	11	11	11	10	9	9	8	8	7	7
9	43	32	27	23	21	18	16	15	14	13	12	12	11	10	9	9	8	8	7
10	55	40	33	28	25	21	19	17	16	15	14	13	12	11	10	9	9	8	7
15	100	96	75	62	54	43	36	32	29	27	25	23	18	16	14	13	11	9	8
20		100	100	100	97	75	62	54	48	43	39	32	28	23	20	17	14	11	9
25					100	100	97	83	73	65	59	54	40	32	28	23	19	13	11
30							100	100	100	92	83	76	54	43	37	29	23	16	12
35										100	100	100	72	57	47	37	29	19	14
40													92	72	60	46	35	22	16
45													100	89	74	56	42	24	18
50														100	90	67	50	30	20
55															100	80	59	35	22
60																93	69	40	25
70																100	91	51	31
80																	100	64	37
90																		78	45
100																		95	53
110																		100	62
120																			72
130																			83
140																			94
150																			100

Note: For SI units, 1 ft = 0.305 m; 1 ft^2 = 0.093 m^2.

Table 7.3.5(b) Maximum Allowable Area of Unprotected Openings (percentage of exterior wall)

Horizontal Separation (ft)	Max. Area of Exposing Building Face (ft^2)																		
	100	**150**	**200**	**250**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1,000**	**1,500**	**2,000**	**2,500**	**3,500**	**5,000**	**10,000**	**20,000**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	6	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6	9	7	7	6	6	5	5	5	5	4	4	4	4	4	4	4	4	4	4
7	12	10	8	8	7	6	6	5	5	5	5	5	4	4	4	4	4	4	4
8	17	13	11	9	9	7	7	6	6	6	5	5	5	4	4	4	4	4	4
9	21	16	13	12	10	9	8	7	7	7	6	6	5	5	5	4	4	4	4
10	27	20	16	14	12	11	9	8	8	7	7	7	6	5	5	5	4	4	4
15	69	48	38	31	27	21	18	16	14	13	12	12	9	8	7	6	6	5	4
20	100	91	70	57	48	38	31	27	24	22	20	18	16	12	10	9	7	6	5
25		100	100	91	77	59	48	41	36	32	29	27	20	16	14	11	9	7	5
30				100	100	86	59	46	52	46	42	38	27	22	18	15	12	8	6
35						100	96	81	70	62	56	51	36	28	24	18	14	10	7
40							100	100	92	81	73	66	46	36	30	23	18	11	8
45									100	100	92	84	58	45	37	28	21	13	9
50											100	100	71	55	45	34	25	15	10
55													85	65	54	40	30	17	11
60													100	77	63	47	34	20	12
70														100	85	62	45	25	15
80															100	80	58	32	19
90																100	73	39	22
100																	89	47	26
110																	100	56	31
120																		66	36
130																		77	41
140																		89	47
150																		100	53
160																			60
170																			67
180																			75
190																			83
200																			91
210																			100

Note: For SI units, 1 ft = 0.305 m; 1 ft^2 = 0.093 m^2.

Table 7.4.1 Height and Area Requirements

Construction Type	TYPE I				TYPE II					TYPE III				TYPE IV		TYPE V			
	442		332		222		111		000	211		200		2HH		111		000	
	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N
Maximum building height (ft)	UL	UL	420	400	180	160	85	65	75	55	85	65	75	55	85	65	70	50	60	40
OCCUPANCY																				
Assembly >1000	UL	4	UL	4	12	4	4	3	1	NP	3	2	NP	NP	3	2	3	2	NP	NP
	UL		UL		UL		15500		8500		14000		NP		15000		11500		NP	
Assembly >300	UL	4	UL	4	12	4	4	3	2	1	4	2	1	1	4	2	4	2	1	1
	UL		UL		UL		15500		8500		14000		8500		15000		11500		5500	
Assembly ≤300	UL	7	UL	7	12	7	4	3	2	1	4	3	2	1	4	3	4	3	2	1
	UL		UL		UL		15500		8500		14000		8500		15000		11500		5500	
Assembly, outdoor	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	4	3	3	2	4	3	3	2	2	1
	UL		UL		UL		UL		UL		UL		UL		UL		UL		UL	
Business	UL	UL	UL	UL	12	11	6	5	5	4	6	5	5	4	6	5	4	3	3	2
	UL		UL		UL		37500		23000		28500		19000		36000		18000		9000	
Board & care, large	UL	NP	UL	NP	12	NP	3	NP	2	NP	2	NP	1	NP	2	NP	2	NP	1	NP
	UL		UL		55000		19000		10000		16500		10000		18000		10500		4500	
Board & care, small	UL	UL	UL	UL	12	11	5	4	5	4	5	4	5	4	5	4	4	3	3	2
	UL		UL		UL		24000		16000		24000		16000		20500		12000		7000	
Day care	UL	2	UL	2	12	2	6	1	4	1	4	1	2	1	2	1	4	1	2	1
	UL		UL		60500		26500		13000		23500		13000		25500		18500		9000	
Detention & correctional	UL	7	UL	7	12	7	2	2	2	NP	2	2	2	NP	2	2	2	2	2	NP
	UL		UL		UL		15000		10000		10500		7500		12000		7500		5000	
Educational	UL	UL	UL	UL	12	5	4	3	3	2	4	3	3	2	4	3	2	1	2	1
	UL		UL		UL		26500		14500		23500		14500		25500		18500		9500	
Health care	UL	NP	UL	NP	12	NP	3	NP	1	NP	1	NP	NP	NP	1	NP	1	NP	NP	NP
	UL		UL		UL		15000		11000		12000		NP		12000		9500		NP	
Health care, ambulatory	UL	UL	UL	UL	12	11	6	5	5	1	6	5	5	1	6	5	4	3	3	1
	UL		UL		UL		37500		23000		28500		19000		36000		18000		9000	
Industrial, ord. hazard	UL	UL	UL	UL	12	11	5	4	3	2	4	3	3	2	5	4	3	2	2	1
	UL		UL		UL		25000		15500		19000		12000		33500		14000		8500	
Industrial, low hazard	UL	UL	UL	UL	12	11	6	5	4	3	5	4	4	3	6	5	4	3	3	2
	UL		UL		UL		37500		23000		28500		18000		50500		21000		13000	
Mercantile	UL	UL	UL	UL	12	11	5	4	5	4	5	4	5	4	5	4	4	3	2	1
	UL		UL		UL		21500		12500		18500		12500		20500		14000		9000	
Residential	UL	UL	UL	UL	12	11	5	4	5	4	5	4	5	4	5	4	4	3	3	2
	UL		UL		UL		24000		16000		24000		16000		20500		12000		7000	
Residential, 1- & 2-family	UL	UL	UL	UL	12	11	5	4	5	4	5	4	5	4	5	4	4	3	3	2
	UL		UL		UL		UL		UL		UL		UL		UL		UL		UL	
Storage, ord. hazard	UL	UL	UL	UL	12	11	5	4	4	3	4	3	4	3	5	4	4	3	2	1
	UL		UL		48000		26000		17500		26000		17500		25500		14000		9000	

(continues)

Table 7.4.1 *Continued*

Construction Type	TYPE I				TYPE II					TYPE III				TYPE IV		TYPE V			
	442		332		222		111		000	211		200		2HH		111		000	
	S	N	S	N	S	N	S	N	S N	S	N	S	N	S	N	S	N	S	N
Storage, low hazard	UL	UL	UL	UL	12	11	6	5	5 4	5	4	5	4	6	5	5	4	3	2
	UL		UL		79000		39000		26000	39000		26000		38500		21000		13500	
HIGH HAZARD CONTENTS																			
Protection Level 1	1	NP	1	NP	1	NP	1	NP	1 NP	1	NP	1	NP	1	NP	1	NP	NP	NP
	21000		21000		16500		11000		7000	9500		7000		10500		7500		NP	
Protection Level 2	UL	NP	UL	NP	3	NP	2	NP	1 NP	2	NP	1	NP	2	NP	1	NP	1	NP
	21000		21000		16500		11000		7000	9500		7000		10500		7500		3000	
Protection Level 3	UL	NP	UL	NP	6	NP	4	NP	2 NP	4	NP	2	NP	4	NP	2	NP	1	NP
	UL		UL		60000		26500		14000	17500		13000		25500		10000		5000	
Protection Level 4	UL	NP	UL	NP	8	NP	6	NP	4 NP	6	NP	4	NP	6	NP	4	NP	3	NP
	UL		UL		UL		37500		17500	28500		17500		36000		18000		6500	
Protection Level 5	3	NP	3	NP	3	NP	3	NP	3 NP	3	NP	3	NP	3	NP	3	NP	2	NP
	UL		UL		UL		37500		23000	28500		19000		36000		18000		9000	

Notes:
1. For SI units, 1 ft = 0.3048 m and 1 ft^2 = 0.093 m^2.
2. Within each occupancy category, the top row refers to the allowable number of stories above grade, and the bottom row refers to allowable area per floor.
3. S = sprinklered maximum building height in feet and maximum number of stories above grade.
4. N = nonsprinklered maximum building height in ft and maximum number of stories above grade.
5. UL = unlimited.
6. NP = not permitted.

7.4.1.3 Special Requirements.

7.4.1.3.1 Mall Buildings. The height and area of mall buildings shall comply with Section 27.4.4.

7.4.1.3.2 Open Parking Structures. The height and area of open parking structures of Type I and Type II construction shall be governed by NFPA 88A, *Standard for Parking Structures*, and 30.8.1.6.6.

7.4.1.3.3 Small Board and Care Occupancies. For board and care occupancies, the values in Table 7.4.1 for sprinklered buildings shall also apply to buildings, four stories or less in height, protected throughout with an approved, electrically supervised sprinkler system in accordance with 55.3.1.1(2).

7.4.1.3.4 Airport Traffic Control Towers.

7.4.1.3.4.1 Airport traffic control towers, with cab areas not exceeding 1500 ft^2 (140 m^2) per floor, shall be permitted to be constructed in accordance with Table 7.4.1.3.4.1.

7.4.1.3.4.2 Height shall be measured from grade to cab floor.

Table 7.4.1.3.4.1 Height and Area Requirements for Airport Traffic Control Tower

Type of Construction	Height		Area	
	ft	m	ft^2	m^2
I (442)	UL	UL	1500	140
I (332)	UL	UL	1500	140
II (222)	240	73	1500	140
II (111)	100	30	1500	140
II (000)	85	26	1500	140
III (211)	65	20	1500	140

Note: UL = unlimited.

7.4.2 Areas.

7.4.2.1 Maximum Allowable Area. The allowable area per floor (A_f) for any individual story in a building shall not exceed the area permitted by Table 7.4.1, as modified by applicable increases in accordance with 7.6.2.

7.4.2.2 Basements. Basements shall not be required to be included in the total allowable building area, provided they do not exceed the area permitted for a one-story building based on the occupancy and type of construction.

7.4.2.3 Multiple Types of Construction. Where two or more types of construction not separated by fire walls exist in the same building, the area of the entire building shall not exceed the least area permitted, based on occupancy for the types of construction used in the building.

7.4.3 Height and Number of Stories.

7.4.3.1 Maximum Height and Number of Stories. The maximum height and number of stories of a building shall depend on the use and occupancy of the building and on the type of construction and shall not exceed the limits specified in Table 7.4.1, except as provided in 7.4.3 and as modified by Section 7.5.

7.4.3.2 Building Height. The height of a building shall be measured from grade to the highest finish roof surface in the case of flat roofs or to the average height of the highest sloped roof.

7.4.3.3 Number of Stories. The number of stories shall be counted starting with the first story above grade and ending with the highest occupiable story containing the occupancy considered.

7.4.3.3.1 Interstitial spaces used solely for building or process systems directly related to the level above or below shall not be considered a separate story.

7.4.3.3.2 A mezzanine shall not be counted as a story for the purpose of determining the allowable number of stories.

7.4.3.4 Multiple Types of Construction. Where two or more types of construction exist in the same building, the height of the entire building shall not exceed the least height permitted, based on the occupancy for the types of construction used in the building, except as modified by 7.4.3.6.5, 7.4.3.6.6, 7.4.3.6.7, or 7.4.3.6.8.

7.4.3.5 Underground Buildings All structural members up to and including the floor of the lowest level of discharge of underground buildings more than 30 ft (9 m) below or more than one level below the lowest level of exit discharge shall be Type I or Type II (222) construction.

7.4.3.6 Special Height Requirements.

7.4.3.6.1 Towers, Spires, Steeples, and Other Roof Structures. Towers, spires, steeples, and other roof structures erected as part of a building and not used for habitation or storage shall be consistent with the required type of construction for the building and shall meet the requirements of 7.4.3.6.1.1 and 7.4.3.6.1.2.

7.4.3.6.1.1 Towers, spires, steeples, and other roof structures shall not be limited in height when constructed entirely of noncombustible materials.

7.4.3.6.1.2 Towers, spires, steeples, and other roof structures shall extend not more than 20 ft (6 m) above the height limit permitted in Table 7.4.1 when constructed of combustible materials.

7.4.3.6.2 Aircraft Hangars. The height of one-story aircraft hangars shall not be limited when the building is surrounded by public space, streets, or permanent open yards not less in width than 1½ times the height of the building and the building is protected with an approved, electrically supervised sprinkler system in accordance with NFPA 13. *(See Chapter 29 and Chapter 30 for special occupancy requirements.)*

7.4.3.6.3* Low-Hazard Industrial Processes Requiring Unusual Heights. Buildings and structures of Type I or Type II construction, or buildings and structures protected throughout with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13, that are designed to house low-hazard industrial processes that require unusual heights to accommodate craneways or special machinery and equipment, shall be permitted to be unlimited in height.

7.4.3.6.4 Rack Storage Buildings. One-story buildings and structures used for rack storage shall not be limited in height, provided that all of the following requirements are met:

(1) The building shall be of Type II construction.
(2) The building shall not be open to the public.
(3) The building shall conform to the requirements of 7.6.3.3.

7.4.3.6.5 Enclosed Parking Structures with Occupancies Above. A basement or first story above grade plane of a building shall be considered as a separate and distinct building for the purpose of determining the limitation on number of stories and type of construction, provided all of the following conditions are met:

(1) The basement or first story above grade plane shall be of Type I construction and shall be separated from the building above with a horizontal assembly having a minimum 3-hour fire resistance rating.
(2) Shaft, stairway, ramp, or escalator enclosures through the horizontal assembly shall have not less than a 2-hour fire resistance rating with opening protectives in accordance with Table 8.7.2.
(3) Where the walls below the horizontal assembly have a minimum 3-hour fire resistance rating with opening protectives as required for walls forming a 3-hour fire barrier, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire resistance rating, provided that all the following conditions are met:
    (a) The building above the horizontal assembly is not required to be of Type I construction.
    (b) The enclosure connects less than four stories.
    (c) The enclosure opening protectives above the horizontal assembly are a minimum 1-hour fire protection rating.
(4) The building above the horizontal assembly shall contain only business, mercantile, or residential occupancies or assembly occupancies having an assembly room with an occupant load of less than 300.
(5) The building below the horizontal assembly shall be an enclosed parking structure used for the parking and storage of private motor vehicles, unless otherwise permitted by the following:
    (a) Entry lobbies, mechanical rooms, and similar uses incidental to the operation of the building shall be permitted.
    (b) Business, mercantile occupancies, and assembly occupancies having an assembly room with an occupant load of less than 300 shall be permitted in addition to those uses incidental to the operation of the building (including storage areas), provided that the entire structure below the horizontal assembly is protected throughout by an approved, electrically supervised automatic sprinkler system.
(6) The maximum building height in feet shall not exceed the limits set forth in Table 7.4.1 for the least restrictive type of construction involved.

7.4.3.6.6 Enclosed Parking Structure with Open Parking Structure Above. An enclosed parking structure located in the basement or first story below an open parking structure shall be classified as a separate and distinct building for the purpose of determining the type of construction, provided the following conditions are met:

(1) The enclosed parking structure shall be of Type I or Type II construction and shall have a fire resistance rating at least equal to the fire resistance rating of the open parking structure.

(2) The height and the number of the floors above the basement shall be limited as specified in 30.8.1.6.
(3) The floor assembly between the enclosed parking structure and open parking structure shall be protected as required for the floor assembly of the enclosed parking structure.
(4) Openings in the floor assembly between the enclosed parking structure and open parking structure, except exit openings, shall not be required to be protected.
(5) The enclosed parking structure shall be used for the parking or storage of private motor vehicles, but shall be permitted to contain an office, a waiting room, and a toilet room having a total area of not more than 1000 ft^2 (93 m^2) and mechanical equipment rooms incidental to the operation of the building.

7.4.3.6.7 Open Parking Structure Beneath Occupancies Other than Assembly and Health Care, Detention and Correctional, and Ambulatory Health Care Occupancies.

7.4.3.6.7.1 Where a maximum one-story abovegrade parking structure, enclosed or open or a combination thereof, of Type I or Type II (222) construction or open Type IV construction, with grade entrance, is provided under a building of occupancies other than assembly and health care, detention and correctional, and ambulatory health care occupancies, the number of stories to be used in determining the minimum type of construction shall be permitted to be measured from the floor above such a parking area.

7.4.3.6.7.2 The floor assembly between the parking structure and occupancies other than assembly and health care, detention and correctional, and ambulatory health care occupancies above shall comply with the following:

(1) The floor assembly shall be of type of construction required for the parking structure.
(2) The floor assembly shall provide a fire resistance rating not less than the mixed occupancy separation required in Table 6.2.4.1.

7.4.3.6.8 Open Parking Structure Beneath Other Occupancies.

7.4.3.6.8.1 Limitations.

(A) Open parking structures constructed under other occupancies shall not exceed the height and area limitations permitted under 30.8.1.6.

(B) The height of the portion of the building above the open parking structure shall not exceed the limitations in Section 7.4 for the upper occupancy.

(C) The height, in both feet and stories, of the portion of the building above the open parking structure shall be measured from grade and shall include both the open parking structure and the portion of the building above the parking structure.

7.4.3.6.8.2 Fire Separation. Fire separation assemblies between the parking occupancy and the upper occupancy shall correspond to the required fire resistance rating prescribed in Table 6.2.4.1 for the uses involved.

7.4.3.6.8.3 Type of Construction. The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, that are necessary to support the upper occupancy shall be provided with the more restrictive fire resistance ratings of the use groups involved, as shown in Table 7.2.2.

7.4.3.6.8.4 Means of Egress. Means of egress for the upper occupancy shall conform to Chapter 11 and shall be separated from the parking occupancy by fire barriers having at least a 2-hour fire resistance rating, with self-closing doors.

7.5 Height Increases Permitted.

7.5.1 General. The allowable building heights and allowable number of stories shall be as shown in Table 7.4.1, as modified in 7.4.3.6.

7.5.2 Residential Sprinkler Increase. For residential occupancies provided with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13R, the maximum overall height shall be increased by 20 ft (6 m) and the maximum number of stories shall be increased by one story, provided the overall building height does not exceed 60 ft (18 m) and the maximum number of stories does not exceed four stories.

7.6 Area Increases Permitted.

7.6.1 General. The floor areas specified in Table 7.4.1 shall be permitted to be increased in accordance with 7.6.2. Unlimited area buildings shall be in accordance with 7.6.3.

7.6.2 Area Increase. The floor areas specified in Table 7.4.1 shall be permitted to be increased to account for frontage (l_f) and automatic sprinkler protection (l_s) in accordance with the following equation:

$$A_f = A_t\left[1+\left(l_f/100\right)+\left(l_s/100\right)\right] \quad \textbf{(7.1)}$$

where:
A_f = allowable area per floor (ft^2 or m^2)
A_t = area per floor (ft^2 or m^2) in accordance with Table 7.4.1
l_f = frontage area increase (percent), as determined per 7.6.2.1
l_s = sprinkler area increase (percent), as determined per 7.6.2.2

7.6.2.1* Frontage Increase. When a building has more than 25 percent of its perimeter fronting or facing on a public way or open space having a minimum width of 20 ft (6 m), the frontage increase shall be determined in accordance with the following equations:

$$l_f = \left\{100\left[\left(F_t/P\right)-0.25\right]W_w\right\}/30 \text{ (English units)} \quad \textbf{(7.2)}$$

$$l_f = \left\{100\left[\left(F_t/P\right)-0.25\right]W_w\right\}/9 \text{ (SI units)} \quad \textbf{(7.3)}$$

where:
l_f = frontage area increase (percent)
F_t = a sum of the building perimeter with a constant width (W_i) (ft or m) that is at least 20 ft (6 m)
P = building perimeter (ft or m)
W_w = weighted width (ft or m) = $\Sigma_{i=1}^{N}\left[(F_{si})(W_i)/F_t\right]$
N = a number of sections of open space with a discretely different constant width (W_i) from other sections of open space
F_{si} = section of building perimeter fronting or facing a public way or open space with a constant width (W_i) (ft or m) that is at least 20 ft (6 m)
W_i = width of any section of public way or open space with a constant dimension (ft or m), as measured in accordance with 7.6.2.1.1, 7.6.2.1.2, and 7.6.2.1.3

7.6.2.1.1 The dimension W_i shall be the distance, measured horizontally, between a building exterior wall and the adjacent property line or between a building exterior wall and the property line on the opposite side of a street, alley, or public way.

7.6.2.1.1.1 The dimension W_i shall be measured perpendicular from the building exterior wall.

7.6.2.1.1.2 Where walls of a building creating a court face each other, W_i shall be measured between facing exterior walls.

7.6.2.1.1.3 Where two or more buildings are located on the same lot, W_i shall be the distance, measured horizontally, between the facing exterior walls of the adjacent buildings.

7.6.2.1.2 The width limit (W_i) shall be a minimum of 20 ft (6 m), and the quantity (W_w) divided by 30 ft (9 m) shall not exceed 1.0 for all occupancies other than those specified in 7.6.2.1.3.

7.6.2.1.3 The width limit (W_i) shall be a minimum of 20 ft (6 m), and the quantity W_w divided by 30 ft (9 m) shall not exceed 2.0 for business, industrial, mercantile, and storage occupancies and assembly occupancies intended for viewing of indoor sporting events with spectator seating.

7.6.2.1.4 Frontage open space shall be in compliance with 7.6.2.1.4.1 and 7.6.2.1.4.2.

7.6.2.1.4.1 Open space shall be on the same lot as the building under consideration, or the space shall be dedicated for public use.

7.6.2.1.4.2 Open space shall be accessible by a fire apparatus road in accordance with 7.1.5.2.

7.6.2.2 Automatic Sprinkler Increase. Buildings protected with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13 shall be permitted to have the following sprinkler (I_s) area increases:

(1) 200 percent ($I_s = 200$) for buildings of two stories or more
(2) 300 percent ($I_s = 300$) for single-story buildings

7.6.2.3 Maximum Area. The maximum area of a building shall be determined by multiplying the allowable area per floor (A_f) by the number of stories up to a maximum of three stories.

7.6.2.3.1 The maximum floor area of a building more than three stories in height shall not exceed that permitted for a three-story building.

7.6.2.3.2* Buildings protected in accordance with NFPA 13R shall not be required to meet the requirement of 7.6.2.3.1.

7.6.3 Unlimited Area Buildings.

7.6.3.1 One-Story Building. The area of a one-story building of Type II construction used as an industrial occupancy with low hazard contents, or as a storage occupancy with low hazard contents, shall not be limited when the building is surrounded and adjoined by public ways or yards not less than 60 ft (18 m) in width.

7.6.3.2 Sprinklered One-Story Building.

7.6.3.2.1 The area of a one-story building used for business, industrial occupancies with ordinary hazard contents, or mercantile occupancies, and assembly uses intended for viewing of indoor sporting events with spectator seating shall not be limited when the building is provided with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13 and is surrounded and adjoined by public ways or yards not less than 60 ft (18 m) in width.

7.6.3.2.2 The electrically supervised automatic sprinkler system specified in 7.6.3.2.1 shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming, and equestrian activities, provided that the following conditions are met:

(1) Exit doors directly to the outside are provided for occupants of the participant sports areas.
(2) The building is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with Section 55.2.

7.6.3.3 Sprinklered, One- or Two-Story Storage Building. The total area of a one- or two-story structure used for storage of ordinary hazard contents shall not be limited, provided all the following requirements are met:

(1) The entire structure is protected throughout with an approved, electrically supervised automatic sprinkler systems installed in accordance with NFPA 13.
(2) The exterior walls face public ways or yards not less than 60 ft (18 m) in width.

7.6.3.4 Two-Story Building. The area of a two-story building used for business, industrial, or mercantile occupancies shall not be limited when the building is provided with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13 and is surrounded and adjoined by public ways or yards not less than 60 ft (18 m) in width.

7.6.3.5 Reduced Open Space. The permanent open space of 60 ft (18 m) required in 7.6.3.1, 7.6.3.2, 7.6.3.3, and 7.6.3.4 shall be permitted to be reduced to not less than 40 ft (12 m), provided the following requirements are met:

(1) The reduced open space shall not be permitted for more than 75 percent of the perimeter of the building.
(2) The exterior wall facing the reduced open space shall have a minimum fire resistance rating of 3 hours.
(3) Openings in the exterior wall, facing the reduced open space, shall have opening protectives with a fire protection rating of 3 hours.

7.6.3.6 High Hazard Uses in Storage and Industrial Occupancies. High hazard contents, other than detonation or deflagration hazards, that are required to be stored in detached buildings and that are in compliance with Chapter 34 shall be permitted in unlimited area buildings of industrial and storage occupancies in accordance with the limitations of 7.6.3.6.1 through 7.6.3.6.3.

7.6.3.6.1 Fire areas located at the perimeter of the unlimited area building shall not exceed 10 percent of the area of the building nor the area limitations specified in Table 7.4.1, as modified by Section 7.6, based on the percentage of the perimeter of the fire area that fronts on a street or other unoccupied space.

7.6.3.6.2 Fire areas other than those specified in 7.6.3.6.1 shall not exceed 25 percent of the area limitations specified in Table 7.4.1.

7.6.3.6.3 Fire resistance rating requirements of fire barrier assemblies shall be in accordance with Table 6.2.4.1.

7.6.3.7 Educational Buildings. The area of one-story buildings of Type II (111), Type II (000), Type III (211), or Type IV construction used for educational occupancies shall not be limited when the following criteria are met:

(1) Each classroom shall have not less than two means of egress, with one of the means of egress being a direct exit to the outside of the building.
(2) The building shall be equipped throughout with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13.
(3) The building shall be surrounded and adjoined by public ways or yards not less than 60 ft (18 m) in width.

7.6.3.8 Motion Picture Theaters. In buildings of Type II construction, the area of one-story motion picture theaters shall not be limited when the building is provided with an approved, electrically supervised automatic sprinkler system throughout in accordance with NFPA 13 and is surrounded and adjoined by public ways or yards not less than 60 ft (18 m) in width.

7.6.3.9 Sprinklered One-Story Building. The area of a one-story, assembly building used as an auditorium, church, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool, or tennis court of Type II construction shall not be limited when all the following criteria are met:

(1) The building shall not have a theatrical stage other than a raised platform.
(2) The building shall be equipped with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13.
(3) The assembly floor shall be located at, or within 21 in. (530 mm) of, street or grade level.
(4) All exits shall be provided with ramps to the street or grade level.
(5) The building shall be surrounded and adjoined by public ways or yards not less than 60 ft (18 m) in width.

Chapter 8 Fire-Resistive Materials and Construction

8.1 General.

8.1.1 The chapter addresses fire protection features intended to restrict or resist the spread of fire and smoke beyond the compartment of fire origin.

8.1.2 Where required by other chapters of this *Code*, every building shall be divided into compartments to limit the spread of fire and restrict or resist the movement of smoke.

8.1.2.1* Fire compartments shall be formed with fire barrier walls that comply with Section 8.4 or horizontal assemblies that comply with Section 8.6, or a combination of both.

8.1.2.2 Smoke compartments shall be formed with smoke barriers that comply with Section 8.11.

8.2* Fire Resistance–Rated Construction.

8.2.1 General.

8.2.1.1 The fire resistance ratings of structural elements and building assemblies shall be determined in accordance with the prescriptive requirements of 8.2.2 based on the test procedures set forth in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, or other approved test methods or analytical methods in accordance with 8.2.3. Materials used to construct fire resistance–rated elements and assemblies shall be limited to those permitted in this *Code*.

8.2.1.2 Fire resistance–rated floor and roof assemblies shall be classified as restrained or unrestrained in accordance with NFPA 251 or ASTM E 119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or UL 263, *Standard for Fire Tests of Building Construction and Materials*.

8.2.2 Prescriptive Requirements.

8.2.2.1 Fire-Resistive Protection of Floors, Roofs, and Walls — General Requirements. Floors and roofs shall be designed and constructed in accordance with Chapter 38, 8.2.2.2, and 8.2.2.3.

8.2.2.2 Fire-Resistive Protection of Floors. Floors shall be protected as required for the type of construction in Table 7.2.2 and the special requirements based on the type of construction specified in Chapter 7.

8.2.2.3 Fire-Resistive Protection of Roofs.

8.2.2.3.1 Roofs shall be protected as required for the type of construction in Table 7.2.2 and Chapter 38.

8.2.2.3.2 Fire resistance–rated roofs shall be permitted to have openings as permitted for roofs in 8.6.2 and 8.6.3 and shall be permitted to have openings as otherwise permitted by this *Code* and 8.2.2.3.3.

8.2.2.3.3 Skylights and other penetrations through a fire resistance–rated roof deck shall be permitted to be unprotected, provided that the structural integrity of the fire resistance–rated roof construction is maintained. Unprotected skylights shall not be permitted in roof construction required to be fire resistance rated in accordance with 8.3.2.10.7(2).

8.2.2.4 Walls.

8.2.2.4.1 Fire-resistive materials and assemblies of materials for walls shall meet the fire resistance requirements of Chapter 7 and this chapter. The fire-resistive materials, assemblies, and systems used shall be limited to those permitted in this *Code*.

8.2.2.4.2 The construction materials and details for fire resistance–rated assemblies and systems for walls described shall comply with all other provisions of this *Code*, except as modified herein.

8.2.2.4.3 Interior walls and partitions of nonsymmetrical construction shall be evaluated from both directions and assigned a fire resistance rating based on the shortest duration obtained in accordance with NFPA 251 when tested on both sides. When the wall is tested with the least fire-resistive side exposed to the furnace, the wall shall not be required to be subjected to tests from the opposite side.

8.2.2.4.4 The required fire resistance rating of nonsymmetrical exterior walls shall be determined by exposure to the test fire from both the interior and exterior sides independently for the entire duration of the fire test except as modified by 8.2.2.4.5. The assigned fire resistance rating for the exterior wall shall be the lesser of the two sides so tested.

8.2.2.4.5 Exterior walls having a horizontal separation greater than 5 ft (1.5 m) shall be permitted to be tested for exposure to fire from the interior side only.

8.2.3 Analytical Methods.

8.2.3.1 Analytical methods utilized to determine the fire resistance rating of building assemblies shall comply with 8.2.3.2 or 8.2.3.3.

8.2.3.2* Where calculations are used to establish the fire resistance rating of structural elements or assemblies, they shall be permitted to be performed in accordance with ASCE/SFPE 29, *Standard Calculation Methods for Structural Fire Protection*. Where calculations are used to establish the fire resistance rating of concrete or masonry elements or assemblies, the provisions of ACI 216.1/TMS 0216.1, *Standard Method for Determining Fire Resistance of Concrete and Masonry Assemblies,* shall be permitted to be used.

8.2.3.3 Except for the method specified in 8.2.3.2, analytical methods used to calculate the fire resistance rating of building assemblies or structural elements shall be approved. Where an approved analytical method is utilized to establish the fire resistance rating of a structural element or building assembly, the calculations shall be based on the fire exposure and acceptance criteria specified in NFPA 251.

8.3 Fire Walls. Each part of a building separated by one or more fire walls shall be permitted to be considered a separate building where the fire wall meets the requirements of 8.3.1 through 8.3.6.

8.3.1 Fire walls shall be of not less than 2-hour fire resistance–rated construction in buildings of any type of construction.

8.3.2 Structural Stability and Strength. Fire walls shall be designed and constructed to remain stable after the collapse of the structure due to fire on either side of the wall. Fire walls constructed in compliance with the requirements of 8.3.2.4, 8.3.2.5, or 8.3.2.6 shall be deemed to provide the required stability. [**221:**2.2.1]

8.3.2.1 Fire walls and their supports shall be designed for the loads in accordance with Chapter 35.

8.3.2.2 Fire walls shall be non-load bearing, except the structural framing within the plane of the wall shall be permitted to be load bearing.

8.3.2.3 Where the fire wall is subject to impact damage from moving vehicles or the handling of merchandise or other activity, protection against impact damage shall be provided for an appropriate height but not less than 5 ft (1.5 m) from the finished floor. [**221:**2.2.2.2]

8.3.2.4* Cantilevered or freestanding fire walls shall be entirely self-supported and non-load bearing. There shall be no connections to the building(s) or contents on either side other than to the flashing. Such walls shall be erected where there is a complete break in the structural framework. The wall shall be secured to the foundation to resist overturning due to design loads. [**221:**2.3]

8.3.2.5* Tied fire walls shall be centered on a single column line or constructed between a double column line. Structural framing on either side of the wall shall line up horizontally and vertically and shall support the roof. The framework on each side of the fire wall shall be continuous or tied together through the wall. The framework on each side shall be designed so that it can resist the maximum lateral force that can be developed due to framework collapse in a fire on the opposite side. Tied fire walls shall be laterally supported by the building framework with flexible anchors. Where centered on a single column line, structural framing (i.e., columns and beams or trusses) at the column line shall have a fire resistance rating of not less than the required fire resistance rating of the fire wall. Where the wall is installed between double column lines, framing along the first column line immediately on each side of the fire wall shall have a fire resistance rating of not less than the required fire resistance rating of the fire wall. [**221:**2.4]

8.3.2.6* A double fire wall consists of two back-to-back walls. There shall be no connections, other than to the flashing, between the walls as shown in Figure 8.3.2.6(a), Figure 8.3.2.6(b), and Figure 8.3.2.6(c). Each fire wall shall be laterally supported by the building frame on its respective side and shall be independent of the fire wall and framing on the opposite side. [**221:**2.5]

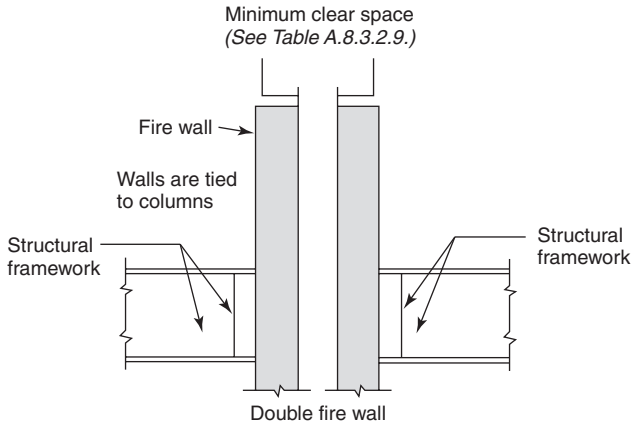


FIGURE 8.3.2.6(a) Double Fire Wall — No Connections.

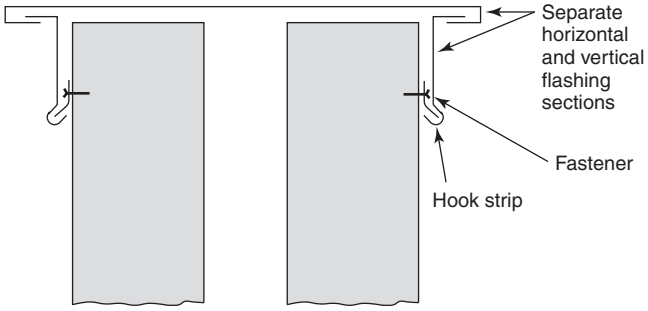


FIGURE 8.3.2.6(b) Double Fire Wall — Separate Horizontal and Vertical Flashing Sections.

8.3.2.7 A wall that is located on a property line and used to separate buildings shall be constructed as a fire wall.

8.3.2.8* A cantilevered fire wall shall be constructed from the foundation to the top of the parapet for the lower roof. The upper wall section shall be permitted to have an exterior fire resistance rating of 1 hour less than the required fire resistance rating of the lower cantilevered portion but not less than a 2-hour rating. The upper wall shall be connected to the framework of the higher building and shall be structurally independent of the cantilevered wall. [**221:**2.6(b)]

8.3.2.9* Clearance to allow for expansion of unprotected structural framework shall be provided. This space shall be provided between cantilevered walls and structural framework on each side and between double walls. [**221:**2.7.1]

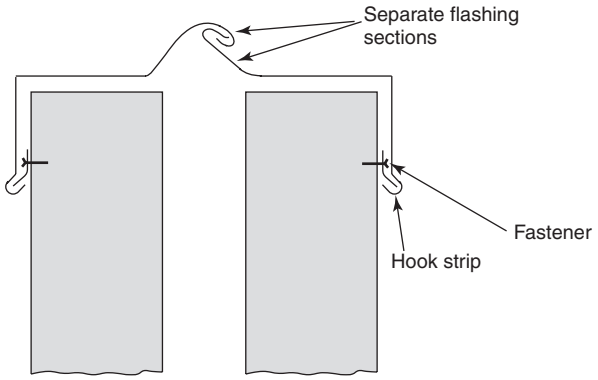


FIGURE 8.3.2.6(c) Double Fire Wall — Separate Flashing Sections.

8.3.2.10 Fire walls shall extend from the foundation to a point at least 36 in. (914 mm) above the roof. Alternative methods shall be permitted to be used in accordance with 8.3.2.10.1 through 8.3.2.10.8.

8.3.2.10.1 Fire walls shall be permitted to terminate tight against the underside of noncombustible or limited-combustible sheathing when the roof assembly is of at least 2-hour fire resistance–rated construction.

8.3.2.10.2 Two-hour fire resistance–rated fire walls shall be permitted to terminate at the underside of the roof sheathing, deck, or slab, provided that the following criteria are met:

(1) The roof assembly within 4 ft (1220 mm) of the wall has not less than a 1-hour fire resistance rating, and the entire length and span of supporting elements for the rated roof assembly has a fire resistance rating of not less than 1 hour.
(2) Openings in the roof shall not be located within 4 ft (1220 mm) of the fire wall.
(3) Each building shall be provided with not less than a Class B roof covering.

8.3.2.10.3 Fire walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck, or slabs in buildings of Type I or Type II construction where both buildings are provided with not less than a Class B roof covering. Openings in the roof shall not be located within 4 ft (1220 mm) of the fire wall.

8.3.2.10.4 In buildings of Type III, Type IV, and Type V construction, fire walls shall be permitted to terminate at the underside of fire retardant–treated wood within 4 ft (1220 mm) of each side of the fire wall where both buildings are provided with not less than a Class B roof covering. Openings in the roof shall not be located within 4 ft (1220 mm) of the fire wall.

8.3.2.10.5 Fire walls shall be permitted to terminate at the roof sheathing or deck in Type III, Type IV, and Type V construction, provided that one of the following criteria is met:

(1) The roof sheathing or deck shall be constructed of approved noncombustible or limited-combustible materials or of fire retardant–treated wood for a distance of 4 ft (1220 mm) on both sides of the wall
(2) The roof shall be protected with ⅝-in. (15.9-mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of 2-in. (51-mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 4 ft (1220 mm) on both sides of the fire wall, and the following shall also apply:
   (a) Openings in the roof shall not be located within 4 ft (1220 mm) of the fire wall.
   (b) The roof shall be covered with a minimum Class C roof covering.

8.3.2.10.6 Buildings located above a parking garage that is separated by a 3-hour fire resistance–rated horizontal assembly, as permitted in 7.4.3.6.5, shall be permitted to have the fire walls for the buildings located above the parking garage extend from the horizontal separation between the parking garage and the buildings.

8.3.2.10.7 Where a fire wall separates parts of a building having different heights, such fire wall shall be permitted to comply with one of the following:

(1) Terminate at a point 36 in. (914 mm) above the lower roof level when the exterior wall for a height of 10 ft (3048 mm) above the lower roof is 1-hour fire resistance–rated construction with openings protected by a ¾-hour fixed or automatic opening protective.
(2) Terminate at the sheathing of the lower roof when the exterior wall is without openings and when the roof is of at least 1-hour fire resistance–rated construction for a width of at least 10 ft (3048 mm), measured from the wall.

8.3.2.10.8 Where horizontal projecting elements such as balconies, roof overhangs, canopies, marquees, and architectural projections cross the terminus of the fire wall, such projecting elements shall be interrupted at the terminus of the fire wall by construction having not less than 1-hour fire resistance–rated construction.

8.3.3 Opening Protectives.

8.3.3.1 Doors and windows used as opening protectives shall comply with the requirements of Section 8.7.

8.3.3.2 The total width of all openings in fire walls shall not exceed 25 percent of the length of the wall in each story. No single opening shall exceed 120 ft^2 (11.15 m^2).

Exception: Openings shall not be limited to 120 ft^2 (11.15 m^2) where both buildings are equipped throughout with an automatic sprinkler system.

8.3.3.3 Fire dampers for ducts and air-transfer openings used as opening protectives shall comply with the requirements of 8.8.8.

8.3.3.4* Fire walls having a required fire resistance rating of 4 hours shall have each opening protected with two fire door assemblies, each having a minimum 3-hour fire resistance rating. Openings in double fire walls shall be protected using one fire door in each separate wall or two fire doors in a freestanding, fire-resistive vestibule. [**221:**5.1.2, 5.2]

8.3.3.5 Ductwork in fire walls having a required fire resistance rating of 4 hours shall be protected with two minimum 3-hour-rated fire damper assemblies. [**221:**6.2.2]

8.3.4 Penetrations. Penetrations in fire walls shall comply with the requirements of Section 8.8.

8.3.5 Joints. Joints in fire walls shall comply with the requirements of Section 8.9.

8.3.6* Horizontal Continuity.

8.3.6.1 Fire walls shall be continuous from exterior wall to exterior wall and shall extend at least 18 in. (457 mm) beyond the exterior surface of exterior walls, except as modified by 8.3.6.2.

8.3.6.2 Fire walls shall be permitted to terminate at the interior face of exterior sheathing, siding, or other exterior finishes where the exterior sheathing, siding, or other exterior finishes are noncombustible or limited combustible and extend 4 ft (1220 mm) on both sides of the fire wall.

8.4 Fire Barrier Walls.

8.4.1 All fire barrier walls and their supports shall be designed to withstand a minimum uniform load of 5 psf (0.24 kPa) from either direction, applied perpendicular to the face of the wall.

8.4.2 Opening Protectives.

8.4.2.1 Doors and windows shall comply with the requirements of Section 8.7.

8.4.2.2 The total glazing area in fire door assemblies and fire window assemblies shall not exceed 25 percent of the wall common to any room.

8.4.2.3 Fire dampers for ducts and air-transfer openings used as opening protectives shall comply with the requirements of 8.8.8.

8.4.3 Penetrations. Penetrations in fire barrier walls shall comply with the requirements of Section 8.8.

8.4.4 Joints. Joints in fire barrier walls shall comply with the requirements of Section 8.9.

8.4.5 Continuity.

8.4.5.1 Fire barrier walls required by this *Code* shall be continuous from an outside wall to an outside wall, from a floor below to a floor or roof above, or from one fire barrier wall to another fire barrier wall, or a combination thereof.

8.4.5.2 Fire barrier walls shall be continuous through all concealed spaces, such as those found above a ceiling, including interstitial spaces.

8.4.5.3 A fire barrier wall required for an occupied space below an interstitial space shall not be required to extend through the interstitial space, provided that the construction assembly forming the bottom of the interstitial space has a fire resistance rating not less than that of the fire barrier wall.

8.5 Exterior Walls — General. Exterior walls shall be designed and constructed in accordance with Chapter 7 and Chapter 37.

8.6 Horizontal Assemblies.

8.6.1 Floor-Ceiling and Roof-Ceiling Assemblies.

8.6.1.1 Construction assemblies required to be fire resistance–rated floors or roofs, or a combination of floors or roofs and ceilings, shall be fire barriers having a fire resistance rating set forth in Table 7.2.2 or as otherwise required by this *Code*.

8.6.1.2 Where a ceiling forms a protective membrane for fire resistance–rated floor-ceiling or roof-ceiling assemblies, the construction and supporting horizontal structural members shall not be required to be fire protected individually, unless required by 8.2.2.3.2.

8.6.1.3 Ceilings shall form continuous fire-resistive membranes but shall be permitted to have steel, ferrous, or copper conduits; electrical outlet boxes; pipes; tubes; combustion vents; exhaust vents; concrete; or masonry penetrating items where the annular space is protected to prevent the free passage of flame and the products of combustion where the ceiling penetrations aggregate area is not more than 100 in.^{2} (64,520 mm^2) for any 100 ft^2 (9.29 m^2) of ceiling.

8.6.1.4 Where 1-hour fire resistance–rated construction is required for floor or floor-ceiling assemblies, the fire-resistive protection shall be permitted to be omitted from the underside of the floor in the crawl space area at grade and from the attic area of the ceiling where the roof forms the upper surface of the attic.

8.6.2 Openings.

8.6.2.1 Openings in floors shall comply with the requirements of Section 8.12.

8.6.2.2 Floor fire door assemblies used as opening protectives shall be installed per 8.7.7.

8.6.2.3 Fire dampers for ducts and air-transfer openings used as opening protectives shall comply with the requirements of 8.8.8.

8.6.3 Penetrations. Penetrations in floor-ceiling and roof-ceiling assemblies shall comply with the requirements of Section 8.8.

8.6.4 Joints. Joints in floor-ceiling and roof-ceiling assemblies shall comply with the requirements of Section 8.9.

8.6.5 Continuity. All floor-ceiling and roof-ceiling assemblies shall be continuous without openings or penetrations, except as provided by this chapter.

8.7 Opening Protectives.

8.7.1 Where required doors and windows serve as opening protectives, they shall comply with the requirements of NFPA 80, *Standard for Fire Doors and Fire Windows*.

8.7.2 Opening protectives shall have a minimum fire protection rating as specified in Table 8.7.2.

8.7.3* Fire Door Closers.

8.7.3.1 Unless otherwise specified, fire doors shall be self-closing or automatic closing.

8.7.3.2 Fire doors used to protect the means of egress shall be self-closing or automatic closing in accordance with 11.2.1.8.2.

8.7.4 Detection devices activating the closer shall conform to *NFPA 72®, National Fire Alarm Code®*.

8.7.5 Fire Door Assemblies and Window Assemblies.

8.7.5.1 Wall openings required to have a fire protection rating by Table 8.7.2 shall be protected by approved, listed, and labeled fire door assemblies and fire window assemblies and their accompanying hardware, including all frames, closing devices, anchorage and sills in accordance with the requirements of NFPA 80, except as otherwise specified in this *Code*.

8.7.5.2* Fire protection ratings for products intended to comply with 8.7.5 shall be as determined and reported by a nationally recognized testing agency in accordance with NFPA 252 or NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*.

(A) NFPA 257 shall evaluate fire protection–rated glazing under positive pressure.

(B) NFPA 252 or UL 10C, *Positive Pressure Fire Tests of Door Assemblies*, shall evaluate side-hinged or pivoted swinging doors under positive pressure.

(C) NFPA 252 shall evaluate doors, other than side-hinged or pivoted swinging doors, with the neutral pressure plane no higher than the top of the door.

(D) All such products shall bear an approved label.

Table 8.7.2 Minimum Fire Protection Ratings for Opening Protectives in Fire Resistance–Rated Assemblies

Component	Fire Resistance Rating	Fire Protection Rating	
	Walls and Partitions (hr)	Fire Door Assemblies (hr)	Fire Window Assemblies (hr)
Elevator hoistways	2	1½	NP
	1	1	NP
Vertical shafts (including stairways, exit, and refuse chutes)	2	1½	NP
	1	1	NP
Fire walls	4	See 8.3.3.4	NP
	3	3	NP
	2	1½	NP
Fire barrier	4	3	NP
	3	3	NP
	2	1½	NP
	1	¾	¾
Horizontal exit	2	1½	NP
Corridors, exit access[2]	1	⅓	¾
	½	⅓	⅓
Smoke barrier[2]	1	⅓	¾
Smoke partition[1,2]	½	⅓	⅓

Note: NP = not permitted.
[1]Fire doors not required to have a hose stream test per NFPA 252, *Standard Methods of Fire Tests of Door Assemblies.*
[2]For residential board and care, see 26.2.3.1.1.

8.7.6 Fire Door Assemblies.

8.7.6.1 Opening protectives in fire walls and fire barrier walls shall have a fire protection rating in accordance with Table 8.7.2.

8.7.6.2 Fire door assemblies and fire window assemblies shall be installed in accordance with NFPA 80.

8.7.6.3 The maximum size of fire doors shall not exceed that specified in NFPA 80, except as modified by Chapter 11.

8.7.7 Floor Fire Door Assemblies. Floor fire door assemblies used to protect openings in fire resistance–rated floors shall be tested in the horizontal position in accordance with NFPA 288, *Standard Methods of Fire Tests of Floor Fire Door Assemblies Installed Horizontally in Fire Resistance–Rated Floor Systems,* and shall achieve a fire-resistance rating not less than the assembly being penetrated. Floor fire door assemblies shall be approved, listed, and labeled.

8.7.8 Use of Wired Glass. One-quarter-in. (6.3-mm) thick wired glass labeled for fire protection purposes shall be permitted to be used in approved opening protectives, with the maximum sizes in accordance with their listing. Other glazing materials that have been tested and labeled to indicate the type of opening to be protected for fire protection purposes shall be permitted to be used in approved opening protectives in accordance with their listing and with the maximum sizes tested.

8.7.9* Fire Window Assemblies. Fire window assemblies shall be permitted in fire barriers having a required fire resistance rating of 1 hour or less and shall be of an approved type with the appropriate fire protection rating for the location in which they are installed.

8.7.10 Windows in Exterior Walls. Three-fourths-hour fire protection–rated windows in exterior walls shall be permitted to have an area not over 84 ft^2 (7.8 m^2), with neither the width nor the height exceeding 12 ft (3.6 m). Fire windows shall be either fixed or automatic closing.

8.7.11 Nonsymmetrical Glazing Systems. Nonsymmetrical fire protection–rated glazing systems shall be tested with each face exposed to the furnace, and the assigned fire-protection rating shall be the shortest duration obtained from the two tests conducted in compliance with NFPA 257.

8.8 Penetrations.

8.8.1 General. The provisions of Section 8.8 shall govern the materials and methods of construction used to protect through-penetrations and membrane penetrations in fire walls, fire barrier walls, and fire resistance–rated horizontal assemblies.

8.8.2 Firestop Systems and Devices Required. Penetrations for cables, cable trays, conduits, pipes, tubes, combustion vents and exhaust vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a wall, floor, or floor-ceiling assembly constructed as a fire barrier, shall be protected by a firestop system or device. The firestop system or device shall be tested in accordance with ASTM E 814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*, or UL 1479, *Standard for Safety for Fire Tests of Through-Penetration Fire Stops*, under a minimum positive pressure differential of 0.01 in. of water column (2.5 Pa) between the exposed and the unexposed surface of the test assembly.

8.8.2.1 Alternative Requirements. The requirements of 8.8.2 shall not apply where otherwise permitted by any one of the following:

(1)*Penetrations tested and installed as part of an assembly in accordance with the NFPA 251 rated assembly
(2) Where penetrations through floors are enclosed in a shaft enclosure designed as a fire barrier
(3) Where concrete, grout, or mortar has been used to fill the annular spaces around cast-iron, copper, or steel piping, or steel conduit or tubing, that penetrates one or more concrete or masonry fire resistance–rated assemblies. The nominal diameter of each penetrating item shall not exceed 6 in. (150 mm), and the opening size shall not exceed 144 in.^{2} (92,909 mm^2). The thickness of the concrete, grout, or mortar shall be the full thickness of the assembly.
(4) Where firestopping materials are used with the penetrating items in (a)–(d), the penetration is limited to one floor, and the firestopping material is capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions of NFPA 251 under a minimum positive pressure differential of 0.01 in. of water column (2.5 Pa) at the location of the penetration for the time period equivalent to the required fire resistance rating of the assembly penetrated. For (a)–(d), the maximum nominal diameter of

the penetrating item shall not be greater than 4 in. (100 mm) and shall not exceed an aggregate 100-in.^{2} (64,520-mm^2) opening in any 100 ft^2 (9.3 m^2) of floor or wall area.

(a) Steel, ferrous, or copper cables
(b) Cable or wire with steel jackets
(c) Cast-iron, steel, or copper pipes
(d) Steel conduit or tubing

8.8.2.2 F Ratings. Firestop systems and devices shall have an F rating of at least 1 hour, but not less than the required fire resistance rating of the fire barrier penetrated.

8.8.2.3 T Ratings. Penetrations in fire resistance–rated horizontal assemblies shall be required to have a T rating of at least 1 hour, but not less than the fire resistance rating of the horizontal assembly, and shall not be required for the following:

(1) A T rating is not required for floor penetrations contained within the cavity of a wall assembly.
(2) A T rating is not required for penetrations through floors or floor assemblies where the penetration is not in direct contact with combustible material.

8.8.3 Use of Sleeves for Penetration. Where the penetrating item uses a sleeve to penetrate the wall or floor, the sleeve shall be securely set in the wall or floor, and the space between the item and the sleeve shall be filled with a material that complies with 8.8.2.

8.8.4 Insulation Coverings. Insulation and coverings for penetrating items shall not pass through the wall or floor unless the insulation or covering has been tested as part of the firestop system or device.

8.8.5 Vibration Isolation. Where designs take transmission of vibrations into consideration, any vibration isolation shall meet one of the following conditions:

(1) It shall be made on either side of the wall or floor.
(2) It shall be designed for the specific purpose.

8.8.6 Transitions.

8.8.6.1 Where piping penetrates a fire resistance–rated wall or floor assembly, combustible piping shall not connect to noncombustible piping within 36 in. (914 mm) of the firestop system or device unless it can be demonstrated that the transition will not reduce the fire resistance rating.

8.8.6.2 Unshielded couplings shall not be used to connect noncombustible piping to combustible piping unless it can be demonstrated that the transition complies with the fire-resistive protection requirements of 8.8.2.

8.8.7 Membrane Penetrations. Membrane penetrations for cables, cable trays, conduits, pipes, tubes, combustion vents, exhaust vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a membrane of a wall, floor, or floor-ceiling assembly constructed as a fire barrier shall be protected by a firestop system or device, and shall comply with 8.8.2 through 8.8.6.2.

8.8.7.1 The firestop system or device shall be tested in accordance with ASTM E 814 or UL 1479 under a minimum positive pressure differential of 0.01 in. of water column (2.5 Pa) between the exposed and the unexposed surface of the test assembly, unless one of the following criteria is met:

(1) Membrane penetrations of ceilings are not an integral part of a fire resistance–rated floor-ceiling or roof-ceiling assembly.
(2) Membrane penetrations of steel, ferrous, or copper conduit, piping or tubing, and steel electrical outlet boxes, and wires, or combustion vents or exhaust vents are permitted where the annular space is protected with an approved material and the aggregate area of the openings does not exceed 100 in.^{2} (64,520 mm^2) in any 100 ft^2 (9.3 m^2) of ceiling area.
(3) Electrical outlet boxes and fittings are permitted, provided that such devices are listed for use in fire resistance–rated assemblies and are installed in accordance with their listing.
(4) The annular space created by the membrane penetration of a fire sprinkler shall be permitted, provided the space is covered by a metal escutcheon plate.

8.8.7.2 Where walls or partitions are required to have a fire resistance rating of not less than 1 hour, recessed fixtures shall be installed in the wall or partition in a manner that the required fire resistance is not reduced, unless one of the following criteria is met:

(1) Any steel electrical box not exceeding 16 in.^{2} (10,300 mm^2) in area shall be permitted where the aggregate area of the openings provided for the boxes does not exceed 100 in.^{2} (64,520 mm^2) in any 100 ft^2 (9.3 m^2) of wall area, and where outlet boxes are installed on opposite sides of the wall, the boxes shall be separated by one of the following means:
   (a) By a horizontal distance of not less than 24 in. (610 mm)
   (b) By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rock wool, or slag wool insulation
   (c) By solid fireblocking in accordance with Section 8.14
   (d) By other listed materials and methods
(2) Membrane penetrations for any listed electrical outlet box made of any material shall be permitted, provided such boxes have been tested for use in fire resistance–rated assemblies and are installed in accordance with the instructions included in the listing.
(3) The annular space created by the membrane penetration of a fire sprinkler shall be permitted, provided the space is covered by a metal escutcheon plate.

8.8.8 Ducts and Air-Transfer Openings.

8.8.8.1 General. The provisions of 8.8.8 shall govern the materials and methods of construction used to protect ducts and air-transfer openings in fire walls, fire resistance–rated horizontal assemblies, and fire barrier walls.

8.8.8.2* Fire Damper Requirements. Fire dampers shall be installed to protect ducts and air-transfer openings that penetrate fire barriers and fire walls as required by other sections of this *Code*. Fire dampers shall be designed and tested in accordance with the requirements of UL 555, *Standard for Fire Dampers,* and shall have the minimum fire protection rating specified in Table 8.8.8.2 for the rating of the assembly penetrated. In systems where fans continue to operate in the emergency mode, dynamic fire dampers shall be required.

8.8.8.2.1 Fire dampers shall be required in the following locations:

(1) Ducts and air-transfer openings penetrating walls or partitions having a fire resistance rating of 2 or more hours
(2) Ducts and air-transfer openings penetrating shaft walls having a fire resistance rating of 1 or more hours

Table 8.8.8.2 Fire Damper Rating

Fire Resistance Rating of Assembly	Minimum Damper Rating (hr)
3-hr or greater fire resistance–rated assemblies	3
Less than 3-hr fire resistance–rated assemblies	1½
Ceiling of floor-ceiling or roof-ceiling assemblies	See 8.8.8.6

(3) Ducts and air-transfer openings penetrating floors that are required to have protected openings where the duct also is not protected by a shaft enclosure
(4) Air-transfer openings that occur in walls or partitions that are required to have a fire-resistive rating of 30 minutes or more

8.8.8.2.2 Fire dampers shall not be required in the following locations:

(1) In floors that do not require protected floor openings
(2) In a duct system serving only one floor and used only for exhaust of air to the outside and not penetrating a wall or partition having a required fire resistance rating of 2 hours or more or passing entirely through the system and contained within its own dedicated shaft
(3) Where branch ducts connect to enclosed exhaust risers, and in which the airflow is upward and steel subducts at least 22 in. (560 mm) in length are carried up inside the riser at each inlet

8.8.8.3 Installation. Air-conditioning, heating, and ventilating ductwork and related equipment, including fire dampers, smoke dampers, combination fire and smoke dampers, and ceiling radiation dampers, shall be installed in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, or NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, as specified in Chapter 50, where applicable. Such equipment shall be installed in accordance with the requirements of 8.8.8, the manufacturer's installation instructions, its listing, and the mechanical code as specified in Chapter 50.

8.8.8.4 Access and Identification. Access shall be provided to fire dampers and smoke dampers for inspection, testing, and maintenance. The access openings shall not reduce the fire resistance rating of the fire barrier assembly. Access shall comply with the requirements of the mechanical code.

8.8.8.5* Fire Damper Actuation Device. The operating temperature of the heat-actuating device shall be approximately 50°F (27.8°C) above the normal temperature within the duct system, but not less than 160°F (71°C), or it shall be not more than 286°F (141°C) where located in a required smoke control system, or, where a combination fire and smoke damper is installed, it shall not exceed 350°F (177°C) where located in a smoke control system.

8.8.8.6 Ceiling Radiation Damper Requirements. Ceiling radiation dampers or other methods of protecting openings in fire resistance–rated floor-ceiling or roof-ceiling assemblies shall comply with the construction details of the tested floor-ceiling or roof-ceiling assembly or with listed ceiling air diffusers or listed ceiling radiation dampers. Ceiling dampers shall be tested in accordance with UL 555C, *Standard for Ceiling Dampers*.

8.9* Joints.

8.9.1 General. The provisions of Section 8.9 shall govern the materials and methods of construction used to protect joints within or between fire walls, fire barrier walls, floors, and floor-ceiling and roof-ceiling assemblies in accordance with 8.9.2, and at the intersection of the exterior wall and the perimeter of the floor assembly in accordance with 8.9.3.

8.9.2 Joint System Required. Joints made within or between fire resistance–rated assemblies shall be protected with a joint system that is designed and tested to prevent the spread of fire for a time period equal to that of the assembly in which the joint is located. Such materials, systems, or devices shall be tested as part of the assembly in accordance with the requirements of ASTM E 1966, *Standard Test Method for Fire-Resistive Joint Systems*, or ANSI/UL 2079, *Standard for Tests for Fire Resistance of Building Joint Systems*.

8.9.2.1 Testing of the joint system shall be representative of the actual installation.

8.9.2.2 All joint systems shall be tested at their maximum joint width in accordance with the requirements of ASTM E 1966 or ANSI/UL 2079 under a minimum positive pressure differential of 0.01 in. of water column (2.5 Pa) for a time period equal to that of the assembly. All test specimens shall comply with the minimum height or length required by the standard. Wall assemblies shall be subjected to a hose stream test in accordance with NFPA 251.

8.9.3 Exterior Curtain Walls and the Perimeter Joint.

8.9.3.1* The provisions of 8.9.3 are intended to restrict the interior vertical passage of flame and hot gases from one floor to another at the location where the floor intersects the inside of an exterior curtain wall assembly. Floor assemblies that are required to be a fire barrier shall extend to, and be tight against, the exterior curtain wall.

8.9.3.2 Where fire resistance–rated floor or floor-ceiling assemblies are required, voids created at the intersection of the exterior curtain wall assemblies and such floor or floor-ceiling assemblies shall be sealed with approved materials.

8.9.3.2.1 The approved materials specified in 8.9.3.2 shall be securely installed in accordance with the approved system.

8.9.3.2.2 The approved materials specified in 8.9.3.2 shall be capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected to the time-temperature fire conditions of NFPA 251 under a minimum positive pressure differential of 0.01 in. of water column (2.5 Pa) for the time period at least equal to the fire resistance rating of the floor assembly.

8.9.3.2.3 Where the fire resistance rating of the floor assembly is less than the time period determined in accordance with 8.9.3.2.2, the time period shall be permitted to be not less than the fire resistance rating of the floor assembly.

8.9.3.3 Height and fire resistance requirements for curtain wall spandrels shall comply with 37.1.4.

8.10 Smoke Partitions.

8.10.1* General. Where required elsewhere in this *Code*, smoke partitions shall be provided to limit the transfer of smoke.

8.10.2 Requirements. Smoke partitions shall comply with one of the following:

(1) Smoke partitions shall extend from the floor to the underside of the floor or roof deck above, through any concealed spaces, such as those above suspended ceilings, and through interstitial structural and mechanical spaces.
(2)*Smoke partitions shall be permitted to terminate at the underside of a monolithic or suspended ceiling system where the following conditions are met:
  (a) The ceiling system forms a continuous membrane.
  (b) A smoke-tight joint is provided between the top of the smoke partition and the bottom of the suspended ceiling.
  (c) The space above the ceiling is not used as a plenum.
(3) Smoke partitions serving hazardous areas shall be permitted to terminate at the underside of a monolithic or suspended ceiling system where the following conditions are met:
  (a) The ceiling system forms a continuous membrane.
  (b) A smoke-tight joint is provided between the tip of the smoke partition and the bottom of the suspended ceiling.
  (c) The space above the ceiling is not used as a plenum, or, if it is, there is no return grille from the hazardous area into the plenums.

8.10.3 Opening Protectives.

8.10.3.1 Doors in smoke partitions shall comply with 8.10.3.2 through 8.10.3.5.

8.10.3.2 Doors shall comply with the provisions of 11.2.1.

8.10.3.3 Doors shall not include louvers.

8.10.3.4* Door clearances shall be in accordance with NFPA 80.

8.10.3.5 Doors shall be self-closing or automatic closing in accordance with 11.2.1.8.

8.10.4 Penetrations.

8.10.4.1 The provisions of 8.10.4 shall govern the materials and methods of construction used to protect through-penetrations and membrane penetrations of smoke partitions.

8.10.4.2 Penetrations for cables, cable trays, conduits, pipes, tubes, vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a smoke partition shall be protected by a system or material that is capable of limiting the transfer of smoke.

8.10.4.3 Where designs take transmissions of vibration into consideration, any vibration isolation shall meet one of the following conditions:

(1) It shall be made on either side of the smoke partitions.
(2) It shall be designed for the specific purpose.

8.10.5 Air-Transfer Openings.

8.10.5.1 General. The provisions of 8.10.5 shall govern the materials and methods of construction used to protect air transfer openings in smoke partitions.

8.10.5.2 Openings in Smoke Partitions. Air-transfer openings in smoke partitions shall be provided with approved smoke dampers designed and tested in accordance with the requirements of UL 555S, *Standard for Leakage Rated Dampers for Use in Smoke Control Systems,* to limit the transfer of smoke.

8.10.5.3 Installation. Air-conditioning, heating, and ventilating ductwork and related equipment, including fire dampers, smoke dampers, combination fire and smoke dampers, and ceiling radiation dampers, shall be installed in accordance with NFPA 90A or NFPA 90B as specified in Chapter 50, where applicable. Such equipment shall be installed in accordance with the requirements of 8.10.5, the manufacturer's installation instructions, its listing, and the mechanical code as specified in Chapter 50.

8.10.5.4 Access and Identification. Access shall be provided to fire dampers and smoke dampers for inspection, testing, and maintenance. The access openings shall not reduce the fire resistance rating of the fire barrier assembly. Access shall comply with the requirements of the mechanical code as specified in Chapter 50.

8.10.5.5 Smoke Damper Ratings. Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall not be less than 250°F (140°C).

8.10.5.6 Smoke Detector. Dampers in air-transfer openings shall close upon detection of smoke by approved smoke detectors installed in accordance with *NFPA 72*.

8.10.6 Joints.

8.10.6.1 The provisions of 8.10.6 shall govern the materials and methods of construction used to protect joints in between and at the perimeter of smoke partitions or, where smoke partitions meet other smoke partitions, the floor or roof deck above, or the outside walls.

8.10.6.2 Joints made within or at the perimeter of smoke partitions shall be protected with a joint system that is capable of limiting the transfer of smoke.

8.11 Smoke Barriers.

8.11.1* General. Where required by Chapter 16 through Chapter 34, smoke barriers shall be provided to subdivide building spaces for the purpose of restricting the movement of smoke.

8.11.2* Continuity.

8.11.2.1 Smoke barriers required by this *Code* shall be continuous from an outside wall to an outside wall, from a floor to a floor, or from a smoke barrier to a smoke barrier, or a combination thereof.

8.11.2.2 Such barriers shall be continuous through all concealed spaces, such as those found above a ceiling, including interstitial spaces.

8.11.2.3 A smoke barrier required for an occupied space below an interstitial space shall not be required to extend through the interstitial space, provided that the construction assembly forming the bottom of the interstitial space provides resistance to the passage of smoke equal to that provided by the smoke barrier.

8.11.3 Fire Barrier Used as Smoke Barrier. A fire barrier shall be permitted to be used as a smoke barrier, provided that it meets the requirements of 8.11.

8.11.4 Opening Protectives.

8.11.4.1* Doors in smoke barriers shall close the opening leaving only the minimum clearance necessary for proper operation and shall be without undercuts, louvers, or grilles.

8.11.4.2 Where a fire resistance rating for smoke barriers is specified elsewhere in the *Code*, openings shall be protected as follows:

(1) Door opening protectives shall have a fire protection rating of not less than 20 minutes where tested in accordance with NFPA 252, without the hose stream test, unless otherwise specified by Chapter 16 through Chapter 34.
(2) Fire window assemblies shall comply with 8.7.5.
(3) Latching hardware shall not be required on doors in smoke barriers where so indicated in Chapter 16 through Chapter 34.

8.11.4.3* Door opening protectives in smoke barrier walls shall comply with 11.2.1.

8.11.5 Penetrations.

8.11.5.1 The provisions of 8.11.5 shall govern the materials and methods of construction used to protect through-penetrations and membrane penetrations of smoke barriers.

8.11.5.2 Penetrations for cables, cable trays, conduits, pipes, tubes, vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a wall, floor, or floor-ceiling assembly constructed as a smoke barrier, or through the ceiling membrane of a roof-ceiling of a smoke barrier, shall be protected by a system or material capable of restricting the transfer of smoke.

8.11.5.3 Where a smoke barrier is also constructed as a fire barrier, the penetrations shall be protected in accordance with the requirements of Section 8.8 to limit the spread of fire for a time period equal to the fire resistance rating of the assembly as required by 8.11.5 to restrict the transfer of smoke.

8.11.5.4 Where sprinklers penetrate a single membrane of a fire resistance–rated assembly in buildings equipped throughout with an approved automatic fire sprinkler system, noncombustible escutcheon plates shall be permitted, provided that the space around each sprinkler penetration does not exceed ½ in. (12.7 mm), measured between the edge of the membrane and the sprinkler.

8.11.5.5 Where the penetration item uses a sleeve to penetrate the smoke barrier, the sleeve shall be securely set in the smoke barrier, and the space between the item and the sleeve shall be filled with a material capable of restricting the transfer of smoke.

8.11.5.6 Where designs take transmission of vibrations into consideration, any vibration isolation shall meet one of the following conditions:

(1) It shall be made on either side of the fire barrier.
(2) It shall be designed for the specific purpose.

8.11.6 Ducts and Air-Transfer Openings.

8.11.6.1 General. The provisions of 8.11.6 shall govern the materials and methods of construction used to protect ducts and air-transfer openings in smoke barriers.

8.11.6.2 Smoke Barriers. Where a smoke barrier is penetrated by a duct or air-transfer opening, a smoke damper designed and tested in accordance with the requirements of UL 555S shall be installed. Where a smoke barrier is also constructed as a fire barrier, a combination fire/smoke damper designed and tested in accordance with the requirements of UL 555 and UL 555S shall be installed.

8.11.6.3 Smoke Damper Exceptions. Smoke dampers shall not be required under the following conditions:

(1) Where specifically exempted by provisions in Chapter 16 through Chapter 34
(2) Where ducts or air-transfer openings are part of an engineered smoke control system
(3) When the air in ducts continues to move and the air handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions
(4) Where the air inlet or outlet openings in ducts are limited to a single smoke compartment
(5) Where ducts penetrate floors that serve as smoke barriers

8.11.6.4 Installation.

8.11.6.4.1 Air-conditioning, heating, and ventilating ductwork and related equipment, including smoke dampers and combination fire and smoke dampers, shall be installed in accordance with NFPA 90A or NFPA 90B as specified in Chapter 50, where applicable.

8.11.6.4.2 The equipment specified in 8.11.6.4.1 shall be installed in accordance with the requirements of 8.11.6.4, the manufacturer's installation instructions, its listing, and the mechanical code as specified in Chapter 50.

8.11.6.5 Access and Identification. Access shall be provided to the dampers for inspection, testing, and maintenance. The access openings shall not reduce the fire resistance rating of the fire barrier assembly. Access shall comply with the requirements of the mechanical code as specified in Chapter 50.

8.11.6.6 Smoke Damper Ratings. Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall not be less than 250°F (140°C).

8.11.6.7 Smoke Detectors.

8.11.6.7.1 Required smoke dampers in ducts penetrating smoke barriers shall close upon detection of smoke by approved smoke detectors in accordance with *NFPA 72*, unless ducts penetrate smoke barriers above the smoke barrier doors and the door release detector actuates the damper.

8.11.6.7.2 Required smoke dampers in air-transfer openings shall close upon detection of smoke by approved smoke detectors in accordance with *NFPA 72*.

8.11.6.7.3 Where a duct is provided on one side of the smoke barrier, the smoke detectors on the duct side shall be in accordance with 8.11.6.7.1.

8.11.7 Joints.

8.11.7.1 The provisions of 8.11.7 shall govern the materials and methods of construction used to protect joints in between and at the perimeter of smoke barriers where smoke barriers meet other smoke barriers, the floor or roof deck above, or the outside walls.

8.11.7.2 Joints made within or at the perimeter of smoke barriers shall be protected with a smoke-tight joint system that is capable of restricting the transfer of smoke.

8.11.7.3 Joints made within or between smoke barriers shall be protected with a smoke-tight joint system that is capable of restricting the transfer of smoke.

8.11.7.4 Smoke barriers that are constructed as fire barriers shall be protected with a joint system that is designed and tested to resist the spread of fire for a time period equal to the

required fire resistance rating of the assembly in accordance with Section 8.9 and restrict the transfer of smoke.

8.12 Vertical Openings.

8.12.1 General.

8.12.1.1 Every floor that separates stories in a building shall be constructed as a smoke barrier and shall meet one of the following:

(1) Openings shall restrict the passage of smoke as specified by 8.11.4, or
(2) The requirement of 8.12.1.1(1) shall not apply where otherwise specified by 8.12.2, 8.12.3, 8.12.4, or Chapter 16 through Chapter 30.

8.12.1.2* Openings through floors shall be enclosed with fire barrier walls, shall be continuous from floor to floor or floor to roof, shall be protected as appropriate for the fire resistance rating of the barrier as specified by 8.6.2 and 8.6.3, and shall restrict the passage of smoke as specified by 8.11.4.

8.12.1.3 The requirements of 8.12.1.2 shall not apply where otherwise specified by the following:

(1) Enclosure shall not be required where otherwise specified by 8.12.2, 8.12.3, 8.12.4, or Chapter 16 through Chapter 30.
(2)*Enclosure shall not be required for expansion or seismic joints designed to prevent the penetration of fire and shown to have a fire resistance rating of not less than the required fire resistance rating of the floor when tested in accordance with ANSI/UL 2079.
(3) Enclosure shall not be required for pneumatic tube conveyors protected in accordance with 8.8.7.

8.12.1.4 Shafts that do not extend to the bottom or the top of the building or structure shall comply with either 8.12.1.4.1, 8.12.1.4.2, or 8.12.1.4.3.

8.12.1.4.1 Shafts shall be enclosed at the lowest or highest level of the shaft, respectively, with construction in accordance with 8.12.1.5 and Section 8.7.

8.12.1.4.2 Shafts shall be permitted to terminate in a room or space having a use related to the purpose of the shaft, provided that the room or space is separated from the remainder of the building by construction having a fire resistance rating and opening protectives in accordance with 8.12.1.5 and Section 8.7.

8.12.1.4.3 Shafts that do not extend to the bottom or top of the building or structure shall be permitted to be protected by approved fire dampers installed in accordance with their listing at the lowest or highest floor level, as applicable, within the shaft enclosure.

8.12.1.5* The fire resistance rating for the enclosure of floor openings shall be not less than as follows:

(1) Enclosures connecting four stories or more shall be 2-hour fire barriers.
(2) Enclosures connecting three stories or less shall be 1-hour fire barriers, but not less than the required fire resistance rating of the floor penetrated, but need not exceed 2 hours.
(3) Enclosures shall be specified in Chapter 23 for lodging and rooming houses, in Chapter 24 for hotels, and in Chapter 25 for apartment buildings.
(4) Enclosures for exits shall be in accordance with 11.1.3.2.

8.12.2 Communicating Space. Unless prohibited by Chapter 16 through Chapter 30, unenclosed floor openings forming a communicating space between floor levels shall be permitted, provided that the following conditions are met:

(1) The communicating space does not connect more than three contiguous stories.
(2) The lowest or next to lowest story within the communicating space is a street floor.
(3) The entire floor area of the communicating space is open and unobstructed, such that a fire in any part of the space will be readily obvious to the occupants of the space prior to the time it becomes an occupant hazard.
(4) The communicating space is separated from the remainder of the building by fire barriers with not less than a 1-hour fire resistance rating, unless one of the following is met:
    (a) In buildings protected throughout by an approved automatic sprinkler system in accordance with Section 55.3, a smoke barrier in accordance with Section 8.11 shall be permitted to serve as the separation required by 8.12.2 (4).
    (b) The requirement of 8.12.2 (4) shall not apply to fully sprinklered residential housing units of detention and correctional occupancies in accordance with 21.3.1(2).
(5) The communicating space has ordinary hazard contents protected throughout by an approved automatic sprinkler system in accordance with Section 55.3 or has only low hazard contents. *(See Chapter 6.)*
(6) Egress capacity is sufficient to provide for all the occupants of all levels within the communicating space to simultaneously egress the communicating space by considering it as single floor area in determining the required egress capacity.
(7)*Each occupant within the communicating space has access to not less than one exit without having to traverse another story within the communicating space.
(8) Each occupant not in the communicating space has access to not less than one exit without having to enter the communicating space.

8.12.3* Atrium. Unless prohibited by Chapter 16 through Chapter 30, an atrium shall be permitted, provided that the following conditions are met:

(1) The atrium is separated from the adjacent spaces by fire barriers with not less than a 1-hour fire resistance rating with opening protectives for corridor walls, unless one of the following is met:
    (a) Any number of levels of the building shall be permitted to open directly to the atrium without enclosure based on the results of the engineering analysis required in 8.12.3(5).
    (b)*Glass walls and inoperable windows shall be permitted in lieu of the fire barriers where all the following are met:
        i. Automatic sprinklers shall be spaced along both sides of the glass wall and the inoperable window at intervals not to exceed 6 ft (1828 mm).
        ii. The automatic sprinklers shall be located at a distance from the glass not to exceed 1 ft (0.3 m) and shall be arranged so that the entire surface of the glass is wet upon operation of the sprinklers.
        iii. The glass shall be tempered, wired, or laminated glass held in place by a gasket system that allows the glass framing system to deflect without breaking (loading) the glass before the sprinklers operate.

iv. The automatic sprinklers shall not be required on the atrium side of the glass wall and the inoperable windows where there is no walkway or other floor area on the atrium side above the main floor level.
v. Doors in these walls shall be glass or other material that restrict the passage of smoke.
vi. Doors shall be self-closing or automatic closing upon detection of smoke.

(2) Access to exits is permitted to be within the atrium, and exit discharge in accordance with 11.7.2 is permitted to be within the atrium.
(3) The occupancy within the space meets the specifications for classification as low or ordinary hazard contents. *(See Chapter 6.)*
(4) The entire building is protected throughout by an approved, supervised automatic sprinkler system in accordance with 55.3 and 55.3.2.
(5)*An engineering analysis is performed that demonstrates that the building is designed to keep the smoke layer interface above the highest unprotected opening to adjoining spaces, or 6 ft (1828 mm) above the highest floor level of exit access open to the atrium for a period equal to 1.5 times the calculated egress time or 20 minutes, whichever is greater.
(6)*Where an engineered smoke control system is installed to meet the requirements of 8.12.3(5) and is independently activated by each of the following:
(a) Upon actuation of the required automatic sprinkler system within the atrium or areas open to the atrium
(b) Manual controls that are readily accessible to the fire department

8.12.4 Convenience Openings.

8.12.4.1 A vertical opening serving as other than an exit enclosure, connecting only two adjacent stories, and piercing only one floor shall be permitted to be open to one of the two stories.

8.12.4.2 Where permitted by Chapter 16 through Chapter 30, unenclosed vertical openings not concealed within the building construction shall be permitted as follows:

(1) Such openings shall connect not more than two adjacent stories (one floor pierced only).
(2) Such openings shall be separated from unprotected vertical openings serving other floors by a barrier complying with 8.6.1.2.
(3) Such openings shall be separated from corridors.
(4)*Such openings shall not serve as a required means of egress.

8.12.5 Service Openings.

8.12.5.1 Service openings for conveyors, where required to be open on more than one story at the same time for purposes of operation, shall be provided with closing devices in accordance with 11.2.1.8.

8.12.5.2 Moving walks not constituting an exit, and escalators, shall have their floor openings enclosed or protected as required for other vertical openings unless permitted by the following:

(1) The requirement of 8.12.5.2 shall not apply to escalators in large, open areas such as atriums and enclosed shopping malls.
(2)*In buildings protected throughout by an approved automatic sprinkler system in accordance with Section 11.3, escalators or moving walk openings shall be permitted to be protected in accordance with the method detailed in NFPA 13, *Standard for the Installation of Sprinkler Systems*, or in accordance with a method approved by the authority having jurisdiction.
(3) Escalators shall be permitted to be protected in accordance with 8.12.5.3

8.12.5.3 In buildings protected throughout by an approved automatic sprinkler system in accordance with Section 55.3, escalators or moving walk openings shall be permitted to be protected by rolling steel shutters appropriate for the fire resistance rating of the vertical opening protected and the following criteria shall be met:

(1) The shutters shall close automatically and independently of each other upon smoke detection and sprinkler operation.
(2) There shall be a manual means of operating and testing the operation of the shutter.
(3) The shutters shall be operated not less than once a week to ensure that they remain in proper operating condition.
(4) The shutters shall operate at a speed not to exceed 30 ft/min (0.15 m/s) and shall be equipped with a sensitive leading edge.
(5) The leading edge shall arrest the progress of a moving shutter and cause it to retract a distance of approximately 6 in. (152 mm) upon the application of a force not exceeding 20 lbf (90 N) applied to the surface of the leading edge.
(6) The shutter, following the retraction specified in 8.12.5.3(5), shall continue to close.
(7) The operating mechanism for the rolling shutter shall be provided with standby power complying with the provisions of Chapter 52.

8.12.5.4 The number of elevator cars permitted in a hoistway shall be in accordance with Section 54.5.

8.13 Mezzanine.

8.13.1 General. A mezzanine shall not be included as a story for the purpose of determining the allowable number of stories in a building.

Exception: Multilevel residential housing areas in detention and correctional occupancies in accordance with Chapter 21 shall be exempt from the provisions of 8.13.2 and 8.13.3.

8.13.2 Area Limitations.

8.13.2.1 The aggregate area of mezzanines within a room, other than those located in special purpose industrial occupancies, shall not exceed one-third the open area of the room in which the mezzanines are located. Enclosed space shall not be included in a determination of the size of the room in which the mezzanine is located.

8.13.2.2 There shall be no limit on the number of mezzanines in a room.

8.13.2.3 For purposes of determining the allowable mezzanine area, the area of the mezzanines shall not be included in the area of the room.

8.13.3 Openness. All portions of a mezzanine, other than walls not more than 42 in. (1065 mm) high, columns, and posts, shall be open to and unobstructed from the room in which the mezzanine is located, unless the occupant load of the aggregate area of the enclosed space does not exceed 10.

Exception: A mezzanine having two or more means of egress shall not be required to open into the room in which it is located if not less than one of the means of egress provides direct access from the enclosed area to an exit at the mezzanine level.

8.14 Concealed Spaces.

8.14.1 Draft Stops.

8.14.1.1 Any concealed combustible space in which building materials having a flame spread index greater than Class A are exposed shall be draftstopped as follows:

(1) Every unoccupied attic space shall be subdivided by draftstops into areas not to exceed 3000 ft^2 (280 m^2).
(2) Any concealed space between the ceiling and the floor or roof above shall be draftstopped for the full depth of the space along the line of support for the floor or roof structural members and, if necessary, at other locations to form areas not to exceed 1000 ft^2 (93 m^2) for any space between the ceiling and floor and 3000 ft^2 (280 m^2) for any space between the ceiling and roof.

8.14.1.2 The requirements of 8.14.1.1 shall not apply if either of the following conditions is met:

(1) The requirements shall not apply where the space is protected throughout by an approved automatic sprinkler system in accordance with Section 55.3.
(2) The requirements shall not apply to concealed spaces serving as plenums.

8.14.1.3 Draftstopping materials shall be not less than ½-in. (13-mm) gypsum board, 15⁄32-in. (12-mm) wood structural panel, or other approved materials adequately supported.

8.14.1.4 The integrity of all draftstops shall be maintained.

8.14.2 Fireblocks.

8.14.2.1 Concealed spaces constructed of combustible materials shall be fireblocked as follows:

(1) In exterior and interior stud walls, at ceilings and floor levels
(2) In combustible stud walls and partitions including furred spaces, placed so that the maximum dimension of a concealed space is 8 ft (2440 mm)
(3) At all interconnections between concealed vertical and horizontal spaces such as those that occur at soffits, drop ceilings, and cove ceiling
(4) In concealed spaces between stair stringers at the top and bottom of the run
(5) At openings around vents, pipes, and ducts at ceiling and floor levels
(6) In the spaces between chimneys and wood framing, which are to be solidly filled with approved materials

8.14.2.2 Fireblocks, when of wood, shall be not less than 2 in. (51 mm) thick and shall effectively fill all spaces for the entire width of depth of the framing or structural member. Fireblocking shall be securely and tightly fitted into place.

8.14.2.3 Fireblocks shall consist of one of the following:

(1) Nominal 2-in. (51-mm) lumber of two thicknesses of nominal 1-in. (25-mm) lumber with broken lap joints; one thickness of 23⁄32-in. (18-mm) wood structural panel with joints backed by 23⁄32-in. (18-mm) wood structural panel; or one thickness of ¾-in. (19-mm) particleboard with joints backed by ¾-in. (19-mm) particleboard
(2) Gypsum board, cement fiber board, batts or blankets of mineral wool or glass fiber, or other approved materials that are capable of resisting the free passage of fire and smoke within the concealed space installed in such a manner as to be securely retained in place

8.14.2.4 Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

8.14.2.5 The integrity of fireblocks shall be maintained.

8.14.3 Combustibles in Concealed Spaces. Combustible materials shall not be permitted within the concealed spaces of buildings classified as Type I or Type II construction and within walls required to be constructed of noncombustible or limited-combustible materials by 7.2.3, unless otherwise permitted by one of the following:

(1) Combustible materials permitted in accordance with 7.2.3.2.14, 7.2.3.2.15, and 7.2.3.2.22
(2) Combustible materials having a Class A rating as specified in Chapter 10
(3) Combustible mechanical, plumbing, and electrical components installed in accordance with the applicable *Code*
(4) Combustible materials permitted within exterior walls in accordance with 7.2.3.2.13

8.15 Special Hazard Protection.

8.15.1 General.

8.15.1.1* Protection from any area having a degree of hazard greater than that normal to the general occupancy of the building or structure shall be provided by one of the following means:

(1) Enclose the area with a fire barrier without windows that has a 1-hour fire resistance rating in accordance with Section 8.4.
(2) Protect the area with automatic extinguishing systems in accordance with Section 55.3.
(3) Apply both 8.15.1.1(1) and 8.15.1.1(2) where the hazard is severe or where otherwise specified by Chapter 16 through Chapter 34.

8.15.1.2 Where protection is provided with automatic extinguishing systems without fire resistance–rated separation, the space protected shall be enclosed with smoke partitions in accordance with Section 8.10, unless otherwise permitted by one of the following:

(1) This requirement shall not apply to mercantile occupancy general storage areas and stockrooms protected by automatic sprinklers in accordance with Section 55.3.
(2) This requirement shall not apply to hazardous areas in industrial occupancies protected by automatic extinguishing systems in accordance with 29.3.2.

8.15.1.3 Doors in barriers required to have a fire–resistance rating shall have a ¾-hour fire protection rating and shall be self-closing or automatic closing in accordance with 11.2.1.8.

8.16 Insulating Materials.

8.16.1 Flame Spread. Insulating materials, including vapor barriers, breather papers, facings, and similar coverings, and every layer of multilayer reflective foil insulations, shall comply with the requirements of Section 8.16.

8.16.1.1 Where a flame spread index or a smoke developed index is specified in Section 8.16, such index shall be determined in accordance with the requirements of NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, or ASTM E 84, *Standard Test Method of Surface Burning Characteristics of Building Materials*.

8.16.1.2 Any material that is subject to an increase in flame spread rating or smoke developed index beyond the limits herein established through the effects of age, moisture, or other atmospheric conditions shall not be permitted, unless such material complies with 8.16.1.2(A) or 8.16.1.2(B).

(A) Duct and pipe insulation, coverings and linings, contained in plenums shall comply with the requirements of NFPA 90A.

(B) Foam plastic insulation, other than duct and pipe insulation, coverings and linings, contained in plenums shall comply with Chapter 48.

8.16.2 Concealed Insulation.

8.16.2.1 Insulating materials shall meet the following criteria:

(1) When concealed as installed in buildings of any type construction, insulating materials shall have a flame spread index of not more than 75 and a smoke developed index of not more than 450.
(2) Cellulose loose-fill insulation that is not spray applied and that complies with the requirements of 8.16.6 shall be required to meet only a smoke developed index of not more than 450.

8.16.2.2 When insulating materials are installed in concealed spaces in buildings of Type III, Type IV, or Type V construction, the flame spread and smoke developed limitations shall not apply to facings, coverings, and layers of reflective foil insulation, provided that the facing is installed behind, and in substantial contact with, the unexposed surface of the ceiling, wall, or floor finish.

8.16.3 Exposed Insulation.

8.16.3.1 General. Insulating materials shall meet the following criteria:

(1) When exposed as installed in buildings of any type construction, insulating materials shall have a flame spread index of not more than 25 and a smoke developed index of not more than 450.
(2) Cellulose loose-fill insulation that is not spray applied and that complies with the requirements of 8.16.6 shall be required to meet only a smoke developed index of not more than 450.

8.16.3.2 Attic Floors.

8.16.3.2.1 Exposed insulation materials installed on attic floors shall have a critical radiant flux of not less than 0.12 W/cm^2 when tested in accordance with ASTM E 970, *Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.*

8.16.3.2.2 Thermoplastic exposed insulation materials that melt or shrink away when exposed to radiant heat shall be permitted to be installed exposed on attic floors if they meet the following criteria:

(1) They comply with 8.16.5.
(2) They do not ignite when tested in accordance with ASTM E 970.
(3) They exhibit a self-ignition temperature of 752°F (400°C) or greater where tested in accordance with ASTM D 1929, *Standard Test Method for Determining Ignition Temperature of Plastics.*

8.16.4 Roof Insulation. The use of combustible roof insulation shall be permitted in any type construction, provided it is covered with approved roof coverings directly applied thereto. *(See Chapter 38.)*

8.16.5 Loose-Fill Insulation. Unless they meet the criteria of 8.16.6, loose-fill insulation materials that cannot be mounted in the NFPA 255 apparatus without a screen or artificial supports shall comply with the flame spread and smoke developed limits of 8.16.2.1 and 8.16.3 when tested in accordance with CAN/ULC S102.2, *Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.*

8.16.6 Cellulose Loose-Fill Insulation. Cellulose loose-fill insulation shall comply with CPSC 16 CFR 1209, *Interim Safety Standard for Cellulose Insulation*, and CPSC 16 CFR 1404, *Cellulose Insulation.* Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR 1209 and CPSC 16 CFR 1404.

8.16.7 Insulation and Covering on Pipe and Tubing. Insulation and covering on pipe and tubing shall have a flame spread index of not more than 25 and a smoke developed index of not more than 450.

8.17 Rubbish Chutes and Laundry Chutes.

8.17.1 Rubbish chutes and laundry chutes shall be separately enclosed by walls or partitions in accordance with the provisions of Section 8.4.

8.17.2 Inlet openings serving chutes shall be protected in accordance with Section 8.4.

8.17.3 Doors of rubbish chutes and laundry chutes shall open only to a room that is designed and used exclusively for accessing the chute opening, except as modified by 8.17.4.

8.17.4 Rubbish chutes and laundry chutes shall be permitted to open into rooms not exceeding 400 ft^2 (37 m^2) in area used for storage, provided that the room is protected by automatic sprinklers.

Chapter 9 Reserved

Chapter 10 Interior Finish

10.1* General.

10.1.1 Classification of interior finish materials shall be in accordance with tests made under conditions simulating actual installations, provided that the authority having jurisdiction shall be permitted to establish the classification of any material on which a rating by standard test is not available, unless otherwise provided in 10.1.2.

10.1.2 Materials applied, in total thickness of less than 1/28 in. (0.90 mm), directly to the surface of walls and ceilings shall be exempt from tests simulating actual installation if they meet the requirements of Class A interior wall or ceiling finish when tested in accordance with 10.3.1 using inorganic reinforced cement board as the substrate material.

10.2* Use of Interior Finishes.

10.2.1 Requirements for interior wall and ceiling finish shall apply as follows:

(1) Where specified elsewhere in this *Code* for specific occupancies as noted in Chapter 11 and Chapter 16 through Chapter 34
(2) As specified in Section 10.4

10.2.2* Requirements for interior floor finish shall apply where any of the following conditions exist:

(1) Where floor finish requirements are specified elsewhere in this *Code*
(2) Where carpet or carpet-like material is used
(3) Where there is a floor finish of unusual hazard

10.3 Interior Wall or Ceiling Finish Testing and Classification.

10.3.1* Interior wall or ceiling finish that is required elsewhere in this *Code* to be Class A, Class B, or Class C shall be classified based on test results from NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, or ASTM E 84, *Standard Test Method of Surface Burning Characteristics of Building Materials*, except as indicated in 10.3.1.1 or 10.3.1.2.

10.3.1.1 Exposed portions of structural members complying with the requirements for Type IV(2HH) construction in accordance with NFPA 220, *Standard on Types of Building Construction,* shall be exempt from the testing and classification requirements of NFPA 255 or ASTM E 84.

10.3.1.2 Interior wall and ceiling finish tested in accordance with NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*, and meeting the conditions of 10.3.6.3 shall be permitted to be used where a Class A classification in accordance with NFPA 255 or ASTM E 84 is required.

10.3.1.3* Fire-retardant coatings shall not be used to obtain compliance with the interior finish requirements of this *Code*.

10.3.2* Products required to be tested in accordance with NFPA 255 or ASTM E 84 shall be grouped in the classes described in 10.3.2(A) through 10.3.2(C) in accordance with their flame spread and smoke development, except as indicated in 10.3.3.

(A) Class A Interior Wall and Ceiling Finish. Class A interior wall and ceiling finishes shall be those finishes with a flame spread of 0–25 and smoke development of 0–450 and shall include any material classified at 25 or less on the flame spread test scale and 450 or less on the smoke test scale. Any element thereof, when so tested, shall not continue to propagate fire.

(B) Class B Interior Wall and Ceiling Finish. Class B interior wall and ceiling finishes shall be those finishes with a flame spread of 26–75 and smoke development of 0–450 and shall include any material classified at more than 25 but not more than 75 on the flame spread test scale and 450 or less on the smoke test scale.

(C) Class C Interior Wall and Ceiling Finish. Class C interior wall and ceiling finishes shall be those finishes with a flame spread of 76–200 and smoke development of 0–450 and shall include any material classified at more than 75 but not more than 200 on the flame spread test scale and 450 or less on the smoke test scale.

10.3.3 Interior wall and ceiling finish tested in accordance with NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*, and meeting the conditions of 10.3.6.3 shall be permitted to be used where a Class A finish is required by NFPA 255 or ASTM E 84.

10.3.4 The classification of interior finish specified in 10.3.2 shall be that of the basic material used by itself or in combination with other materials.

10.3.5 Wherever the use of Class C interior wall and ceiling finish is required, Class A or Class B shall be permitted. Where Class B interior wall and ceiling finish is required, Class A shall be permitted.

10.3.6 Products tested in accordance with NFPA 265, *Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings in Full Height Panels and Walls*, shall comply with the criteria of 10.3.6.1 or 10.3.6.2. Products tested in accordance with NFPA 286 shall comply with the criteria of 10.3.6.3.

10.3.6.1* The following criteria shall be met when using the method A test protocol of NFPA 265:

(1) Flame shall not spread to the ceiling during the 40-kW exposure.
(2) During the 150-kW exposure, the following criteria shall be met:
   (a) Flame shall not spread to the outer extremities of the sample on the 6 ft × 12 ft (2.4 m × 3.7 m) wall.
   (b) The specimen shall not burn to the outer extremity of the 2-ft (610-mm) wide samples mounted vertically in the corner of the room.
   (c) Burning droplets that are judged to be capable of igniting the textile wall covering or that persist in burning for 30 seconds or more shall not form and drop to the floor.
   (d) Flashover shall not occur.
   (e) The maximum instantaneous net peak rate of heat release shall not exceed 300 kW.

10.3.6.2* The following conditions shall be met when using the method B test protocol of NFPA 265:

(1) Flame shall not spread to the ceiling during the 40-kW exposure.
(2) During the 150-kW exposure, the following criteria shall be met:
   (a) Flame shall not spread to the outer extremities of the sample on the 8-ft × 12-ft (2.4-m × 3.7-m) wall.
   (b) Flashover shall not occur.

10.3.6.3 The following conditions shall be met when using the test protocol of NFPA 286:

(1) Flame shall not spread to the ceiling during the 40-kW exposure.
(2) During the 160-kW exposure, the following criteria shall be met:
   (a) Flame shall not spread to the outer extremities of the sample on the 8-ft × 12-ft (2.4-m × 3.7-m) wall.
   (b) Flashover shall not occur.
(3) For new installations, the total smoke released throughout the test shall not exceed 1000 m^2.

10.4* Specific Materials.

10.4.1 Textile Wall or Ceiling Materials. The use of textile materials on walls or ceilings shall comply with one of the following conditions:

(1) Textile materials having a Class A rating *(see 10.3.2)* shall be permitted on the walls or ceilings of rooms or areas protected by an approved automatic sprinkler system.
(2) Textile materials having a Class A rating *(see 10.3.2)* shall be permitted on partitions that do not exceed ¾ of the floor-to-ceiling height or do not exceed 8 ft (2.4 m) in height, whichever is less.

(3) Textile materials having a Class A rating *(see 10.3.2)* shall be permitted to extend not more than 4 ft (1.2 m) above the finished floor on ceiling-height walls and ceiling-height partitions.
(4)*Textile materials shall be permitted on walls and partitions where tested in accordance with NFPA 265. *(See 10.3.6.)*

10.4.2* Expanded Vinyl Wall or Ceiling Coverings. The use of expanded vinyl wall or ceiling coverings shall comply with one of the following conditions:

(1) Materials having a Class A rating *(see 10.3.2)* shall be permitted on the walls or ceilings of rooms or areas protected by an approved automatic sprinkler system.
(2) Materials having a Class A rating *(see 10.3.2)* shall be permitted on partitions that do not exceed ¾ of the floor-to-ceiling height or do not exceed 8 ft (2.4 m) in height, whichever is less.
(3) Materials having a Class A rating *(see 10.3.2)* shall be permitted to extend up to 4 ft (1.2 m) above the finished floor on ceiling-height walls and ceiling-height partitions.
(4) Materials shall be permitted on walls and partitions where tested in accordance with NFPA 265. *(See 10.3.6.)*
(5) Materials shall be permitted on walls, partitions, and ceilings where tested in accordance with NFPA 286. *(See 10.3.6.)*

10.4.3 Cellular or Foamed Plastic. Cellular or foamed plastic materials shall not be used as interior wall and ceiling finish, unless specifically permitted by 10.4.3.1 or 10.4.3.2.

10.4.3.1 Cellular or foamed plastic material shall be permitted on the basis of fire tests that substantiate their combustibility characteristics for the use intended under actual fire conditions by the use of large-scale tests performed on the finished foam plastic assembly, related to the actual end-use configuration and on the maximum thickness intended for use.

10.4.3.2 Cellular or foamed plastic shall be permitted for trim not in excess of 10 percent of the wall or ceiling area, provided that it is not less than 20 lb/ft^3 (320 kg/m^3) in density, is limited to ½ in. (13 mm) in thickness and 4 in. (102 mm) in width, and complies with the requirements for Class A or Class B interior wall and ceiling finish as described in 10.3.2; however, the smoke rating shall not be limited.

10.4.4* Light-Transmitting Plastics. Light-transmitting plastics used as interior wall and ceiling finish shall be permitted based on large-scale fire tests that substantiate the combustibility characteristics of the plastics for the use intended under actual fire conditions. The tests shall be performed on a light-transmitting plastic assembly related to the actual end-use configuration and on the maximum thickness intended for use.

10.5 Trim and Incidental Finish. Interior wall and ceiling finish not in excess of 10 percent of the aggregate wall and ceiling areas of any room or space shall be permitted to be Class C materials in occupancies where interior wall and ceiling finish of Class A or Class B is required.

10.6* Interior Floor Finish Testing and Classification.

10.6.1 Carpet and carpet-like interior floor finishes shall comply with ASTM D 2859, *Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.*

10.6.2* Floor coverings other than carpet that are judged to represent an unusual hazard shall have a minimum critical radiant flux of 0.1 W/cm^2.

10.6.3* Interior floor finishes shall be classified in accordance with 10.6.4 based on test results from NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, or ASTM E 648, *Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.*

10.6.4 Interior floor finishes shall be grouped in the following classes in accordance with the critical radiant flux ratings.

(A) Class I Interior Floor Finish. Class I interior floor finish shall have a critical radiant flux of not less than 0.45 W/cm^2 as determined by the test described in 10.6.3.

(B) Class II Interior Floor Finish. Class II interior floor finish shall have a critical radiant flux of not less than 0.22 W/cm^2, but less than 0.45 W/cm^2, as determined by the test described in 10.6.3.

10.6.5 Wherever the use of Class II interior floor finish is required, Class I interior floor finish shall be permitted.

10.7 Automatic Sprinklers.

10.7.1 Unless specifically prohibited elsewhere in this *Code*, where an approved automatic sprinkler system is in accordance with Section 55.3, Class C interior wall and ceiling finish materials shall be permitted in any location where Class B is required, and Class B interior wall and ceiling finish materials shall be permitted in any location where Class A is required.

10.7.2 Unless specifically prohibited elsewhere in this *Code*, where an approved automatic sprinkler system is in accordance with Section 55.3 throughout the fire compartment or smoke compartment containing the interior floor finish, Class II interior floor finish shall be permitted in any location where Class I interior floor finish is required, and where Class II is required, no critical radiant flux rating shall be required.

Chapter 11 Means of Egress

11.1 General.

11.1.1* Application. Means of egress for buildings shall comply with this chapter.

11.1.2 Definitions. See Chapter 3.

11.1.3 Separation of Means of Egress.

11.1.3.1 Exit Access Corridors. Except as otherwise provided in Chapter 16 through Chapter 31, corridors used as exit access and serving an area having an occupant load exceeding 30 shall be separated from other parts of the building by walls having not less than a 1-hour fire resistance rating in accordance with Section 8.4.

11.1.3.2 Exits.

11.1.3.2.1 Where this *Code* requires an exit to be separated from other parts of the building, the exit shall be separated by horizontal and vertical fire barriers that meet the requirements of Section 8.4 and Section 8.6 and 11.1.3.2.1(A) through 11.1.3.2.1(H).

(A) The fire barriers shall have not less than a 1-hour fire resistance rating where the exit connects three stories or less.

(B) The fire barriers shall have not less than a 2-hour fire resistance rating where the exit connects four or more stories.

The fire barriers shall be supported by construction having not less than a 2-hour fire resistance rating.

(C) One-hour enclosures in accordance with 24.2.2.1.2 and 25.2.2.1.2 shall be permitted as an alternative to 11.1.3.2.1(B).

(D) Openings in the separation shall be protected by fire door assemblies equipped with door closers complying with 11.2.1.8.

(E) Openings in exit enclosures shall be limited to doors from normally occupied spaces and corridors and for egress from the enclosure.

Exception: Openings in exit passageways in mall buildings as provided in 27.2.2.7 shall be permitted.

(F) Penetrations into and openings through an exit enclosure assembly shall be prohibited except for the following:

(1) Doors permitted by 11.1.3.2.1(E)
(2) Electrical conduit serving the stairway
(3) Ductwork and equipment necessary for independent stair pressurization
(4) Water or steam piping necessary for the heating or cooling of the exit enclosure
(5) Sprinkler piping
(6) Standpipes

(G) Penetrations for fire alarm circuits shall be permitted within enclosures where fire alarm circuits are installed in metal conduit and penetrations are protected in accordance with Section 8.8.

(H) Penetrations or communicating openings shall be prohibited between adjacent exit enclosures.

11.1.3.2.2 An exit enclosure shall provide a continuous protected path of travel to an exit discharge.

11.1.3.2.3* An exit enclosure shall not be used for any purpose that has the potential to interfere with its use as an exit and, if so designated, as an area of refuge. *(See also 11.2.2.5.3.)*

11.1.4 Interior Finish in Exit Enclosures.

11.1.4.1* Interior Wall and Ceiling Finish in Exit Enclosures. The flame spread of interior finish on walls and ceilings in exit enclosures shall be limited to Class A or Class B in accordance with Chapter 10.

11.1.4.2* Interior Floor Finish in Exit Enclosures. Interior floor finish in exit enclosures, including stair treads and risers, shall be not less than Class II in accordance with 10.6.4.

11.1.5* Headroom. Means of egress shall be designed and maintained to provide headroom as provided in other sections of this *Code* and shall be not less than 7 ft 6 in. (2.3 m) with projections from the ceiling not less than 6 ft 8 in. (2 m) nominal height above the finished floor. The minimum ceiling height shall be maintained for not less than two-thirds of the ceiling area of any room or space, provided the ceiling height of the remaining ceiling area is not less than 6 ft 8 in. (2 m). Headroom on stairs shall be not less than 6 ft 8 in. (2 m) and shall be measured vertically above a plane parallel to and tangent with the most forward projection of the stair tread.

Exception: Headroom in industrial equipment access areas provided in 29.2.5.3 shall be permitted.

11.1.6 Walking Surfaces in the Means of Egress.

11.1.6.1 General. Walking surfaces in the means of egress shall comply with 11.1.6.2 through 11.1.6.4.

11.1.6.2 Changes in Elevation. Abrupt changes in elevation of walking surfaces shall not exceed ¼ in. (0.6 cm). Changes in elevation exceeding ¼ in. (0.6 cm), but not exceeding ½ in. (1.3 cm), shall be beveled 1 to 2. Changes in elevation exceeding ½ in. (1.3 cm) shall be considered a change in level and shall be subject to the requirements of 11.1.7.

11.1.6.3 Level. The slope of a walking surface in the direction of travel shall not exceed 1 in 20 unless the ramp requirements of 11.2.5 are met. The slope perpendicular to the direction of travel shall not exceed 1 in 48.

11.1.6.4* Slip Resistance. Walking surfaces shall be slip resistant under foreseeable conditions. The walking surface of each element in the means of egress shall be uniformly slip resistant along the natural path of travel.

11.1.7 Changes in Level in Means of Egress.

11.1.7.1 Changes in level in means of egress shall be achieved by an approved means of egress where the elevation difference exceeds 21 in. (53.3 cm).

11.1.7.2* Changes in level in means of egress not in excess of 21 in. (53.3 cm) shall be achieved either by a ramp complying with the requirements of 11.2.5 or by a stair complying with the requirements of 11.2.2.

11.1.7.2.1 Where a ramp is used to meet the requirement of 11.1.7.2, the presence and location of ramped portions of walkways shall be readily apparent.

11.1.7.2.2 Where a stair is used to meet the requirement of 11.1.7.2, the tread depth of such stair shall be not less than 13 in. (33 cm).

11.1.7.2.3 Tread depth in industrial equipment access areas as provided in 29.2.5.3 shall be permitted.

11.1.7.2.4 The presence and location of each step shall be readily apparent.

11.1.8 Guards. Guards in accordance with 11.2.2.4 shall be provided at the open sides of means of egress that exceed 30 in. (76 cm) above the floor or grade below.

Exception: Guards shall not be required for the following locations:

(1) On the loading side of loading docks or piers
(2) On the audience side of stages and raised platforms, including steps leading up to the stage and raised platforms
(3) On raised stage and platform floor areas such as runways, ramps, and side stages used for entertainment or presentations
(4) Where vertical openings are included in the performance area of stages and platforms
(5) At walking surfaces appurtenant to stages and platforms for utilization of special lighting or equipment
(6) Along vehicle service pits not accessible to the public
(7) In assembly seating in accordance with 16.2.11

11.1.9 Impediments to Egress. Any device or alarm installed to restrict the improper use of a means of egress shall be designed and installed so that it cannot, even in case of failure, impede or prevent emergency use of such means of egress, unless otherwise provided in 11.2.1.6 and Chapter 19 and Chapter 21.

11.1.10 Means of Egress Reliability.

11.1.10.1* Maintenance. Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

11.1.10.2 Furnishings and Decorations in Means of Egress.

11.1.10.2.1 No furnishings, decorations, or other objects shall obstruct the access to, egress from, or visibility of exits.

11.1.10.2.2 There shall be no obstructions by railings, barriers, or gates that divide the open space into sections appurtenant to individual rooms, apartments, or other occupied spaces. Where the authority having jurisdiction finds the required path of travel to be obstructed by furniture or other movable objects, the authority shall be permitted to require that such objects be secured out of the way or shall be permitted to require that railings or other permanent barriers be installed to protect the path of travel against encroachment.

11.1.10.2.3 Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of egress.

11.1.11 Sprinkler System Supervision. Where another provision of this chapter requires an automatic sprinkler system to be supervised, the sprinkler system shall be electrically supervised in accordance with 55.3.2.

11.2 Means of Egress Components.

11.2.1 Doors.

11.2.1.1 General.

11.2.1.1.1 A door assembly in a means of egress shall conform to the general requirements of Section 11.1 and to the special requirements of 11.2.1. Such an assembly shall be designated as a door.

11.2.1.1.2 Every door and every principal entrance that is required to serve as an exit shall be designed and constructed so that the way of egress travel is obvious and direct. Windows that, because of their physical configuration or design and the materials used in their construction, have the potential to be mistaken for doors shall be made inaccessible to the occupants by barriers or railings.

11.2.1.1.3* For the purposes of Section 11.2, a building shall be considered to be occupied at any time it is open for general occupancy, at any time it is open to the public, or at any other time it is occupied by more than 10 persons.

11.2.1.1.4* Doors and door assemblies required elsewhere in this *Code* to comply with the provisions of 11.2.1.1.4 shall be tested in accordance with UL 1784, *Standard for Air Leakage Tests of Door Assemblies*. The maximum air leakage rate of the door or door assembly shall be 3 $ft^3/min/ft^2$ (0.9 $m^3/min/m^2$) of door opening at 0.10 in. water column (25 Pa) for both the ambient and elevated temperature tests.

11.2.1.2 Width.

11.2.1.2.1* Egress Capacity Width. For purposes of calculating capacity, the width of doors shall be measured as follows:

(1) For swinging doors, only the width of the doorway when the door is open 90 degrees, as measured in accordance with 11.2.1.2.1(3) and 11.2.1.2.1(4), shall be included.
(2) For other types of doors, only the width of the doorway when the door is in the fully open position, as measured in accordance with 11.2.1.2.1(3) and 11.2.1.2.1(4), shall be included.
(3) For all doors, projections not more than 3½ in. (90 mm) at each side of the doorway at a height of not more than 38 in. (965 mm) shall not be considered a reduction in egress capacity width.
(4) For swinging doors, egress capacity width shall be measured between the face of the door and the stop.

11.2.1.2.2 Clear Width. Clear width shall be measured as follows:

(1) Clear width shall be measured at the narrowest point in the door opening.
(2) For swinging doors, clear width shall be measured between the face of the door and the stop.
(3) Clear width shall be measured without subtracting for the obstructions permitted by 11.2.1.2.3.2 and 11.2.1.2.3.3.

11.2.1.2.3* Measurement.

11.2.1.2.3.1 For purposes of determining minimum door width, the clear width shall be used unless door leaf width is specified.

11.2.1.2.3.2 For swinging doors, projections of not more than 4 in. (100 mm) into the doorway width on the hinge side shall not be considered reductions in width, provided such projections are for purposes of accommodating panic hardware or fire exit hardware and are located not less than 34 in. (865 mm) above the floor.

11.2.1.2.3.3 Projections exceeding 80 in. (2030 mm) above the floor shall not be considered reductions in width.

11.2.1.2.4 Minimum Door Width. Door openings in means of egress shall be not less than 32 in. (81 cm) in clear width unless one of the following conditions exists:

(1) Where a pair of doors is provided, not less than one of the doors shall provide not less than a 32-in. (81-cm) clear width opening.
(2) Exit access doors serving a room not exceeding 70 ft^2 (6.5 m^2) and not required to be accessible to persons with severe mobility impairments shall be not less than 24 in. (61 cm) in door leaf width.
(3) Doors serving a building or portion thereof not required to be accessible to persons with severe mobility impairments shall be permitted to be 28 in. (71 cm) in door leaf width.
(4) Doors in detention and correctional occupancies as otherwise permitted in 21.2.11 shall not be required to comply with 11.2.1.2.4.
(5) Interior doors in dwelling units as otherwise permitted in 22.2.4 shall not be required to comply with 11.2.1.2.4.
(6) A power-operated door leaf located within a two-leaf opening shall be exempt from the minimum 32-in. (81-cm) single-leaf requirement in accordance with Exception No. 2 to 11.2.1.9.1.
(7) Revolving doors as provided in 11.2.1.10 shall be exempt from the minimum 32-in. (81-cm) width requirement.

11.2.1.3 Floor Level. The elevation of the floor surfaces on both sides of a door shall not vary by more than ½ in. (1.3 cm). The elevation shall be maintained on both sides of the doorway for a distance not less than the width of the widest leaf. Thresholds at doorways shall not exceed ½ in. (1.3 cm) in height. Raised thresholds and floor level changes in excess of ¼ in. (0.64 cm) at doorways shall be bevelled with a slope not steeper than 1 in 2.

Exception No. 1: In one- and two-family dwellings where the door discharges to the outside or to an exterior exit access, the floor level outside the door shall be permitted to be one step lower than the inside, but shall not be in excess of 8 in. (20.3 cm) lower.

Exception No. 2: Where an exterior door serves an exterior balcony contained within a dwelling unit, the floor level outside the door shall be permitted to be one step lower than the inside, but shall not be in excess of 8 in. (20.3 cm) lower.

Exception No. 3: Within a dwelling unit, a door at the top of a stair shall be permitted to open directly at a stair, provided that the door does not swing over the stair and the door serves an area with an occupant load of fewer than 50 persons.

11.2.1.4 Swing and Force to Open.

11.2.1.4.1* Any door in a means of egress shall be of the side-hinged or pivoted-swinging type. The door shall be designed and installed so that it is capable of swinging from any position to the full required width of the opening in which it is installed.

Exception No. 1: The requirements of 11.2.1.4.1 shall not apply to sliding doors as provided in 21.2.11 and doors as provided in 22.2.4.

Exception No. 2: Where permitted in Chapter 16 through Chapter 31, horizontal-sliding or vertical-rolling security grilles or doors that are part of the required means of egress shall be permitted, provided that the following criteria are met:

(1) Such grilles or doors shall remain secured in the full open position during the period of occupancy by the general public.
(2) On or adjacent to the door, there shall be a readily visible, durable sign in letters at least 1 in. (2.5 cm) high on a contrasting background that reads as follows: THIS DOOR TO REMAIN OPEN WHEN THE BUILDING IS OCCUPIED.
(3) Doors or grilles shall not be brought to the closed position when the space is occupied.
(4) Doors or grilles shall be operable from within the space without the use of any special knowledge or effort.
(5) Where two or more means of egress are required, not more than half of the means of egress shall be equipped with horizontal-sliding or vertical-rolling doors, or horizontal-sliding or vertical-rolling grilles.

Exception No. 3: Horizontal-sliding doors complying with 11.2.1.14 shall be permitted.

Exception No. 4: Doors to private garages, business areas, industrial areas, and storage areas with an occupant load not exceeding 10, where such private garages, business areas, industrial areas, and storage areas contain low or ordinary hazard contents, shall be exempt from the requirement of 11.2.1.4.1.

Exception No. 5: Revolving doors complying with 11.2.1.10 shall be permitted.

11.2.1.4.2 Side-hinged or pivoted-swinging doors in the required means of egress shall swing in the direction of egress travel where any of the following conditions exist:

(1) The doors shall serve an area with an occupant load of 50 or more.
(2) The doors shall be used in an exit enclosure.
(3) The requirement of 11.2.1.4.2(2) shall not apply to doors from individual dwelling units that open directly into an exit enclosure.
(4) The doors shall serve a high hazard contents area.

11.2.1.4.3* During its swing, any door in a means of egress shall leave not less than one-half of the required width of an aisle, corridor, passageway, or landing unobstructed and shall not project more than 7 in. (17.8 cm) into the required width of an aisle, corridor, passageway, or landing when fully open. Doors shall not open directly onto a stair without a landing. The landing shall have a width not less than the width of the door. *(See 11.2.1.3.)*

11.2.1.4.4 The forces required to fully open any door manually in a means of egress shall not be more than 15 lbf (67 N) to release the latch, 30 lbf (133 N) to set the door in motion, and 15 lbf (67 N) to open the door to the minimum required width. Opening forces for interior side-hinged or pivoted-swinging doors without closers shall not be more than 5 lbf (22 N). These forces shall be applied at the latch stile.

Exception No. 1: The opening forces for horizontal-sliding doors in detention and correctional occupancies shall be as provided in 21.2.11.

Exception No. 2: The opening forces for power-operated doors shall be as provided in 11.2.1.9.

11.2.1.4.5 Screen doors and storm doors used in a means of egress shall be subject to the requirements for direction of swing that are applicable to other doors used in a means of egress.

11.2.1.5 Locks, Latches, and Alarm Devices.

11.2.1.5.1 Doors shall be arranged to be opened readily from the egress side whenever the building is occupied. Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the inside of the building.

Exception No. 1: The requirement of 11.2.1.5.1 shall not apply where otherwise provided in Chapter 19, Chapter 20, and Chapter 21.

Exception No. 2: Exterior doors shall be permitted to have key-operated locks from the egress side, provided that the following criteria are met:

(1) Use of this exception shall be permitted in Chapter 16 through Chapter 31 for the specific occupancy.
(2) On or adjacent to the door, a readily visible, durable sign with letters not less than 1 in. (2.5 cm) high on a contrasting background shall be provided and shall read as follows: THIS DOOR TO REMAIN UNLOCKED WHEN THE BUILDING IS OCCUPIED.
(3) The locking device shall be a type that is readily distinguishable as locked.
(4) A key shall be immediately available to any occupant inside the building when it is locked.
(5) The alternatives of 11.2.1.5.1, Exception No. 2(1) through Exception No. 2(4) shall be permitted to be revoked by the authority having jurisdiction for cause.

Exception No. 3: Where permitted in Chapter 16 through Chapter 31, key operation shall be permitted, provided that the key cannot be removed when the door is locked from the side from which egress is to be made.

11.2.1.5.2* Every door in a stair enclosure serving more than four stories shall provide for one of the following:

(1) Re-entry from the stair enclosure to the interior of the building
(2) Automatic release to unlock all stair enclosure doors to allow re-entry

(A) Where automatic release is used to comply with 11.2.1.5.2(2), it shall be actuated with the initiation of the building fire alarm system.

Exception: The requirement of 11.2.1.5.2 shall not apply to the following:

(1) Stair enclosures serving a building permitted to have a single exit in accordance with Chapter 16 through Chapter 31
(2) Stair enclosures where otherwise provided in Chapter 19 and Chapter 21

(B) Doors on stair enclosures shall be permitted to be equipped with hardware that prevents re-entry into the interior of the building, provided that the following criteria are met:

(1) There shall be not less than two levels where it is possible to leave the stair enclosure to access another exit.

(2) There shall be not more than four stories intervening between stories where it is possible to leave the stair enclosure to access another exit.
(3) Re-entry shall be possible on the top or next to top story that allows access to another exit.
(4) Doors allowing re-entry shall be identified as such on the stair side of the door.
(5) Doors not allowing re-entry shall be provided with a sign on the stair side indicating the location of the nearest door, in each direction of travel, that allows re-entry or exit.

11.2.1.5.3 If a stair enclosure allows access to the roof of the building, the door to the roof either shall be kept locked or shall allow re-entry from the roof.

11.2.1.5.4* A latch or other fastening device on a door shall be provided with a releasing device having an obvious method of operation and that is readily operated under all lighting conditions. The releasing mechanism for any latch shall be located not less than 34 in. (86 cm), and not more than 48 in. (122 cm), above the finished floor. Doors shall be operable with not more than one releasing operation.

Exception: Egress doors from individual living units and guest rooms of residential occupancies shall be permitted to be provided with devices that require not more than one additional releasing operation, provided that such device is operable from the inside without the use of a key or tool and is mounted at a height not exceeding 48 in. (122 cm) above the finished floor. Automatic latching devices shall not be located more than 48 in. (122 cm) above the finished floor.

11.2.1.5.5 Where pairs of doors are required in a means of egress, each leaf of the pair shall be provided with its own releasing device. Devices that depend on the release of one door before the other shall not be used.

Exception: Where exit doors are used in pairs and approved automatic flush bolts are used, the door leaf equipped with the automatic flush bolts shall have no doorknob or surface-mounted hardware. The unlatching of any leaf shall not require more than one operation.

11.2.1.5.6* Devices shall not be installed in connection with any door on which panic hardware or fire exit hardware is required where such device prevents or is intended to prevent the free use of the door for purposes of egress.

Exception: The requirement of 11.2.1.5.6 shall not apply where otherwise provided in 11.2.1.6.

11.2.1.6 Special Locking Arrangements.

11.2.1.6.1 Delayed-Egress Locks. Approved, listed, delayed-egress locks shall be permitted to be installed on doors serving low and ordinary hazard contents in buildings protected throughout by an approved, supervised automatic fire detection system in accordance with Section 55.2, or an approved, supervised automatic sprinkler system in accordance with Section 55.3, and where permitted in Chapter 16 through Chapter 31, provided that the criteria of 11.2.1.6.1(A) through 11.2.1.6.1(F) are met.

(A) The doors shall unlock upon actuation of an approved, supervised automatic sprinkler system installed in accordance with Section 55.3, or upon the actuation of any heat detector or not more than two smoke detectors of an approved, supervised automatic fire detection system installed in accordance with Section 55.2.

(B) The doors shall unlock upon loss of power controlling the lock or locking mechanism.

(C) An irreversible process shall release the lock within 15 seconds upon application of a force to the release device required in 11.2.1.5.4 that shall not be required to exceed 15 lbf (67 N) nor be required to be continuously applied for more than 3 seconds. The initiation of the release process shall activate an audible signal in the vicinity of the door. Once the door lock has been released by the application of force to the releasing device, relocking shall be by manual means only.

(D) Where approved by the authority having jurisdiction, a delay not exceeding 30 seconds shall be permitted.

(E)* On the door adjacent to the release device, there shall be a special sign in letters at least 1 in. (2.5 cm) high that complies with 11.10.8.1 and 11.10.8.2 and reads as follows:

PUSH UNTIL ALARM SOUNDS

DOOR CAN BE OPENED IN 15 SECONDS

(F) Emergency lighting shall be provided in the area of the door.

11.2.1.6.2 Access-Controlled Egress Doors. Where permitted in Chapter 16 through Chapter 30, doors in the means of egress shall be permitted to be equipped with an approved entrance and egress access control system, provided that the following criteria are met:

(1) Either of the following shall be provided:
   (a) A sensor shall be provided on the egress side and arranged to detect an occupant approaching the doors, and the doors shall be arranged to unlock in the direction of egress upon detection of an approaching occupant or loss of power to the sensor.
   (b) Listed panic hardware or fire exit hardware that, when operated, unlocks the door shall be provided.
(2) Loss of power to the part of the access control system that locks the doors shall automatically unlock the doors in the direction of egress.
(3) The doors shall be arranged to unlock in the direction of egress from a manual release device located 40 in. to 48 in. (102 cm to 122 cm) vertically above the floor and within 5 ft (1.5 m) of the secured doors.
(4) The manual release device specified in 11.2.1.6.2(3) shall be readily accessible and clearly identified by a special sign that complies with 11.10.8.1 and 11.10.8.2 and reads as follows: PUSH TO EXIT.
(5) When operated, the manual release device specified in 11.2.1.6.2(3) shall result in direct interruption of power to the lock—independent of the access control system electronics—and the doors shall remain unlocked for not less than 30 seconds.
(6) Activation of the building fire-protective signaling system, if provided, shall automatically unlock the doors in the direction of egress, and the doors shall remain unlocked until the fire-protective signaling system has been manually reset.
(7) Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the doors in the direction of egress and the doors shall remain unlocked until the fire-protective signaling system has been manually reset.

11.2.1.7 Panic Hardware and Fire Exit Hardware.

11.2.1.7.1 Where a door is required to be equipped with panic hardware or fire exit hardware, such hardware shall meet the following criteria:

(1) It shall consist of a cross bar or push pad, the actuating portion of which extends across not less than one-half of the width of the door leaf and not less than 34 in. (86 cm), but not more than 48 in. (122 cm), above the floor.
(2) It shall be constructed so that a horizontal force not to exceed 15 lbf (66 N) actuates the cross bar or push pad and latches.

11.2.1.7.2 Only approved panic hardware shall be used on doors that are not fire doors. Only approved fire exit hardware shall be used on fire doors.

11.2.1.7.3 Required panic hardware and fire exit hardware shall not be equipped with any locking device, set screw, or other arrangement that prevents the release of the latch when pressure is applied to the releasing device. Devices that hold the latch in the retracted position shall be prohibited on fire exit hardware unless listed and approved for that purpose.

Exception: The requirement of 11.2.1.7.3 shall not apply where otherwise provided in 21.2.11.

11.2.1.8 Self-Closing Devices.

11.2.1.8.1* A door normally required to be kept closed shall not be secured in the open position at any time and shall be self-closing or automatic closing in accordance with 11.2.1.8.2.

11.2.1.8.2 In any building of low or ordinary hazard contents, as defined in 6.3.2, or where approved by the authority having jurisdiction, doors shall be permitted to be automatic closing, provided that the following criteria are met:

(1) Upon release of the hold-open mechanism, the door becomes self-closing.
(2) The release device is designed so that the door instantly releases manually and upon release becomes self-closing, or the door can be readily closed.
(3) The automatic releasing mechanism or medium is activated by the operation of approved smoke detectors installed in accordance with the requirements for smoke detectors for door release service in *NFPA 72, National Fire Alarm Code.*
(4) Upon loss of power to the hold-open device, the hold-open mechanism is released and the door becomes self-closing.
(5) The release by means of smoke detection of one door in a stair enclosure results in closing all doors serving that stair.

11.2.1.9* Powered Doors.

11.2.1.9.1* General. Where means of egress doors are operated by power upon the approach of a person or are doors with power-assisted manual operation, the design shall be such that, in the event of power failure, the door opens manually to allow egress travel or closes where necessary to safeguard the means of egress.

(A) The forces required to open the doors specified in 11.2.1.9.1 manually shall not exceed those required in 11.2.1.4.4, except that the force required to set the door in motion shall not exceed 50 lbf (222 N).

(B) The door shall be designed and installed so that, when a force is applied to the door on the side from which egress is made, it shall be capable of swinging from any position to the full use of the required width of the opening in which it is installed. *(See 11.2.1.4.)*

(C) On the egress side of each door, there shall be a special sign that complies with 11.10.8.1 and 11.10.8.2 and reads as follows:

IN EMERGENCY, PUSH TO OPEN

(D) The sign shall be in letters not less than 1 in. (2.5 cm) high on a contrasting background.

Exception No. 1: Sliding, power-operated doors in exit access serving an occupant load of fewer than 50 that manually open in the direction of door travel with forces not exceeding those required in 11.2.1.4.4 shall not be required to have a swing-out feature. The sign required by 11.2.1.9.1(C) shall read as follows: IN EMERGENCY, SLIDE TO OPEN

Exception No. 2: In the emergency breakout mode, a door leaf located within a two-leaf opening shall be exempt from the minimum 32-in. (81-cm) single-leaf requirement of 11.2.1.2.4, provided that the clear width of the single leaf is not less than 30 in. (76 cm).

Exception No. 3: For a biparting sliding door in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 32-in. (81-cm) single-leaf requirement of 11.2.1.2.4 if a clear opening of not less than 32 in. (81 cm) is provided by all leaves broken out.

Exception No. 4: Doors complying with 11.2.1.14 shall be permitted to be used.

Exception No. 5: The requirements of 11.2.1.9.1(A) through 11.2.1.9.1(D) shall not apply where otherwise provided in 21.2.11.

11.2.1.9.2 Doors Required to Be Self-Closing. Where doors are required to be self-closing and are operated by power upon the approach of a person or are provided with power-assisted manual operation, they shall be permitted in the means of egress under the following conditions:

(1) The doors can be opened manually in accordance with 11.2.1.9.1 to allow egress travel in the event of power failure.
(2) New doors remain in the closed position unless actuated or opened manually.
(3) When actuated, new doors remain open for not more than 30 seconds.
(4) Doors held open for any period of time close—and the power-assist mechanism ceases to function—upon operation of approved smoke detectors installed in such a way as to detect smoke on either side of the door opening in accordance with the provisions of *NFPA 72, National Fire Alarm Code.*
(5) Doors required to be self-latching are either self-latching or become self-latching upon operation of approved smoke detectors per 11.2.1.9.2(4).
(6) New power-assisted swinging doors comply with BHMA/ANSI A156.19, *American National Standard for Power Assist and Low Energy Power Operated Doors.*

11.2.1.10 Revolving Doors.

11.2.1.10.1 Revolving doors shall comply with the following:

(1) Revolving doors shall be capable of being collapsed into a book-fold position.
(2) When revolving doors are collapsed into the book-fold position, the parallel egress paths formed shall provide an aggregate width of 36 in. (91 cm).
(3) Revolving doors shall not be used within 10 ft (3 m) of the foot or the top of stairs or escalators.
(4) Under all conditions, there shall be a dispersal area acceptable to the authority having jurisdiction between the stairs or escalators and revolving doors.

(5) The revolutions per minute (rpm) of revolving doors shall not exceed the values in Table 11.2.1.10.1.
(6) Each revolving door shall have a conforming side-hinged swinging door in the same wall as the revolving door and within 10 ft (3 m) of the revolving door.
(7) Revolving doors shall be permitted without the adjacent swinging doors required by 11.2.1.10.1(6) for street floor elevator lobbies, provided that no stairways or doors from other parts of the building discharge through the lobby and the lobby has no occupancy other than as a means of travel between the elevators and street.

Table 11.2.1.10.1 Revolving Door Maximum Speed

Inside Diameter		Power Driven-Type Speed Control (rpm)	Manual-Type Speed Control (rpm)
ft	m		
6½	2.0	11	12
7	2.1	10	11
7½	2.3	9	11
8	2.4	9	10
8½	2.6	8	9
9	2.7	8	9
9½	2.9	7	8
10	3.0	7	8

11.2.1.10.2 Where permitted in Chapter 16 through Chapter 30, revolving doors shall be permitted as a component in a means of egress, provided that the following criteria are met:

(1) Revolving doors shall not be given credit for more than 50 percent of the required egress capacity.
(2) Each revolving door shall be credited with not more than a 50-person capacity, or, if of not less than a 9-ft (2.7-m) diameter, revolving doors shall be permitted egress capacity based on the clear opening width provided when collapsed into a book-fold position.
(3) Revolving doors shall be capable of being collapsed into a book-fold position when a force not exceeding 130 lbf (578 N) is applied to the wings within 3 in. (7.6 cm) of the outer edge.

11.2.1.10.3 Revolving doors not used as a component of a means of egress shall have a collapsing force not exceeding 180 lbf (800 N).

Exception: The requirement of 11.2.1.10.3 shall not apply to revolving doors, provided that the collapsing force is reduced to a force not to exceed 130 lbf (578 N) if the following conditions occur:

(1) If a power failure occurs, or if power is removed to the device holding the wings in position
(2) If an actuation of the automatic sprinkler system occurs where such a system is provided
(3) If an actuation of a smoke detection system that is installed to provide coverage in all areas within the building that are within 75 ft (23 m) of the revolving doors occurs
(4) If an actuation of a clearly identified manual control switch in an approved location that reduces the holding force to a force not to exceed 130 lbf (578 N) occurs

11.2.1.11 Turnstiles.

11.2.1.11.1 Turnstiles or similar devices that restrict travel to one direction or are used to collect fares or admission charges shall not be placed so as to obstruct any required means of egress.

Exception No. 1: Approved turnstiles not exceeding 39 in. (99 cm) in height that turn freely in the direction of egress travel shall be permitted where revolving doors are permitted in Chapter 16 through Chapter 31.

Exception No. 2: Where turnstiles are approved by the authority having jurisdiction and permitted in Chapter 16 through Chapter 31, each turnstile shall be credited for a 50-person capacity, provided that such turnstiles meet the following criteria:

(1) They freewheel in the egress direction when primary power is lost, and they freewheel in the direction of egress travel upon manual release by an employee assigned in the area.
(2) They are not given credit for more than 50 percent of the required egress width.
(3) They are not in excess of 39 in. (99 cm) in height and have a clear width of not less than 16½ in. (41.9 cm).

11.2.1.11.2 Turnstiles exceeding 39 in. (99 cm) in height shall meet the requirements for revolving doors in 11.2.1.10.

11.2.1.11.3 Turnstiles located in, or furnishing access to, required exits shall provide not less than 16½ in. (41.9 cm) clear width at and below a height of 39 in. (99 cm) and at least 22 in. (55.9 cm) clear width at heights above 39 in. (99 cm).

11.2.1.12 Doors in Folding Partitions. Where permanently mounted folding or movable partitions divide a room into smaller spaces, a swinging door or open doorway shall be provided as an exit access from each such space.

Exception No. 1: A door or opening in the folding partition shall not be required, provided that the following criteria are met:

(1) The subdivided space is not used by more than 20 persons at any time.
(2) The use of the space is under adult supervision.
(3) The partitions are arranged so that they do not extend across any aisle or corridor used as an exit access to the required exits from the story.
(4) The partitions conform to the interior finish and other requirements of this Code.
(5) The partitions are of an approved type, have a simple method of release, and are capable of being opened quickly and easily by experienced persons in case of emergency.

Exception No. 2: Where a subdivided space is provided with not less than two means of egress, the swinging door in the folding partition shall not be required, and one such means of egress shall be permitted to be equipped with a horizontal-sliding door complying with 11.2.1.14.

11.2.1.13 Balanced Doors. If panic hardware is installed on balanced doors, the panic hardware shall be of the push-pad type, and the pad shall not extend more than approximately one-half the width of the door, measured from the latch side. *[See 11.2.1.7.1(1).]*

11.2.1.14 Horizontal-Sliding Doors. Horizontal-sliding doors used in accordance with Exception No. 3 to 11.2.1.4.1 shall meet the following criteria:

(1) The door is readily operable from either side without special knowledge or effort.
(2) The force that, when applied to the operating device in the direction of egress, is required to operate the door is not more than 15 lbf (67 N).

(3) The force required to operate the door in the direction of door travel is not more than 30 lbf (133 N) to set the door in motion and is not more than 15 lbf (67 N) to close the door or open it to the minimum required width.
(4) The door is operable with a force of not more than 50 lbf (222 N) when a force of 250 lbf (1110 N) is applied perpendicularly to the door adjacent to the operating device.
(5) The door assembly complies with the fire protection rating and, where rated, is self-closing or automatic closing by means of smoke detection in accordance with 11.2.1.8, and is installed in accordance with NFPA 80, *Standard for Fire Doors and Fire Windows.*

11.2.2 Stairs.

11.2.2.1 General. Stairs used as a component in the means of egress shall conform to the general requirements of Section 11.1 and to the special requirements of 11.2.2.

Exception: The requirement of 11.2.2.1 shall not apply to aisle stairs as provided in Chapter 16.

11.2.2.2 Dimensional Criteria.

11.2.2.2.1 Standard Stairs. Dimensional criteria for stairs shall be in accordance with Table 11.2.2.2.1.

Table 11.2.2.2.1 Dimensional Criteria

Feature	Dimensional Criteria
Minimum width clear of all obstructions, except projections not more than 4½ in. (11.4 cm) at or below handrail height on each side	44 in. (112 cm); 36 in. (91 cm) where total occupant load of all stories served by stairways is fewer than 50
Maximum height of risers	7 in. (17.8 cm)
Minimum height of risers	4 in. (10.2 cm)
Minimum tread depth	11 in. (27.9 cm)
Minimum headroom	6 ft 8 in. (203 cm)
Maximum height between landings	12 ft (3.7 m)
Landing	See 11.2.1.3 and 11.2.1.4.3

Exception: The requirement of 11.2.2.2.1 shall not apply to industrial equipment access areas as otherwise provided in 29.2.5.3.

11.2.2.2.2 Curved Stairs. Curved stairs shall be permitted as a component in a means of egress, provided that the depth of tread is not less than 11 in. (27.9 cm) at a point 12 in. (30.5 cm) from the narrower end of the tread and the smallest radius is not less than twice the stair width.

11.2.2.2.3 Spiral Stairs.

11.2.2.2.3.1 Where specifically permitted for individual occupancies by Chapter 16 through Chapter 30, spiral stairs shall be permitted as a component in a means of egress in accordance with 11.2.2.2.3.2 through 11.2.2.2.3.3.

11.2.2.2.3.2 Spiral stairs shall be permitted, provided the following criteria are met:

(1) Riser heights shall not exceed 7 in. (17.8 cm).
(2) The stairway shall have a tread depth of not less than 11 in. (27.9 cm) for a portion of the stairway width sufficient to provide egress capacity for the occupant load served in accordance with 11.3.3.1.
(3) At the outer side of the stairway, an additional 10½ in. (26.7 cm) of width shall be provided clear to the other handrail, and this width shall not be included as part of the required egress capacity.
(4) Handrails complying with 11.2.2.4 shall be provided on both sides of the spiral stairway.
(5) The inner handrail shall be located within 24 in. (61.0 cm), measured horizontally, of the point where a tread depth of not less than 11 in. (27.9 cm) is provided.
(6) The turn of the stairway shall be such that descending users have the outer handrail at their right side.

11.2.2.2.3.3 Where the occupant load served does not exceed three, spiral stairs shall be permitted, provided that the following criteria are met:

(1) The clear width of the stairs shall be not less than 26 in. (66 cm).
(2) The height of risers shall not exceed 9½ in. (24.1 cm).
(3) The headroom shall be not less than 6 ft 6 in. (198 cm).
(4) Treads shall have a depth not less than 7½ in. (19.1 cm) at a point 12 in. (30.5 cm) from the narrower edge.
(5) All treads shall be identical.
(6) Handrails shall be provided on both sides of the stairway.

11.2.2.2.4* Winders. Where specified in Chapter 16 through Chapter 30, winders shall be permitted in stairs. Winders shall have a tread depth of not less than 6 in. (15.2 cm) and a tread depth of not less than 11 in. (27.9 cm) at a point 12 in. (30.5 cm) from the narrowest edge.

11.2.2.3 Stair Details.

11.2.2.3.1 Construction.

11.2.2.3.1.1 All stairs serving as required means of egress shall be of permanent fixed construction, unless they are stairs serving seating that is designed to be repositioned in accordance with 16.2.2.3.1.

11.2.2.3.1.2 All components of a stairway, including platforms and landings, shall be constructed of materials consistent with the types permitted for floor construction, based on the type of construction of the building, except that wood handrails shall be permitted for all types of construction. All walking surfaces of a stairway shall be capable of supporting the loads specified in Chapter 35.

11.2.2.3.2 Landings. Stairs shall have landings at door openings. Stairs and intermediate landings shall continue with no decrease in width along the direction of egress travel. In new buildings, every landing shall have a dimension measured in the direction of travel that is not less than the width of the stair.

Exception No. 1: Landings shall not be required to exceed 4 ft (122 cm) in the direction of travel, provided that the stair has a straight run.

Exception No. 2: Within a dwelling unit, a door at the top of a stair shall be permitted to open directly at a stair, provided that the door does not swing over the stair and the door serves an area with an occupant load of fewer than 50 persons.

11.2.2.3.3* Tread and Landing Surfaces. Stair treads and landings shall be solid, without perforations, and free of projections or lips that could trip stair users. If not vertical, risers shall be permitted to slope under the tread at an angle not to

exceed 30 degrees from vertical, but the permitted projection of the nosing shall not exceed 1½ in. (3.8 cm).

Exception: The requirement of 11.2.2.3.3 shall not apply to noncombustible grated stair treads and landings as provided in 16.2.2.3.2, 21.2.2.3.1, and 29.2.2.3.1.

11.2.2.3.4* Tread Slope. Tread slope shall not exceed ¼ in./ft (2 cm/m) (a slope of 1 in 48).

11.2.2.3.5* Riser Height and Tread Depth. Riser height shall be measured as the vertical distance between tread nosings. Tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads, and at a right angle to the tread's leading edge, but shall not include bevelled or rounded tread surfaces that slope more than 20 degrees (a slope of 1 in 2.75). At tread nosings, such bevelling or rounding shall not exceed ½ in. (1.3 cm) in horizontal dimension.

11.2.2.3.6 Dimensional Uniformity. There shall be no variation in excess of 3⁄16 in. (0.5 cm) in the depth of adjacent treads or in the height of adjacent risers, and the tolerance between the largest and smallest riser or between the largest and smallest tread shall not exceed ⅜ in. (1 cm) in any flight.

Exception: Where the bottom riser adjoins a sloping public way, walk, or driveway having an established grade and serving as a landing, a variation in height of the bottom riser not to exceed 3 in. in every 3 ft (7.6 cm in every 91 cm) of stairway width shall be permitted.

11.2.2.4* Guards and Handrails.

11.2.2.4.1 Handrails.

11.2.2.4.1.1 Stairs and ramps shall have handrails on both sides unless otherwise permitted in 11.2.2.4.1.6.

11.2.2.4.1.2 In addition, handrails shall be provided within 30 in. (76 cm) of all portions of the required egress width of new stairs.

11.2.2.4.1.3 Where intermediate handrails are provided in accordance with 11.2.2.4.1.2, the minimum clear width between handrails shall be 20 in. (510 mm).

11.2.2.4.1.4 The required egress width shall be provided along the natural path of travel.

11.2.2.4.1.5 If a single step or a ramp is part of a curb that separates a sidewalk from a vehicular way, it shall not be required to have a handrail.

11.2.2.4.1.6 Stairs within dwelling units and within guest rooms, and ramps within dwelling units and guest rooms, shall be permitted to have a handrail on one side only.

11.2.2.4.2* Continuity. Required guards and handrails shall continue for the full length of each flight of stairs. At turns of new stairs, inside handrails shall be continuous between flights at landings.

11.2.2.4.3 Projections. The design of guards and handrails and the hardware for attaching handrails to guards, balusters, or walls shall be such that there are no projections that might engage loose clothing. Openings in guards shall be designed to prevent loose clothing from becoming wedged in such openings.

11.2.2.4.4* Handrail Details.

(A)* Handrails on stairs and ramps shall have a consistent height of not less than 34 in. (86 cm) and not more than 38 in. (96 cm) above the surface of the stair tread or ramp walking surface, measured vertically to the top of the rail from the leading edge of the stair tread or the ramp walking surface.

Exception No. 1: The height of required handrails that form part of a guard in stairways not required to be accessible to persons with disabilities shall be permitted to exceed 38 in. (96 cm) but shall not exceed 42 in. (107 cm), measured vertically to the top of the rail from the leading edge of the tread.

Exception No. 2: Additional handrails that are lower or higher than the main handrail shall be permitted.

(B) Handrails shall provide a clearance of not less than 2¼ in. (57 mm) between the handrail and the wall to which it is fastened.

(C)* Handrails shall have a circular cross section with an outside diameter of not less than 1¼ in. (3.2 cm) and not more than 2 in. (5 cm).

Exception: Any shape, other than circular, with a perimeter dimension of not less than 4 in. (10.2 cm), but not more than 6¼ in. (15.9 cm), and with the largest cross-sectional dimension not more than 2¼ in. (5.7 cm) shall be permitted, provided that graspable edges are rounded so as to provide a radius of not less than ⅛ in. (0.3 cm).

(D) Handrails shall be continuously graspable along their entire length.

Exception: Handrail brackets or balusters attached to the bottom surface of the handrail shall not be considered to be obstructions to graspability, provided that the following criteria are met:

(1) They do not project horizontally beyond the sides of the handrail within a vertical clearance of 1½ in. (3.75 cm) of the bottom surface of the handrail.
(2) For each ½ in. (1.3 cm) of additional handrail perimeter dimension greater than 4 in. (10 cm), as specified in (1), the vertical clearance dimension of 1½ in. (3.75 cm) shall be permitted to be reduced by ⅛ in. (0.3 cm).
(3) They have edges with a radius of not less than 0.01 in. (0.25 mm).
(4) They obstruct not in excess of 20 percent of the handrail length if the graspable perimeter dimension is less than 5½ in. (140 mm).

(E) Handrail ends shall return to the wall or floor or shall terminate at newel posts.

(F) Handrails that are not continuous between flights shall extend horizontally, at the required height, not less than 12 in. (30.5 cm) beyond the top riser and continue to slope for a depth of one tread beyond the bottom riser.

Exception: Within dwelling units, the handrail shall be permitted to extend, at the required height, to points directly above the top and bottom risers.

11.2.2.4.5 Guard Details.

(A) The height of guards required in 11.1.8 shall be measured vertically to the top of the guard from the surface adjacent thereto.

(B) Guards shall be not less than 42 in. (107 cm) high.

Exception: The requirement of 11.2.2.4.5(B) shall not apply where otherwise provided in 16.2.11.

(C)* Open guards shall have intermediate rails or an ornamental pattern such that a sphere 4 in. (10.1 cm) in diameter shall not be capable of passing through any opening up to a height of 34 in. (86 cm).

Exception No. 1: The triangular openings formed by the riser, tread, and bottom element of a guardrail at the open side of a stair shall be of such size that a sphere 6 in. (15.2 cm) in diameter shall not be capable of passing through the triangular opening.

Exception No. 2: In detention and correctional occupancies, in industrial occupancies, and in storage occupancies, the clear distance between intermediate rails, measured at right angles to the rails, shall not exceed 21 in. (53.3 cm).

11.2.2.5 Enclosure and Protection of Stairs.

11.2.2.5.1 Enclosures. All inside stairs serving as an exit or exit component shall be enclosed in accordance with 11.1.3.2. All other inside stairs shall be protected in accordance with Section 8.12.

11.2.2.5.2* Exposures. Where nonrated walls or unprotected openings enclose the exterior of a stairway, and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees, the building enclosure walls within 10 ft (3 m) horizontally of the nonrated wall or unprotected opening shall be constructed as required for stairway enclosures, including opening protectives. Construction shall extend vertically from the ground to a point 10 ft (3 m) above the topmost landing of the stairs or to the roofline, whichever is lower.

Exception No. 1: The fire resistance rating of the separation extending 10 ft (3 m) from the stairs shall not be required to exceed 1 hour where openings have not less than a ¾-hour fire protection rating.

Exception No. 2: Separation shall not be required between corridors and outside stairs, provided that the following conditions are met:

(1) The building, including corridors and stairs, shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, or, where applicable, NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.
(2) The corridors shall comply with 11.1.3.1.
(3) The corridors shall be connected on each end to an outside stair complying with 11.2.2.7.
(4) At any location in the corridor where a change in direction exceeding 45 degrees occurs, a clear opening to the exterior of not less than 35 ft² (3.25 m²), located to restrict the accumulation of smoke and toxic gases, or an outside stair shall be provided.

11.2.2.5.3* Usable Space. There shall be no enclosed, usable space within an exit enclosure, including under stairs, nor shall any open space within the enclosure be used for any purpose that has the potential to interfere with egress.

Exception: Enclosed, usable space shall be permitted under stairs, provided that the space is separated from the stair enclosure by the same fire resistance rating as the exit enclosure. Entrance to such enclosed, usable space shall not be from within the stair enclosure. (See also 11.1.3.2.3.)

11.2.2.6* Stairway Marking.

11.2.2.6.1 Stairs serving five or more stories shall be provided with special signage within the enclosure at each floor landing. The signage shall indicate the floor level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair enclosure. The signage also shall state the floor level of, and the direction to, exit discharge. The signage shall be located inside the enclosure approximately 5 ft (1.5 m) above the floor landing in a position that is visible when the door is in the open or closed position. The signage shall comply with 11.10.8.1 and 11.10.8.2. The floor level designation shall also be tactile in accordance with ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities.*

11.2.2.6.2 Wherever an enclosed stair requires travel in an upward direction to reach the level of exit discharge, special signs with directional indicators showing the direction to the level of exit discharge shall be provided at each floor level landing from which upward direction of travel is required. Such signage shall comply with 11.10.8.1 and 11.10.8.2 and be visible when the door is in the open or closed position.

Exception No. 1: The requirement of 11.2.2.6.2 shall not apply where signs required by 11.2.2.6.1 are provided.

Exception No. 2: Stairs extending not more than one story below the level of exit discharge where the exit discharge is clearly obvious shall not be subject to the requirement of 11.2.2.6.2.

11.2.2.6.3 The sign shall be painted or stenciled on the wall or on a separate sign securely attached to the wall.

11.2.2.6.4 The stairway identification letter shall be placed at the top of the sign in minimum 1-in. (2.5-cm) high lettering in accordance with 11.10.8.2.

11.2.2.6.5 The provision of roof access or lack of roof access shall be designated by the words "roof access" or "no roof access" and placed under the stairway identification letter. Lettering shall be a minimum of 1 in. (2.5 cm) high and in accordance with 11.10.8.2.

11.2.2.6.6 The floor level shall be placed in the middle of the sign in minimum 5-in. (12.7-cm) high numbers and in accordance with 11.10.8.2. Mezzanine levels shall have the letter "M" or other appropriate identification letter preceding the floor level number, while basement levels shall have the letter "B" or other appropriate identification letter preceding the floor level number.

11.2.2.6.7 The lower and upper terminus of the stairway shall be placed at the bottom of the sign in minimum 1-in. (2.5-cm) high letters and in accordance with 11.10.8.2.

11.2.2.7 Special Provisions for Outside Stairs.

11.2.2.7.1 Access. Where approved by the authority having jurisdiction, outside stairs shall be permitted to lead to roofs of other sections of a building or an adjoining building where the construction is fire resistive and there is a continuous and safe means of egress from the roof. *(See also 11.7.6.)*

11.2.2.7.2* Visual Protection. Outside stairs shall be arranged to avoid any impediments to the use of the stairs by persons having a fear of high places. For stairs more than three stories in height, any arrangement intended to meet this requirement shall be not less than 4 ft (1.2 m) in height.

11.2.2.7.3 Separation and Protection of Outside Stairs. Outside stairs shall be separated from the interior of the building by construction with the fire resistance rating required for enclosed stairs with fixed or self-closing opening protectives. This construction shall extend vertically from the ground to a point 10 ft (3 m) above the topmost landing of the stairs or to the roofline, whichever is lower, and to a point not less than 10 ft (3 m) horizontally.

Exception No. 1: Outside stairs serving an exterior exit access balcony that has two remote outside stairways or ramps shall be permitted to be unprotected.

Exception No. 2: Outside stairs serving not in excess of two adjacent stories, including the story of exit discharge, shall be permitted to be unprotected where there is a remotely located second exit.

Exception No. 3: The fire resistance rating of the separation extending 10 ft (3 m) from the stairs shall not be required to exceed 1 hour where openings have not less than a ¾-hour fire protection rating.

11.2.2.7.4 Protection of Openings. All openings below an outside stair shall be protected with an assembly having not less than a ¾-hour fire protection rating where the following conditions exist:

(1) Where the stair is located in a court, the smallest dimension of which does not exceed one-third its height
(2) Where the stair is located in an alcove having a width that does not exceed one-third its height and a depth that does not exceed one-fourth its height

11.2.2.7.5* Water Accumulation. Outside stairs and landings shall be designed to minimize water accumulation on their surfaces.

11.2.2.7.6 Openness. Outside stairs shall be not less than 50 percent open on one side and shall be arranged to restrict the accumulation of smoke.

11.2.3 Smokeproof Enclosures.

11.2.3.1 General. Where smokeproof enclosures are required in other sections of this *Code*, they shall comply with 11.2.3.

11.2.3.2 Performance Design. An appropriate design method shall be used to provide a system that meets the definition of smokeproof enclosure *(see 3.3.157.2, Smokeproof Enclosure)*. The smokeproof enclosure shall be permitted to be created by using natural ventilation, by using mechanical ventilation incorporating a vestibule, or by pressurizing the enclosure.

11.2.3.3 Enclosure. A smokeproof enclosure shall be enclosed from the highest point to the lowest point by barriers having 2-hour fire resistance ratings. Where a vestibule is used, it shall be within the 2-hour-rated enclosure and shall be considered part of the smokeproof enclosure.

11.2.3.4 Vestibule. Where a vestibule is provided, the doorway into the vestibule shall be protected with an approved fire door assembly having a 1½-hour fire protection rating, and the fire door assembly from the vestibule to the smokeproof enclosure shall have not less than a 20-minute fire protection rating. Doors shall be designed to minimize air leakage in accordance with 11.2.1.1.4 and shall be self-closing or shall be automatic closing by actuation of a smoke detector within 10 ft (3 m) of the vestibule door.

11.2.3.5 Discharge. Every smokeproof enclosure shall discharge into a public way, into a yard or court having direct access to a public way, or into an exit passageway. Such exit passageways shall be without openings other than the entrance from the smokeproof enclosure and the door to the outside yard, court, or public way. The exit passageway shall be separated from the remainder of the building by a 2-hour fire resistance rating.

11.2.3.6 Access. Access to the smokeproof enclosure shall be by way of a vestibule or by way of an exterior balcony.

Exception: The requirement of 11.2.3.6 shall not apply to smokeproof enclosures consisting of a pressurized enclosure complying with 11.2.3.9.

11.2.3.7 Natural Ventilation. Smokeproof enclosures using natural ventilation shall comply with 11.2.3.3 and the following:

(1) Where access to the enclosure is by means of an open exterior balcony, the door assembly to the enclosure shall have a 1½-hour fire protection rating and shall be self-closing or shall be automatic closing by actuation of a smoke detector.
(2) Openings adjacent to the exterior balconies specified in 11.2.3.7(1) shall be protected in accordance with 11.2.2.7.4.
(3) Every vestibule shall have a net area of not less than 16 ft^2(1.5 m^2) of opening in an exterior wall facing an exterior court, yard, or public space not less than 20 ft (6.1 m) in width.
(4) Every vestibule shall have a minimum dimension of not less than the required width of the corridor leading to it and a dimension of not less than 72 in. (183 cm) in the direction of travel.

11.2.3.8 Mechanical Ventilation. Smokeproof enclosures using mechanical ventilation shall comply with 11.2.3.3 and the following.

(1) Vestibules shall have a dimension of not less than 44 in. (112 cm) in width and not less than 72 in. (183 cm) in direction of travel.
(2) Vestibules shall be provided with not less than one air change per minute, the exhaust shall be 150 percent of the supply, and the following criteria also shall be met:
   (a) Supply air shall enter and exhaust air shall discharge from the vestibule through separate tightly constructed ducts used only for such purposes.
   (b) Supply air shall enter the vestibule within 6 in. (15.2 cm) of the floor level.
   (c) The top of the exhaust register shall be located not more than 6 in. (15.2 cm) below the top of the trap and shall be entirely within the smoke trap area.
   (d) Doors, when in the open position, shall not obstruct duct openings.
   (e) Controlling dampers shall be permitted in duct openings if needed to meet the design requirements.
(3) To serve as a smoke and heat trap and to provide an upward-moving air column, the vestibule ceiling shall be not less than 20 in. (50.8 cm) higher than the door opening into the vestibule, unless such height is permitted to be decreased where justified by engineering design and field testing.
(4) The smokeproof enclosure shall be provided with a dampered relief opening at the top and supplied mechanically with sufficient air to discharge at least 2500 ft^3/min (70.8 m^3/min) through the relief opening while maintaining a positive pressure of not less than 0.10 in. water column (25 Pa) in the enclosure relative to the vestibule with all doors closed.

11.2.3.9 Enclosure Pressurization.

11.2.3.9.1* Smokeproof enclosures using pressurization shall use an approved engineered system with a design pressure difference across the barrier of not less than 0.05 in. water column (12.5 Pa) in sprinklered buildings, or 0.10 in. water column (25 Pa) in nonsprinklered buildings, and shall be capable of maintaining these pressure differences under likely conditions of stack effect or wind. The pressure difference across doors shall not exceed that which allows the door to begin to be opened by a force of 30 lbf (133 N) in accordance with 11.2.1.4.4.

11.2.3.9.2 Equipment and ductwork for pressurization shall be located as specified by one of the following:

(1) Exterior to the building and directly connected to the enclosure by ductwork enclosed in noncombustible or limited-combustible construction
(2) Within the enclosure with intake and exhaust air directly to the outside or through ductwork enclosed by a 2-hour fire-resistive rating
(3) Within the building if separated from the remainder of the building, including other mechanical equipment, by a 2-hour fire-resistive rating

Exception: Where the building, including the enclosure, is protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3, the fire resistance rating shall be permitted to be not less than 1 hour.

11.2.3.9.3 In all cases specified by 11.2.3.9.2(1) through 11.2.3.9.2(3), openings into the required fire resistance rating shall be limited to those needed for maintenance and operation and shall be protected by self-closing fire protection–rated devices.

11.2.3.10 Activation of Mechanical Ventilation and Pressurized Enclosure Systems.

11.2.3.10.1 For both mechanical ventilation and pressurized enclosure systems, the activation of the systems shall be initiated by a smoke detector installed in an approved location within 10 ft (3 m) of the entrance to the smokeproof enclosure.

11.2.3.10.2 The required mechanical systems shall operate upon the activation of the smoke detectors specified in 11.2.3.10.1 and by manual controls accessible to the fire department. The required system also shall be initiated by the following, if provided:

(1) Waterflow signal from a complete automatic sprinkler system
(2) General evacuation alarm signal *(see 55.2.3)*

11.2.3.11 Door Closers. The activation of an automatic-closing device on any door in the smokeproof enclosure shall activate all other automatic-closing devices on doors in the smokeproof enclosure.

11.2.3.12 Standby Power. Standby power for mechanical ventilation equipment shall be provided by an approved, self-contained generator that is set to operate whenever there is a loss of power in the normal house current. The generator shall be located in a room having a minimum 1-hour fire resistance–rated separation from the remainder of the building. The generator shall have a fuel supply not less than that which is adequate to operate the equipment for 2 hours.

11.2.3.13 Testing. Before the mechanical equipment is accepted by the authority having jurisdiction, it shall be tested to confirm that the mechanical equipment is operating in compliance with the requirements of 11.2.3. All operating parts of the system shall be tested semiannually by approved personnel, and a log shall be kept of the results.

11.2.4 Horizontal Exits.

11.2.4.1 General.

11.2.4.1.1 Where horizontal exits are used in the means of egress, they shall conform to the general requirements of Section 11.1 and the requirements of 11.2.4.

11.2.4.1.2* Horizontal exits shall be permitted to be substituted for other exits where the total egress capacity of the other exits (stairs, ramps, doors leading outside the building) is not less than half that required for the entire area of the building or connected buildings, and provided that none of the other exits is a horizontal exit.

Exception: The requirement of 11.2.4.1.2 shall not apply where otherwise provided in 19.2.2.5 and 21.2.2.5.

11.2.4.2 Fire Compartments.

11.2.4.2.1 Every fire compartment for which credit is permitted in connection with a horizontal exit shall have, in addition to the horizontal exit or exits, at least one exit, but not less than 50 percent of the required number and capacity of exits, that is not a horizontal exit. Any fire compartment not having an exit leading outside shall be considered as part of an adjoining compartment with an exit leading to the outside.

Exception: The requirement of 11.2.4.2.1 shall not apply where otherwise provided in 19.2.2.5 and 21.2.2.5.

11.2.4.2.2 Every horizontal exit for which credit is given shall be arranged so that there are continuously available paths of travel leading from each side of the exit to stairways or other means of egress leading to outside the building.

11.2.4.2.3 Wherever either side of the horizontal exit is occupied, the doors used in connection with the horizontal exit shall be unlocked from the egress side.

Exception: The requirement of 11.2.4.2.3 shall not apply where otherwise provided in Chapter 19 and Chapter 21.

11.2.4.2.4 The floor area on either side of a horizontal exit shall be sufficient to hold the occupants of both floor areas and shall provide at least 3 ft^2 (0.28 m^2) clear floor area per person.

Exception: Special floor area requirements shall be permitted where provided in 19.2.2.5 and 21.2.2.5.

11.2.4.3 Fire Barriers.

11.2.4.3.1 Fire barriers separating building areas between which there are horizontal exits shall have a 2-hour fire resistance rating and shall provide a separation that is continuous to ground.

Exception: Where a fire barrier provides a horizontal exit in any story of a building, such fire barrier shall not be required on other stories, provided that the following criteria are met:

(1) The stories on which the fire barrier is omitted are separated from the story with the horizontal exit by construction having a fire resistance rating at least equal to that of the horizontal exit fire barrier.
(2) Vertical openings between the story with the horizontal exit and the open fire area story are enclosed with construction having a fire resistance rating at least equal to that of the horizontal exit fire barrier.
(3) All required exits, other than horizontal exits, discharge directly to the outside.

11.2.4.3.2 Where fire barriers serving horizontal exits terminate at outside walls, and the outside walls are at an angle of less than 180 degrees for a distance of 10 ft (3 m) on each side of the horizontal exit, the outside walls shall have not less than a 1-hour fire resistance rating with not less than ¾-hour fire protection–rated opening protectives for a distance of 10 ft (3 m) on each side of the horizontal exit.

11.2.4.3.3 Fire barriers forming horizontal exits shall not be penetrated by ducts.

Exception No. 1: The requirement of 11.2.4.3.3 shall not apply to buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

Exception No. 2: The requirement of 11.2.4.3.3 shall not apply to duct penetrations permitted in 21.2.2.5.3 and protected by combination fire dampers/smoke leakage–rated dampers that meet the smoke damper actuation requirements of 8.11.6.7.

11.2.4.3.4 Any opening in fire barriers forming horizontal exits shall be protected as provided in Section 8.7 and Section 8.8.

11.2.4.3.5 Doors in horizontal exits shall comply with 11.2.1.4, unless they are sliding doors as otherwise provided in 29.2.2.5.2 and 30.2.2.5.2.

11.2.4.3.6 Swinging fire doors shall be permitted in horizontal exits, provided that the doors swing in the direction of egress travel.

11.2.4.3.7* Doors in horizontal exits shall be designed and installed to minimize air leakage in accordance with 11.2.1.1.4.

11.2.4.3.8* All fire doors in horizontal exits shall be self-closing or automatic closing in accordance with 11.2.1.8. Horizontal exit doors located across a corridor shall be automatic closing in accordance with 11.2.1.8.2.

11.2.4.4 Bridges and Balconies.

11.2.4.4.1 Each bridge or balcony used in conjunction with horizontal exits shall have guards and handrails in conformity with the requirements of 11.2.2.4.

11.2.4.4.2 Every bridge or balcony shall be not less than the width of the door to which it leads and shall be not less than 44 in. (112 cm) wide for new construction.

11.2.4.4.3 Where the bridge or balcony serves as a horizontal exit in one direction, the door shall be required to swing only in the direction of egress travel.

11.2.4.4.4 Where the bridge or balcony serves as a horizontal exit in both directions, doors shall be provided in pairs that swing in opposite directions. Only the door swinging in the direction of egress travel shall be included in the determination of egress capacity.

Exception: The requirement of 11.2.4.4.4 shall not apply if the bridge or balcony has sufficient floor area to accommodate the occupant load of either connected building or fire area on the basis of 3 ft^2 (0.28 m^2) per person.

11.2.4.4.5 In climates subject to the accumulation of snow and ice, the bridge or balcony floor shall be protected to prevent the accumulation of snow and ice.

11.2.4.4.6 In both of the connected buildings or fire areas, all wall openings, any part of which is within 10 ft (3 m) of any bridge or balcony, as measured horizontally or below, shall be protected with fire door assemblies or fixed fire window assemblies having a ¾-hour fire protection rating.

11.2.5 Ramps.

11.2.5.1 General. Every ramp used as a component in a means of egress shall conform to the general requirements of Section 11.1 and to the requirements of 11.2.5.

11.2.5.2 Dimensional Criteria. Dimensional criteria for ramps shall be in accordance with Table 11.2.5.2.

Table 11.2.5.2 Ramp Dimensional Criteria

Feature	Dimensional Criteria
Minimum width clear of all obstructions, except projections not more than 4½ in. (11.4 cm) at or below handrail height on each side	44 in. (112 cm)
Maximum slope	1 in 12
Maximum cross slope	1 in 48
Maximum rise for a single ramp	30 in. (76 cm)

Exception No. 1: The maximum slope requirement shall not apply to ramps as otherwise provided in 16.2.2.6.

Exception No. 2: The requirements of Table 11.2.5.2 shall not apply to industrial equipment access areas as otherwise provided in 29.2.5.3.

Exception No. 3: Ramps providing access to vehicles, vessels, mobile structures, and aircraft shall not be required to comply with the maximum slope or maximum rise for a single ramp run.

11.2.5.3 Ramp Details.

11.2.5.3.1 Construction. Ramp construction shall be as follows:

(1) All ramps serving as required means of egress shall be of permanent fixed construction.
(2) Each ramp in buildings required by this *Code* to be of Type I or Type II construction shall be noncombustible or limited-combustible throughout. The ramp floor and landings shall be solid and without perforations.

11.2.5.3.2 Landings. Ramp landings shall comply with 11.2.5.3.2(A) and 11.2.5.3.2(B):

(A) Ramps shall have landings located at the top, at the bottom, and at doors opening onto the ramp. The slope of the landing shall not be steeper than 1 in 48. Every landing shall have a width not less than the width of the ramp. Every landing shall be not less than 60 in. (152 cm) long in the direction of travel.

(B) Any changes in travel direction shall be made only at landings. Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel.

11.2.5.3.3 Drop-offs. Ramps and landings with drop-offs shall have curbs, walls, railings, or projecting surfaces that prevent people from traveling off the edge of the ramp. Curbs or barriers shall be not less than 2 in. (5.1 cm) in height.

11.2.5.4 Guards and Handrails. Guards complying with 11.2.2.4 shall be provided for ramps. Handrails complying with 11.2.2.4 shall be provided along both sides of a ramp run with a rise greater than 6 in. (15.2 cm). The height of handrails and guards shall be measured vertically to the top of the guard or rail from the walking surface adjacent thereto.

Exception: The requirement of 11.2.5.4 shall not apply to guards and handrails provided for ramped aisles in accordance with 16.2.5.6.

11.2.5.5 Enclosure and Protection of Ramps. Ramps in a required means of egress shall be enclosed or protected as a stair in accordance with 11.2.2.5 and 11.2.2.7. The use of Exception No. 2 to 11.2.2.7.3 shall be prohibited.

11.2.5.6 Special Provisions for Outside Ramps.

11.2.5.6.1* Visual Protection. Outside ramps shall be arranged to avoid any impediments to their use by persons having a fear of high places. For ramps more than three stories in height, any arrangement intended to meet this requirement shall be at least 4 ft (122 cm) in height.

11.2.5.6.2* Water Accumulation. Outside ramps and landings shall be designed to minimize water accumulation on their surfaces.

11.2.6* Exit Passageways.

11.2.6.1* General. Exit passageways used as exit components shall conform to the general requirements of Section 11.1 and to the requirements of 11.2.6.

11.2.6.2 Enclosure. An exit passageway shall be separated from other parts of the building as specified in 11.1.3.2.

Exception: Fire window assemblies in accordance with 8.7.5 shall be permitted to be installed in separations required by 11.1.3.2 where the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

11.2.6.3 Stair Discharge. An exit passageway that serves as a discharge from a stair enclosure shall have not less than the same fire resistance rating and opening protective fire protection rating as those required for the stair enclosure.

11.2.6.4* Width. The width of an exit passageway shall be adequate to accommodate the aggregate required capacity of all exits that discharge through it.

Exception No. 1: Where an exit passageway serves occupants of the level of exit discharge as well as other stories, the capacity shall not be required to be aggregated.

Exception No. 2: As provided in 27.2.2.7, an exit passageway in a mall building shall be permitted to accommodate occupant loads from the mall and the tenant spaces independently.

11.2.6.5 Floor. The floor shall be solid and without perforations.

11.2.7 Escalators and Moving Walks. Escalators and moving walks shall not constitute any part of the required means of egress.

11.2.8* Fire Escape Stairs. Fire escape stairs shall not constitute any of the required means of egress.

11.2.9 Fire Escape Ladders.

11.2.9.1 General. Fire escape ladders complying with 11.2.9.2 and 11.2.9.3 shall be permitted in the means of egress only where providing one of the following:

(1) A second means of egress from storage elevators as permitted in 30.7.2
(2) A means of egress from towers and elevated platforms around machinery or similar spaces subject to occupancy not to exceed three persons who are all capable of using the ladder
(3) A secondary means of egress from boiler rooms or similar spaces subject to occupancy not to exceed three persons who are all capable of using the ladder

11.2.9.2 Construction and Installation.

11.2.9.2.1 Fire escape ladders shall comply with ANSI A14.3, *Safety Code for Fixed Ladders.*

Exception: Industrial stairs complying with the minimum requirements for fixed stairs of ANSI A1264.1, Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems, shall be permitted where fire escape ladders are permitted in accordance with 29.2.2.9.

11.2.9.2.2 Ladders shall be installed with a pitch that exceeds 75 degrees.

11.2.9.3 Access. The lowest rung of any ladder shall be not more than 12 in. (30.5 cm) above the level of the surface beneath it.

11.2.10 Slide Escapes.

11.2.10.1 General.

11.2.10.1.1 A slide escape shall be permitted as a component in a means of egress where permitted in Chapter 16 through Chapter 30.

11.2.10.1.2 Each slide escape shall be of an approved type.

11.2.10.2 Capacity.

11.2.10.2.1 Slide escapes, where permitted as required means of egress, shall be rated at a capacity of 60 persons.

11.2.10.2.2 Slide escapes shall not constitute more than 25 percent of the required egress capacity from any building or structure or any individual story thereof.

Exception: The requirement of 11.2.10.2.2 shall not apply where otherwise permitted in 29.2.2.10.

11.2.11* Alternating Tread Devices.

11.2.11.1 Alternating tread devices complying with 11.2.11.2 shall be permitted in the means of egress only where providing one of the following:

(1) A second means of egress from storage elevators as permitted in 30.7.2
(2) A means of egress from towers and elevated platforms around machinery or similar spaces subject to occupancy not to exceed three persons who are all capable of using the alternating tread device
(3) A secondary means of egress from boiler rooms or similar spaces subject to occupancy not to exceed three persons who are all capable of using the alternating tread device

11.2.11.2 Alternating tread devices shall comply with the following:

(1) Handrails shall be provided on both sides of alternating tread devices in accordance with 11.2.2.4.4.
(2) The clear width between handrails shall be not less than 17 in. (43.2 cm) and not more than 24 in. (61 cm).
(3) Headroom shall be not less than 6 ft 8 in. (2 m).
(4) The angle of the device shall be between 50 degrees and 68 degrees to horizontal.
(5) The height of the riser shall not exceed 9.5 in. (24.1 cm).
(6) Treads shall have a projected tread depth of not less than 5.8 in. (14.7 cm), measured in accordance with 11.2.2.3.5, with each tread providing 9.5 in. (24.1 cm) of depth, including tread overlap.
(7) A distance of not less than 6 in. (15.2 cm) shall be provided between the stair handrail and any other object.
(8) The initial tread of the stair shall begin at the same elevation as the platform, landing, or floor surface.
(9) The alternating treads shall not be laterally separated by a distance of more than 2 in. (5.0 cm).
(10) The occupant load served shall not exceed three.

11.2.12 Areas of Refuge.

11.2.12.1 General. An area of refuge used as part of a required accessible means of egress in accordance with 11.5.4, or used as a part of any required means of egress, shall conform to the following:

(1) The general requirements of Section 11.1
(2) The requirements of 11.2.12.2 and 11.2.12.3

Exception: The requirement of 11.2.12.1(2) shall not apply to areas of refuge consisting of stories of buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

11.2.12.2 Accessibility.

11.2.12.2.1 Required portions of an area of refuge shall be accessible from the space they serve by an accessible means of egress.

11.2.12.2.2 Required portions of an area of refuge shall have access to a public way via an exit or an elevator without returning to the building spaces used for travel to the area of refuge.

11.2.12.2.3* Where the exit providing egress from an area of refuge to a public way that is in accordance with 11.2.12.2.2 includes stairs, the clear width of landings and stair flights, measured between handrails and at all points below handrail height, shall not be less than 48 in. (122 cm).

Exception No. 1: The minimum 48-in. (122-cm) clear width shall not be required where the area of refuge is separated from the remainder of the story by a horizontal exit meeting the requirements of 11.2.4. (See also 11.2.12.3.4.)

Exception No. 2: For stairs where egress is in the descending direction, a clear width of not less than 37 in. (94 cm), measured at and below handrail height, shall be permitted if approved alternative measures are provided that do not necessitate carrying occupied wheelchairs on the stairs.

11.2.12.2.4* Where an elevator provides access from an area of refuge to a public way that is in accordance with 11.2.12.2.2, the elevator shall be provided with fire fighters emergency operation in compliance with ASME A17.1, *Safety Code for Elevators and Escalators*. The power supply shall be protected against interruption from fire occurring within the building but outside the area of refuge. The elevator shall be located in a shaft system meeting the requirements for smokeproof enclosures in accordance with 11.2.3.

Exception No. 1: The smokeproof enclosure shall not be required for areas of refuge that are more than 1000 ft ^{2} (93 m^2) and that are created by a horizontal exit meeting the requirements of 11.2.4.

Exception No. 2: The smokeproof enclosure shall not be required for elevators complying with 11.2.13.

11.2.12.2.5 The area of refuge shall be provided with a two-way communications system for communication between the area of refuge and a central control point. The door to the stair enclosure or the elevator door and the associated portion of the area of refuge that the stair enclosure door or elevator door serves shall be identified by signage. *(See 11.2.12.3.5.)*

11.2.12.2.6* Instructions for summoning assistance, via the two-way communications system, and written identification of the area of refuge location shall be posted adjacent to the two-way communications system.

11.2.12.3 Details.

11.2.12.3.1* Each area of refuge shall be sized to accommodate one wheelchair space of 30 in. × 48 in. (76 cm × 122 cm) for each 200 occupants, or fraction thereof, based on the occupant load served by the area of refuge. Such wheelchair spaces shall maintain the width of a means of egress to not less than that required for the occupant load served, but to not less than 36 in. (91 cm).

11.2.12.3.2* For any area of refuge that does not exceed 1000 ft^2 (93 m^2), it shall be demonstrated by calculation or test that tenable conditions are maintained within the area of refuge for a period of 15 minutes when the exposing space on the other side of the separation creating the area of refuge is subjected to the maximum expected fire conditions.

11.2.12.3.3 Access to any designated wheelchair space in an area of refuge shall not be through more than one adjoining wheelchair space.

11.2.12.3.4* Each area of refuge shall be separated from the remainder of the story by a barrier with not less than a 1-hour fire resistance rating, unless a greater rating is required in other provisions of this *Code*.

(A) Barriers, and any openings in them, shall minimize air leakage and restrict the passage of smoke.

(B) Doors in barriers shall be designed to minimize air leakage in accordance with 11.2.1.1.4.

(C) Doors in barriers shall have not less than a 20-minute fire protection rating, unless a greater rating is required in other provisions of this *Code*, and shall be either self-closing or automatic closing in accordance with 11.2.1.8.

(D) Ducts shall be permitted to penetrate such barriers, unless prohibited in other provisions of this *Code*, and shall be protected by a smoke damper in accordance with 8.11.6 or other approved means to resist the transfer of smoke into the area of refuge.

11.2.12.3.5 Signs complying with 11.10.8.1 and 11.10.8.2 that read "area of refuge," that are illuminated in accordance with exit sign illumination requirements, and that include the international symbol of accessibility shall be provided to identify the location of areas of refuge as follows:

(1) At each door providing access to the area of refuge
(2) At all exits not providing an accessible means of egress *(see 3.3.343.1, Accessible Means of Egress)*
(3) Where necessary to indicate clearly the direction to an area of refuge

11.2.12.3.6 Tactile signage complying with ICC/ANSI A117.1 shall be located at each door to an area of refuge.

11.2.13 Elevators in Towers.

11.2.13.1* General. An elevator complying with the requirements of Chapter 54 and 11.2.13 shall be permitted to be used as a second means of egress from towers as defined in 3.3.550 *(see 3.3.550, Tower)*, provided that the following criteria are met:

(1) The tower and any attached structure shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.
(2) The tower shall be subject to occupancy not to exceed 90 persons.
(3) Primary egress discharges shall be directly to the outside.

(4) No areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3 shall exist in the tower or attached structure.
(5) One hundred percent of the egress capacity shall be provided independent of the elevators.
(6) An evacuation plan shall be implemented, specifically including the elevator, and staff personnel shall be trained in operations and procedures for elevator emergency use in normal operating mode prior to fire fighter recall.
(7) The tower shall not be used by the general public.

11.2.13.2 Elevator Evacuation System Capacity.

11.2.13.2.1 The elevator car shall have a capacity of not less than eight persons.

11.2.13.2.2 The elevator lobby shall have a capacity of not less than 50 percent of the occupant load of the area served by the lobby. The capacity shall be calculated by using 3 ft^2 (0.28 m^2) per person and shall also include one wheelchair space of 30 in. × 48 in. (76 cm × 122 cm) for each 50 persons, or fraction thereof, of the total occupant load served by that lobby.

11.2.13.3 Elevator Lobby. On every floor served by the elevator, there shall be an elevator lobby. Barriers forming the elevator lobby shall have a fire resistance rating of not less than 1 hour and shall be arranged as a smoke barrier in accordance with Section 8.11.

11.2.13.4 Elevator Lobby Doors. Elevator lobby doors shall have a fire protection rating of at least 1 hour. The transmitted temperature end point shall not exceed 450°F (250°C) above ambient at the end of 30 minutes of the fire exposure specified in the test method referenced in 8.7.5.2. Elevator lobby doors shall be self-closing or automatic closing in accordance with 11.2.1.8.

11.2.13.5 Door Activation. The elevator lobby doors shall close in response to a signal from a smoke detector located directly outside the elevator lobby adjacent to or on each door opening. Closing of lobby doors in response to a signal from the building fire alarm system shall be permitted. Closing of one elevator lobby door by means of a smoke detector or a signal from the building fire alarm system shall result in closing of all elevator lobby doors serving that elevator evacuation system.

11.2.13.6* Water Protection. Building elements shall be used to restrict water exposure of elevator equipment.

11.2.13.7* Power and Control Wiring. Elevator equipment, elevator communications, elevator machine room cooling, and elevator controller cooling shall be supplied by both normal and standby power. Wiring for power and control shall be located and properly protected to ensure at least 1 hour of operation in the event of a fire.

11.2.13.8* Communications. Two-way communication systems shall be provided between elevator lobbies and a central control point and between elevator cars and a central control point. Communications wiring shall be protected to ensure at least 1 hour of operation in the event of fire.

11.2.13.9* Elevator Operation. Elevators shall be provided with fire fighters emergency operation in accordance with ASME A17.1, *Safety Code for Elevators and Escalators.*

11.2.13.10 Maintenance. Where an elevator lobby is served by only one elevator car, the elevator evacuation system shall have a program of scheduled maintenance during times of building shutdown or low building activity. Repairs shall be performed within 24 hours of breakdown.

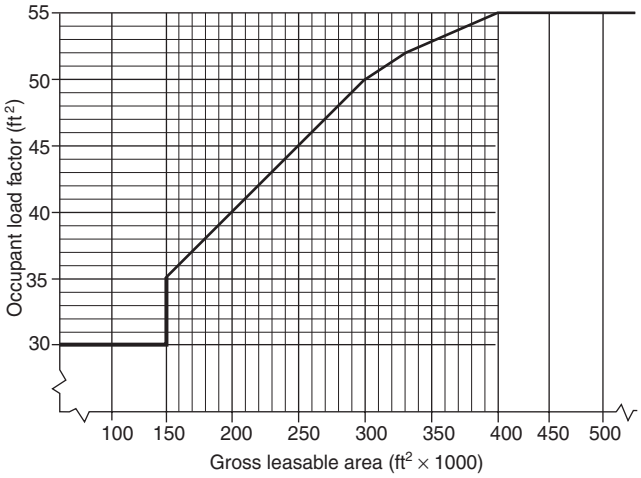
11.2.13.11 Signage. Signage shall comply with 11.10.8.2.

11.3 Capacity of Means of Egress.

11.3.1 Occupant Load.

11.3.1.1 Sufficient Capacity for Occupant Load. The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof.

11.3.1.2* Occupant Load Factor. The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use, as specified in Table 11.3.1.2 and Figure 11.3.1.2. Where both gross and net area figures are given for the same occupancy, calculations shall be made by applying the gross area figure to the gross area of the portion of the building devoted to the use for which the gross area figure is specified, and by applying the net area figure to the net area of the use for which the net area figure is specified.



Note: For SI units, 1 ft^2 = 0.093 m^2.

FIGURE 11.3.1.2 Mall Building Occupant Load Factors.

11.3.1.3 Occupant Load Increases.

11.3.1.3.1 The occupant load in any building or portion thereof shall be permitted to be increased from the occupant load established for the given use in accordance with 11.3.1.2 where all other requirements of this *Code* are also met, based on such increased occupant load.

11.3.1.3.2 The authority having jurisdiction shall be permitted to require an approved aisle, seating, or fixed equipment diagram to substantiate any increase in occupant load and shall be permitted to require that such a diagram be posted in an approved location.

11.3.1.4 Exits Serving More than One Story. Where exits serve more than one story, only the occupant load of each story considered individually shall be used in computing the required capacity of the exits at that story, provided that the

Table 11.3.1.2 Occupant Load Factor

Use	ft^2 (per person)[1]	m^2 (per person)[1]
Assembly Use		
Concentrated use, without fixed seating	7 net	0.65 net
Less concentrated use, without fixed seating	15 net	1.4 net
Bench-type seating	1 person/ 18 linear in.	1 person/45.7 linear cm
Fixed seating	Number of fixed seats	Number of fixed seats
Waiting spaces	See 16.1.6.1	See 16.1.6.1
Kitchens	100	9.3
Library stack areas	100	9.3
Library reading rooms	50 net	4.6 net
Swimming pools	50—of water surface	4.6—of water surface
Swimming pool decks	30	2.8
Exercise rooms with equipment	50	4.6
Exercise rooms without equipment	15	1.4
Stages	15 net	1.4 net
Lighting and access catwalks, galleries, gridirons	100 net	9.3 net
Casinos and similar gaming areas	11	1
Skating rinks	50	4.6
Educational Use		
Classrooms	20 net	1.9 net
Shops, laboratories, vocational rooms	50 net	4.6 net
Day-Care Use	35 net	3.3 net
Health Care Use		
Inpatient treatment departments	240	22.3
Sleeping departments	120	11.1
Detention and Correctional Use	120	11.1
Residential Use		
Hotels and dormitories	200	18.6
Apartment buildings	200	18.6
Board and care, large	200	18.6
Industrial Use		
General and high hazard industrial	100	9.3
Special purpose industrial	NA	NA
Business Use	100	9.3
Storage Use (other than mercantile storerooms)	NA	NA
Mercantile Use		
Sales area on street floor[2,3]	30	2.8
Sales area on two or more street floors[3]	40	3.7
Sales area on floor below street floor[3]	30	2.8
Sales area on floors above street floor[3]	60	5.6
Floors or portions of floors used only for offices	See business use	See business use
Floors or portions of floors used only for storage, receiving, and shipping, and not open to general public	300	27.9
Mall buildings	Per factors applicable to use of space[4]	Per factors applicable to use of space[4]

Note: NA = not applicable. The occupant load is the maximum probable number of occupants present at any time.

[1]All factors expressed in gross area unless marked "net."

[2]For the purpose of determining occupant load in mercantile occupancies where, due to differences in grade of streets on different sides, two or more floors directly accessible from streets (not including alleys or similar backstreets) exist, each such floor is considered a street floor. The occupant load factor is one person for each 40 ft^2 (3.7 m^2) of gross floor area of sales space.

[3]For the purposes of determining occupant load in mercantile occupancies with no street floor, but with access directly from the street by stairs or escalators, the floor at the point of entrance to the mercantile occupancy is considered the street floor. *(See 3.3.221.2, Street Floor.)*

[4]The portions of the mall, where considered a pedestrian way and not used as gross leasable area, are not assessed an occupant load based on Table 11.3.1.2. However, means of egress from a mall pedestrian way are provided for an occupant load determined by dividing the gross leasable area of the mall building (not including anchor stores) by the appropriate lowest whole number occupant load factor from Figure 11.3.1.2.

Each individual tenant space has means of egress to the outside or to the mall based on occupant loads figured by using the appropriate occupant load factor from Table 11.3.1.2.

Each individual anchor store has means of egress independent of the mall.

required egress capacity of the exit is not decreased in the direction of egress travel.

11.3.1.5 Capacity from a Point of Convergence. Where means of egress from a story above and a story below converge at an intermediate story, the capacity of the means of egress from the point of convergence shall be not less than the sum of the capacity of the two means of egress.

11.3.1.6 Egress Capacity from Balconies and Mezzanines. Where any required egress capacity from a balcony or mezzanine passes through the room below, that required capacity shall be added to the required egress capacity of the room in which it is located.

11.3.2 Measurement of Means of Egress. The width of means of egress shall be measured in the clear at the narrowest point of the exit component under consideration.

Exception: Projections not more than 4½ in. (114 mm) on each side shall be permitted at 38 in. (96 cm) and below.

11.3.3 Egress Capacity.

11.3.3.1 Egress capacity for approved components of means of egress shall be based on the capacity factors shown in Table 11.3.3.1.

Table 11.3.3.1 Capacity Factors

	Stairways		Level Components and Ramps	
Occupancy Area	**in.***	**cm***	**in.***	**cm***
Board and care	0.4	1.0	0.2	0.5
Health care, sprinklered	0.3	0.8	0.2	0.5
Health care, nonsprinklered	0.6	1.5	0.5	1.3
High hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3.	0.7	1.8	0.4	1.0
All others	0.3	0.75	0.2	0.5

*Per person.

11.3.3.2 The required capacity of a corridor shall be the occupant load that utilizes the corridor for exit access divided by the required number of exits to which the corridor connects, but the corridor capacity shall be not less than the required capacity of the exit to which the corridor leads.

11.3.4 Minimum Width.

11.3.4.1* The width of any means of egress shall be not less than that required for a given egress component in Chapter 11 or Chapter 16 through Chapter 30, and shall be not less than 36 in. (91 cm).

Exception No. 1: The width of exit access formed by furniture and movable partitions, serving not more than six people and having a length not exceeding 50 ft (15 m), shall be not less than 18 in. (45.7 cm) at and below a height of 38 in. (96 cm), or 28 in. (71 cm) above a height of 38 in. (96 cm), provided that widths not less than 36 in. (91 cm) for exit access are provided without moving permanent walls.

Exception No. 2: The requirement of 11.3.4.1 shall not apply to doors as otherwise provided for in 11.2.1.2.4.

Exception No. 3: The requirement of 11.3.4.1 shall not apply to aisles and aisle accessways as otherwise provided in 16.2.5.5 through 16.2.5.8.

Exception No. 4: The requirement of 11.3.4.1 shall not apply to industrial equipment access as otherwise provided in 29.2.5.3.

11.3.4.2 Where a single exit access leads to an exit, its capacity in terms of width shall be not less than the required capacity of the exit to which it leads. Where more than one exit access leads to an exit, each shall have a width adequate for the number of persons it accommodates.

11.4 Number of Means of Egress.

11.4.1 General.

11.4.1.1 The number of means of egress from any balcony, mezzanine, story, or portion thereof shall be not less than two.

Exception No. 1: The requirement of 11.4.1.1 shall not apply where a single means of egress is permitted in Chapter 16 through Chapter 30.

Exception No. 2: A mezzanine or balcony shall be permitted to have a single means of egress, provided that the common path of travel limitations of Chapter 16 through Chapter 30 are met.

11.4.1.2 The number of means of egress from any story or portion thereof shall be as follows:

(1) Occupant load more than 500 but not more than 1000—not less than 3
(2) Occupant load more than 1000—not less than 4

11.4.1.3 Accessible means of egress in accordance with 11.5.4 that do not utilize elevators shall be permitted to serve as any or all of the required minimum number of means of egress.

11.4.1.4 The occupant load of each story considered individually shall be required to be used in computing the number of means of egress at each story, provided that the required number of means of egress is not decreased in the direction of egress travel.

11.4.1.5 Doors, other than the hoistway door; the elevator car door; and doors that are readily openable from the car side without a key, tool, special knowledge, or special effort, shall be prohibited at the point of access to an elevator car.

11.4.1.6 Elevator lobbies shall have access to at least one exit. Such exit access shall not require the use of a key, tool, special knowledge, or special effort.

11.5 Arrangement of Means of Egress.

11.5.1 General.

11.5.1.1 Exits shall be located and exit access shall be arranged so that exits are readily accessible at all times.

11.5.1.2* Where exits are not immediately accessible from an open floor area, continuous passageways, aisles, or corridors leading directly to every exit shall be maintained and shall be arranged to provide access for each occupant to not less than two exits by separate ways of travel. Exit access corridors shall

provide access to not less than two approved exits without passing through any intervening rooms other than corridors, lobbies, and other spaces permitted to be open to the corridor.

Exception No. 1: The requirement of 11.5.1.2 shall not apply where a single exit is permitted in Chapter 16 through Chapter 30.

Exception No. 2: Where common paths of travel are permitted for an occupancy in Chapter 16 through Chapter 30, such common paths of travel shall be permitted but shall not exceed the limit specified.

Exception No. 3: Corridors that are not required to be fire resistance rated shall be permitted to discharge into open floor plan areas.

11.5.1.3 Where more than one exit is required from a building or portion thereof, such exits shall be remotely located from each other and shall be arranged and constructed to minimize the possibility that more than one has the potential to be blocked by any one fire or other emergency condition.

11.5.1.4* Where two exits or exit access doors are required, they shall be located at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. Where exit enclosures are provided as the required exits and are interconnected by not less than a 1-hour fire resistance–rated corridor, exit separation shall be permitted to be measured along the line of travel within the corridor.

Exception: In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, the minimum separation distance between two exits or exit access doors measured in accordance with 11.5.1.4 shall be not less than one-third the length of the maximum overall diagonal dimension of the building or area to be served.

11.5.1.5 Where more than two exits or exit access doors are required, at least two of the required exits or exit access doors shall be arranged to comply with the minimum separation distance requirement. The other exits or exit access doors shall be located so that, if one becomes blocked, the others are available.

11.5.1.6* Interlocking or scissor stairs shall only be permitted to be considered as a single exit.

11.5.1.7* Exit access shall be arranged so that there are no dead ends in corridors, unless permitted by and limited to the length specified in Chapter 16 through Chapter 30.

11.5.1.8 Exit access from rooms or spaces shall be permitted to be through adjoining or intervening rooms or areas, provided that such adjoining rooms are accessory to the area served. Foyers, lobbies, and reception rooms constructed as required for corridors shall not be construed as intervening rooms. Exit access shall be arranged so that it is not necessary to pass through any area identified under hazardous area protection in Chapter 16 through Chapter 30.

11.5.2 Impediments to Egress. See also 11.1.9 and 11.2.1.5.

11.5.2.1 Access to an exit shall not pass through kitchens, storerooms other than as provided in 27.2.5.8, restrooms, closets, bedrooms or similar spaces, or other rooms or spaces subject to locking, unless passage through such rooms or spaces is permitted for the occupancy by Chapter 19, Chapter 20, and Chapter 21.

11.5.2.2* Exit access and exit doors shall be designed and arranged to be clearly recognizable. Hangings or draperies shall not be placed over exit doors or located to conceal or obscure any exit. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.

Exception: Curtains shall be permitted across means of egress openings in tent walls if the following criteria are met:

(1) They are distinctly marked in contrast to the tent wall so as to be recognizable as means of egress.
(2) They are installed across an opening that is at least 6 ft (1.8 m) in width.
(3) They are hung from slide rings or equivalent hardware so as to be readily moved to the side to create an unobstructed opening in the tent wall of the minimum width required for door openings.

11.5.3 Exterior Ways of Exit Access.

11.5.3.1 Exit access shall be permitted to be by means of any exterior balcony, porch, gallery, or roof that conforms to the requirements of this chapter.

11.5.3.2 The long side of the balcony, porch, gallery, or similar space shall be at least 50 percent open and shall be arranged to restrict the accumulation of smoke.

11.5.3.3 Exterior exit access balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors, unless the exterior exit access balcony is served by at least two remote stairs that can be accessed without it being necessary for any occupant to travel past an unprotected opening to reach one of the stairs, or unless dead ends on the exterior exit access do not exceed 20 ft (6.1 m).

11.5.3.4 Exterior exit access shall be arranged so that there are no dead ends in excess of those permitted for dead-end corridors in Chapter 16 through Chapter 30.

11.5.4 Accessible Means of Egress.

11.5.4.1* Areas accessible to people with severe mobility impairment shall have not less than two accessible means of egress. Access shall be provided to not less than one accessible area of refuge or one accessible exit providing an accessible route to an exit discharge and shall remain within the allowable travel distance.

Exception No. 1: Exit access travel along the accessible means of egress shall be permitted to be common for the distances permitted as common paths of travel.

Exception No. 2: A single accessible means of egress shall be permitted from buildings or areas of buildings permitted to have a single exit.

Exception No. 3: The requirement of 11.5.4.1 shall not apply to health care occupancies protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

11.5.4.2 If two accessible means of egress are required, the exits serving these paths shall be located at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edge of the exit doors or exit access doors. Where exit enclosures are provided as the required exits and are interconnected by not less than a 1-hour fire resistance–rated corridor, exit separation shall be permitted to be measured along the line of travel within the corridor.

Exception No. 1: The requirement of 11.5.4.2 shall not apply to buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

Exception No. 2: Where approved by the authority having jurisdiction, the requirement of 11.5.4.2 shall not apply where the physical arrangement of means of egress prevents the possibility that access to both accessible means of egress will be blocked by any one fire or other emergency condition.

11.5.4.3 Each required accessible means of egress shall be continuous from each accessible occupied area to a public way or area of refuge in accordance with 11.2.12.2.2.

11.5.4.4 Where an exit stair is used in an accessible means of egress, it shall comply with 11.2.12.2.3 and shall either incorporate an area of refuge within an enlarged story-level landing or shall be accessed from an area of refuge.

11.5.4.5 To be considered part of an accessible means of egress, an elevator shall be in accordance with 11.2.12.2.4.

11.5.4.6 To be considered part of an accessible means of egress, a smoke barrier in accordance with Section 8.11 with not less than a 1-hour fire resistance rating, or a horizontal exit in accordance with 11.2.4, shall discharge to an area of refuge in accordance with 11.2.12.

11.5.4.7 Accessible stories that are four or more stories above or below a story of exit discharge shall have not less than one elevator complying with 11.5.4.5.

11.6 Measurement of Travel Distance to Exits.

11.6.1 The travel distance within any occupied space to not less than one exit, measured in accordance with 11.6.2 through 11.6.5, shall not exceed the limits specified in this *Code*.

11.6.2* The travel distance to an exit shall be measured on the floor or other walking surface along the centerline of the natural path of travel, starting from the most remote point subject to occupancy, curving around any corners or obstructions with a 1-ft (0.3-m) clearance therefrom, and ending at the center of the doorway or other point at which the exit begins. Where measurement includes stairs, the measurement shall be taken in the plane of the tread nosing.

11.6.3* Where open stairways or ramps are permitted as a path of travel to required exits, measurement of the distance shall include the travel on the stairway or ramp and the travel from the end of the stairway or ramp to an outside door or other exit in addition to the distance traveled to reach the stairway or ramp.

11.6.4 Travel distance limitations shall be as provided in Chapter 16 through Chapter 30 and, for areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, shall be in accordance with Chapter 34.

11.6.5 Where any part of an exterior exit is within a 10-ft (3-m) horizontal distance of any unprotected building opening, as permitted by an exception to 11.2.2.7.3 for outside stairs, the travel distance to the exit shall include the length of travel to ground level.

11.7 Discharge from Exits.

11.7.1* Exits shall terminate directly at a public way or at an exterior exit discharge. Yards, courts, open spaces, or other portions of the exit discharge shall be of required width and size to provide all occupants with a safe access to a public way.

Exception No. 1: The requirement of 11.7.1 shall not apply to interior exit discharge as otherwise provided in 11.7.2.

Exception No. 2: The requirement of 11.7.1 shall not apply to rooftop exit discharge as otherwise provided in 11.7.6.

Exception No. 3: Means of egress shall be permitted to terminate in an exterior area of refuge as provided in 21.2.7.1.

11.7.2 Not more than 50 percent of the required number of exits, and not more than 50 percent of the required egress capacity, shall be permitted to discharge through areas on the level of exit discharge, provided that the criteria of 11.7.2(A) through 11.7.2(C) are met.

(A) Discharge shall lead to a free and unobstructed way to the exterior of the building, and such way is readily visible and identifiable from the point of discharge from the exit.

(B) The level of discharge shall be protected throughout by an approved, automatic sprinkler system in accordance with Section 55.3, or the portion of the level of discharge used for discharge shall be protected by an approved, automatic sprinkler system in accordance with Section 55.3 and shall be separated from the nonsprinklered portion of the floor by a fire resistance rating meeting the requirements for the enclosure of exits. *(See 11.1.3.2.1.)*

Exception: The requirement of 11.7.2(B) shall not apply where the discharge area is a vestibule or foyer meeting all of the following:

(1) The depth from the exterior of the building shall be not more than 10 ft (3 m), and the length shall be not more than 30 ft (9.1 m).
(2) The foyer shall be separated from the remainder of the level of discharge by construction providing protection not less than the equivalent of wired glass in steel frames.
(3) The foyer shall serve only as means of egress and shall include an exit directly to the outside.

(C) The entire area on the level of discharge shall be separated from areas below by construction having a fire resistance rating not less than that required for the exit enclosure.

Exception No. 1: In an atrium, levels below the level of discharge shall be permitted to be open to the level of discharge in accordance with 8.12.3.

Exception No. 2: One hundred percent of the exits shall be permitted to discharge through areas on the level of exit discharge as provided in 21.2.7.2.

11.7.3 The exit discharge shall be arranged and marked to make clear the direction of egress to a public way. Stairs shall be arranged so as to make clear the direction of egress to a public way. Stairs that continue more than one-half story beyond the level of exit discharge shall be interrupted at the level of exit discharge by partitions, doors, or other effective means.

11.7.4 Doors, stairs, ramps, corridors, exit passageways, bridges, balconies, escalators, moving walks, and other components of an exit discharge shall comply with the detailed requirements of this chapter for such components.

11.7.5 Signs. See 11.2.2.6.

11.7.6 Where approved by the authority having jurisdiction, exits shall be permitted to discharge to roofs or other sections

of the building or an adjoining building where the following criteria are met:

(1) The roof construction has a fire resistance rating not less than that required for the exit enclosure.
(2) There is a continuous and safe means of egress from the roof.

11.8 Illumination of Means of Egress.

11.8.1 General.

11.8.1.1* Illumination of means of egress shall be provided in accordance with Section 11.8 for every building and structure where required in Chapter 16 through Chapter 30. For the purposes of this requirement, exit access shall include only designated stairs, aisles, corridors, ramps, escalators, and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, aisles, corridors, ramps, escalators, walkways, and exit passageways leading to a public way.

11.8.1.2 Illumination of means of egress shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use. Artificial lighting shall be employed within the means of egress for such periods of time as are required to maintain the illumination to the minimum criteria values herein specified.

Exception: Automatic, motion sensor–type lighting switches shall be permitted within the means of egress, provided that the switch controllers are equipped for fail-safe operation, the illumination timers are set for a minimum 15-minute duration, and the motion sensor is activated by any occupant movement in the area served by the lighting units.

11.8.1.3* The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 11.8.1.1 shall be illuminated to values of at least 1 ft-candle (10 lux) measured at the floor.

Exception No. 1: In assembly occupancies, the illumination of the floors of exit access shall be at least 0.2 ft-candle (2 lux) during performances or projections involving directed light.

Exception No. 2: The requirement of 11.8.1.3 shall not apply where operations or processes require low lighting levels.

11.8.1.4* Required illumination shall be arranged so that the failure of any single lighting unit does not result in an illumination level of less than 0.2 ft-candle (2 lux) in any designated area.

11.8.1.5 The equipment or units installed to meet the requirements of Section 11.10 also shall be permitted to serve the function of illumination of means of egress, provided that all requirements of Section 11.8 for such illumination are met.

11.8.2 Sources of Illumination.

11.8.2.1* Illumination of means of egress shall be from a source considered reliable by the authority having jurisdiction.

11.8.2.2 Battery-operated electric lights and other types of portable lamps or lanterns shall not be used for primary illumination of means of egress. Battery-operated electric lights shall be permitted to be used as an emergency source to the extent permitted under Section 11.9.

11.9 Emergency Lighting.

11.9.1 General.

11.9.1.1* Emergency lighting facilities for means of egress shall be provided in accordance with Section 11.9 for the following:

(1) Buildings or structures where required in Chapter 16 through Chapter 30
(2) Underground and limited-access structures as addressed in Chapter 30
(3) High-rise buildings as required by other sections of this *Code*
(4) Doors equipped with delayed-egress locks
(5) The stair shaft and vestibule of smokeproof enclosures, for which the following also apply:
   (a) The stair shaft and vestibule shall be permitted to include a standby generator that is installed for the smokeproof enclosure mechanical ventilation equipment.
   (b) The standby generator shall be permitted to be used for the stair shaft and vestibule emergency lighting power supply.

11.9.1.2 For the purposes of 11.9.1.1, exit access shall include only designated stairs, aisles, corridors, ramps, escalators, and passageways leading to an exit. Exit discharge shall include only designated stairs, ramps, aisles, walkways, and escalators leading to a public way.

11.9.1.3 Where maintenance of illumination depends on changing from one energy source to another, a delay of not more than 10 seconds shall be permitted.

11.9.2 Performance of System.

11.9.2.1* Emergency illumination shall be provided for not less than 1½ hours in the event of failure of normal lighting. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 ft-candle (10 lux) and, at any point, not less than 0.1 ft-candle (1 lux), measured along the path of egress at floor level. Illumination levels shall be permitted to decline to not less than an average of 0.6 ft-candle (6 lux) and, at any point, not less than 0.06 ft-candle (0.6 lux) at the end of the required 1½ hours. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

11.9.2.2* The emergency lighting system shall be arranged to provide the required illumination automatically in the event of any interruption of normal lighting due to any of the following:

(1) Failure of a public utility or other outside electrical power supply
(2) Opening of a circuit breaker or fuse
(3) Manual act(s), including accidental opening of a switch controlling normal lighting facilities

11.9.2.3 Emergency generators providing power to emergency lighting systems shall be installed, tested, and maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems.* Stored electrical energy systems, where required in this *Code*, shall be installed and tested in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems.*

11.9.2.4* Battery-operated emergency lights shall use only reliable types of rechargeable batteries provided with suitable facilities for maintaining them in properly charged condition. Batteries used in such lights or units shall be approved for their intended use and shall comply with NFPA 70, *National Electrical Code.*

11.9.2.5 The emergency lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

11.10 Marking of Means of Egress.

11.10.1 General.

11.10.1.1 Where Required. Means of egress shall be marked in accordance with Section 11.10 where required in Chapter 16 through Chapter 30.

11.10.1.2* Exits. Exits, other than main exterior exit doors that obviously and clearly are identifiable as exits, shall be marked by an approved sign that is readily visible from any direction of exit access.

11.10.1.3 Exit Door Tactile Signage. Tactile signage shall be located at each exit door requiring an exit sign, shall comply with ICC/ANSI A117.1 and shall read as follows:

EXIT

11.10.1.4* Exit Access. Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to occupants. Sign placement shall be such that no point in an exit access corridor is more than the rated viewing distance or 100 ft (30 m), whichever is less, from the nearest sign.

11.10.1.5* Floor Proximity Exit Signs. Where floor proximity exit signs are required in Chapter 16 through Chapter 30, signs shall be placed near the floor level in addition to those signs required for doors or corridors. Such signs shall be illuminated in accordance with 11.10.5. Externally illuminated signs shall be sized in accordance with 11.10.6.1. The bottom of the sign shall be not less than 6 in. (15.2 cm), but not more than 18 in. (455 mm), above the floor. For exit doors, the sign shall be mounted on the door or adjacent to the door, with the nearest edge of the sign within 4 in. (10.2 cm) of the door frame.

11.10.1.6* Floor Proximity Egress Path Marking. Where floor proximity egress path marking is required in Chapter 16 through Chapter 30, a listed and approved floor proximity egress path marking system that is internally illuminated shall be installed within 18 in. (455 mm) of the floor. The system shall provide a visible delineation of the path of travel along the designated exit access and shall be essentially continuous, except as interrupted by doorways, hallways, corridors, or other such architectural features. The system shall operate continuously or at any time the building fire alarm system is activated. The activation, duration, and continuity of operation of the system shall be in accordance with 11.9.2.

11.10.1.7 Egress Marking Location. Egress markings shall be located at a vertical distance of not more than 6 ft 8 in. (2 m), measured from above the top edge of the egress opening intended for designation by that marking to the bottom of the marking. Egress markings shall be located at a horizontal distance of not more than the required width of the egress opening as measured from the edge of the egress opening intended for designation by that marking to the nearest edge of the marking.

11.10.1.8* Visibility. Every sign required in Section 11.10 shall be located and of such size, distinctive color, and design that it is readily visible and shall provide contrast with decorations, interior finish, or other signs. No decorations, furnishings, or equipment that impairs the visibility of a sign shall be permitted. No brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision of the required exit sign that could detract attention from the exit sign shall be permitted.

11.10.2* Directional Signs. A sign complying with 11.10.3 with a directional indicator showing the direction of travel shall be placed in every location where the direction of travel to reach the nearest exit is not apparent.

11.10.3* Sign Legend. Signs required by 11.10.1 and 11.10.2 shall display the word "exit" or other appropriate wording in plainly legible letters.

Exception: Where approved by the authority having jurisdiction, pictograms shall be permitted.

11.10.4* Power Source. Where emergency lighting facilities are required by the applicable provisions of Chapter 16 through Chapter 30 for individual occupancies, the signs, other than approved self-luminous signs and listed photoluminescent signs in accordance with 11.10.7, shall be illuminated by the emergency lighting facilities. The level of illumination of the signs shall be in accordance with 11.10.6.3 or 11.10.7 for the required emergency lighting duration as specified in 11.9.2.1. However, the level of illumination shall be permitted to decline to 60 percent at the end of the emergency lighting duration.

11.10.5 Illumination of Signs.

11.10.5.1* General. Every sign required by 11.10.1.2 or 11.10.1.4, other than signs in locations where operations or processes require low lighting levels, shall be suitably illuminated by a reliable light source. Externally and internally illuminated signs shall be legible in both the normal and emergency lighting mode.

11.10.5.2* Continuous Illumination. Every sign required to be illuminated by 11.10.6.3 and 11.10.7 shall be continuously illuminated as required under the provisions of Section 11.8.

Exception: Illumination for signs shall be permitted to flash on and off upon activation of the fire alarm system.

11.10.6 Externally Illuminated Signs.

11.10.6.1* Size of Signs. Externally illuminated signs required by 11.10.1 and 11.10.2 shall have the word "exit" or other appropriate wording in plainly legible letters not less than 6 in. (15.2 cm) high, with the principal strokes of letters not less than ¾ in. (1.9 cm) wide. The word "exit" shall have letters of a width not less than 2 in. (5 cm), except the letter "I", and the minimum spacing between letters shall be not less than ⅜ in. (1 cm). Signs larger than the minimum established in this requirement shall have letter widths, strokes, and spacing in proportion to their height.

Exception No. 1: The requirement of 11.10.6.1 shall not apply to marking required by 11.10.1.3 and 11.10.1.5.

Exception No. 2: Where approved by the authority having jurisdiction, pictograms shall be permitted.

11.10.6.2* Size and Location of Directional Indicator.

(A) The directional indicator shall be located outside of the exit legend, not less than ⅜ in. (1 cm) from any letter.

(B) The directional indicator shall be of a chevron type, as shown in Figure 11.10.6.2.

(C) The directional indicator shall be identifiable as a directional indicator at a distance of 40 ft (12.2 m).

(D) A directional indicator larger than the minimum needed to satisfy the requirement of 11.10.6.2(C) shall be proportionately increased in height, width, and stroke.

(E) The directional indicator shall be located at the end of the sign for the direction indicated.

FIGURE 11.10.6.2 Chevron-type Indicator.

11.10.6.3* Level of Illumination. Externally illuminated signs shall be illuminated by not less than 5 ft-candles (54 lux) at the illuminated surface and shall have a contrast ratio of not less than 0.5.

11.10.7 Internally Illuminated Signs.

11.10.7.1 Listing. Internally illuminated signs shall be listed in accordance with UL 924, *Standard for Emergency Lighting and Power Equipment.*

Exception: The requirement of 11.10.7.1 shall not apply to signs that are in accordance with 11.10.1.3 and 11.10.1.5.

11.10.7.2* Photoluminescent Signs. The face of a photoluminescent sign shall be continually illuminated while the building is occupied. The illumination levels on the face of the photoluminescent sign shall be in accordance with its listing. The charging illumination shall be a reliable light source as determined by the authority having jurisdiction. The charging light source shall be of a type specified in the product markings.

11.10.8 Special Signs.

11.10.8.1 Sign Illumination. Where required by other provisions of this *Code*, special signs shall be illuminated. Where emergency lighting facilities are required by the applicable provisions of Chapter 16 through Chapter 30, the required illumination of special signs shall additionally be provided under emergency lighting conditions.

11.10.8.2 Characters. Special signs, where required by other provisions of this *Code*, shall comply with the visual character requirements of ICC/ANSI A117.1.

11.10.8.3* No Exit.

11.10.8.3.1 Any door, passage, or stairway that is neither an exit nor a way of exit access and that is located or arranged so that it is likely to be mistaken for an exit shall be identified by a sign that reads as follows:

NO

EXIT

11.10.8.3.2 Such sign shall comply with 11.10.8.2 and have the word "no" in letters 2 in. (5 cm) high and the word "exit" in letters 1 in. (2.5 cm) high, with the word "exit" below the word "no."

11.10.8.4 Elevator Signs. Elevators that are a part of a means of egress *(see 11.2.13.1)* shall have the following signs, with a minimum letter height of ⅝ in. (1.6 cm), in every elevator lobby:

(1)*Signs that indicate that the elevator can be used for egress, including any restrictions on use
(2)*Signs that indicate the operational status of elevators

11.11 Special Provisions for Occupancies with High Hazard Contents. See Section 6.3, Section 6.4, and Chapter 34.

11.12 Mechanical Equipment Rooms, Boiler Rooms, and Furnace Rooms.

11.12.1 Mechanical equipment rooms, boiler rooms, furnace rooms, and similar spaces shall be arranged to limit common path of travel to a distance not exceeding 50 ft (15 m).

Exception: A common path of travel not exceeding 100 ft (30 m) shall be permitted in the following locations:

(1) In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3
(2) In mechanical equipment rooms with no fuel-fired equipment

11.12.2 Stories used exclusively for mechanical equipment, furnaces, or boilers shall be permitted to have a single means of egress where the travel distance to an exit on that story is not in excess of the common path of travel limitations of 11.12.1.

Chapter 12 Accessibility

12.1 General.

12.1.1 The requirements of this chapter shall apply to the design and construction of buildings and structures for accessibility.

12.1.2 Buildings and facilities that are required to be accessible shall comply with the requirements of ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities.*

12.1.3 The technical requirements of ICC/ANSI A117.1 shall be permitted to be modified for buildings and facilities used primarily by children as modified in Section 12.26.

12.1.4 Technical requirements for unisex toilet rooms shall comply with Section 12.13.

12.2 General Requirements.

12.2.1 Scope. All areas of newly designed or newly constructed buildings and facilities and altered portions of existing buildings and facilities shall comply with the provisions of this chapter.

12.2.2 Application Based on Use. Where a site, building, or facility contains more than one use, each portion shall comply with the applicable requirements for that use.

12.2.3 Temporary and Permanent Structures. The requirements of this chapter shall apply to temporary and permanent buildings and facilities.

12.3 Application to Existing Buildings and Facilities.

12.3.1 General. Additions and alterations to existing buildings or facilities, including qualified historic buildings and facilities, shall comply with this chapter, except as modified by Section 12.3.

12.3.2 Additions. Each addition to an existing building or facility shall comply with the requirements for new construction. Each addition that affects the accessibility of an area containing a primary function shall comply with 12.3.4.

12.3.3 Alterations. Where existing elements or spaces are altered, each altered element or space shall comply with the applicable provisions of this chapter.

12.3.3.1 Compliance with Provisions for Accessible Route. Altered elements or spaces shall not be required to be located on an accessible route, unless required by 12.3.4.

12.3.3.2 Where Compliance with Accessibility Is Infeasible. In alterations, where compliance with applicable provisions is technically infeasible, the alteration shall provide accessibility to the maximum extent feasible. Any elements or spaces of the building or facility that are being altered and can be made accessible shall be made accessible within the scope of the alteration.

12.3.3.3 Prohibited Reduction in Access. An alteration that decreases or has the effect of decreasing the accessibility of a building or facility below the requirements for new construction at the time of alteration shall be prohibited.

12.3.3.4 Extent of Application. An alteration of an existing element, space, or area of a building or facility shall not impose a requirement for greater accessibility than that which would be required for new construction.

12.3.4 Alterations Affecting Primary Function Areas. In addition to the requirements of 12.3.3, an alteration that affects the accessibility of an area containing a primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to the altered area and the restrooms, telephones, and drinking fountains serving the altered area, are accessible, provided that one of the following criteria is met:

(1) The cost of providing the accessible route does not exceed 20 percent of the cost of the alterations affecting the primary function area
(2) The alteration work is limited solely to the electrical, mechanical, or plumbing system; hazardous material abatement; or automatic sprinkler alteration or installation
(3) The alteration work is undertaken for the primary purpose of increasing the accessibility of an existing building, facility, or element.

12.3.5 Qualified Historic Buildings and Facilities.

12.3.5.1 The provisions of 12.3.5.2 through 12.3.5.2.6 shall not apply when technically infeasible.

12.3.5.2 Where compliance would threaten or destroy the historical significance of the building or facility as determined by the authority having jurisdiction, the alternative requirements for the specific element shall be permitted as described in 12.3.5.2.1 through 12.3.5.2.6.

12.3.5.2.1 Site Access Points. At least one accessible route from a site arrival point to an accessible entrance shall be provided.

12.3.5.2.2 Multilevel Buildings and Facilities. An accessible route from an accessible entrance to all publicly used spaces on the level of the accessible entrance shall be provided.

12.3.5.2.3 Entrances. At least one accessible entrance shall be provided. Where no public entrance can be made accessible, an entrance not used by the public shall be made accessible. Such nonpublic entrance shall remain unlocked while the building is occupied, or a locked accessible entrance with a notification system or remote monitoring shall be provided.

12.3.5.2.4 Toilet Rooms. Where toilet rooms are provided, not less than one toilet room complying with ICC/ANSI A117.1, Section 603, or a unisex room complying with 12.12.2.1 shall be provided.

12.3.5.2.5 Displays. Displays and written information shall be located where they can be seen by a seated person. Exhibits and signs displayed horizontally shall be 44 in. (1120 mm) maximum above the floor.

12.3.5.2.6 Ramps. The slope of a ramp run of 24 in. (610 mm) maximum shall not be steeper than 1:6.

12.4 General Exceptions.

12.4.1 General. Sites, buildings, facilities, and elements shall be exempt from the provisions of this chapter as specified in 12.4.2 through 12.4.7.

12.4.2 Construction Sites. Structures, sites, and equipment directly associated with the actual processes of construction including, but not limited to, scaffolding, bridging, materials hoists, materials storage, or construction trailers shall not be required to be accessible. Portable toilet units provided for use exclusively by construction personnel on a construction site shall not be required to be accessible.

12.4.3* Employee Work Areas. Employee work areas shall be designed and constructed so that individuals with disabilities can approach, enter, and exit the employee work areas.

12.4.4 Raised Areas. Raised areas used primarily for purposes of security, life safety, or fire safety including, but not limited to, observation galleries, prison guard towers, fire towers, or lifeguard stands shall not be required to be accessible or to be served by an accessible route.

12.4.5 Limited Access Spaces. Spaces accessed only by ladders, catwalks, crawl spaces, very narrow passageways, or tunnels shall not be required to be accessible or to be served by an accessible route.

12.4.6 Equipment Spaces. Spaces frequented only by service personnel for maintenance, repair, or occasional monitoring of equipment shall not be required to be accessible or to be served by an accessible route. Such spaces shall include, but are not limited to, elevator pits; elevator penthouses; mechanical, electrical, or communications equipment rooms; piping or equipment catwalks; water or sewage treatment pump rooms and stations; electric substations and transformer vaults; and highway and tunnel utility facilities.

12.4.7 Single-Occupant Structures. Single-occupant structures accessed only by passageways below grade or elevated above grade including, but not limited to, toll booths that are accessed only by underground tunnels shall not be required to be accessible or to be served by an accessible route.

12.5 Protruding Objects. Protruding objects on circulation paths shall comply with ICC/ANSI A117.1, Section 307.

12.6 Operable Parts. Operable parts located on accessible routes and in accessible rooms and spaces shall be accessible.

12.7 Accessible Routes.

12.7.1 General. Accessible routes shall be provided in accordance with Section 12.7.

12.7.2 Where Required. Accessible routes shall be provided where required by 12.7.2.1 through 12.7.2.6 and shall be accessible.

12.7.2.1 Site Arrival Points. At least one accessible route shall be provided within the boundary of the site from public transportation stops, accessible parking spaces, passenger loading zones, and public streets or sidewalks to the accessible building entrance they serve.

12.7.2.2 Within a Site. Where pedestrian access is provided between accessible buildings, facilities, elements, and spaces, at least one accessible route shall connect accessible buildings, accessible facilities, accessible elements, and accessible spaces that are on the same site.

12.7.2.3 Multilevel Buildings and Facilities. At least one accessible route shall connect each level, including mezzanines, in multistory buildings and facilities.

12.7.2.3.1 An accessible route shall not be required to levels located above or below the accessible level in buildings or facilities that are less than three stories or that have less than 3000 ft^2 (278.71 m^2) per story, unless the level contains a shopping center, a shopping mall, the office of a health care provider, or passenger transportation facilities.

12.7.2.3.2 An accessible route shall not be required to levels located above or below the accessible level in public buildings or facilities that are less than three stories and that are not open to the public if the level above or below the accessible level houses no more than five persons and is less than 500 ft^2 (46.45 m^2).

12.7.2.3.3 An accessible route shall not be required to levels located above or below the accessible level in detention and correctional facilities where accessible cells or rooms provided in accordance with Section 12.28, all common use areas serving such cells or rooms, and all public use areas are on an accessible route.

12.7.2.3.4 In air traffic control towers, an accessible route shall not be required to serve the cab and the floor immediately below the cab.

12.7.2.4 Stairs and Escalators in Existing Buildings. In alterations and additions, where an escalator or stair is provided where none existed previously, and major structural modifications are necessary for such installation, an accessible route shall be provided between the levels served by the escalator or stair, unless exempted by 12.7.2.3.

12.7.2.5 Accessible Spaces and Elements. At least one accessible route shall connect accessible building or facility entrances with all accessible spaces and elements within the building or facility that are otherwise connected by a circulation path.

12.7.2.5.1 An accessible route shall not be required between levels where exempted by 12.7.2.3.

12.7.2.5.2 Vertical access to raised judges' benches or courtroom stations shall not be required to be installed, provided that the required clear floor space, maneuvering space, and, if appropriate, electrical service are installed at the time of initial construction to allow future installation of a means of vertical access complying with 12.7.6, 12.7.7, or ICC/ANSI A117.1, Section 303.4, without requiring substantial reconstruction of the space.

12.7.2.6 Restaurants and Cafeterias. In restaurants and cafeterias, an accessible route shall be provided to all dining areas, including raised or sunken dining areas and outdoor dining areas.

12.7.2.6.1 In buildings without elevators, an accessible route to a mezzanine dining area shall not be required, provided that the mezzanine contains less than 25 percent of the total area for seating and dining, and the same services are provided in the accessible area.

12.7.2.6.2 In alterations, accessibility to existing raised or sunken dining areas, or to all parts of existing outdoor dining areas, shall not be required, provided that the same services and decor are provided in an accessible space usable by the general public and not restricted to use by people with disabilities.

12.7.2.7 Performance Areas. An accessible route shall be provided where a circulation path directly connects a performance area to an assembly seating area. An accessible route shall be provided from performance areas to ancillary areas or facilities used by performers. In alterations, where it is technically infeasible to alter all performance areas so that they are located on an accessible route, at least one of each type of performance area shall be made accessible.

12.7.3 Location. Accessible routes shall coincide with, or shall be located in, the same area as a general circulation path. Where the circulation path is interior, the accessible route shall also be interior.

12.7.4 Entrances. Accessible entrances shall be provided in accordance with 12.7.4.1 through 12.7.4.6.

12.7.4.1 Parking Structure Entrances. Where direct access to a building from a parking structure is provided for pedestrians, at least one direct entrance from the structure to the building shall be accessible.

12.7.4.2 Entrances from Tunnels or Elevated Walkways. Where direct access from a pedestrian tunnel or elevated walkway to a building is provided for pedestrians, at least one direct entrance to the building from each tunnel or walkway shall be accessible.

12.7.4.3 Public Entrances. In addition to the accessible entrances required by 12.7.4.1 and 12.7.4.2, at least 50 percent of all other public entrances shall be accessible. At least one accessible entrance shall be a ground floor entrance.

12.7.4.4 Tenant Spaces. At least one accessible entrance shall be provided to each tenancy in a facility, except as specified in Section 12.21.

12.7.4.5 Service Entrances. If a service entrance is the only entrance to a building or to a tenancy in a facility, that entrance shall be accessible.

12.7.4.6 Restricted Entrances. Where restricted entrances are provided to a building or facility, at least one restricted entrance to the building or facility shall be accessible.

12.7.4.7 Entrances for Inmates or Detainees. Where entrances used only by inmates or detainees and security personnel are provided at judicial facilities, detention facilities, or correctional facilities, at least one such entrance shall be accessible.

12.7.4.8 Signs. Where not all entrances are accessible, accessible entrances shall be identified by the international symbol of accessibility, and directional signs indicating the location of the nearest accessible entrance shall be provided at inaccessible entrances. Directional signs shall comply with ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities*, Section 703.4. No signs shall be required where all entrances are accessible.

12.7.5 Doors and Doorways. Accessible doors and doorways shall be provided in accordance with 12.7.5.1 and 12.7.5.2.

12.7.5.1 Accessible Entrances. Each accessible entrance to a building or facility shall have at least one accessible door or doorway.

12.7.5.2 Accessible Rooms and Spaces. Within a building or facility, at least one door or doorway serving each accessible room or space shall be accessible.

12.7.6 Elevators. New elevators shall be accessible in accordance with ICC/ANSI A117.1.

12.7.7 Existing Elevators. Altered elements of existing elevators shall comply with ICC/ANSI A117.1, Section 407.5. Such elements shall also be altered in all elevators that are programmed to respond to the same hall call control as the altered elevator.

12.7.8 Wheelchair (Platform) Lifts. Wheelchair (platform) lifts shall be permitted as a component of an accessible route in new construction as permitted by 12.7.8.1 through 12.7.8.4 and shall comply with ASME A18.1, *Safety Standard for Platform Lifts and Stairway Chairlifts*, and ICC/ANSI A117.1. Wheelchair (platform) lifts shall be permitted as a component of an accessible route in alterations and shall comply with ASME A17.1.

12.7.8.1 Performance Areas and Speaker's Platforms. Wheelchair (platform) lifts shall be permitted to provide an accessible route to a performance area or speaker's platform in an assembly occupancy.

12.7.8.2 Wheelchair Spaces. Wheelchair (platform) lifts shall be permitted to comply with the wheelchair space dispersion and line-of-sight requirements of Section 12.18 and ICC/ANSI A117.1, Section 802.

12.7.8.3 Incidental Spaces. Wheelchair (platform) lifts shall be permitted to provide an accessible route to incidental occupiable spaces and rooms that are not open to the public and that are occupied by not more than five persons.

12.7.8.4 Judicial Spaces. Wheelchair (platform) lifts shall be permitted to provide an accessible route to raised judges' benches, clerks' stations, jury boxes, and witness stands or to depressed areas, such as the well of a court.

12.7.9 Security Barriers. Security barriers including, but not limited to, security bollards and security checkpoints shall not obstruct a required accessible route or accessible means of egress.

Exception: Where security barriers incorporate equipment such as metal detectors, fluoroscopes, or other similar devices that cannot be made accessible, an accessible route shall be provided adjacent to such security screening devices to facilitate an equivalent circulation path. The circulation path shall allow persons with disabilities passing through security barriers to maintain visual contact with their personal items to the same extent provided others traversing the barrier.

12.7.10 Accessible Means of Egress.

12.7.10.1 General. Accessible means of egress shall comply with 11.5.4.

Exception: The requirement of 12.7.10.1 shall not apply where otherwise permitted by the following:

(1) Accessible means of egress shall not be required in alterations to existing buildings or facilities.
(2) Areas of refuge shall not be required in detention and correctional facilities.

12.7.10.2 Signs. At exit stairways and elevators serving a required accessible space, but not serving as an accessible means of egress, directional signs indicating the location of accessible means of egress shall be provided. Such signs shall comply with ICC/ANSI A117.1, Section 703.4.

12.8 Parking Spaces.

12.8.1 General. Where parking spaces are provided, accessible parking spaces shall be provided in accordance with Section 12.8. Section 12.8 shall not apply to parking spaces used exclusively for buses, trucks, other delivery vehicles, law enforcement vehicles, or vehicular impound and motor pools where lots accessed by the public are provided with an accessible passenger loading zone.

12.8.2 Number Required. Where parking spaces are provided, accessible parking spaces shall be provided in accordance with Table 12.8.2, except as required by 12.8.2.1.

Table 12.8.2 Accessible Parking Spaces

Total Number of Parking Spaces Provided	Minimum Number of Required Accessible Parking Spaces
1–25	1
26–50	2
51–75	3
76–100	4
101–150	5
151–200	6
201–300	7
301–400	8
401–500	9
501–1000	2 percent of total
≥1001	20 plus 1 for every 100 >1000

12.8.2.1 Rehabilitation Facilities and Outpatient Physical Therapy Facilities. Twenty percent of patient and visitor parking spaces provided at rehabilitation facilities and outpatient physical therapy facilities shall be accessible.

12.8.2.2 Hospital Outpatient Facilities. Ten percent of patient and visitor parking spaces provided to serve hospital outpatient facilities shall be accessible.

12.8.2.3 Van Parking Spaces. For every eight, or fraction of eight, accessible parking spaces required by 12.8.2 and 12.8.2.1, at least one shall be an accessible van parking space.

12.8.3 Identification. Where more than five parking spaces are provided, accessible parking spaces shall be identified by signs complying with ICC/ANSI A117.1, Section 502.6.

12.8.4 Location.

12.8.4.1 Accessible parking spaces serving a particular building shall be located on the shortest accessible route from adjacent parking to an accessible entrance. In buildings with multiple accessible entrances with adjacent parking, accessible parking spaces shall be dispersed and located closest to the accessible entrances. In parking facilities that do not serve a particular building, accessible parking spaces shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility.

12.8.4.2 All accessible van parking spaces shall be permitted to be grouped on one level of a parking structure.

Exception: Accessible parking spaces shall be permitted to be located in different lots if equivalent or greater accessibility is provided in terms of distance from an accessible entrance, cost, and convenience.

12.9 Passenger Loading Zones.

12.9.1 General. Where passenger loading zones are provided, one passenger loading zone shall be accessible for not more than every continuous 100 linear feet (30 linear m) of loading zone space.

12.9.2 Health Care Occupancies. A passenger loading zone shall be provided at an accessible entrance to medical and long-term care facilities where people receive physical or medical treatment or care and where the period of stay exceeds 24 hours.

12.9.3 Valet Parking. Valet parking services shall provide a passenger loading zone.

12.10 Drinking Fountains and Water Coolers.

12.10.1 General. Where drinking fountains or water coolers are provided, they shall be provided in accordance with Section 12.10.

12.10.2 Minimum Required. Not less than two drinking fountains or water coolers shall be provided on a site, on a floor, or within a secured area. A "high-low" drinking unit shall be counted as two units.

12.10.3 Types. Fifty percent of the drinking fountains or waters coolers shall comply with ICC/ANSI A117.1, Section 602. The remainder shall have spout outlets of not less than 39 in. (0.99 m) and not more than 43 in. (1.09 m) above the finish floor or ground.

12.11 Sinks, Kitchens, Kitchenettes, and Wet Bars.

12.11.1 General. Sinks, kitchens, kitchenettes, and wet bars shall comply with 12.11.

12.11.1.1 Sinks. Where sinks are provided, at least 5 percent, but not less than one of each type provided in each accessible room or space, shall comply with ICC/ANSI A117.1, Section 606.

Exception: Mop or service sinks shall not be required to be accessible.

12.11.1.2 Kitchens, Kitchenettes, and Wet Bars. Where kitchens, kitchenettes, or wet bars are provided, they shall comply with ICC/ANSI A117.1, Section 804.2.

Exception: In detention and correctional facilities, housing cells shall not be required to be accessible.

12.12 Toilet and Bathing Facilities.

12.12.1 General. Where toilet or bathing facilities are provided, they shall comply with Section 12.12. Where toilet or bathing facilities are provided on an inaccessible level, toilet and bathing facilities shall also be provided on an accessible level.

12.12.2 Toilet and Bathing Rooms. Where toilet rooms are provided, each toilet room shall be accessible. Where bathing rooms are provided, each bathing room shall be accessible.

12.12.2.1 Alterations. In alterations where it is technically infeasible to make existing toilet and bathing rooms accessible, altering existing toilet or bathing rooms shall not be required where a single unisex toilet room or bathing room complying with 12.12.2.4 is provided and located in the same area and on the same floor as existing inaccessible toilet or bathing rooms.

12.12.2.2 Multiple, Single-User Portable Toilet or Bathing Units. Where multiple, single-user portable toilet or bathing units are clustered at a single location, at least 5 percent, but not less than one toilet unit or bathing unit at each cluster, shall be accessible. Accessible units shall be identified by the international symbol of accessibility.

12.12.2.3 Multiple Single-User Toilet Rooms. Where multiple single-user toilet rooms are clustered at a single location and contain fixtures in excess of the minimum required number of plumbing fixtures, at least 5 percent, but not less than one room for each use at each cluster, shall be accessible. Accessible rooms shall be identified by the international symbol of accessibility.

12.12.2.4 Unisex Toilet and Bathing Rooms. Unisex toilet and bathing rooms shall be provided in accordance with Section 12.13.

12.12.3 Signs. Where existing toilet or bathing rooms are altered and not made accessible, directional signs indicating the location of the nearest accessible toilet or bathing room within the facility shall be provided. Such signs shall comply with ICC/ANSI A117.1, Section 703.4, and shall include the international symbol of accessibility. Where existing toilet or bathing rooms are altered and not made accessible, the accessible toilet or bathing room shall be identified by the international symbol of accessibility.

12.12.4 Fixtures and Accessories. Plumbing fixtures and accessories provided in toilet or bathing rooms required to be accessible by 12.12.2 shall comply with 12.12.4.1 through 12.12.4.7.

12.12.4.1 Toilet Compartments. Where toilet compartments are provided, at least one shall be a wheelchair-accessible compartment. Where six or more toilet compartments are provided, an ambulatory-accessible compartment shall be provided in addition to the wheelchair-accessible compartment. Water closets in such compartments shall be accessible.

12.12.4.2 Water Closets. Where water closets are provided, but are not in toilet compartments, at least one shall be accessible.

12.12.4.3 Urinals. Where urinals are provided, at least one shall be accessible.

12.12.4.4 Lavatories. Where lavatories are provided, at least one shall be accessible. Where only one accessible lavatory is provided, it shall not be located in a toilet compartment.

12.12.4.5 Mirrors. Where mirrors are provided, at least one shall be accessible.

12.12.4.6 Dispensers and Receptacles. Where dispensers or receptacles are provided, at least one of each type shall be accessible.

12.12.4.7 Bathing Facilities. Where bathtubs or showers are provided, at least one accessible bathtub, or at least one accessible shower, shall be provided.

12.13 Unisex Toilet and Bathing Facilities.

12.13.1 Unisex Toilet Rooms.

12.13.1.1 Where Required. In assembly or mercantile occupancies, an accessible unisex toilet room complying with 12.13.1.2 and ICC/ANSI A117.1, Section 3.0, shall be provided where an aggregate of six or more male and female water closets are required. In buildings of mixed occupancy, only

those water closets required for those portions classified as assembly or mercantile occupancies shall be considered when determining the need for accessible unisex toilet rooms.

12.13.1.2 Location.

12.13.1.2.1 Unisex toilet rooms shall be located on an accessible route and shall be available to all users of separate-sex toilet rooms.

12.13.1.2.2 Unisex toilet rooms shall be located not more than one story above or below separate-sex toilet rooms, and the accessible route from any separate-sex toilet room to the unisex toilet room shall not exceed 500 ft (152.4 m).

12.13.1.2.3 In passenger transportation facilities and airports, the accessible route from separate-sex toilet rooms to unisex toilet rooms shall not pass through security checkpoints.

12.13.2 Unisex Bathing Rooms.

12.13.2.1 Where Required. In assembly occupancies where separate-sex bathing rooms are provided, an accessible unisex bathing room complying with 12.13.2.2 and ICC/ANSI A117.1, Section 3.0, shall be provided.

Exception: The requirement of 12.13.2.1 shall not apply where each separate-sex bathing room has not more than one water closet, lavatory, and shower fixture.

12.13.2.2 Location. Unisex bathing rooms shall be located on an accessible route and shall be available to all users of separate-sex bathing rooms.

12.13.3 Technical Provisions for Unisex Toilet and Bathing Facilities.

12.13.3.1 General. Unisex toilet and bathing rooms required by Section 12.13 shall comply with 12.13.3.2 through 12.13.3.4.2 and with ICC/ANSI A117.1, Section 603.

12.13.3.2 Doors.

12.13.3.2.1 Where doors swing into the room, a 30 in. × 48 in. (762 mm × 1219 mm) clear floor space shall be provided within the room, beyond the arc of the door swing.

12.13.3.2.2 Doors to accessible unisex toilet and bathing rooms shall be securable from within the room.

12.13.3.3 Required Elements.

12.13.3.3.1 Unisex Toilet Rooms.

12.13.3.3.1.1 Unisex toilet rooms shall include not more than one water closet and one lavatory that comply with ICC/ANSI A117.1, Section 604 and Section 606, respectively.

12.13.3.3.1.2 A separate-sex toilet room containing not more than two water closets without urinals, or one water closet and one urinal, shall be considered as complying with the requirement of 12.13.3.3.1.1, provided that signage in accordance with 12.13.3.4 is provided.

12.13.3.3.2 Unisex Bathing Rooms. Unisex bathing rooms shall include not more than one water closet, one lavatory, and one shower complying with Section 604, Section 606, and Section 608, respectively, of ICC/ANSI A117.1. Where storage facilities are provided in separate-sex bathing facilities, accessible storage facilities shall be provided for the unisex bathing room.

12.13.3.4 Signs.

12.13.3.4.1 Unisex Toilet and Bathing Rooms. Unisex toilet and bathing rooms shall be designated by the international symbol of accessibility.

12.13.3.4.2 Directional Signs. Directional signage shall be provided at all separate-sex toilet rooms indicating the location of the nearest unisex toilet room.

12.14 Laundry Equipment.

12.14.1 General. Where washing machines or clothes dryers are provided in spaces required to be accessible, accessible washing machines and clothes dryers shall be provided in accordance with Section 12.14.

12.14.2 Washing Machines. Where three or fewer washing machines are provided, at least one shall be accessible. Where more than three washing machines are provided, at least two shall be accessible.

12.14.3 Dryers. Where three or fewer clothes dryers are provided, at least one shall be accessible. Where more than three clothes dryers are provided, at least two shall be accessible.

12.15 Fire Alarm Systems.

12.15.1 General. Where fire alarm systems are provided in public-use or common-use areas to alert occupants, the alarm shall provide both audible and visual signals and shall be installed in accordance with *NFPA 72, National Fire Alarm Code.*

12.15.2 Visual Alarms in Alterations. Visual alarms shall not be required in alterations, except where an existing fire alarm system is upgraded or replaced or a new fire alarm system is installed.

12.15.3 Visible-only Signals. Visible-only signals shall be provided where specifically permitted in health care occupancies in accordance with the provisions of Chapter 19.

12.16 Signs.

12.16.1 General. Signs shall be provided in accordance with Section 12.16 and shall be accessible.

Exception: In detention and correctional facilities, signs not located in public-use areas shall not be required to comply.

12.16.2 Permanent Designations. Where exterior signs are provided as permanent designations of permanent interior rooms and spaces at the door to the space they serve, the signs shall be tactile. Where interior signs are provided as permanent designations of permanent interior rooms and spaces, the signs shall be tactile. Where pictograms are provided as permanent designations of permanent interior rooms and spaces, the pictograms shall be accessible and shall have tactile text descriptors.

12.16.3 Directional and Informational Signs. Signs that provide direction to, or information about, permanent interior spaces of the site and facilities shall comply with ICC/ANSI A117.1, Section 703.4.

Exception: Building directories, personnel names, company or occupant names and logos, menus, and temporary signs shall not be required to comply with ICC/ANSI A117.1, Section 703.4.

12.16.4 Exit Doors. Exit doors shall be identified by tactile signs in accordance with 11.10.1.3.

12.17 Assistive Listening Systems.

12.17.1 General. Assistive listening systems shall be provided in accordance with Section 12.17 and shall be accessible.

12.17.2 Required Systems. In each assembly area where audible communication is integral to the use of the space, an assistive listening system shall be provided.

Exception: Other than in courtrooms, the requirement of 12.17.2 shall not apply where no audio amplification is provided.

12.17.3 Receivers. Accessible receivers shall be provided for assistive listening systems in accordance with Table 12.17.3. Twenty-five percent of receivers, but not less than two, shall be hearing-aid compatible.

Table 12.17.3 Receivers for Assistive Listening Systems

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Receivers Required to be Hearing-aid Compatible
≤50	2	2
51–200	2 plus 1 for every 25 seats > 50*	2
201–500	2 plus 1 for every 25 seats > 50*	1 for every 4 receivers*
501–1000	20 plus 1 for every 33 seats > 500*	1 for every 4 receivers*
1001–2000	35 plus 1 for every 50 seats > 1000*	1 for every 4 receivers*
≥2001	55 plus 1 for every 100 seats > 2000*	1 for every 4 receivers*

*Number of receivers required or fraction thereof.

12.17.4 Signs. Where assistive listening systems are provided, signs shall be provided to inform patrons of the availability of the system. The signs shall be located at ticket offices or windows, where ticket offices or windows are provided. The signs shall comply with ICC/ANSI A117.1, Section 703.4, and shall include the international symbol of access for hearing loss.

12.18 Wheelchair Spaces in Assembly Seating.

12.18.1 General. In assembly seating areas, accessible wheelchair spaces shall be provided in accordance with Section 12.18.

12.18.2 Number Required. Accessible wheelchair spaces shall be provided in accordance with Table 12.18.2 and shall be accessible.

12.18.3 Wheelchair Space Clusters. Accessible wheelchair spaces shall be grouped in wheelchair space clusters in accordance with Table 12.18.3.

12.18.3.1 In assembly seating areas where sight lines require more than one step for a rise in elevation between rows, the minimum required number of wheelchair space clusters in such an area shall be one-half of that required by Table 12.18.3.

12.18.3.2 In alterations, where it is technically infeasible to disperse wheelchair space clusters in accordance with Table 12.18.3, the minimum required number of wheelchair space clusters shall be one-half of that required by Table 12.18.3.

Table 12.18.2 Accessible Wheelchair Spaces

Capacity of Seating in Assembly Areas	Minimum Number of Required Wheelchair Spaces
4–25	1
26–50	2
51–100	4
101–300	5
301–500	6
>500	6 plus 1 additional space for each total seating capacity increase of 200

Table 12.18.3 Wheelchair Space Clusters

Capacity of Seating in Assembly Areas	Minimum Number of Wheelchair Space Clusters Required
≤300	1
301–600	2
601–900	3
901–1500	4
1501–2100	5
2101–3000	6
>3000	6 plus 1 additional cluster for every 1000 seats or portion thereof

12.18.4 Dispersion of Wheelchair Space Clusters.

12.18.4.1 General. Dispersion of wheelchair space clusters shall be based on the availability of accessible routes to various seating areas, including seating at various levels in multilevel facilities.

12.18.4.2 Multilevel Assembly Seating Areas. In multilevel assembly seating areas, wheelchair space clusters shall be provided on the main level and on one level for every two additional levels.

12.18.4.3 Existing Assembly Seating Areas. In existing assembly seating areas with a mezzanine, where the main level provides three-quarters or more of the total seating capacity, wheelchair space clusters shall be permitted to be dispersed on the main level.

12.18.4.4 Separation Between Clusters. Wheelchair space clusters shall be separated by a minimum of five intervening rows or by a minimum of 10 intervening seats. Wheelchair spaces within any one wheelchair space cluster shall not be separated by an intervening row, nor by more than two intervening seats, nor by more than a 7-in. (180-mm) vertical level change.

12.19 Dressing, Fitting, and Locker Rooms.

12.19.1 Where dressing rooms, fitting rooms, or locker rooms are provided, at least 5 percent, but not less than one, of each type of use in each cluster provided shall be accessible.

12.19.2 In alterations where it is technically infeasible to provide accessible rooms in accordance with Section 12.19, one room for each sex on each level shall be accessible. Where

only unisex rooms are provided, an accessible unisex room shall be permitted.

12.20 Residential, Residential Board and Care, Dormitory, Institutional, and Long-Term Care Facilities.

12.20.1 General. Residential, residential board and care, dormitory, institutional, and long-term care facilities shall comply with ICC 2000 (CRHA), *Code Requirements for Housing Accessibility.*

12.20.2 Type A Units. Type A units shall be permitted to contain the following adaptable features:

(1) Kitchen and laundry appliances that do not have accessible controls
(2) Refrigerator/freezers that do not have the required accessible freezer space
(3) Kitchen and bathroom sink cabinets and countertops that are not accessible, but that can be made accessible without cutting the countertop or damaging adjacent cabinets, walls, doors and/or structural elements

12.21 Self-Service Storage Facilities.

12.21.1 General. Self-service storage facilities shall provide accessible, individual self-storage spaces in accordance with Table 12.21.1.

Table 12.21.1 Accessible Self-Service Storage Facilities

Total Spaces in Facility	Minimum Number of Required Accessible Spaces
1–200	5 percent, but not less than 1 space
≥201	10 plus 2 percent of total number of units >200

12.21.2 Dispersion. Accessible, individual self-service storage spaces shall be dispersed throughout the various classes of spaces provided. Where more classes of spaces are provided than the number of required accessible spaces, the number of accessible spaces shall not be required to exceed that required by Table 12.21.1. Accessible spaces shall be permitted to be dispersed in a single building of a multibuilding facility.

12.22 Dining Surfaces and Work Surfaces.

12.22.1 General. Where dining surfaces and work surfaces are provided in accessible spaces, at least 5 percent, but not less than one, of the seating and standing spaces at the dining surfaces and work surfaces in a room or space shall be accessible.

12.22.2 Dispersion. Accessible dining surfaces and work surfaces shall be distributed throughout the space or facility containing such surfaces.

12.23 Sales and Service Counters.

12.23.1 General. Where sales and service counters are provided, they shall be accessible in accordance with Section 12.23.

12.23.2 Checkout Aisles. Where checkout aisles are provided, accessible checkout aisles shall be provided in accordance with Table 12.23.2. Where checkout aisles serve different functions, at least one accessible checkout aisle shall be provided for each function. Where checkout aisles are dispersed throughout the building or facility, accessible checkout aisles shall also be dispersed.

Table 12.23.2 Accessible Checkout Aisles

Total Checkout Aisles of Each Function	Minimum Number of Accessible Checkout Aisles of Each Function
1–4	1
5–8	2
9–15	3
>15	3 plus 20 percent of additional aisles

12.23.2.1 Selling Space Less than 5000 ft² (465 m²). Where the area of the selling space is less than 5000 ft² (465 m²), only one checkout aisle shall be required to be accessible.

12.23.2.2 Selling Space of 5000 ft² (465 m²) or More. Where checkout aisles are altered in facilities having a selling space of 5000 ft² (465 m²) or more, at least one of each checkout aisle serving each function shall be made accessible until the number of accessible checkout aisles complies with 12.23.2.

12.23.2.3 Identification. Accessible checkout aisles shall be identified by the international symbol of accessibility, unless all checkout aisles in the facility are accessible. The sign shall be above the checkout aisle in the same location as the checkout aisle number or other type of checkout aisle identification.

12.23.3 Point of Sales and Service Counters.

12.23.3.1 Where counters are provided for sales or distribution of goods or services, at least one of each type provided shall be accessible.

12.23.3.2 Where such counters are dispersed throughout the building or facility, the accessible counters shall also be dispersed.

12.23.4 Food Service Lines. Tray slides at food service lines shall be accessible. Where self-service shelves are provided, at least 50 percent, but not less than one, of each type of shelf provided shall comply with ICC/ANSI A117.1.

12.23.5 Queue and Waiting Lines. Queue and waiting lines servicing accessible counters or checkout aisles shall be accessible.

12.24 Storage.

12.24.1 General. Where fixed or built-in storage elements such as cabinets, shelves, medicine cabinets, closets, and drawers are provided in accessible spaces, at least one of each type shall be accessible.

12.24.2 Lockers. Where lockers are provided in accessible spaces, at least 5 percent, but not less than one, of each type of locker shall be accessible.

12.24.3 Shelving and Display Units. Self-service shelves and display units in mercantile occupancies and shelving in stack areas of libraries shall be located on an accessible route. Such shelving and display units shall not be required to comply with reach range provisions of ICC/ANSI A117.1.

12.24.4 Coat Hooks and Folding Shelves. Where coat hooks or folding shelves are provided in inaccessible toilet rooms; toilet compartments; or dressing, fitting, or locker rooms, at least one of each type shall be provided in accessible toilet rooms; toilet compartments; and dressing, fitting, and locker rooms.

12.25 Windows. In accessible rooms or spaces, each glazed opening required to be operable shall comply with ICC/ANSI A117.1, Section 309.

12.26 Provisions for Children's Use.

12.26.1 Drinking Fountains. A parallel approach complying with ICC/ANSI A117.1, Section 602.2.2, shall be permitted at wall and post-mounted cantilevered units for children's use where the spout is not more than 30 in. (760 mm) above the floor or ground.

12.26.2 Water Closets and Toilet Compartments. Water closets and toilet compartments for children's use shall be permitted to comply with 12.26.2.1 through 12.26.2.7.

12.26.2.1 Location. The water closet shall be located with a wall or partition to the rear and to one side. The centerline of the water closet shall be not less than 12 in. (305 mm), and not more than 18 in. (455 mm), from the sidewall or partition, except that the water closet shall be centered in the ambulatory accessible toilet compartment specified in ICC/ANSI A117.1, Section 604.8.2.

12.26.2.2 Clear Floor Space. Clearance around a water closet shall comply with ICC/ANSI A117.1 Section 604.3.

12.26.2.3 Height. The height of water closets shall be not less than 11 in. (280 mm), and not more than 17 in. (430 mm), measured to the top of the toilet seat. Seats shall not be sprung to return to a lifted position.

12.26.2.4 Grab Bars. Grab bars for water closets shall comply with ICC/ANSI A117.1, Section 604.5.

Exception: If administrative authorities require flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, the grab bar shall be permitted to be split or shifted to the open side of the toilet area.

12.26.2.5 Flush Controls. Flush controls shall be hand operated or automatic. Hand-operated flush controls shall comply with ICC/ANSI A117.1, Section 309.2 and Section 309.4, and shall be installed not more than 36 in. (915 mm) above the floor.

12.26.2.6 Dispensers. Toilet paper dispensers shall comply with ICC/ANSI A117.1, Section 309.4, and shall be located not less than 7 in. (180 mm), and not more than 9 in. (230 mm), from the front of the water closet. The outlet of the dispenser shall be not less than 14 in. (355 mm), and not more than 19 in. (485 mm), above the floor. There shall be a clearance of not less than 1½ in. (38 mm) below the grab bar. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow.

12.26.2.7 Toilet Compartments. Accessible toilet compartments shall meet the requirements of 12.26.2.7.1 through 12.26.2.7.2. Compartments containing more than one plumbing fixture shall comply with ICC/ANSI A117.1, Section 603.

12.26.2.7.1 Wheelchair-Accessible Compartments.

12.26.2.7.1.1 Size. Wheelchair-accessible compartments shall be not less than 60 in. (1525 mm) wide, measured perpendicular to the sidewall, and not less than 59 in. (1500 mm) deep, measured perpendicular to the rear wall.

12.26.2.7.1.2 Doors. Toilet compartment doors, including door hardware, shall comply with ICC/ANSI A117.1, Section 404, except that, if the approach is to the latch side of the compartment door, clearance between the door side of the stall and any obstruction shall be not less than 42 in. (1065 mm). The door shall be hinged not more than 4 in. (100 mm) from the sidewall or partition farthest from the water closet. The door shall be self-closing. A door pull complying with ICC/ANSI A117.1, Section 404.2.7, shall be placed on both sides of the door near the latch. Compartment doors shall not swing into the minimum required compartment area.

12.26.2.7.1.3 Approach. Compartments shall be arranged for left-hand or right-hand approach.

12.26.2.7.1.4 Toe Clearance. In wheelchair-accessible compartments, the front partition and at least one side partition shall provide a toe clearance of not less than 12 in. (305 mm) above the floor and not less than 6 in. (150 mm) deep beyond the compartment-side face of the partition, exclusive of partition support members.

12.26.2.7.1.5 Grab Bars. Grab bars shall comply with ICC/ANSI A117.1, Section 609. A sidewall grab bar complying with ICC/ANSI A117.1, Section 604.5.1, located on the wall closest to the water closet, and a rear-wall grab bar complying with ICC/ANSI A117.1, Section 604.5.2, shall be provided. Grab bars at water closets for children's use shall be installed in a horizontal position not less than 18 in. (455 mm), and not more than 27 in. (685 mm), above the floor.

12.26.2.7.2 Ambulatory-Accessible Compartments. Ambulatory-accessible compartments shall comply with ICC/ANSI A117.1, Section 604.8.2.

12.26.3 Lavatories and Sinks.

12.26.3.1 Clear Floor Space. Knee clearance of not less than 24 in. (610 mm) above the floor or ground shall be permitted at lavatories and sinks used primarily by children ages 6 through 12 where the rim or counter surface is not more than 31 in. (760 mm) above the floor or ground.

12.26.3.2 Approach. A parallel approach to lavatories and sinks used primarily by children ages 5 and younger shall be permitted in lieu of a forward approach.

12.27 Judicial Facilities.

12.27.1 General. Judicial facilities shall comply with 12.27.

12.27.2 Courtrooms. Each courtroom shall comply with 12.27.2.1 through 12.27.2.3.

12.27.2.1 Raised or Depressed Areas. Where provided, areas that are raised or depressed and accessed by ramps or wheelchair (platform) lifts with entry ramps shall provide unobstructed turning space complying with ICC/ANSI A117.1, Section 304.

12.27.2.2 Jury Boxes and Witness Stands. Each jury box and witness stand shall have, within its defined area, clear floor space complying with ICC/ANSI A117.1, Section 305.

Exception: In alterations, accessible wheelchair spaces shall not be required to be located within the defined area of raised jury boxes or witness stands and shall be permitted to be located outside these spaces where ramp or lift access poses a hazard by restricting or projecting into a means of egress required by the appropriate administrative authority.

12.27.2.3 Judges' Benches and Courtroom Stations. Judges' benches, clerk stations, bailiff stations, deputy clerk stations, court reporter stations, and litigant and counsel stations shall comply with ICC/ANSI A117.1, Section 902.

12.27.3 Holding Cells. Where provided, central holding cells and court-floor holding cells shall comply with 12.27.3.1 and 12.27.3.2.

12.27.3.1 Central Holding Cells. Where separate central holding cells are provided for an adult male, a juvenile male, an adult female, or a juvenile female, one of each type shall comply with Section 12.29. Where central holding cells are provided and are not separated by age or sex, at least one cell complying with 12.29.2 shall be provided.

12.27.3.2 Court-Floor Holding Cells. Where separate court-floor holding cells are provided for an adult male, a juvenile male, an adult female, or a juvenile female, each courtroom shall be served by one cell of each type complying with Section 12.29. Where court-floor holding cells are provided and are not separated by age or sex, courtrooms shall be served by at least one cell complying with 12.29.2. Cells shall be permitted to serve more than one courtroom.

12.27.4 Visiting Areas. Visiting areas shall comply with 12.27.4.1 and 12.27.4.2.

12.27.4.1 Cubicles and Counters. At least 5 percent of all cubicles, but not less than one cubicle, shall comply with ICC/ANSI A117.1, Section 902, on both the visitor and detainee sides. Where counters are provided, at least one shall comply with ICC/ANSI A117.1, Section 902.3, on both the visitor and detainee sides.

Exception: The requirement of 12.27.4.1 shall not apply to the detainee side of cubicles or counters at noncontact visiting areas not serving accessible holding cells.

12.27.4.2 Partitions. Solid partitions or security glazing that separates visitors from detainees shall comply with ICC/ANSI A117.1, Section 904.6.

12.28 Detention and Correctional Facilities.

12.28.1 General. Buildings, facilities, or portions thereof in which people are detained for penal or correctional purposes, or in which the liberty of the inmates is restricted for security reasons, shall comply with Section 12.28.

12.28.2 General Holding Cells and General Housing Cells or Rooms. Accessible general holding cells and accessible general housing cells or rooms shall be provided in accordance with 12.28.2.1 through 12.28.2.4.

12.28.2.1 Accessible Cells or Rooms. At least 2 percent, but not less than one, of the total number of cells or rooms in a facility shall comply with 12.29.2.

12.28.2.2 Accessible Beds. In cells or rooms having four or more beds, the number of beds in the cell or room required to have clear floor space complying with 12.29.2 shall comply with Table 12.28.2.2.

Table 12.28.2.2 Number of Accessible Beds

Total Number of Beds in a Cell or Room	Minimum Number of Required Accessible Beds
4–25	1
26–50	2
≥51	5 percent of beds

12.28.2.3 Communication Features. At least 2 percent, but not less than one, of the total number of general holding cells and general housing cells or rooms that are equipped with audible emergency alarm systems or permanently installed telephones within the cell or room shall comply with 12.29.3.

12.28.2.4 Dispersion. Fifty percent, but not less than one, of the cells or rooms required to comply with 12.29.2 shall also comply with 12.29.3.

12.28.3 Special Holding Cells and Special Housing Cells or Rooms. Where special holding cells or special housing cells or rooms are provided, at least one serving each purpose shall comply with 12.29.2. Cells or rooms subject to this requirement shall include, but are not limited to, those used for purposes of orientation, protective custody, administrative or disciplinary detention or segregation, detoxification, and medical isolation.

Exception: Cells or rooms specially designed without protrusions and that are used solely for purposes of suicide prevention shall not be required to comply with ICC/ANSI A117.1, Section 604.5.

12.28.4 Medical Care Facilities. Patient bedrooms or cells required to be accessible in accordance with Section 12.20 shall be provided in addition to any medical isolation cells required to be accessible under 12.28.3.

12.28.5 Visiting Areas. Visiting areas shall comply with 12.28.5.1 and 12.28.5.2.

12.28.5.1 Cubicles and Counters.

(A) General. At least 5 percent of all cubicles, but not less than one cubicle, shall comply with ICC/ANSI A117.1, Section 902, on both the visitor and detainee sides. Where counters are provided, at least one shall provide for forward approach on both the visitor and detainee or inmate sides in accordance with 12.28.5.1(B).

(B) Forward Approach. A portion of the counter surface not less than 30 in. (760 mm) long, and not more than 36 in. (915 mm) high, shall be provided. Knee and toe space complying with ICC/ANSI A117.1, Section 306, shall be provided under the accessible counter. A clear floor or ground space complying with ICC/ANSI A117.1, Section 305, shall be positioned for a forward approach to the accessible counter.

Exception: The requirements of 12.28.5.1(A) shall not apply to the inmate or detainee side of cubicles or counters at noncontact visiting areas not serving accessible holding or housing cells or rooms.

12.28.5.2 Partitions.

(A) General. Solid partitions or security glazing that separates visitors from detainees shall comply with 12.28.5.2(B).

(B) Communication. Where partitions or security glazing is used to separate visitors from detainees, at least one of each type shall provide a method to facilitate voice communication. Such methods shall be permitted to include, but are not limited to, grilles, slats, talk-through baffles, intercoms, or telephone handset devices. The method of communication shall be accessible to both individuals who use wheelchairs and individuals who have difficulty bending or stooping. Hand-operable communications devices, if provided, shall comply with ICC/ANSI A117.1, Section 704.3.

12.29 Technical Provisions for Holding Cells and Housing Cells or Rooms.

12.29.1 General. Holding cells or housing cells or rooms required to be accessible shall comply with 12.29.2. Holding cells or housing cells or rooms required to have accessible communication features shall comply with 12.29.3.

12.29.2 Accessible Cells or Rooms. Accessible cells or rooms shall comply with 12.29.2.1 through 12.29.2.5.

12.29.2.1 Wheelchair Turning Space. Wheelchair turning space complying with ICC/ANSI A117.1, Section 304, shall be provided within the cell or room and shall not overlap with or extend beneath a bed.

12.29.2.2 Benches. Where benches are provided, at least one bench shall comply with ICC/ANSI A117.1, Section 903.

12.29.2.3 Beds. Where beds are provided, clear floor space complying with ICC/ANSI A117.1, Section 305, shall be provided on at least one side of the bed. The clear floor space shall be positioned for parallel approach to the side of the bed.

12.29.2.4 Drinking Fountains and Water Coolers. Where drinking fountains or water coolers are provided, at least one shall comply with ICC/ANSI A117.1, Section 602.1 through Section 602.6.

12.29.2.5 Toilet and Bathing Facilities. Toilet facilities or bathing facilities that are provided as part of a cell or room shall comply with ICC/ANSI A117.1, Section 603.

12.29.3 Communication Features.

(A) General. Cells or rooms required to have accessible communication features shall comply with 12.29.3(B).

(B) Alarms. Where audible emergency alarm systems are provided to serve the occupants of cells or rooms, visual alarms shall be provided.

Exception: The requirement of 12.29.3 shall not apply where inmates or detainees are not allowed independent means of egress.

Chapter 13 Encroachments into the Public Right of Way

13.1 General.

13.1.1 No part of any structure or any appendage thereto, except signs, shall project beyond the property lines of the building site, except as specified in Section 13.1. Signs and their method of installation shall conform to the requirements of Chapter 32.

13.1.2 Structures or appendages regulated by this *Code* shall be constructed of materials as specified in Chapter 35.

13.1.3 The projection of any structure or appendage shall be the distance measured horizontally from the property line to the outermost point of the projection.

13.1.4 No provisions of this chapter shall be construed to permit the violation of other laws or ordinances regulating the use and occupancy of public property.

13.2 Projection into Alleys.

13.2.1 No part of any structure or any appendage thereto shall project into any alley.

13.2.2 A curb or buffer block shall be permitted to project not more than 9 in. (230 mm) into an alley and shall not exceed a height of 9 in. (230 mm) above grade.

13.2.3 Footings located at least 8 ft (2440 mm) below grade shall be permitted to project not more than 12 in. (305 mm) into an alley.

13.3 Space Below Sidewalk. The space adjoining a building below a sidewalk on public property shall be permitted to be used and occupied in connection with the building for a purpose not inconsistent with this *Code* or other laws or rules regulating the use and occupancy of such space on the condition that the right to use and occupy shall be permitted to be revoked by the authority having jurisdiction at any time, and that the owner of the building will construct the necessary walls and footing to separate such space from the building and pay all costs and expenses attendant thereto.

13.4 Balconies and Appendages. Oriel windows, balconies, unroofed porches, cornices, belt courses, and appendages such as water tables, sills, capitals, bases, and architectural projections shall be permitted to project over the public property of the building side for a distance determined by the clearance of the lowest point of the projection above the grade immediately below, as follows:

(1) Clearance above grade less than 8 ft (2440 mm) — no projection permitted
(2) Clearance above grade over 8 ft (2440 mm) — 1 in. (25 mm) of projection permitted for each additional 1 in. (25 mm) of clearance, provided that no such projection exceeds a distance of 4 ft (1220 mm)

13.5 Doors. Doors, while either fully opened or while opening, shall not project beyond the property line.

13.6 Roof Drainage. Drainage water from the roof of a building shall not be permitted to flow over or accumulate on a public walkway.

13.7 Air-Right Structures. Air-right structures shall comply with the requirements of this *Code* and NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways.*

13.8 Skywalk Bridges.

13.8.1 General. Skywalk bridges shall comply with 13.8.2 through 13.8.7.

13.8.2 Building Separations. Required building separations shall be in accordance with Chapter 37, regardless of whether fire barriers are required in accordance with Chapter 7 or Chapter 8. Smoke barriers in accordance with Section 8.11 shall separate the skywalk bridge from adjacent buildings.

13.8.3 Exits. Each building connected by a skywalk bridge shall have exits as required by this *Code*.

13.8.4 Vertical Clearance. Skywalk bridges shall have a minimum of 16½ ft (5030 mm) clearance above the existing street grade in the center lane, and a minimum of 15 ft (4570 mm) clearance above the street pavement at the curb and over alleys.

13.8.5 Dimensions. Skywalk bridges shall be not less than 8 ft (2440 mm), nor more than 14 ft (4270 mm), in width, and not more than 14 ft (4270 mm) in height.

13.8.6 Ramps. Ramps within the skywalk bridge shall not exceed a slope of 1 in 12. There shall be no steps within a skywalk bridge.

13.8.7 Street Access. Skywalk bridges shall have pedestrian access to and from the street level. Access shall be available at a minimum of one of the termini points of each skywalk bridge.

Chapter 14 Safeguards During Construction

14.1* Purpose. The purpose of this chapter shall be to provide regulations for reasonable safety for life, limb, and property during building construction and demolition.

14.2 Application. The provisions of Section 14.2 and NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, shall apply to all building and demolition operations and shall not be construed as replacing or conflicting with the provisions of other sections of this *Code*.

14.3 Protection of Utilities. Substantial protective frame and boarding shall be built around and over every street lamp, utility box, fire or police alarm box, fire hydrant, catch basin, and manhole that can be damaged by work being done and shall not obstruct the normal functioning of the device being protected.

14.4 Temporary Light and Power. All parts of a building under construction or being demolished, for which temporary lighting and power are required, shall be in accordance with the requirements of NFPA 70, *National Electrical Code*.

14.5 Use of Explosives. Explosives shall not be used in the demolition of a building without written approval of the authority having jurisdiction and, when used, shall conform to the requirements of NFPA 1, *Fire Prevention Code*.

Chapter 15 Building Rehabilitation

15.1 Administration.

15.1.1 Purpose and Intent.

15.1.1.1 The purpose of this chapter is to encourage the continued use or reuse of legally existing buildings and structures. The intent of this chapter is to permit repairs, renovations, modifications, reconstructions, additions, and changes of use that maintain or improve the health, safety, and welfare of occupants in existing buildings, without requiring full compliance with the other sections of this *Code*, the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, except for proportional additional work as specified in this chapter.

15.1.1.2 Nothing in this chapter shall be interpreted as requiring the repair, renovation, modification or reconstruction of existing buildings.

15.1.1.3 All work shall be classified into categories for repair, renovation, modification, reconstruction, change of use, and addition, with specific requirements established for each work category.

15.1.1.4 Work of more than one category shall be permitted to be part of a single work project.

15.1.1.4.1 Where a project includes one category of work in one building area and another category of work in a separate area of the building, each project area shall comply with the requirements of the respective category of work.

15.1.1.4.2 The separate rehabilitation work areas shall not be considered together for the purpose of determining supplemental requirements.

15.1.1.4.3 Where a project consisting of modifications and reconstruction is performed in the same work area, or in contiguous work areas, the project shall comply with the requirements applicable to a reconstruction.

Exception: Where the reconstruction work area is less than 10 percent of the modification work area, each shall be considered as an independent work area, and the respective requirements shall apply.

15.1.2 Compliance.

15.1.2.1 Categories of Work. Repairs, renovations, modifications, reconstruction, additions, and changes of use shall conform to the requirements of this chapter.

15.1.2.2 Equivalent Alternatives. Equivalency shall be permitted in accordance with Section 1.5.

15.1.2.3 Other Alternatives. Where compliance with this chapter, or with any other code as required by this chapter, is technically infeasible or would impose undue hardship because of structural, construction, or dimensional difficulties, the authority having jurisdiction shall be permitted to accept other alternative materials, design features, and operational features.

15.1.2.4 Compliance with Other Codes. Buildings, elements, components, or systems in compliance with other sections of this *Code*, or the current edition of the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, shall not be required to comply with any more restrictive requirement of this chapter.

15.1.2.4.1 Elements, components, and systems of existing buildings with features that exceed the requirements of the codes for new construction, and not otherwise required as part of prior documented, approved alternative arrangements, shall not be prevented by this chapter from being modified, provided that they remain in compliance with the applicable codes for new construction.

15.1.2.4.2* Existing life safety features obvious to the public, if not required by the *Code*, shall be either maintained or removed.

15.1.2.4.3 The provisions of this chapter shall not supersede any codes or ordinances that address dangerous or unsafe buildings.

15.1.2.4.4 Work mandated by any accessibility code, property code, housing code, or fire code, or mandated by any licensing rule or ordinance, that has been adopted pursuant to law, shall conform only to the requirements of that code, rule, or ordinance and shall not be required to conform to this chapter, unless the code requiring such work so provides.

15.1.2.4.5 Buildings and structures located wholly or partially within the flood hazard area established by 39.4.2 shall comply with Section 39.13.

15.1.3 Preliminary Meeting.

15.1.3.1 If a building permit is required for a complex rehabilitation project involving multiple codes, the authority having jurisdiction or its designee, and representatives from all

necessary agencies, shall meet with the prospective permit applicant at the request of the prospective applicant and upon payment of a fee, if required by the local jurisdiction, prior to the submission of the construction permit application. The purpose of such meeting shall be to discuss plans for any proposed work or change of occupancy under this *Code* prior to the application for the permit.

15.1.3.1.1* The preliminary meeting, to the extent possible, shall include the officials responsible for permit approval and enforcement with respect to the following, as applicable to the rehabilitation project:

(1) Building code
(2) Mechanical code
(3) Plumbing code
(4) Electrical code
(5) Fire code
(6) Boiler safety code
(7) Energy code
(8) Elevator code
(9) Local historic preservation ordinances

15.1.3.1.2 Decisions made at the preliminary meeting shall be binding upon the prospective applicant and the code officials unless unforeseen circumstances arise that were unknown or could not be ascertained at the time of the preliminary meeting.

15.1.3.2 For a rehabilitation project or portion thereof that is in the repair, renovation, or modification category of work, a preliminary meeting shall be permitted to be granted at the discretion of the authority having jurisdiction when a request for a preliminary meeting is made by the prospective applicant prior to the submission of the construction permit application.

15.1.4 Permits. The rehabilitation work area *(see 3.3.32.12.2, Rehabilitation Work Area)* shall be clearly identified on all construction permit applications, construction documents, and permits required by the authority having jurisdiction.

15.2 Definitions and Chapter Organization.

15.2.1 Definitions. See Chapter 3 for definitions of terms.

15.2.2 Organization of Chapter 15.

15.2.2.1 Repair. *Repair* shall be defined as the patching, restoration, or painting of materials, elements, equipment, or fixtures for the purpose of maintaining such materials, elements, equipment or fixtures in good or sound condition. *(See Section 15.3.)*

15.2.2.2 Renovation. *Renovation* shall be defined as the change, strengthening or addition of load bearing elements, the refinishing, replacement, bracing, strengthening, upgrading of existing materials, elements, equipment and/or fixtures, without reconfiguration of spaces. *(See Section 15.4.)*

15.2.2.3 Modification. *Modification* shall be defined as the reconfiguration of any space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment. *(See Section 15.5.)*

15.2.2.4 Reconstruction. *Reconstruction* shall be defined as the reconfiguration of a space that affects an exit, or a corridor shared by more than a single tenant; or reconfiguration of space such that the rehabilitation work area is not permitted to be occupied because existing means of egress and fire protection systems, or their equivalent, are not in place or continuously maintained. *(See Section 15.6.)*

15.2.2.5 Change of Use. *Change of use* shall be defined as a change in the purpose or level of activity within a structure that involves a change in application of the requirements of the building code. *(See Section 15.7.)*

15.2.2.6 Change of Occupancy Classification. *Change of occupancy classification* shall be defined as a change of use involving a change in the occupancy classification of a structure or portion of a structure. *(See Section 15.7.)*

15.2.2.7 Addition. *Addition* shall be defined as an increase in building area, aggregate floor area, height, or number of stories of a structure. *(See Section 15.8.)*

15.2.2.8 Historic Building. *Historic Building* shall be defined as a building or facility deemed to have historical, architectural, or cultural significance by a local, regional, or national jurisdiction. *(See Section 15.9.)*

15.3 Repair.

15.3.1 General Requirements.

15.3.1.1 Repair shall comply with the requirements of Section 15.3. *(See 3.3.454, Repair.)*

Exception: The requirement of 15.3.1.1 shall not apply as otherwise modified in Section 15.9 for repairs in historic buildings.

15.3.1.2 Except as is otherwise required herein, work shall be done using like materials, or materials permitted by other sections of this *Code*, mechanical code, plumbing code, fire code, electrical code, boiler safety code or elevator code, as applicable.

15.3.1.2.1 Hazardous materials that are no longer permitted, such as asbestos and lead-based paint, shall not be used.

15.3.1.2.2 Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Chapter 46.

Exception No. 1: Glass-block walls shall be permitted to be repaired using like materials.

Exception No. 2: Louvered windows and jalousies shall be permitted to be repaired using like materials.

15.3.1.3 Repairs shall not require parts of the existing building not subject to the work involved to comply with the requirements of this *Code* for new construction.

15.3.1.4 Repairs shall not make the building less conforming with other sections of this *Code*, the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, or with any previously approved alternative arrangements, than it was before the repair was undertaken.

15.3.2 Nonstructural Requirements (Reserved).

15.3.3 Structural Requirements. The work shall cause no diminution of structural strength.

15.3.4 Accessibility Requirements (Reserved).

15.3.5 Electrical Requirements. Existing electrical wiring and equipment undergoing repair shall be permitted to be repaired or replaced with like material.

Exception No. 1: Electrical products shall comply with Section 110.3(B) of the National Electrical Code.

Exception No. 2: Replacement of electrical receptacles shall comply with the requirements of Section 406.3(D) of the National Electrical Code.

Exception No. 3: Plug fuses of the Edison-base type shall be permitted to be used for replacements only where there is no evidence of overfusing or tampering per Section 240.51(B) of the National Electrical Code.

Exception No. 4: For replacement of non-grounding-type receptacles with grounding-type receptacles, and for branch circuits that do not have an equipment grounding conductor in the branch circuit, the grounding conductor of a grounding-type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system as described in Section 250.130(C) of the National Electrical Code, or to any accessible point on the grounding electrode conductor.

Exception No. 5: Non-hospital-grade receptacles in patient bed locations of health care occupancies shall be replaced with hospital grade receptacles, as required by NFPA 99, Standard for Health Care Facilities.

Exception No. 6: Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and outlet or junction boxes that are part of the existing branch circuit for these appliances shall be permitted to be grounded to the grounded circuit conductor if all the conditions of Section 250.60 of the National Electrical Code are met.

15.3.6 Mechanical Requirements.

15.3.6.1 Defective material or parts shall be replaced or repaired in such a manner so as to preserve the original approval or listing.

15.3.6.2 Temporary repairs shall not be made to a damaged heat exchanger.

15.3.7 Plumbing Requirements.

15.3.7.1 The following plumbing materials and supplies shall not be used:

(1) All-purpose solvent cement other than transition glues
(2) Flexible traps and tailpieces
(3) Sheet and tubular copper and brass trap and tailpiece fittings less than B&S 17 gauge (0.045 in.)
(4) Solder having more than 0.2 percent lead in the repair of potable water systems

15.3.7.2 When any water closet, urinal, lavatory faucet, kitchen faucet or shower head is replaced, the replacement fixture shall comply with the water conservation requirements specified in the plumbing code.

15.3.8 Boiler and Pressure Vessel Requirements.

15.3.8.1 Repairs and replacements of fittings or appliances for boilers and pressure vessels shall comply with the appropriate ASME code.

15.3.8.2 Repairs of boilers and pressure vessels shall comply with the requirements specified in the boiler safety code.

15.3.9 Elevator Requirements. All repairs shall be done in accordance with Section 8.6 of ASME A17.1, *Safety Code for Elevators and Escalators.*

15.4 Renovation.

15.4.1 General Requirements.

15.4.1.1 Renovation shall comply with the requirements of Section 15.4 *(See 3.3.453, Renovation.)*

Exception: The requirement of 15.4.1.1 shall not apply as otherwise modified in Section 15.9 for historic buildings.

15.4.1.2 All new work shall comply with the materials and methods requirements. *(See 3.3.341, Materials and Methods Requirements.)*

15.4.1.3 Where renovations are made, parts of the existing building not subject to the work involved shall not be required to comply with the requirements of this *Code* for new construction.

15.4.1.4 Renovations shall not make the building less conforming with other sections of this *Code,* the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, or accessibility code, or with any previously approved alternative arrangements, than it was before the renovation was undertaken.

Exception: Minor reductions in the clear opening dimensions of replacement doors and windows that result from the use of different materials shall be permitted, unless such reductions are prohibited by ADAAG.

15.4.2 Nonstructural Requirements.

15.4.2.1 New wood paneling and textile wall coverings used as an interior finish shall comply with the flame spread requirements for new construction.

15.4.2.2 New carpeting used as an interior floor finish material shall comply with the radiant flux requirements for new construction.

15.4.2.3 Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Chapter 46.

Exception No. 1: Glass-block walls shall be permitted to be repaired using like materials.

Exception No. 2: Louvered windows and jalousies shall be permitted to be repaired using like materials.

15.4.2.4 All reroofing shall comply with 15.4.2.5 through 15.4.2.9.3 unless otherwise cited.

15.4.2.5 A maximum of two layers of roof covering shall be permitted on any roof.

15.4.2.6 The following shall apply to reroofing of wet areas:

(1) Reroofing shall not be installed over areas where the roof deck or above-deck components are wet.
(2) In wet areas, the roof covering and insulation shall be cut out, and the roof deck shall be dried, cleaned, and repaired or replaced as necessary.
(3) All above-deck components shall be replaced.

15.4.2.7 The addition of a reroofing system shall result in performance of the composite assembly that meets the requirements of Section 38.2, Section 38.3, Section 38.4, and Section 38.5.

15.4.2.8 Where reroofing systems are adhered directly to an existing roof system, verification that the existing roof system provides wind resistance as required by Section 38.4 shall be required.

15.4.2.9 Access shall be provided to spaces created when a new roof assembly is constructed over an existing roof where one of the following conditions applies:

(1) The existing roof covering is not one of the types identified in 38.2.2.
(2) The new roof assembly is of combustible construction.

15.4.2.9.1 The requirements of 15.4.2.9 shall not apply, provided that one of the following criteria is met:

(1) Access shall not be required to spaces created when a new, noncombustible roof covering is applied on noncombustible structural supports, and the existing roof covering is covered with a noncombustible or limited-combustible material.
(2) Access shall not be required where the space created is protected by an approved sprinkler system in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*
(3) Access shall not be required where the joist channels are fireblocked into volumes not exceeding 160 ft^3 (4.5 m^3).

15.4.2.9.2 When required, access shall be provided every 2500 ft^2(230 m^2) by an accessible opening of 20 in. × 30 in. (500 mm × 760 mm).

15.4.2.9.3 Access shall not be required to spaces where both of the following conditions exist:

(1) The vertical distance between the existing roof and the new roof is less than 12 in. (300 mm).
(2) A noncombustible or limited-combustible material is applied directly over the existing roof covering when it is not one of the types identified in 38.2.2.

15.4.3 Structural Requirements. The minimum design loads for the structure shall be the loads applicable at the time the building was constructed, provided that no structurally deficient condition is created. Structural elements that are uncovered during the course of the modification and that are found to be unsound or structurally deficient shall comply with the load requirements of Chapter 35 and the applicable material stress requirements of Chapter 41 (concrete), Chapter 42 (aluminum), Chapter 43 (masonry), Chapter 44 (steel), Chapter 45 (wood), or Chapter 46 (glass).

15.4.4 Accessibility Requirements.

15.4.4.1 Dwelling Units. Dwelling units, as defined in the accessibility code, that are undergoing renovation shall comply with the applicable requirements of the accessibility code.

Exception No. 1: The requirement of 15.4.4.1 shall not apply to reroofing.

Exception No. 2: The requirement of 15.4.4.1 shall not apply to changes to mechanical and electrical systems that do not affect the usability of the building or facility.

Exception No. 3: The requirement of 15.4.4.1 shall not apply to dwelling units used on a transient basis and covered under 15.4.4.2 or 15.4.4.3.

Exception No. 4: The requirement of 15.4.4.1 shall not apply to residential buildings consisting of less than four dwelling units.

Exception No. 5: The requirement of 15.4.4.1 shall not apply to existing buildings and facilities, as defined in the accessibility code, that are undergoing renovation for the sole purpose of complying with the Americans with Disabilities Act, which requires removal of architectural barriers in existing buildings and facilities where removal is readily achievable.

15.4.4.2 State and Local Government Buildings and Facilities. State and local government-owned buildings and facilities, as defined in the accessibility code, that are undergoing renovation shall comply with the applicable requirements of the accessibility code.

Exception No. 1: The requirement of 15.4.4.2 shall not apply to reroofing.

Exception No. 2: The requirement of 15.4.4.2 shall not apply to changes to mechanical and electrical systems that do not affect the usability of the building or facility.

Exception No. 3: The requirement of 15.4.4.2 shall not apply to observation galleries of less than 150 ft^2 (13.9 m^2) and used primarily for security purposes.

Exception No. 4: The requirement of 15.4.4.2 shall not apply to nonoccupiable spaces accessed only by ladders, catwalks, crawl spaces, very narrow passageways, or nonpassenger freight elevators, and frequented only by service personnel for repair purposes, including, but not limited to, elevator pits, elevator penthouses, and piping or equipment catwalks.

Exception No. 5: The requirement of 15.4.4.2 shall not apply to existing buildings and facilities undergoing renovation for the sole purpose of complying with the Americans with Disabilities Act, which requires removal of architectural barriers in existing buildings and facilities where removal is readily achievable.

15.4.4.3 All Other Buildings and Facilities. Buildings and facilities, as defined in the accessibility code, that are undergoing renovation, and are not covered by 15.4.4.1 and 15.4.4.2, shall comply with the applicable requirements of the accessibility code.

Exception No. 1: The requirement of 15.4.4.3 shall not apply to reroofing.

Exception No. 2: The requirement of 15.4.4.3 shall not apply to changes to mechanical and electrical systems that do not affect the usability of the building or facility.

Exception No. 3: The requirement of 15.4.4.3 shall not apply to observation galleries of less than 150 ft^2 (13.9 m^2) and used primarily for security purposes.

Exception No. 4: The requirement of 15.4.4.3 shall not apply to nonoccupiable spaces accessed only by ladders, catwalks, crawl spaces, very narrow passageways, or nonpassenger freight elevators, and frequented only by service personnel for repair purposes, including, but not limited to, elevator pits, elevator penthouses, and piping or equipment catwalks.

Exception No. 5: The requirement of 15.4.4.3 shall not apply to existing buildings and facilities undergoing renovation for the sole purpose of complying with the Americans with Disabilities Act, which requires removal of architectural barriers in existing buildings and facilities where removal is readily achievable.

15.4.5 Electrical Requirements (Reserved).

15.4.6 Mechanical Requirements (Reserved).

15.4.7 Plumbing Requirements.

15.4.7.1 Discharge.

15.4.7.1.1 In areas where public sanitary sewers are not available, existing structures that are being renovated, and that discharge liquid wastes containing grease, flammable wastes, sand, solids, and other ingredients harmful to the building drainage system, shall either permanently plug all existing floor drains or shall retrofit all existing floor drains so as to allow them to flow into an approved sand interceptor that drains into a 1000-gal (3.8-m^3) or larger approved holding tank.

15.4.7.1.2 An oil and water separator shall not be required when the waste discharges into a holding tank.

15.4.7.1.3 Any renovation of an existing structure that discharges liquid wastes containing grease, flammable wastes, sand, solids, and other ingredients harmful to the building drainage system, or that discharges other industrial waste waters, shall have the option of discharging into an on-site subsurface disposal system, provided that the facility's owner/operator applies for and obtains a water discharge permit.

15.4.7.2 Water Conservation. When any water closet, urinal, lavatory faucet, kitchen faucet, or shower head is replaced, the replacement fixture shall comply with the water conservation requirements of the plumbing code.

15.4.8 Boiler and Pressure Vessel Requirements.

15.4.8.1 A replacement boiler installed in an existing building shall comply with access and egress requirements of the boiler safety code.

15.4.8.2 A boiler room in which a replacement boiler is installed shall comply with the air and ventilation requirements specified in the boiler safety code.

15.4.8.3 Replacement of fittings, appliances, and boilers shall be in accordance with the appropriate ASME code.

15.4.9 Elevator Requirements. Any renovation of an existing elevator shall comply with Section 8.7 of ASME A17.1.

15.5 Modifications.

15.5.1 General Requirements.

15.5.1.1 General Modifications. Modification shall comply with the requirements of Section 15.5. *(See 3.3.352, Modification.)*

Exception: The requirement of 15.5.1.1 shall not apply as otherwise modified in Section 15.9 for historic buildings.

15.5.1.2 Extensive Modifications.

15.5.1.2.1 The modification of an entire building or an entire occupancy within a building shall be considered as a reconstruction and shall comply with the requirements of Section 15.6 for the applicable occupancy.

Exception: Modification work that is exclusively electrical, mechanical, or structural, or that exclusively involves plumbing or the fire protection system, shall not be considered a reconstruction, regardless of its extent.

15.5.1.2.2 When the total area of all the rehabilitation work areas included in a modification exceeds 50 percent of the area of the building, the work shall be considered as a reconstruction and shall comply with the requirements of Section 15.6 for the applicable occupancy.

Exception: Rehabilitation work areas in which the modification work is exclusively mechanical or electrical, or in which the modification work exclusively involves plumbing or the fire protection system, shall not be included in the computation of total area of all rehabilitation work areas.

15.5.1.2.3 In health care occupancies, modifications of more than 50 percent or 4500 ft^2 (420 m^2) of the area of the smoke compartment shall comply with 15.6.2.5.2.3. Work that is exclusively mechanical or electrical, or that exclusively involves plumbing, the fire protection system, medical gas, or medical equipment, shall not be included in the computation of the modification area within the smoke compartment.

15.5.1.3 Additional Requirements. In addition to the requirements of Section 15.5, all work shall comply with all the requirements of Section 15.4.

15.5.1.4 Newly Constructed Elements, Components, and Systems. All newly constructed elements, components, and systems shall comply with the requirements of other sections of this *Code*, the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, and accessibility code.

Exception No. 1: Openable windows shall be permitted to be added without requiring compliance with the light and ventilation requirements of Chapter 49.

Exception No. 2: Newly installed electrical equipment shall comply with the requirements of 15.5.5.

15.5.1.5 Noncompliance and Nonconformity. The modification work shall not increase the extent of noncompliance with the requirements of Section 15.6 or create a nonconformity with those requirements that did not previously exist.

15.5.2 Nonstructural Requirements.

15.5.2.1 Interior Space Dimensions.

15.5.2.1.1 In residential occupancies other than one- and two-family dwellings, when habitable rooms *(see 3.3.470.4, Habitable Room)* are created in a previously unoccupied space, other than a kitchen, they shall not be less than 7 ft (2135 mm) in any plan dimension.

15.5.2.1.2 In residential occupancies other than one- and two-family dwellings, when habitable rooms *(see 3.3.470.4, Habitable Room)* are created in a previously unoccupied space, they shall have a ceiling height of not less than 7 ft (2135 mm).

Exception No. 1: The requirement of 15.5.2.1.2 shall not apply to beams, girders, ducts, or pipes spaced not less than 4 ft (1220 mm) on center and projecting not more than 6 in. (150 mm) below the required ceiling height.

Exception No. 2: For rooms with a sloped ceiling, the minimum 7-ft (2135-mm) ceiling height shall be exempted for all but 35 ft^2 (3.25 m^2) of the floor area of the room. Any portion of the room measuring less than 5 ft (1525 mm) from the finished floor to the finished ceiling shall not be considered usable floor area and shall not be included in any computation of the minimum area thereof.

15.5.2.1.3 In apartment occupancies, when habitable rooms *(see 3.3.470.4, Habitable Room)* are created in a previously unoccupied space, other than a kitchen, they shall have a net floor area of not less than 70 ft^2 (6.5 m^2).

15.5.2.2 Health Care Occupancies.

15.5.2.2.1 Where automatic sprinklers are not provided, modifications in nonsprinklered health care occupancies shall comply with 19.4.3.

15.5.2.2.2 In modifications where the smoke compartment is not protected throughout by an approved, supervised automatic sprinkler system, corridor walls shall have a fire resistance rating of not less than ½ hour, shall be continuous from the floor to the underside of the floor or roof deck above, and shall resist the passage of smoke.

15.5.2.2.3 In modifications where the smoke compartment is not protected throughout by an approved, supervised automatic sprinkler system, doors protecting corridor openings shall be constructed of 1¾-in. (4.4-cm) thick, solid-bonded

core wood or of construction that resists the passage of fire for not less than 20 minutes.

15.5.2.2.4 In modifications, existing roller latches demonstrated to keep the door closed against a force of 5 lbf (22 N) shall be permitted.

15.5.2.2.5 In modifications where the smoke compartment is not protected throughout by an approved, supervised automatic sprinkler system, door frames shall be labeled or shall be of steel.

15.5.2.3 Detection and Correctional Occupancies. Where automatic sprinklers are not provided, modifications in nonsprinklered detention and correctional occupancies shall comply with 21.4.4.

15.5.3 Structural Requirements (Reserved).

15.5.4 Accessibility Requirements. Modifications shall comply with 15.4.4.

15.5.5 Electrical Requirements.

15.5.5.1 All newly installed electrical equipment and wiring relating to work done in any rehabilitation work area shall comply with the materials and methods requirements. *(See 3.3.341, Materials and Methods Requirements.)*

Exception: Electrical equipment and wiring in newly installed partitions and ceilings shall comply with all applicable requirements of the National Electrical Code.

15.5.5.2 Existing wiring in all rehabilitation work areas in assembly occupancies having an occupant load greater than 300, health care occupancies, detention and correctional occupancies, residential board and care occupancies, and areas containing other than high hazard Level 4 hazardous materials in excess of the exempt amount permitted in Chapter 34 shall be upgraded to meet the materials and methods requirements. *(See 3.3.341, Materials and Methods Requirements.)*

15.5.5.3 Residential Occupancies.

15.5.5.3.1 In other than hotel and dormitory occupancies, service to each existing dwelling unit in any rehabilitation work area shall be a minimum of 100-ampere, three-wire capacity, and service equipment shall be dead front, having no live parts exposed whereby accidental contact could be made. Type S fuses shall be installed in accordance with Section 240.53 and Section 240.54 of the *National Electrical Code* when fused equipment is used.

Exception: Existing service of 60-ampere, three-wire capacity, and feeders of 30-ampere or larger, two- or three-wire capacity, shall be accepted if adequate for the electrical load being served.

15.5.5.3.2 The requirements of 15.5.5.3.2.1 through 15.5.5.3.2.7 shall apply to other than hotel and dormitory occupancies when the rehabilitation work area within a dwelling unit includes any of the areas or locations specified in these requirements.

15.5.5.3.2.1 All enclosed areas, other than closets, kitchens, basements, garages, hallways, laundry areas, and bathrooms, shall have a minimum of two duplex receptacle outlets or one duplex receptacle outlet and one ceiling or wall-type lighting outlet.

15.5.5.3.2.2 Kitchen areas shall have a minimum of two duplex receptacle outlets and a hard-wired lighting outlet. At least one of the required duplex receptacles shall be provided to serve counter space.

15.5.5.3.2.3 Laundry areas shall have a minimum of one duplex receptacle outlet located near the laundry equipment and installed on an independent circuit.

15.5.5.3.2.4 Ground-fault circuit interruption shall be provided on newly installed receptacle outlets if required by Section 210.8(a) of the *National Electrical Code*.

15.5.5.3.2.5 At least one lighting outlet shall be provided in every bathroom, hallway, stairway, attached garage, and detached garage with electric power, and in sufficient quantity to illuminate outdoor entrances and exits.

15.5.5.3.2.6 At least one lighting outlet shall be provided in utility rooms and basements where these spaces are used for storage or contain equipment requiring service.

15.5.5.3.2.7 Clearance for electrical service equipment shall be provided in accordance with Section 110.26 of the *National Electrical Code*.

15.5.5.3.3 In other than hotel and dormitory occupancies, when the rehabilitation work area includes spaces converted into kitchen or laundry areas, receptacle outlets in these areas shall comply with applicable requirements of Section 210.52(a), Section 210.52(b), Section 210.52(c), and Section 210.52(f) of the *National Electrical Code*.

15.5.5.4 Where ground-fault circuit interruption is not required and the work changes an existing space into a location where such protection is required, existing receptacle outlets shall be provided with such protection in accordance with the following requirements of the *National Electrical Code*, as applicable:

(1) Sections 210.8 (dwelling units, all bathrooms, and rooftops)
(2) Section 555.3 (boathouses)
(3) Section 511.10 (commercial garages)
(4) Section 620.85 (elevators, escalators, and moving walkways)
(5) Section 517.20 and Section 517.21 (health care facilities)
(6) Section 422.8(d)(3) (high-pressure spray washing appliances)
(7) Section 680.70 (hydromassage bathtubs)
(8) Section 550.8(b) and Section 550.23(d) (mobile homes)
(9) Section 530.73(a)(1) (motion picture and TV studios)
(10) Section 680.6(a) (permanently installed pools)

15.5.6 Mechanical Requirements.

15.5.6.1 All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any rehabilitation work area shall be provided with either natural or mechanical ventilation.

15.5.6.1.1 Natural ventilation shall be provided by a minimum openable area to the outdoors of 4 percent of the floor area being ventilated and shall comply with the requirements of the mechanical code.

15.5.6.1.2 Newly installed mechanical ventilation systems shall comply with the requirements of the mechanical code.

15.5.6.2 In mechanically ventilated spaces, existing mechanical ventilation systems that are altered, reconfigured, or extended shall be capable of providing not less than 5 ft^3/min (0.4 m^3/min) per person of outdoor air and not less than

15 ft^3/min (0.4 m^3/min) of ventilation air per person; or not less than the amount of ventilation air determined by the Indoor Air Quality Procedure of ASHRAE 62, *Ventilation for Acceptable Indoor Air Quality*.

15.5.6.3 All newly introduced devices, equipment, or operations that produce airborne particulate matter, odors, fumes, vapor, combustion products, gaseous contaminants, pathogenic and allergenic organisms, and microbial contaminants in such quantities to adversely affect or impair health, or cause discomfort to occupants, shall be provided with an exhaust system in compliance with the mechanical code or a means of collection and removal of the contaminants. Such exhaust system shall discharge directly to an approved location at the exterior of the building.

15.5.6.4 Where the rehabilitation work area includes a commercial kitchen and the modification includes reconfiguration or extension of cooking equipment, or the installation of additional cooking equipment, existing grease ducts, exhaust equipment, and kitchen hoods shall be brought into compliance with all the requirements of the mechanical code.

15.5.7 Plumbing Requirements. Where the rehabilitation work area is more than 50 percent of the gross floor area *(see 3.3.32.8.1, Gross Floor Area)*, and the occupant load will be increased by at least 20 percent as a result of the modification, plumbing fixtures shall be provided, based on the increased occupant load in the rehabilitation work area, in quantities and locations specified in the plumbing code, based on the increased occupant load.

15.5.8 Boiler Safety Requirements (Reserved).

15.5.9 Elevator Requirements (Reserved).

15.6 Reconstruction.

15.6.1 General Requirements.

15.6.1.1 Reconstruction *(see 3.3.445, Reconstruction)* shall comply with the requirements of Section 15.6.

Exception: The requirement of 15.6.1.1 shall not apply as otherwise modified in Section 15.9 for historic buildings.

15.6.1.2 In addition to the requirements of Section 15.6, all work shall comply with all the requirements of Section 15.4 and Section 15.5.

Exception No. 1: Buildings in which the reconfiguration of space affecting exits or shared egress access is exclusively the result of compliance with the accessibility requirements of 15.4.4 shall not be required to comply with Section 15.6.

Exception No. 2: Existing dead-end corridors shall be permitted to be extended, and new dead-end corridors shall be permitted to be added in accordance with 15.6.2.1.5.

Exception No. 3: Any stairway replacing an existing stairway within a space where, because of existing construction, the pitch or slope cannot be reduced, shall not be required to comply with the maximum riser height and minimum tread depth requirements of 11.2.2.2.

15.6.1.3 Wherever the term *rehabilitation work area* is used in Section 15.6, it shall include only the area affected by reconstruction work and areas covered by 15.5.1.2. Other rehabilitation work areas affected exclusively by renovation or modification work shall not be included in the rehabilitation work area required to comply with Section 15.6.

15.6.2 Nonstructural Requirements.

15.6.2.1 Means of Egress.

15.6.2.1.1 General. The means of egress shall comply with the requirements of 15.6.2.1.

15.6.2.1.2 Number of Means of Egress. Every story utilized for human occupancy on which there is a rehabilitation work area shall be provided with the minimum number of means of egress required by NFPA *101*, *Life Safety Code*, for existing occupancies.

15.6.2.1.2.1 Mezzanines. Mezzanines in the rehabilitation work area shall be provided with the minimum number of means of egress required by NFPA *101* for existing occupancies.

15.6.2.1.2.2 Buildings with a Single Means of Egress. In buildings having only one means of egress, the single exit condition serving the rehabilitation work area shall be permitted to continue in accordance with the existing occupancy requirements of NFPA *101*.

Exception: The requirement of 15.6.2.1.2.2 shall not apply to one- and two-family dwellings complying with the means of escape requirements in NFPA 101.

15.6.2.1.2.3 Assembly Occupancies. Assembly occupancies shall be provided with a main entrance/exit as required by 16.2.3.3.

15.6.2.1.3* Capacity of Means of Egress. The capacity of the means of egress in each rehabilitation work area and throughout the egress path of each rehabilitation work area shall be sufficient for the occupant load thereof. Capacity shall be determined in accordance with Section 11.3.

Exception No. 1: The authority having jurisdiction shall be permitted to establish the occupant load as the number of persons for which existing means of egress is adequate, provided that measures are established to prevent occupancy by a greater number of persons.

Exception No. 2: The requirement of 15.6.2.1.3 shall not apply where the building was previously determined to have adequate egress capacity.

15.6.2.1.4 Egress Doorways.

15.6.2.1.4.1 Large Areas. In any rehabilitation work area, all rooms and spaces having an occupant load greater than 50, or in which the travel distance exceeds 75 ft (23 m), shall have a minimum of two egress doorways.

Exception: The requirement of 15.6.2.1.4.1 shall not apply where a single means of egress is permitted by the existing occupancy requirements in NFPA 101.

15.6.2.1.4.2 Health Care Occupancies. In health care occupancies, any patient sleeping room or suite of rooms in the rehabilitation work area greater than 1000 ft^2 (93 m^2) shall have a minimum of two egress doorways.

Exception: Where the room or suite of rooms is not greater than 2500 ft^2 (232 m^2) and does not contain patient sleeping rooms, two egress doorways shall not be required.

15.6.2.1.4.3 Corridor Doors. Corridor doors in the rehabilitation work area shall meet the requirements for existing occupancies in NFPA *101*. Existing doors in buildings protected throughout with an approved automatic sprinkler system shall be required only to resist smoke, to be reasonably tight-fitting, and to have no louvers.

Exception No. 1: 1⅜-in. (35 mm), solid-bonded wood core doors shall be considered acceptable where 1¾-in. (44-mm), solid-bonded wood core doors are required but where the existing frames will not accommodate such a door.

Exception No. 2: The requirements of 15.6.2.1.4.3 shall not apply to existing doors meeting the requirements for a rating of 15 minutes or better.

Exception No. 3: In small residential board and care occupancies having prompt evacuation capability in accordance with Chapter 33 of NFPA 101 and that are protected with an approved automatic detection system, closing devices shall not be required.

15.6.2.1.4.4 Transoms. In all buildings of residential and residential board and care occupancies, all transoms in corridor walls in rehabilitation work areas shall be either glazed with ¼-in. (6.3-mm) wired glass set in metal frames or shall be other glazing assemblies having a fire protection rating as required for the door and permanently secured in the closed position or sealed with materials consistent with the corridor construction.

Exception: The requirement of 15.6.2.1.4.4 shall not apply where transoms are permitted by the existing occupancy requirements of NFPA 101.

15.6.2.1.4.5 Other Corridor Openings. In any rehabilitation work area; any other sash, grille, or opening in a corridor; and any window in a corridor not opening to the outside air shall be sealed with materials consistent with the corridor construction.

15.6.2.1.4.6 Supplemental Requirements. The requirements of 15.6.2.1.4.3 through 15.6.2.1.4.5 shall apply on the entire floor when the rehabilitation work area exceeds 50 percent of the floor area.

Exception: Corridors within a tenant space that is entirely outside the rehabilitation work area shall not be required to comply with 15.6.2.1.4.6.

15.6.2.1.4.7 Door Swing. In the rehabilitation work area, and in the egress path from any rehabilitation work area to the exit discharge, all egress doors serving an occupant load greater than 50 shall swing in the direction of egress travel.

15.6.2.1.4.8 Door Closers. In any rehabilitation work area, all doors opening onto an exit passageway at grade or onto an exit stair shall be self-closing or automatic closing by listed closing devices.

Exception: The requirement of 15.6.2.1.4.8 shall not apply where exit enclosure is not required by the fire code.

15.6.2.1.4.9 Panic or Fire Exit Hardware. In any rehabilitation work area, and in the egress path from any rehabilitation work area to the exit discharge, located in a building or portion thereof of an assembly or educational occupancy with an occupant load greater than 100, all required egress doors equipped with latching devices shall be equipped with approved panic hardware or fire exit hardware.

15.6.2.1.4.10 Supplemental Requirements. The requirements of 15.6.2.1.4.7 through 15.6.2.1.4.9 shall apply on the entire floor when the rehabilitation work area exceeds 50 percent of the floor area.

Exception: Means of egress within a tenant space that is entirely outside the rehabilitation work area shall not be required to comply with 15.6.2.1.4.10.

15.6.2.1.4.11 Detention and Correctional Occupancies. Rehabilitation work areas in detention and correctional occupancies having remote power-unlocking capability for more than 10 locks shall be provided with an emergency power source for such locks as required for existing occupancies in NFPA *101*.

15.6.2.1.5 Dead-End Corridors. Existing dead-end corridors in any rehabilitation work area shall not exceed 35 ft (11 m). Newly constructed dead-end corridors shall comply with other sections of this *Code*.

Exception No. 1: The requirement of 15.6.2.1.5 shall not apply where dead-end corridors of greater length are permitted by the existing occupancy requirements of NFPA 101.

Exception No. 2: In other than assembly occupancies and areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, the maximum length of an existing dead-end corridor shall be 50 ft (15 m) in buildings equipped throughout with an approved, complete automatic fire alarm system.

Exception No. 3: In other than assembly occupancies and areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, the maximum length of an existing dead-end corridor shall be 70 ft (21 m) in buildings equipped throughout with an approved automatic sprinkler system.

Exception No. 4: In other than assembly occupancies and areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, the maximum length of a newly constructed or extended dead-end corridor shall not exceed 50 ft (15 m) in buildings equipped throughout with an approved automatic sprinkler system.

15.6.2.1.6 Means of Egress Lighting.

15.6.2.1.6.1 Means of egress in all rehabilitation work areas shall be provided with artificial lighting in accordance with the requirements of other sections of this *Code*.

15.6.2.1.6.2 Supplemental Requirements.

(A) Where the reconstruction rehabilitation work area on any floor exceeds 50 percent of that floor area, means of egress throughout the floor shall be provided with artificial lighting in accordance with the requirements of other sections of this *Code*.

Exception: Means of egress within a tenant space that is entirely outside the rehabilitation work area shall not be required to comply with 15.6.2.1.6.2(A).

(B) In a building with rehabilitation work areas involving over 50 percent of the aggregate floor area within the building, the means of egress within the rehabilitation work area and the means of egress, including the exit and exit discharge paths, serving the rehabilitation work area shall be provided with artificial lighting in accordance with the requirements of other sections of this *Code*.

Exception: Means of egress within a tenant space that is entirely outside the rehabilitation work area shall not be required to comply with 15.6.2.1.6.2(B).

15.6.2.1.7 Exit Signs.

15.6.2.1.7.1 Means of Egress. Means of egress in all rehabilitation work areas shall be provided with exit signs in accordance with the requirements of other sections of this *Code*.

15.6.2.1.7.2 Supplemental Requirements.

(A) Where the reconstruction rehabilitation work area on any floor exceeds 50 percent of that floor area, means of egress throughout the floor shall be provided with exit signs in accordance with the requirements of other sections of this *Code*.

Exception: Means of egress within a tenant space that is entirely outside the rehabilitation work area shall not be required to comply with 15.6.2.1.7.2(A).

(B) In a building with rehabilitation work areas involving over 50 percent of the aggregate floor area within the building, means of egress from the floor of the highest rehabilitation work area to the floor of exit discharge shall be provided with exit signs in accordance with the requirements of other sections of this *Code*.

Exception: Means of egress within a tenant space that is entirely outside the rehabilitation work area shall not be required to comply with 15.6.2.1.7.2(B).

15.6.2.1.8 Handrails. The requirements of 15.6.2.1.8.1 and 15.6.2.1.8.2 shall apply from the highest rehabilitation work area floor to the level of exit discharge.

15.6.2.1.8.1 Every required exit stairway that is part of the means of egress for any rehabilitation work area that has three or more risers and is not provided with at least one handrail, or in which the existing handrails are judged to be in danger of collapsing, shall be provided with handrails for the full length of the run of steps on at least one side. All exit stairways with a required egress width of more than 66 in. (1675 mm) shall have handrails on both sides.

15.6.2.1.8.2 Where there are no handrails, or where the existing handrails must be replaced in accordance with 15.6.2.1.8.1, the handrails shall be designed and installed in accordance with the requirements for new construction.

15.6.2.1.9 Guards. The requirements of 15.6.2.1.9.1 and 15.6.2.1.9.2 shall apply from the highest rehabilitation work area floor to the level of exit discharge, but shall be confined to the egress path of any rehabilitation work area.

15.6.2.1.9.1 Every open portion of a stair, landing, or balcony that is more than 30 in. (760 mm) above the floor or grade below and not provided with guards, or those in which the existing guards are judged to be in danger of collapsing, shall be provided with guards.

15.6.2.1.9.2 Where there are no guards, or where the existing guards must be replaced in accordance with 15.6.2.1.9.1, the guards shall be designed and installed in accordance with the requirements for new construction.

15.6.2.2 Interior Finish.

15.6.2.2.1 Interior Wall and Ceiling Finish. The interior finish of walls and ceilings in any rehabilitation work area shall comply with the requirements for existing occupancies in NFPA *101*. All existing interior finish materials that do not comply with the requirements of Section 15.6 shall be removed or shall be treated with an approved fire-retardant coating in accordance with the manufacturer's instructions to secure compliance with the requirements of 15.6.2.2.

15.6.2.2.2 Supplemental Requirements.

15.6.2.2.2.1 Where the rehabilitation work area on any floor exceeds 50 percent of that floor area, the requirements of 15.6.2.2.1 shall apply to the interior finish in exits and corridors serving the rehabilitation work area on the entire floor.

Exception: Interior finish within a tenant space that is entirely outside the rehabilitation work area shall not be required to comply with 15.6.2.2.2.1.

15.6.2.2.2.2 In a building with rehabilitation work areas involving over 50 percent of the aggregate floor area within the building, the requirements for interior finishes in exits shall apply from the floor of the highest rehabilitation work area to the floor of exit discharge.

15.6.2.3 Shaft Enclosures.

15.6.2.3.1 In any rehabilitation work area, newly constructed vertical openings connecting two or more floors shall comply with the requirements for new construction.

15.6.2.3.2 In any rehabilitation work area, all existing interior vertical openings connecting two or more floors shall be enclosed as required for existing occupancies in NFPA *101*.

15.6.2.3.3 Supplemental Requirements.

15.6.2.3.3.1 Where the reconstruction rehabilitation work area on any floor exceeds 50 percent of that floor area, 15.6.2.3.2 shall apply throughout the floor.

15.6.2.3.3.2 Where the reconstruction rehabilitation work area on any floor exceeds 50 percent of that floor area, stairways that are part of the means of egress serving the rehabilitation work area shall be enclosed with smoke-tight enclosures on all floors below the highest rehabilitation work area floor.

Exception: The requirement of 15.6.2.3.3.2 shall not apply where the stairway enclosure is not required for existing occupancies in NFPA 101.

15.6.2.3.3.3 In a building with rehabilitation work areas involving over 50 percent of the aggregate floor area within the building, stairways that are part of the means of egress shall be enclosed in accordance with 15.6.2.3.3.2 on the highest rehabilitation work area floor and on all floors below.

15.6.2.4 Fire Barriers and Smoke Barriers.

15.6.2.4.1 Health Care Occupancies. Where the rehabilitation work area is on a story used for sleeping purposes for more than 30 patients, the story shall be divided into not less than two compartments by smoke barriers as required for existing health care occupancies in NFPA *101*.

15.6.2.4.2 Small Residential Board and Care and One- and Two-Family Dwellings. Where the rehabilitation work area is in any attached dwelling unit in a small residential board and care occupancy and one- and two-family dwellings, walls separating the dwelling units that are not continuous from the foundation to the underside of the roof sheathing shall be constructed to provide a continuous fire separation using construction materials consistent with the existing wall or complying with the requirements for new structures. All work shall be performed on the side of the wall of the dwelling unit that is part of the rehabilitation work area.

Exception: Walls shall not be required to be continuous through concealed floor spaces.

15.6.2.5 Automatic Sprinkler Systems.

15.6.2.5.1 General. All rehabilitation work areas in any building or portion thereof that is required to be sprinklered in

accordance with the provisions of NFPA *101* for existing buildings shall be provided with an automatic sprinkler system.

Exception: In other than high-rise structures, where an adequate water supply for sprinkler protection is not available, the authority having jurisdiction shall be permitted to accept alternative protection. For purposes of this exception, "adequate water supply" shall mean that the water supply available at the site has sufficient flow capability at a residual pressure of 20 psi (138,000 Pa) to meet the sprinkler system demand criteria.

15.6.2.5.2 Supplemental Requirements.

15.6.2.5.2.1 Where the rehabilitation work area on any floor exceeds 50 percent of that floor area, the requirement of 15.6.2.5.1 shall apply to the entire floor.

Exception: In other than high-rise structures, where an adequate water supply for sprinkler protection is not available, the authority having jurisdiction shall be permitted to accept alternative protection. For purposes of this exception, "adequate water supply" shall mean that the water supply available at the site has sufficient flow capability at a residual pressure of 20 psi (138,000 Pa) to meet the sprinkler system demand criteria.

15.6.2.5.2.2 In a building with rehabilitation work areas involving over 50 percent of the aggregate building area, automatic sprinkler systems shall be provided in accordance with requirements for new construction. This requirement shall apply to the highest floor containing a rehabilitation work area and all floors below.

Exception No. 1: In other than high-rise structures, where an adequate water supply for sprinkler protection is not available, the authority having jurisdiction shall be permitted to accept alternative protection. For purposes of this exception, "adequate water supply" shall mean that the water supply available at the site has sufficient flow capability at a residual pressure of 20 psi (138,000 Pa) to meet the sprinkler system demand criteria.

Exception No. 2: The requirement of 15.6.2.5.2.2 shall not apply to residential occupancies less than four stories in height and with no more than four units per floor.

15.6.2.5.2.3 In health care occupancies, the smoke compartment where the rehabilitation work, or work per 15.5.1.2.3, is being done, shall be protected by automatic sprinklers in accordance with 19.1.1.4.3.

15.6.2.5.3 Multiple Uses. In buildings containing multiple uses, one or more of which require automatic sprinkler protection in accordance with 15.6.2.5.1 or 15.6.2.5.2, automatic sprinklers shall not be required throughout the building, provided that the occupancies requiring automatic sprinklers are separated from those not requiring automatic sprinklers by fire-resistive construction as follows:

(1) Minimum 2-hour rating for areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, other than high hazard Level 4
(2) Minimum 1-hour rating for all other conditions

15.6.2.5.4 Supervision. Automatic sprinkler systems required by 15.6.2.5 shall be supervised by one of the following methods in accordance with *NFPA 72, National Fire Alarm Code*:

(1) Approved central station system
(2) Approved proprietary system
(3) Approved remote-station system of the jurisdiction
(4) Approved local alarm service that will cause the sounding of an alarm

Exception No. 1: The requirement of 15.6.2.5.4 shall not apply to an underground gate valve with roadway boxes.

Exception No. 2: The requirement of 15.6.2.5.4 shall not apply to halogenated extinguishing systems.

Exception No. 3: The requirement of 15.6.2.5.4 shall not apply to carbon dioxide extinguishing systems.

Exception No. 4: The requirement of 15.6.2.5.4 shall not apply to dry and wet chemical extinguishing systems.

Exception No. 5: The requirement of 15.6.2.5.4 shall not apply to limited-area sprinkler systems.

Exception No. 6: The requirement of 15.6.2.5.4 shall not apply to residential occupancies complying with NFPA 13R, Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height, or NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, as appropriate.

Exception No. 7: The requirement of 15.6.2.5.4 shall not apply where supervision is not required for existing occupancies in NFPA 101.

15.6.2.5.5 Standpipes. Any rehabilitation work areas in a building that is required to be provided with a standpipe system by other sections of this *Code* shall be provided with standpipes up to and including the highest rehabilitation work area floor. The standpipes shall be located and installed in accordance with NFPA 14, *Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems.*

Exception No. 1: No pump shall be required, provided that the standpipes are capable of accepting delivery by fire department apparatus of a minimum of 250 gpm at 65 psi (0.9 m^3/min at 448,000 Pa) to the topmost floor in buildings equipped throughout with an automatic sprinkler system, or a minimum of 500 gpm at 65 psi (1.9 m^3/min at 448,000 Pa) to the topmost floor in all other buildings. Where the standpipe terminates below the topmost floor, the standpipe shall be designed to meet these flow/pressure requirements for possible future extension of the standpipe.

Exception No. 2: In other than high-rise buildings, the required interconnection of the standpipes for a wet system shall be permitted at the lowest level of the rehabilitation work area.

15.6.2.5.6 Elevator Recall. When sprinklers are installed in an elevator hoistway or elevator machine room as part of the rehabilitation work, the elevators shall be provided with a means to disconnect power to the affected elevator(s) in compliance with ASME A17.1.

15.6.2.6 Fire Alarm Systems.

15.6.2.6.1 Smoke Alarms.

15.6.2.6.1.1 In hotels and dormitories and apartment occupancies, individual guest rooms and individual dwelling units in any rehabilitation work area shall be provided with smoke alarms complying with the requirements for new construction.

15.6.2.6.1.2 Where the reconstruction rehabilitation work area is in residential board and care occupancies and one- and two-family dwellings, smoke alarms complying with the requirements for new construction shall be provided through-

out the dwelling unit at each level and outside each sleeping area.

Exception No. 1: Interconnection of smoke detectors shall not be required outside of the rehabilitation work area.

Exception No. 2: Battery-powered single-station smoke detectors listed in accordance with UL 217, Standard for Single and Multiple Station Smoke Alarms, shall be permitted outside the rehabilitation work area.

15.6.2.6.2 Manual Fire Alarm Systems.

15.6.2.6.2.1 Where the rehabilitation work area on any floor exceeds 50 percent of that floor area and the rehabilitation work area is in a building that is required to have a manual fire alarm system in accordance with the existing occupancy requirements of NFPA *101* a manual fire alarm system shall be provided on the floor. Alarm-indicating appliances shall be provided on the floor and shall be automatically activated as required NFPA *101* by all new and existing initiating devices.

15.6.2.6.2.2 Where the rehabilitation work area involves over 50 percent of the aggregate building area and the rehabilitation work area is in a building that is required to have a manual fire alarm system in accordance with other provisions of this *Code*, a manual fire alarm system shall be provided throughout the building.

15.6.2.6.3 Automatic Fire Detection Systems.

15.6.2.6.3.1 Where the rehabilitation work area is in a building that is required to have an automatic fire detection system in accordance with the existing occupancy requirements of NFPA *101* an automatic fire detection system shall be installed in the rehabilitation work area. Existing alarm-indicating appliances shall be automatically activated throughout the building. Where the building is not equipped with a fire alarm system, alarm-indicating appliances within the rehabilitation work area shall be provided and automatically activated.

Exception: Where selective notification is permitted, alarm-indicating appliances shall be automatically activated in the areas selected.

15.6.2.6.3.2 Where the rehabilitation work area on any floor exceeds 50 percent of that floor area and the rehabilitation work area is in a building that is required to have an automatic fire detection system in accordance with the existing occupancy requirements of NFPA *101* an automatic fire detection system shall be installed throughout the floor. Alarm-indicating appliances shall be automatically activated throughout the building.

Exception No. 1: Where selective notification is permitted, alarm-indicating appliances shall be automatically activated in the areas selected.

Exception No. 2: Where the building is not equipped with a fire alarm system, alarm-indicating appliances on the floor shall be provided and automatically activated.

15.6.2.6.3.3 Where the rehabilitation work area involves over 50 percent of the aggregate building area and the building is required to have an automatic fire detection system in accordance with other provisions of this *Code*, an automatic fire detection system shall be provided throughout the building.

15.6.2.7 High-Rise Buildings. Any building or structure having one or more floors more than 75 ft (23 m) above the lowest level accessible to a fire department vehicle shall comply with the requirements of 15.6.2.7.1 through 15.6.2.7.3.

15.6.2.7.1 Recirculating Air or Exhaust Systems. When the rehabilitation work area is located on a floor that is served by a recirculating air or exhaust system serving more than one floor, the recirculating air or exhaust system that serves the rehabilitation work area shall be equipped with approved smoke and heat detection devices installed in accordance with the mechanical code. The devices shall stop the fans automatically and shall be of the manual reset type. Automatic fan shutdown is not required when the system is part of an approved smoke removal or smoke control system.

15.6.2.7.2 Elevators. When the rehabilitation work area is located on one entire floor, or when the rehabilitation work area is 20 percent or more of the occupied floor area of the building, the elevators in the buildings shall be equipped with firefighters emergency operation in compliance with ASME A17.1.

15.6.2.7.3 Smoke Barriers. Where the rehabilitation work area on any floor exceeds 50 percent of that floor area and is located on a floor that is above the main floor level in hotel and dormitory occupancies and apartment occupancies, smoke barriers conforming to the requirements for existing occupancies in NFPA *101* shall be provided.

15.6.2.8 Boiler/Furnace Equipment Rooms.

15.6.2.8.1 Boiler/furnace equipment rooms shall be enclosed by 1-hour fire-rated construction when the rehabilitation work area is in a day-care occupancy or residential occupancy.

Exception No. 1: The requirement of 15.6.2.8.1 shall not apply to one- and two-family dwellings.

Exception No. 2: The requirement of 15.6.2.8.1 shall not apply to furnace and boiler equipment of the low-pressure type [operating at gauge pressures of 15 psi (103 kPa) or less for steam equipment or 160 psi (1100 kPa) or less for hot water equipment] when installed in accordance with manufacturer recommendations, or furnace and boiler equipment of the residential type [200,000 Btu/hr (210 MJ/hr) input rating or less] shall not be required to be enclosed.

Exception No. 3: The requirement of 15.6.2.8.1 shall not apply to furnace rooms protected with automatic sprinkler protection.

Exception No. 4: The requirement of 15.6.2.8.1 shall not apply to boiler/furnace equipment rooms protected in accordance with the mechanical code.

15.6.2.8.2 Emergency controls shall be provided in all structures classified as a day-care occupancy or residential board and care occupancy in accordance with the following:

(1) Emergency shutoff switches for furnaces and boilers in basements shall be at the top of the stairs leading to the basement.
(2) Emergency shutoff switches for furnaces and boilers in other enclosed rooms shall be located outside of the room.

15.6.2.9 Transportation of Hazardous Production Materials. Hazardous production materials shall be permitted to be transported through exit access corridors in accordance with 34.3.7.1.2.

15.6.3 Structural Requirements (Reserved).

15.6.4 Accessibility Requirements (Reserved).

15.6.5 Electrical Requirements (Reserved).

15.6.6 Mechanical Requirements (Reserved).

15.6.7 Plumbing Requirements (Reserved).

15.6.8 Boiler Safety Requirements (Reserved).

15.6.9 Elevator Requirements (Reserved).

15.7 Change of Use and Change of Occupancy Classification.

15.7.1 General Requirements.

15.7.1.1 Applicable Requirements. Any repair, renovation, modification, or reconstruction work undertaken in connection with a change of use that does not involve a change of occupancy classification shall conform to the requirements of Section 15.3, Section 15.4, Section 15.5, and Section 15.6, respectively, for the applicable occupancy classification, and with 15.7.2.

15.7.1.2 Change of Occupancy. The occupancy classification of an existing building or structure shall be permitted to be changed, provided that the building or structure meets all the requirements of Section 15.6, applied throughout the building for the new occupancy classification, and the requirements of 15.7.2 and 15.7.3.

Exception No. 1: Compliance with all the provisions of Section 15.6 shall not be required where the change of use complies with the requirements of 15.7.3.4.

Exception No. 2: The requirement of 15.7.1.2 shall not apply as otherwise modified in Section 15.9 for historic buildings.

15.7.2 Change of Use.

15.7.2.1 Special Use and Occupancy.

15.7.2.1.1 Where the use of an existing building or part of an existing building is changed to one of the following special use or occupancy categories as defined in another chapter of this *Code*, the building shall comply with all the applicable requirements of that chapter, regardless of whether a change of occupancy classification is involved:

(1) Mall buildings
(2) Atriums
(3) Private garages
(4) Parking garages
(5) Hazardous areas
(6) Motion picture projection rooms
(7) Stages and platforms
(8) Special amusement buildings
(9) Semiconductor facilities

15.7.2.1.2 An underground structure *(see 3.3.530.15, Underground Structure)* in which there is a change of occupancy shall comply with the requirements of Section 31.2 applicable to underground structures.

15.7.2.2 Structural Requirements.

15.7.2.2.1 Live Loads. Any existing structure in which the proposed new use requires floor live loads equal to or less than those required for the existing use shall be permitted to be continued in use for the originally approved live loads, provided that the structure is not dangerous and is adequate for the proposed use. If the approved floor live load is less than required by Section 35.6, the areas designed for the reduced live load shall be posted with the approved load or shall be structurally strengthened to support the new load. Placards shall be of an approved design.

Exception: Analysis and test methods for evaluation of existing materials shall be permitted to use the methods specified in the code under which the building was constructed, the current code, or other standards as approved by the authority having jurisdiction.

15.7.2.2.2 Vertical Loads on Roofs. Buildings and structures shall comply with the roof load requirements of Section 35.7 for roof live load.

Exception: Existing roofs shall be permitted to be retained, provided that any unsafe or overloaded conditions are corrected and where the roof dead load is not increased by use, reroofing, or added equipment.

15.7.2.2.3* Wind and Snow Loads. Where a change of use results in an existing building being assigned a higher occupancy category in accordance with Table 35.3, the building or affected portion shall be strengthened to meet the snow load or wind load requirements of Section 35.8 and Section 35.9.

15.7.2.2.4 Earthquake Loads. Where a change of use results in an existing building being reclassified to a higher occupancy category, other than occupancy category I, as shown in Table 35.3, the building shall be strengthened to meet the earthquake requirements of Section 35.10.

Exception: For buildings located in seismic map areas having an effective peak velocity–related acceleration (S_{v1}) value of less than 0.15, strengthening the building to meet the seismic requirements for new buildings shall be required only where the change of use results in a building being reclassified to risk category IV (highest). All other buildings so located shall not be required to be strengthened.

15.7.2.3 Accessibility. Compliance with the accessibility provisions of Chapter 12 shall apply only where renovation, modification, or reconstruction work occurs.

15.7.2.4 Electrical Requirements.

15.7.2.4.1 Where the use of an existing building or part of an existing building is changed to one of the following special uses as described in Chapter 5 of NFPA 70, the electrical wiring and equipment of the building or portion thereof that contains the proposed use shall comply with all applicable requirements of NFPA 70, regardless of whether a change of occupancy classification is involved:

(1) Hazardous (classified) locations
(2) Commercial garages used for repair and storage
(3) Aircraft hangars
(4) Motor fuel dispensing facilities and repair garages
(5) Bulk storage plants
(6) Spray application, dipping, and coating processes
(7) Health care facilities
(8) Places of assembly
(9) Theaters, audience areas of motion picture and television studios, and similar locations
(10) Motion picture and television studios and similar locations
(11) Motion picture projectors
(12) Agricultural buildings

15.7.2.4.2 Where the use of an existing building or part of an existing building is changed, all unsafe conditions, as determined by the authority having jurisdiction, shall be corrected

without requiring that all parts of the electrical system be brought into compliance with NFPA 70.

15.7.2.5 Mechanical Requirements. Where the use of an existing building or part of an existing building is changed such that the new use is subject to different kitchen exhaust requirements or to increased mechanical ventilation requirements in accordance with the mechanical code, compliance with the intent of the respective mechanical code provisions shall be required.

15.7.2.6 Plumbing Requirements.

15.7.2.6.1 Where the use of an existing building or part of an existing building is changed such that the new use is subject to increased or different plumbing fixture requirements in accordance with the plumbing code, or to increased water supply requirements in accordance with the plumbing code, compliance with the respective plumbing code provisions shall be required.

15.7.2.6.2 If the new use is a food-handling establishment, all existing sanitary waste lines above the food or drink preparation, storage, display, or serving areas shall be panned or otherwise protected to prevent leaking pipes or condensation on pipes from contaminating food or drink. New drainage lines shall not be installed above such areas or shall be protected in accordance with the plumbing code.

15.7.2.6.3 If the new use will produce grease or oil-laden wastes, interceptors as required in the plumbing code shall be provided.

15.7.2.6.4 If the new use will produce chemical wastes, the following shall apply:

(1) If the existing piping is not compatible with the chemical waste, the waste shall be neutralized prior to entering the drainage system, or the piping shall be changed to a compatible material.
(2) No chemical waste shall discharge to a public sewer system without the approval of the sewage authority.

15.7.2.7 Health and Hygiene—Light and Ventilation. Lighting and ventilation shall comply with the requirements of Chapter 49 for the new use.

15.7.3 Change of Occupancy Classification.

15.7.3.1 Certificate of Occupancy. Every change of occupancy classification shall require a new certificate of occupancy, regardless of whether any renovations, modifications, or reconstruction work is required by this *Code*.

15.7.3.2 Part Change of Occupancy Classification.

15.7.3.2.1 Where a portion of an existing building is changed to a new occupancy classification, and that portion is not separated from the remainder of the building with fire barrier walls or horizontal assemblies, or both, having a fire-resistance rating as required in Table 6.2.4.1 of this *Code* for the separate occupancy classification, or with approved compliance alternatives, the entire building shall comply with all the requirements of Section 15.6, applied throughout the building for the new occupancy classification, and with the requirements of Section 15.7.

Exception: Compliance with all the provisions of Section 15.6 shall not be required when the change of occupancy classification complies with the requirements of 15.7.3.4.

15.7.3.2.2 Where a portion of an existing building is changed to a new occupancy classification, and that portion is separated from the remainder of the building with fire barrier walls or horizontal assemblies, or both, having a fire resistance rating as required in Table 6.2.4.1 of this *Code* for the separate occupancy classification, or with approved compliance alternatives, the portion changed shall comply with all the requirements of Section 15.6 for the new occupancy classification and the requirements of Section 15.7.

Exception: Compliance with all the provisions of Section 15.6 shall not be required when the change of occupancy classification complies with the requirements of 15.7.3.4.

15.7.3.3 Risk Category Classifications. The relative degree of hazard between different occupancy classifications shall be as set forth in the risk category classifications in Table 15.7.3.5.1.1, Table 15.7.3.8.1, and Table 15.7.3.9.1.

15.7.3.3.1 An existing building or portion thereof shall be permitted to have its use changed to an occupancy classification within the same hazard classification category or to an occupancy classification in a lesser hazard classification category (higher number) in all three risk category classifications designated in Table 15.7.3.5.1.1, Table 15.7.3.8.1, and Table 15.7.3.9.1, provided that the building complies with the provisions of Section 15.6 for the new occupancy classification, applied throughout the building or portion thereof, in accordance with 15.7.3.3.2, 15.7.2.2.1 (live loads), 15.7.2.2.2 (vertical loads on roofs), and 15.7.2.7 (health and hygiene).

Exception: Compliance with all the provisions of Section 15.6 shall not be required where the change of occupancy classification complies with the requirements of 15.7.3.4.

15.7.3.3.2 An existing building shall comply with all the applicable requirements of Section 15.7 when a change in occupancy classification will place it in a higher risk category or when the use contains high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3.

15.7.3.3.3 An existing building shall be permitted to have its occupancy classification changed to a higher hazard rating (lower number) in all three risk category classifications designated in Table 15.7.3.5.1.1, Table 15.7.3.8.1, and Table 15.7.3.9.1, provided that the building complies with Section 15.7 or with the requirements of this *Code* for new construction.

15.7.3.4 Change of Occupancy Classification to an Equal or Lesser Hazard. A change of use to an occupancy classification within the same hazard classification category or to an occupancy classification in a lesser hazard classification category (higher number) in the three risk category classifications addressed by Table 15.7.3.5.1.1, Table 15.7.3.8.1, and Table 15.7.3.9.1 shall be permitted in an existing building or portion thereof, provided that the provisions of Section 15.7 are met.

15.7.3.4.1 Regardless of the occupancy classification involved, the following requirements shall be met throughout the building:

(1) The capacity of the means of egress shall comply with 15.6.2.1.3.
(2) The interior finish of walls and ceilings shall comply with the requirements of 15.6.2.2.
(3) The high-rise building requirements of 15.6.2.7 shall apply.
(4) The boiler/furnace room requirements of 15.6.2.8 shall apply.

15.7.3.4.2 Where the new occupancy classification is classified as a residential occupancy or residential board and care occupancy, the following requirements shall be met throughout the building:

(1) Corridor doors and transoms shall comply with the requirements of 15.6.2.1.4.3 and 15.6.2.1.4.4.
(2) Fire alarm systems shall comply with the requirements of 15.6.2.6.

15.7.3.4.3 Where the new occupancy classification is classified as a health care occupancy, the following requirements shall be met throughout the building:

(1) Egress doorways from patient sleeping rooms and suites of rooms shall comply with the requirements of 15.6.2.1.4.2.
(2) Shaft enclosures shall comply with the requirements of 15.6.2.3.
(3) Smoke barriers shall comply with the requirements of 15.6.2.4.1.
(4) Fire alarm systems shall comply with the requirements of 15.6.2.6.

15.7.3.4.4 Where the new occupancy classification is classified as a detention and correctional occupancy, the following requirements shall be met throughout the building:

(1) Locking of egress doors shall comply with the requirements of 15.6.2.1.4.11.
(2) Shaft enclosures shall comply with the requirements of 15.6.2.3.
(3) Fire alarm systems shall comply with the requirements of 15.6.2.6.

15.7.3.4.5 Where the new occupancy classification is classified as a one- and two-family dwelling, the following requirements shall be met:

(1) Dwelling unit separation shall comply with the requirements of 15.6.2.4.2.
(2) The smoke alarm requirements of 15.6.2.6.1 shall be met.

15.7.3.4.6 When a change of occupancy classification includes a commercial kitchen, existing grease ducts, exhaust equipment, and kitchen hoods shall be brought into compliance with all the requirements of the mechanical code.

15.7.3.5 Fire and Life Safety.

15.7.3.5.1 Means of Egress/General.

15.7.3.5.1.1 Occupancy Change to Higher Risk Category. When a change of occupancy classification results in a higher risk category (lower number) in accordance with Table 15.7.3.5.1.1, egress capacity, arrangement of the means of egress, and all elements of the means of egress including, but not limited to, the exit access, exit discharge, occupant load, corridors, doors, enclosures, stairs and ramps, guards and handrails, means of egress doorways, fire escapes, and exit lighting and signs shall comply with the applicable requirements for new construction.

Exception No. 1: Stairways shall be enclosed in compliance with applicable portions of 15.7.3.6.

Exception No. 2: Existing stairways including handrails and guards complying with the requirements of Section 15.6 shall be permitted for continued use subject to approval of the authority having jurisdiction.

Table 15.7.3.5.1.1 Hazard Categories and Classifications — Life Safety and Exits

Relative Hazard	Occupancy Classification
1 (highest hazard)	High hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3
2	Health care, detention and correctional, residential board and care
3	Assembly, educational, day care, ambulatory health care, residential, mercantile, business, industrial, storage
4 (lowest hazard)	Industrial and storage occupancies with low hazard contents

Exception No. 3: Any stairway replacing an existing stairway within a space where, because of existing construction, the pitch or slope cannot be reduced shall not be required to comply with the maximum riser height and minimum tread depth requirements.

Exception No. 4: Existing corridor walls constructed of wood lath and plaster in good condition or ½-in. (12.7-mm)-thick gypsum wallboard shall be permitted.

Exception No. 5: Existing corridor doorways, transoms, and other corridor openings shall comply with the requirements in 15.6.2.1.4.3, 15.6.2.1.4.4, and 15.6.2.1.4.5.

Exception No. 6: Existing dead-end corridors shall comply with the requirements in 15.6.2.1.5.

Exception No. 7: An existing operable window with a clear opening area of not less than 5 ft^2 (0.46 m^2), and with a minimum opening height and width of 22 in. (560 mm) and 20 in. (510 mm), respectively, shall be accepted as an egress window.

Exception No. 8: In a change of occupancy classification from an existing residential or health care occupancy to a residential board and care occupancy, 28-in. (710-mm) doors shall be permitted.

Exception No. 9: In a change of occupancy classification from an existing residential or health care occupancy to a residential board and care occupancy, winders complying with 11.2.2.2.4 shall be permitted.

15.7.3.5.1.2 Occupancy Change to Equal or Lesser Risk Category. When a change of occupancy classification is to an equal or lesser risk category in accordance with Table 15.7.3.5.1.1, existing elements of the means of egress shall comply with the requirements of 15.6.2.1 for the new occupancy classification. Newly constructed or configured means of egress shall comply with the applicable requirements for new construction.

Exception No. 1: Any stairway replacing an existing stairway within a space where, because of existing construction, the pitch or slope cannot be reduced shall not be required to comply with the maximum riser height and minimum tread depth requirements of 11.2.2.2.

Exception No. 2: Compliance with Section 15.6 shall not be required where the change of occupancy classification complies with the requirements of 15.7.3.4.

15.7.3.5.1.3 Day-Care Occupancy Conversion. A conversion from a day-care home to a day-care occupancy with more than

12 clients shall be permitted only if the day-care occupancy conforms with the requirements of Chapter 18 for new day-care occupancies with more than 12 clients.

15.7.3.5.1.4 Egress Capacity for Occupancy Change to Equal or Lesser Risk Category. Egress capacity shall meet or exceed the occupant load as specified in 15.6.2.1.3 if the change of occupancy classification is to an equal or lesser risk category when evaluated in accordance with Table 15.7.3.5.1.1.

15.7.3.6 Enclosure of Vertical Shafts.

15.7.3.6.1 General. Vertical openings shall be designed to meet the requirements for atriums or the requirements of 15.7.3.6.2 through 15.7.3.6.4.

15.7.3.6.2 Stairways. When a change of occupancy classification is to a higher risk category in accordance with Table 15.7.3.5.1.1, interior stairways shall be enclosed as required by 15.7.3.6.

Exception No. 1: In other than health care and detention and correctional occupancies, an enclosure shall not be required for openings serving only one adjacent floor and not connected with corridors or stairways serving other floors.

Exception No. 2: Where there is at least one exit that complies with 11.1.3.2, unenclosed existing stairways shall not be required to be enclosed in a continuous vertical shaft if each story is separated from other stories by 1-hour fire-resistive construction or approved wired glass set in steel frames and all exit corridors are sprinklered. The openings between the corridor and occupant space shall have at least one sprinkler head above the openings of the tenant side. The sprinkler system shall be permitted to be supplied from the domestic water supply systems, provided that the system is of adequate pressure, capacity, and sizing for the combined domestic and sprinkler requirements.

Exception No. 3: Existing penetrations of stairway enclosures shall be permitted if they are properly protected in accordance with Section 8.8.

15.7.3.6.3 Other Vertical Shafts. Where there is a change of occupancy classification to a higher risk category in accordance with Table 15.7.3.5.1.1, interior vertical shafts, other than stairways and those enclosing commercial kitchen exhaust ducts including, but not limited to, elevator hoistways and service and utility shafts, shall be enclosed as required by Section 8.12.

Exception No. 1: Existing 1-hour interior shaft enclosures shall be permitted where a higher rating is required.

Exception No. 2: Vertical openings, other than stairways, shall not be required to be enclosed if the entire building is provided with an approved automatic sprinkler system.

Exception No. 3: Where 1-hour fire-resistive floor construction is required, vertical shafts shall not be required to be enclosed where floor penetrations are fireblocked at every floor level.

15.7.3.6.4 Openings. Where there is a change of occupancy classification to a higher risk category in accordance with Table 15.7.3.5.1.1, all openings into existing vertical shaft enclosures shall be protected by fire assemblies having a fire protection rating of not less than 1 hour and shall be maintained self-closing or shall be automatic closing by actuation of a smoke detector. All other openings shall be fire protected in an approved manner. Existing fusible link–type automatic door-closing devices shall be permitted in all shafts except stairways if the fusible link rating does not exceed 135°F (57°C).

15.7.3.7* Automatic Sprinkler Systems. Any change of occupancy classification shall comply with the automatic sprinkler system requirements for new construction. The provisions of 15.6.2.5 shall be used to determine the extent of sprinkler protection required using the area that has changed occupancy as the rehabilitation work area.

Exception: In a change of occupancy classification from an existing residential or health care occupancy to a residential board and care occupancy, sprinklers shall not be required in small board and care homes, serving eight or fewer residents, when all occupants have the ability to move as a group within 3 minutes to a point exterior to, and away from, the building or to an approved exit.

15.7.3.8 Heights and Areas.

15.7.3.8.1 Occupancy Change to Higher Risk Category.

(A) Where a change of occupancy classification is to a higher risk category in accordance with Table 15.7.3.8.1, heights and areas of buildings and structures shall meet the limitations of Chapter 7 for the new occupancy classification.

Table 15.7.3.8.1 Hazard Categories and Classifications — Heights and Areas

Relative Hazard	Occupancy Classification
1 (highest hazard)	High hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3
2	Assembly, day care, health care, ambulatory health care, detention and correctional, large residential board and care
3	Educational, residential, small residential board and care, mercantile, business, industrial, storage
4 (lowest hazard)	Industrial and storage occupancies with low hazard contents

Exception No. 1: A one-story building changed into educational occupancy shall not be required to meet the compartment area limitations of Section 7.4.

Exception No. 2: Where a change of occupancy to a higher risk category is to an assembly, health care, or detention or correctional occupancy, heights of buildings and structures shall meet the limitations of Chapter 7 for the new occupancy classification.

(B) When a change of occupancy classification is to a higher risk category in accordance with Table 15.7.3.8.1, fire barrier walls or horizontal assemblies, or both, in mixed use buildings shall comply with the requirements for multiple occupancies in Section 6.2.

Exception: Where the fire barrier walls are required to have a 1-hour fire resistance rating, existing wood lath and plaster in good condition or existing stud wall clad in ½-in. (12.7-mm)-thick gypsum wallboard or other equivalent assemblies shall be permitted.

15.7.3.8.2 Occupancy Changes to Equal or Lesser Risk Category. When a change of occupancy classification is to an equal or lesser risk category in accordance with Table 15.7.3.8.1, the height and area of the existing building shall be deemed to be acceptable.

15.7.3.8.3 Stories in Detention and Correctional Occupancies. For the purposes of applying the height and area provisions of this *Code* in detention and correctional occupancies, the number of stories shall be counted starting with the primary level of exit discharge. The primary level of exit discharge of a building shall be that floor that is level with or above finished grade on the exterior wall line for 50 percent or more of its perimeter. Building levels below the primary level shall not be counted as a story in determining the height of the building.

15.7.3.8.4 Ambulatory Health Care Occupancies. Where new ambulatory health care facilities are located in existing buildings, the authority having jurisdiction shall be permitted to accept construction systems of lesser fire resistance than that required by 20.1.6, provided that it can be demonstrated to the authority's satisfaction that prompt evacuation of the facility can be achieved in case of fire, or that the exposing occupancies and materials of construction present no threat of fire penetration from such occupancy to the ambulatory health care facility or to the collapse of the structure.

15.7.3.9 Exterior Wall Fire Resistance Ratings.

15.7.3.9.1 Occupancy Change to Higher Risk Category. Where a change of occupancy classification is to a higher risk category in accordance with Table 15.7.3.9.1, exterior walls shall have fire resistance and exterior opening protectives as required in Chapter 7. This provision shall not apply to walls at right angles to the property line.

Table 15.7.3.9.1 Hazard Categories and Classifications — Exposure of Exterior Walls

Relative Hazard	Occupancy Classification
1 (highest hazard)	High hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3
2	Mercantile, industrial, and storage occupancies with ordinary hazard contents
3	Assembly, educational, day care, health care, ambulatory health care, detention and correctional, residential, residential board and care, and business
4 (lowest hazard)	Occupancies containing low hazard contents

Exception: Where a fire resistance rating greater than 2 hours is required for a building of any type of construction, existing noncombustible exterior walls having a fire resistance rating equivalent to 2 hours as determined by NFPA 914, Code for Fire Protection of Historic Structures, shall be permitted, provided that the building does not exceed three stories in height and is classified as an assembly occupancy having an occupant load less than 300, a business occupancy, an industrial occupancy, a mercantile occupancy, or a storage occupancy.

15.7.3.9.2 Occupancy Change to Equal or Lesser Risk Category. When a change of occupancy classification is to an equal or lesser risk category in accordance with Table 15.7.3.9.1, existing exterior walls, including openings, shall be deemed to be acceptable.

15.7.3.9.3 Opening Protectives. Openings in exterior walls shall be protected as required by Chapter 7. When openings in the exterior walls are required to be protected due to distance from the property line, the sum of the area of such openings shall not exceed 50 percent of the total area of the wall in each story.

Exception No. 1: The requirement of 15.7.3.9.3 shall not apply where Section 7.3 permits openings in excess of 50 percent.

Exception No. 2: Existing openings shall not be required to be protected in buildings of residential occupancies that do not exceed three stories in height and that have a fire separation distance of at least 3 ft (914 mm).

Exception No. 3: Where exterior opening protectives are required, an approved automatic sprinkler system throughout shall be permitted to be substituted for opening protection.

Exception No. 4: Exterior opening protectives shall not be required when the change of occupancy classification is to an equal or lower hazard classification in accordance with Table 15.7.3.9.1.

15.7.3.10 Where the occupancy classification of an existing building or part of an existing building is changed to a residential occupancy, other than hotel and dormitory occupancies, or a residential board and care occupancy, electrical service shall be upgraded to meet the requirements of Article 220 of NFPA 70 for the new occupancy classification.

15.7.3.11 If the occupancy classification is changed to a health care occupancy, the plumbing system shall comply with the requirements of the plumbing code.

15.8 Additions.

15.8.1 General Requirements.

15.8.1.1 An addition to a building or structure shall comply with other sections of this *Code*, the mechanical code, plumbing code, fire code, electrical code, boiler safety code, energy code, elevator code, and accessibility code without requiring the existing building or structure to comply with any requirements of those codes or of this *Code*.

15.8.1.2 An addition shall not create or extend any nonconformity in the existing building to which the addition is constructed with regard to accessibility; structural strength; fire safety; means of egress; or capacity of mechanical, plumbing, or electrical systems.

15.8.1.3 Any repair, renovation, alteration, or reconstruction work within an existing building to which an addition is being made shall comply with the requirements of Section 15.3, Section 15.4, Section 15.5, and Section 15.6.

15.8.2 Heights and Areas. No addition shall increase the height or area of an existing building beyond that permitted under the applicable provisions of Section 7.4 for new buildings unless fire separation as required by Section 7.4 is provided.

Exception: In filling of floor openings, nonoccupiable appendages such as elevator and exit stair shafts, and the addition of mezzanines and equipment rooftop structures shall be permitted beyond that permitted by Section 38.12.

15.8.3 Fire Protection Systems. Existing building areas increased by the addition shall be protected with an approved automatic sprinkler system. The building area shall be determined by fire barrier walls having a fire resistance rating as determined in accordance with Section 7.2.

15.8.4 Structural Loads.

15.8.4.1 An addition shall not impose loads that would cause the existing building to be subject to stresses exceeding those permitted by Chapter 35.

15.8.4.2 An addition shall not increase the stress in any structural element of the existing building or structure by more than 5 percent, unless the increased load on the element remains in compliance with Chapter 35 for new structures.

15.8.5 Smoke Alarms in One- and Two-Family Dwellings and Small Residential Board and Care Occupancies.

15.8.5.1 Where an addition is made to a one- and two-family dwelling or a small residential board and care occupancy, hard-wired, interconnected smoke alarms meeting the requirements of the other sections of this *Code* shall be installed and maintained in the addition.

15.8.5.2 Where an addition is made to a one- and two-family dwelling or a small residential board and care occupancy, the existing building shall be provided with smoke alarms as required by NFPA *101*.

15.8.6 Accessibility Requirements. Additions shall comply with Chapter 12.

15.8.7 Energy Conservation. Additions to existing buildings or structures shall be permitted to be made to such buildings or structures without the entire building or structure complying with the requirements of Chapter 51. The addition shall conform to the requirements of Chapter 51 as they relate to new construction only, provided that the allowable amount of glass in the addition is based on the area of the entire building.

15.8.8 Plumbing Requirements. In areas where public sanitary sewers are not available, existing structures that are being enlarged, and that discharge liquid wastes containing grease, flammable wastes, sand, solids, and other ingredients harmful to the building drainage system, shall have all existing floor drains permanently plugged or retrofitted to allow them to flow into an approved sand interceptor, which shall drain into a 1000-gal (3.8-m^3) or larger approved holding tank.

15.9 Historic Buildings.

15.9.1 General Requirements.

15.9.1.1 General. Historic buildings shall comply with the provisions of Section 15.9, or with the provisions of Section 15.3, Section 15.4, Section 15.5, Section 15.6, and Section 15.7, relating to their repair, renovation, modification, reconstruction, movement, and change of occupancy.

15.9.1.2 Investigation and Evaluation. A historic building undergoing modification, reconstruction, or change of occupancy shall be investigated and evaluated.

(A) If it is intended that the building meet the requirements of this chapter, a written report shall be prepared for such a building and filed with the local jurisdiction by a registered design professional.

(B) If the subject matter of the report does not require an evaluation by a registered design professional, the local jurisdiction shall be permitted to allow the report to be prepared by a licensed building contractor, an electrician, a plumber, a mechanical contractor, or a certified interior designer responsible for the work.

(C) The licensed person preparing the report shall be knowledgeable in historic preservation, or the report shall be co-authored by a preservation professional. Such report shall identify each required safety feature in compliance with this chapter and specify where compliance with other chapters of this *Code* would be damaging to the contributing historic features.

(D) The report also shall describe each feature not in compliance with this *Code* and demonstrate how compliance with the intent of this *Code* is met by providing an equivalent level of safety.

(E) The local preservation official shall review and comment on the written report or shall be permitted to request and review comments on the report from the state historic preservation officer.

(F) Unless determined by the local jurisdiction that a report is required to protect the health and safety of the public, the following rehabilitation projects shall not require the submission of a report:

(1) Historic buildings complying with NFPA 914
(2) A building or structure that is being rehabilitated for the personal use of the owner or a member of the immediate family of that person and is not intended for any use or occupancy by the public, including assembly or employment

15.9.1.3 Flood Hazard Areas. For historic buildings or structures located in whole or in part in flood hazard areas established in 39.4.2, work on the building or structure shall be permitted, provided that both of the following are met:

(1) The proposed work will not preclude continued designation as a historic building or structure.
(2) A variance to the flood provisions of this *Code* is granted by the board of appeals.

15.9.1.4 Accessibility Requirements. The accessibility requirements contained in this *Code* shall apply to historic buildings undergoing renovations, modifications, reconstruction, or a change of occupancy. If the historic character of the building is adversely affected, and the building is required to comply with ADAAG by the provisions of Section 15.4, then substantially equivalent alternative provisions of accessibility shall be permitted in accordance with the accessibility code. If the historic character of the building is adversely affected, then a waiver shall be permitted to be requested in accordance with the accessibility code.

15.9.1.5 Energy Efficiency. A building or structure that has been designated as historically significant by the state or local jurisdiction or that is listed in the National Register of Historic Places by the U.S. secretary of the interior, or a building or structure that has been determined as eligible for said listing, shall be exempt from the provisions of Chapter 51 to the extent permitted in 4.5.2.

15.9.2 Repairs. Repairs to any portion of a historic building or structure shall be permitted to be made with original or like materials and original methods of construction, subject to the provisions of Section 15.9.

15.9.3 Relocated Buildings.

15.9.3.1 Construction. Any repair, renovation, modification, reconstruction, movement, and change of use of relocated historic structures shall comply with the requirements of Section 15.9.

15.9.3.2 Foundations. Foundations of relocated historic buildings and structures shall comply with Chapter 36. Relocated historic buildings shall otherwise be considered as historic buildings for the purposes of this *Code*.

15.9.3.3 Siting. Relocated historic buildings and structures shall be so sited that fire separation distance and opening protectives comply with the requirements of Section 7.3.

15.9.4 Repair, Renovation, Modification, or Reconstruction.

15.9.4.1 General. Historic buildings undergoing repair, renovation, modification, or reconstruction shall comply with all of the applicable requirements of Section 15.3, Section 15.4, Section 15.5, and Section 15.6, except as specifically permitted in Section 15.9.

15.9.4.2 Replacement. Replacement of existing or missing features using original or like materials shall be permitted. Partial replacement for repairs that match the original in configuration, height, and size shall be permitted. Such replacements shall not be required to meet the materials and methods requirements in 15.4.1.2. Replacement glazing in hazardous locations shall comply with 15.3.1.2.2.

15.9.4.3 Roof Covering. The existing type of roof covering shall be permitted to be continued and replaced with the same materials if the historic materials are documented to the satisfaction of the local jurisdiction.

15.9.4.4 Means of Egress. Existing door openings, window openings intended for emergency egress, and corridor and stairway widths of less than those that would be acceptable for nonhistoric buildings under this *Code* shall be approved, provided that, in the opinion of the local jurisdiction, there is sufficient width and height for a person to pass through the opening or traverse the exit and that the capacity of the exit system is adequate for the occupant load, or provided that other operational controls to limit occupancy are approved by the local jurisdiction.

15.9.4.5 Door Swing. When approved by the local jurisdiction, the existing front doors shall not be required to swing in the direction of exit travel, provided that other approved exits having sufficient capacity to serve the total occupant load are provided.

15.9.4.6 Transoms. In fully sprinklered buildings in hotels and dormitories, apartment buildings, and residential board and care occupancies, existing transoms in corridors and other fire-rated walls shall be permitted to be maintained if fixed in the closed position. A sprinkler shall be installed on each side of the transom.

15.9.4.7 Interior Finishes. The existing finishes of walls and ceilings shall be permitted where it is demonstrated that such finish is the historic finish. In other than one- and two-family dwellings, finishes in exitways shall have a flame spread classification of Class C or better. Existing nonconforming materials shall be surfaced with an approved fire-retardant paint or finish, unless the building is equipped throughout with an approved automatic sprinkler system.

15.9.4.8 Stairway Enclosure.

15.9.4.8.1 Stairway enclosures shall not be required in a historic building where a stairway serves only one adjacent floor.

15.9.4.8.2 In buildings of three stories or less, exit enclosure construction shall limit the spread of smoke by the use of tight-fitting doors and solid elements. Such elements shall not be required to have a fire rating.

15.9.4.9 One-Hour Fire-Resistive Assemblies. Where 1-hour fire-resistive construction is required by this *Code*, it shall not be required to be provided where the existing wall and ceiling finish is wood lath and plaster, regardless of construction or occupancy.

15.9.4.10 Stairway Railing. Grand stairways shall be permitted without complying with the handrail and guardrail requirements. Existing handrails and guards shall be permitted to remain, provided that they are not structurally dangerous.

15.9.4.11 Exit Signs. The local jurisdiction shall be permitted to accept an alternate exit sign or egress path marking location where such sign or marking would have an adverse effect on the historic character. Alternative signs shall identify the exits and egress path.

15.9.4.12 Sprinkler Alternative. Every historic building that does not conform to the construction requirements specified in other chapters of this *Code* for the specific occupancy or use and that, in the opinion of the local jurisdiction, constitutes a fire safety hazard shall be equipped throughout with an approved automatic sprinkler system. However, such automatic sprinkler system shall not be used as a substitute for, or act as an alternate to, the required number of exits from any facility.

15.9.5 Change of Occupancy.

15.9.5.1 General. Historic buildings undergoing a change of occupancy shall comply with the applicable provisions of Section 15.7, except as specifically permitted in 15.9.5.2 through 15.9.5.13. Where Section 15.7 requires compliance with specific requirements of Section 15.6, and where those requirements are subject to exceptions in 15.9.4, the same exceptions shall apply to the requirements of 15.9.5.

15.9.5.2 Compartment Area. The allowable compartment area for historic buildings undergoing a change of occupancy shall be permitted to exceed the allowable areas specified in Section 7.4 by 20 percent.

15.9.5.3 Location on Property. Historic structures undergoing a change of use to a higher hazard category in accordance with 15.7.3.9.1 shall be permitted to use alternative methods to comply with the fire resistance and exterior opening protective requirements. Such alternatives shall comply with 15.9.1.2.

15.9.5.4 Roof Covering. Regardless of occupancy or use group, roof-covering materials not less than Class C shall be permitted where a fire-retardant roof covering is required.

15.9.5.5 Means of Egress. Existing door openings, window openings intended for emergency egress, and corridor and stairway widths of less than those that would be acceptable for nonhistoric buildings under this *Code* shall be approved, provided that, in the opinion of the local jurisdiction, there is sufficient width and height for a person to pass through the opening or traverse the exit and that the capacity of the exit system is adequate for the occupant load, or provided that

other operational controls to limit occupancy are approved by the local jurisdiction.

15.9.5.6 Door Swing. When approved by the local jurisdiction, the existing front doors shall not be required to swing in the direction of exit travel, provided that other approved exits having sufficient capacity to serve the total occupant load are provided.

15.9.5.7 Transoms. In corridor walls required to be fire rated by this *Code*, existing transoms shall be permitted to be maintained if fixed in the closed position and if fixed wired glass set in a steel frame or other approved glazing is installed on one side of the transom.

Exception: Transoms conforming to 15.9.4.6 shall be permitted.

15.9.5.8 Finishes. Where finish materials are required to have a flame spread classification of Class C or better, existing nonconforming materials shall be surfaced with an approved fire-retardant paint or finish.

Exception: Existing nonconforming materials shall not be required to be surfaced with an approved fire-retardant paint or finish when the building is equipped throughout with an approved automatic sprinkler system and the nonconforming materials can be substantiated as historic in character.

15.9.5.9 One-Hour Fire-Resistive Assemblies. Where 1-hour fire-resistive construction is required by this chapter, it shall not be required to be provided where the existing wall and ceiling finish is wood lath and plaster, regardless of construction or occupancy.

15.9.5.10 Stairs and Railing. Existing stairways shall comply with the requirements of this chapter. The local jurisdiction shall grant alternatives for grand stairways and railings if alternative stairways are found to be acceptable or if judged as meeting the intent of this *Code*. Existing stairways shall comply with 15.9.4.10.

15.9.5.11 Exit Signs. The local jurisdiction shall be permitted to accept alternate exit sign locations where such signs would have an adverse effect on the historic character. Such signs shall identify the exits and exit path.

15.9.5.12 Exit Stair Live Load. Existing historic stairways in buildings changed to hotels and dormitories and apartment occupancies shall be permitted where it can be shown that the stairway can support a 75 lbf/ft^2 (3590 N/m^2) live load.

15.9.5.13 Natural Light. When it is determined by the local jurisdiction that compliance with the natural light requirements of 15.7.2.7 will lead to loss of historic character, historic materials, or both, in the building, the existing level of natural lighting shall be considered acceptable.

Chapter 16 Assembly Occupancies

16.1 General Requirements.

16.1.1 Application.

16.1.1.1 The requirements of this chapter shall apply to new buildings or portions thereof used as an assembly occupancy.

16.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of an assembly occupancy and changes of use, including change of occupancy classification to an assembly occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

16.1.2 Multiple Occupancies.

16.1.2.1 General. Multiple occupancies shall be in accordance with Section 6.2 and 16.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

16.1.2.2* Simultaneous Occupancy. Exits shall be sufficient for simultaneous occupancy of both the assembly occupancy and other parts of the building.

Exception: The requirement of 16.1.2.2 shall not apply where the authority having jurisdiction determines that the conditions are such that simultaneous occupancy will not occur.

16.1.2.3 Assembly and Mercantile Occupancies in Mall Buildings. The provisions of this chapter shall apply to the assembly occupancy tenant space. The provisions of 27.4.4 shall be permitted to be used outside the assembly occupancy tenant space.

16.1.3* Classification of Occupancy. Classification of occupancy shall be in accordance with 6.1.2.

16.1.4 Classification of Hazard of Contents.

16.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

16.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

16.1.5 Minimum Construction Requirements.

16.1.5.1 Construction shall be in accordance with all of the following, except as otherwise modified by 16.1.5.2:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

16.1.5.2 The location of an assembly occupancy shall be limited in accordance with Chapter 7 or Table 16.1.5.2, whichever is more stringent.

16.1.6* Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space or shall be determined as the maximum probable population of the space under consideration, whichever is greater. In areas not in excess of 10,000 ft^2 (930 m^2), the occupant load shall not exceed one person in 5 ft^2 (0.46 m^2); in areas in excess of 10,000 ft^2 (930 m^2), the occupant load shall not exceed one person in 7 ft^2 (0.65 m^2).

Table 16.1.5.2 Construction Type Limitations

Type of Construction	Below LED	LED	Number of Levels above LED			
			1	2	3	≥4
I(442)[†‡§] I(332)[†‡§] II(222)[†‡§]	Any assembly[#]	Any assembly	Any assembly	Any assembly	Any assembly	Any assembly, if OL > 300[#]
II(111)[†‡§]	Any assembly,[#] limited to 1 level below LED	Any assembly	Any assembly	Any assembly, if OL > 1000[#]	Assembly with OL ≤1000[#]	NP
III(211)[‡] IV(2HH) V(111)	Any assembly,[#] limited to 1 level below LED	Any assembly	Any assembly	Any assembly, if OL > 300[#]	Assembly with OL ≤1000[#]	NP
II(000)	Assembly with OL ≤1000,[#] limited to 1 level below LED	Any assembly, if OL > 1000[#]	Assembly with OL ≤300[#]	NP	NP	NP
III(200) V(000)	Assembly with OL ≤1000,[#] limited to 1 level below LED	Assembly with OL ≤1000	Assembly with OL ≤300[#]	NP	NP	NP

Notes:
1. LED = level of exit discharge.
2. OL = occupant load.
3. NP = not permitted.
4. For the purpose of this table, a mezzanine is not counted as a level.

[†]Where every part of the structural framework of roofs in Type I or Type II construction is 20 ft (6.1 m) or more above the floor immediately below, omission of all fire protection of the structural members is permitted, including protection of trusses, roof framing, decking, and portions of columns above 20 ft (6.1 m).

[‡]Where seating treads and risers serve as floors, such seating treads and risers are permitted to be of 1-hour fire resistance–rated construction. Structural members supporting seating treads and risers are to conform to the requirements of Table 16.1.5.2. Joints between seating tread and riser units are permitted to be unrated, provided that such joints do not involve separation from areas containing high hazard contents and the facility is constructed and operated in accordance with 16.4.2.

[§]In open-air fixed seating facilities, including stadia, omission of fire protection of structural members exposed to the outside atmosphere is permitted where substantiated by an approved engineering analysis.

[#]Permitted if all the following are protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3:

(1) The level of the assembly occupancy
(2) Any level below the level of the assembly occupancy
(3) In the case of an assembly occupancy located below the level of exit discharge, any level intervening between that level and the level of exit discharge, including the level of exit discharge

16.1.6.1 Waiting Spaces. In theaters and other assembly occupancies where persons are admitted to the building at times when seats are not available to them, or when the permitted occupant load has been reached based on 16.1.6 and persons are allowed to wait in a lobby or similar space until seats or space is available, such use of a lobby or similar space shall not encroach upon the required clear width of exits. Such waiting shall be restricted to areas other than the required means of egress. Exits shall be provided for such waiting spaces on the basis of one person for each 3 ft^2 (0.28 m^2) of waiting space area. Such exits shall be in addition to the exits specified for the main auditorium area and shall conform in construction and arrangement to the general rules for exits given in this chapter.

16.1.6.2 Large Occupant Loads. Where the occupant load of an assembly occupancy is greater than 6000, a life safety evaluation shall be performed in accordance with 16.4.1.

Exception: Where approved by the authority having jurisdiction, the number of usually seated occupants provided with a minimum of 15 ft^2 (1.4 m^2) of lawn surface in outdoor facilities shall be permitted to be excluded in determining the need for a life safety evaluation.

16.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

16.2 Means of Egress Requirements.

16.2.1 General. All means of egress shall be in accordance with Chapter 11 and this chapter.

16.2.2 Means of Egress Components.

16.2.2.1 General. Components of means of egress shall be limited to the types described in 16.2.2.2 through 16.2.2.10.

16.2.2.2 Doors.

16.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

16.2.2.2.2 Assembly occupancies with occupant loads of 300 or less in malls *(see 27.4.4.5)* shall be permitted to have horizontal or vertical security grilles or doors complying with Exception No. 2 to 11.2.1.4.1 on the main entrance/exits.

16.2.2.2.3 Any door in a required means of egress from an area having an occupant load of 100 or more persons shall be permitted to be provided with a latch or lock only if it is panic hardware or fire exit hardware complying with 11.2.1.7.

Exception No. 1: The requirement of 16.2.2.2.3 shall not apply to delayed-egress locks as permitted in 16.2.2.2.5.

Exception No. 2: The requirement of 16.2.2.2.3 shall not apply to access-controlled egress doors as permitted in 16.2.2.2.6.

16.2.2.2.4 Locking devices complying with Exception No. 2 to 11.2.1.5.1 shall be permitted to be used on a single door or a single pair of doors serving as the main exit from assembly occupancies having an occupant load not greater than 500. Any latching devices on such a door(s) from assembly occupancies having an occupant load of 100 or more shall be released by panic hardware or fire exit hardware.

16.2.2.2.5 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted on doors other than main entrance/exit doors.

16.2.2.2.6 Doors in the means of egress shall be permitted to be equipped with an approved access control system complying with 11.2.1.6.2. Doors shall not be locked from the egress side when the assembly occupancy is occupied.

16.2.2.2.7 Revolving doors complying with the requirements of 11.2.1.10 shall be permitted. The exceptions to 11.2.1.11.1 that permit turnstiles where revolving doors are permitted shall not apply.

16.2.2.2.8 No turnstiles or other devices that restrict the movement of persons shall be installed in any assembly occupancy in such a manner as to interfere in any way with required means of egress facilities.

16.2.2.3 Stairs.

16.2.2.3.1* General. Stairs complying with 11.2.2 shall be permitted.

Exception No. 1: Stairs serving seating that is designed to be repositioned shall not be required to comply with 11.2.2.3.1.

Exception No. 2: The requirement of 16.2.2.3.1 shall not apply to stages and platforms as permitted by 16.4.5.

16.2.2.3.2 Catwalk, Gallery, and Gridiron Stairs.

16.2.2.3.2.1 Noncombustible grated stair treads and landing floors shall be permitted in means of egress from lighting and access catwalks, galleries, and gridirons.

16.2.2.3.2.2 Spiral stairs complying with 11.2.2.2.3 shall be permitted in means of egress from lighting and access catwalks, galleries, and gridirons.

16.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

16.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

16.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

Exception: Ramps not part of an accessible means of egress and serving only stages or nonpublic areas and ramped aisles shall be permitted to have a slope not steeper than 1 in 8.

16.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

16.2.2.8 Fire Escape Ladders.

16.2.2.8.1 Fire escape ladders complying with 11.2.9 shall be permitted.

16.2.2.8.2 For ladders serving catwalks, the three-person limitation specified in 11.2.9.1(3) shall be permitted to be increased to 10 persons.

16.2.2.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

16.2.2.10 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

16.2.3 Capacity of Means of Egress.

16.2.3.1 General. The capacity of means of egress shall be in accordance with Section 11.3 or, for means of egress serving theater-type seating or similar seating arranged in rows, in accordance with 16.2.3.2, or, for smoke-protected assembly seating, in accordance with 16.4.2.

16.2.3.2* Theater-type Seating. Minimum clear widths of aisles and other means of egress serving theater-type seating, or similar seating arranged in rows, shall be in accordance with Table 16.2.3.2. The minimum clear widths shown shall be modified in accordance with all of the following:

(1) If risers exceed 7 in. in height, the stair width in the table shall be multiplied by factor *A*, where *A* equals the following:

$$A = 1 + \frac{\text{riser height} - 7}{5}$$

(2) If risers exceed 178 mm in height, the stair width in the table shall be multiplied by factor *A*, where *A* equals the following:

$$A = 1 + \frac{\text{riser height} - 178}{125}$$

(3) Stairs not having a handrail within a 30-in. (760-mm) horizontal distance shall be 25 percent wider than otherwise calculated; that is, their width shall be multiplied by factor *B*, where *B* equals the following:

$$B = 1.25$$

Table 16.2.3.2 Capacity Factors

	Clear Width per Seat Served	
No. of Seats	**Stairs**	**Passageways, Ramps, and Doorways**
Unlimited	0.3 *AB* (in.) 7.6 *AB* (mm)	0.22 *C* (in.) 5.6 *C* (mm)

(4) Ramps steeper than 1 in 10 slope where used in ascent shall have their width increased by 10 percent; that is, their width shall be multiplied by factor *C,* where *C* equals the following:

$$C = 1.10$$

Exception: The requirements of 16.2.3.2 shall not apply to lighting and access catwalks as permitted by 16.4.5.8.

16.2.3.3 Main Entrance/Exit. Every assembly occupancy shall be provided with a main entrance/exit. The main entrance/exit shall be of sufficient width to accommodate one-half of the total occupant load and shall be at the level of exit discharge or shall connect to a stairway or ramp leading to a street. Each level of an assembly occupancy shall have access to the main entrance/exit, and such access shall have sufficient capacity to accommodate 50 percent of the occupant load of such levels. Where the main entrance/exit from an assembly occupancy is through a lobby or foyer, the aggregate capacity of all exits from the lobby or foyer shall be permitted to provide the required capacity of the main entrance/exit, regardless of whether all such exits serve as entrances to the building.

Exception No. 1: A bowling establishment shall have a main entrance/exit of sufficient capacity to accommodate 50 percent of the total occupant load without regard to the number of aisles that it serves.

Exception No. 2: In assembly occupancies where there is no well-defined main entrance/exit, exits shall be permitted to be distributed around the perimeter of the building, provided that the total exit width furnishes a minimum of 100 percent of the width needed to accommodate the permitted occupant load.

16.2.3.4 Other Exits. Each level of an assembly occupancy shall have access to the main entrance/exit and shall be provided with additional exits of sufficient width to accommodate a minimum of one-half of the total occupant load served by that level. Such exits shall discharge in accordance with 16.2.7. Such exits shall be located as far apart as practicable and as far from the main entrance/exit as practicable. Such exits shall be accessible from a cross aisle or a side aisle.

Exception: In assembly occupancies where there is no well-defined main entrance/exit, exits shall be permitted to be distributed around the perimeter of the building, provided that the total exit width furnishes a minimum of 100 percent of the width needed to accommodate the permitted occupant load.

16.2.3.5 Corridor Minimum Width. The minimum width of any exit access corridor serving 50 or more persons shall be 44 in. (112 cm).

16.2.4* Number of Exits.

16.2.4.1 The number of exits shall be in accordance with Section 11.4.

Exception: Fenced outdoor assembly occupancies in accordance with 16.2.4.2.

16.2.4.2 A fenced outdoor assembly occupancy shall have at least two widely separated means of egress from the enclosure. If more than 6000 persons are to be served by such means of egress, there shall be at least three means of egress; if more than 9000 persons are to be served, there shall be at least four means of egress.

16.2.4.3 Balconies or mezzanines having an occupant load not greater than 50 shall be permitted to be served by a single means of egress, and such means of egress shall be permitted to lead to the floor below.

16.2.4.4 Balconies or mezzanines having an occupant load greater than 50, but not greater than 100, shall have at least two remote means of egress, but both such means of egress shall be permitted to lead to the floor below.

16.2.4.5 Balconies or mezzanines having an occupant load greater than 100 shall be provided with means of egress as for a floor.

16.2.4.6 A second means of egress shall not be required from lighting and access catwalks, galleries, and gridirons where a means of escape to a floor or a roof is provided. Ladders, alternating tread devices, or spiral stairs shall be permitted in such means of escape.

16.2.5 Arrangement of Means of Egress.

16.2.5.1 General.

16.2.5.1.1 Means of egress shall be arranged in accordance with Section 11.5.

16.2.5.1.2 Common paths of travel shall be permitted for the first 20 ft (6.1 m) from any point where serving any number of occupants and for the first 75 ft (23 m) from any point where serving not more than 50 occupants.

16.2.5.1.3 Dead-end corridors shall not exceed 20 ft (6.1 m).

16.2.5.2 Limitations. Means of egress shall not be permitted through kitchens, storerooms, restrooms, closets, or hazardous areas as described in 16.3.2.

16.2.5.3 Auditoriums and Arenas. Where the floor area of auditoriums and arenas is used for assembly activities/events, at least 50 percent of the occupant load shall have means of egress provided without passing through adjacent fixed seating areas.

16.2.5.4 General Requirements for Access and Egress Routes within Assembly Areas.

16.2.5.4.1 Festival seating shall be prohibited within a building.

Exception No. 1: Festival seating shall be permitted in assembly occupancies having occupant loads of 1000 or less.

Exception No. 2: Festival seating shall be permitted in assembly occupancies with occupant loads greater than 1000 with an approved life safety evaluation. (See 16.4.1.)

16.2.5.4.2* Access and egress routes shall be designed and constructed so that any individual is able to move without undue hindrance, on personal initiative and at any time, from an occupied position to exits.

16.2.5.4.3* Access and egress routes shall be designed and constructed so that crowd management, security, and emergency medical personnel are able to move without undue hindrance at any time to any individual.

16.2.5.4.4* The width of aisle accessways and aisles shall provide sufficient egress capacity for the number of persons accommodated by the catchment area served by the aisle accessway or aisle in accordance with 16.2.3.1 or, for smoke-protected assembly seating, in accordance with 16.4.2. Where aisle accessways or aisles converge to form a single path of egress travel, the required egress capacity of that path shall not be less than the combined required capacity of the converging aisle accessways and aisles.

16.2.5.4.5 Those portions of aisle accessways and aisles where egress is possible in either of two directions shall be uniform in required width.

Exception: The requirements of 16.2.5.4.5 shall not apply to those portions of aisle accessways where the required width, not including the seat space described by 16.2.5.7.2, does not exceed 12 in. (30.5 cm).

16.2.5.4.6 In the case of side boundaries, other than nonfixed seating at tables, for aisle accessways or aisles, the clear width shall be measured to boundary elements such as walls, guardrails, handrails, edges of seating, tables, and side edges of treads, with the measurement made horizontally to the vertical projection of the elements resulting in the smallest width measured perpendicularly to the line of travel.

16.2.5.5* Aisle Accessways Serving Seating Not at Tables.

16.2.5.5.1* To determine the required clear width of aisle accessways between rows of seating, horizontal measurements shall be made (between vertical planes) from the back of one seat to the front of the most forward projection of the seat immediately behind it. Where the entire row consists of automatic or self-rising seats that comply with ASTM F 851, *Test Method for Self-Rising Seat Mechanisms*, the measurement shall be permitted to be made with the seats in the up position.

16.2.5.5.2 The aisle accessway between rows of seating shall have a clear width of not less than 12 in. (30.5 cm), and this minimum clear width shall be increased as a function of row length in accordance with 16.2.5.5.3 and 16.2.5.5.4.

Exception No. 1: If used by not more than four persons, there shall be no minimum clear width requirement for the portion of the aisle accessway having a length not exceeding 6 ft (1.8 m), measured from the center of the seat farthest from the aisle.

Exception No. 2: The increase in aisle accessway width required by 16.2.5.5.2 shall not apply to grandstands, bleachers, and folding and telescopic seating, provided that the number of seats between the farthest seat and an aisle does not exceed that shown in Table 16.4.8.2.5.

16.2.5.5.3* Rows of seating served by aisles or doorways at both ends shall have not more than 100 seats per row. The 12-in. (30.10-cm) minimum clear width of aisle accessway between such rows shall be increased by 0.3 in. (7.6 mm) for every seat over a total of 14, but shall not be required to exceed 22 in. (55.9 cm).

Exception: The requirements of 16.2.5.5.3 shall not apply to smoke-protected assembly seating as permitted by 16.4.2.4.

16.2.5.5.4 Rows of seating served by an aisle or doorway at one end only shall have a path of travel not exceeding 30 ft (9.1 m) in length from any seat to an aisle. The 12-in. (30.10-cm) minimum clear width of aisle accessway between such rows shall be increased by 0.6 in. (15 mm) for every seat over a total of seven.

Exception: The requirements of 16.2.5.5.4 shall not apply to smoke-protected assembly seating as permitted by 16.4.2.5 and 16.4.2.6.

16.2.5.5.5 Rows of seating utilizing tablet-arm chairs shall be permitted only if the clear width of aisle accessways complies with the requirements of 16.2.5.5 where the tablet is in the usable position.

Exception: Tablet arms shall be permitted to be measured in the stored position where the tablet arm automatically returns to the stored position when raised manually to a vertical position in one motion and falls to the stored position by force of gravity.

16.2.5.5.6 The depth of seat boards shall not be less than 9 in. (23 cm) where the same level is not used for both seat boards and footboards. Footboards, independent of seats, shall be provided such that there is no horizontal opening that allows the passage of a ½-in. (1.3-cm) diameter sphere.

16.2.5.6 Aisles Serving Seating Not at Tables.

16.2.5.6.1 Number of Seats. Aisles shall be provided so that the number of seats served by the nearest aisle is in accordance with 16.2.5.5.2 through 16.2.5.5.4.

Exception: Aisles shall not be required in bleachers if all of the following conditions are met:

(1) Egress from the front row is not obstructed by a rail, guard, or other obstruction.
(2) Row spacing is 28 in. (71.1 cm) or less.
(3) Rise per row, including the first row, is 6 in. (15.2 cm) or less.
(4) The number of rows does not exceed 16.
(5) The seat spaces are not physically defined.
(6) Seat boards that are also used as stepping surfaces for descent provide a walking surface with a minimum width of 12 in. (30.5 cm), and, where there is a depressed footboard, the gap between seat boards of adjacent rows does not exceed 12 in. (30.5 cm), measured horizontally, and the following criteria are met:
(a) The leading edges of the walking surfaces are provided with a contrasting marking stripe so that the location of such leading edge is readily apparent, particularly where viewed in descent, but is not required where bleacher surfaces and environmental conditions under all conditions of use are such that the location of each leading edge is readily apparent, particularly when viewed in descent.
(b) The contrasting marking stripe is at least 1 in. (2.5 cm) wide and does not exceed 2 in. (5.1 cm) in width.

16.2.5.6.2 Dead-end Aisles. Dead-end aisles shall not exceed 20 ft (6.1 m) in length.

Exception No. 1: A longer dead-end aisle shall be permitted where seats served by the dead-end aisle are not more than 24 seats from another aisle, measured along a row of seats having a minimum clear width of 12 in. (30.5 cm) plus 0.6 in. (1.5 cm) for each additional seat over a total of seven in the row.

Exception No. 2: A 16-row dead-end aisle shall be permitted in folding and telescopic seating and grandstands.

Exception No. 3: The requirement of 16.2.5.6.2 shall not apply to aisle termination as permitted by 16.4.2.7 for smoke-protected assembly seating.

16.2.5.6.3* Minimum Clear Width of Aisles. The minimum clear width of aisles shall be sufficient to provide egress capacity in accordance with 16.2.3.2 but shall be not less than the following:

(1) 48 in. (122 cm) for stairs having seating on each side or 36 in. (91 cm) where the aisle does not serve more than 50 seats

(2) 36 in. (91 cm) for stairs having seating on only one side
(3) 23 in. (58 cm) between a handrail and seating or a guardrail and seating where the aisle is subdivided by a handrail
(4) 42 in. (107 cm) for level or ramped aisles having seating on both sides or 36 in. (91 cm) where the aisle does not serve more than 50 seats
(5) 36 in. (91 cm) for level or ramped aisles having seating on only one side
(6) 23 in. (58 cm) between a handrail or guardrail and seating where the aisle does not serve more than five rows on one side

16.2.5.6.4* Aisle Gradients. Aisles having a gradient steeper than 1 in 20, but not steeper than 1 in 8, shall consist of a ramp. Aisles having a gradient steeper than 1 in 8 shall consist of an aisle stair. The exception to 16.2.5.6.8 shall not apply.

Exception: The limitation on height between landings in Table 11.2.2.2.1 shall not apply to aisle stairs.

16.2.5.6.5 Aisle Stair Treads.

(A) There shall be no variation exceeding 3⁄16 in. (0.5 cm) in the depth of adjacent treads.

(B)* Treads shall be a minimum of 11 in. (27.9 cm).

(C) All treads shall extend the full width of the aisle.

16.2.5.6.6 Aisle Stair Risers.

(A) Riser heights shall be a minimum of 4 in. (10.2 cm).

Exception: The riser height of aisle stairs in folding and telescopic seating shall be permitted to be a minimum of 3½ in. (8.9 cm).

(B) Riser heights shall not exceed 8 in. (20.3 cm).

Exception No. 1: Where the gradient of an aisle is steeper than 8 in. (20.3 cm) in rise in 11 in. (27.9 cm) of run (to maintain necessary sight lines in the adjoining seating area), the riser height shall be permitted to exceed 8 in. (20.3 cm), but shall not exceed 9 in. (22.9 cm).

Exception No. 2: The riser height of aisle stairs in folding and telescopic seating shall be permitted to be a maximum of 11 in. (27.9 cm).

(C) Riser heights shall be designed to be uniform in each aisle, and the construction-caused nonuniformities shall not exceed 3⁄16 in. (0.5 cm) between adjacent risers.

Exception: Riser height shall be permitted to be nonuniform only for the purpose of accommodating necessary changes in gradient to maintain necessary sight lines within a seating area and shall be permitted to exceed 3⁄16 in. (0.5 cm) in any flight. Where nonuniformities exceed 3⁄16 in. (0.5 cm) between adjacent risers, the exact location of such nonuniformities shall be indicated by a distinctive marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform risers.

16.2.5.6.7* Ramped aisles having a gradient exceeding 1 in 12 and aisle stairs shall be provided with handrails at one side or along the centerline and shall be in accordance with 11.2.2.4.4.

(A) Where there is seating on both sides of the aisle, the handrails shall be discontinuous with gaps or breaks at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other.

(B) Gaps or breaks shall have a clear width of not less than 22 in. (55.9 cm) and not greater than 36 in. (91 cm), measured horizontally, and the handrail shall have rounded terminations or bends.

(C) Where handrails are provided in the middle of aisle stairs, there shall be an additional intermediate rail located approximately 12 in. (30 cm) below the main handrail.

Exception No. 1: Handrails shall not be required for ramped aisles having a gradient not steeper than 1 in 8 and having seating on both sides where the aisle does not serve as an accessible route.

Exception No. 2: The requirement for a handrail shall be permitted to be met by the use of a guard providing a rail that complies with the graspability requirements for handrails and is located at a consistent height of 34 in. to 42 in. (86 cm–107 cm), measured vertically from the top of the rail to the leading edge (nosing) of stair treads or to the adjacent walking surface in the case of a ramp.

16.2.5.6.8* A contrasting marking stripe shall be provided on each tread at the nosing or leading edge such that the location of the tread is readily apparent, particularly when viewed in descent. Such stripes shall be at least 1 in. (2.5 cm) wide and shall not exceed 2 in. (5 cm) in width.

Exception: The marking stripe shall not be required where tread surfaces and environmental conditions under all conditions of use are such that the location of each tread is readily apparent, particularly when viewed in descent.

16.2.5.7* Aisle Accessways Serving Seating at Tables.

16.2.5.7.1 The minimum required clear width of an aisle accessway shall be 12 in. (30.5 cm), where measured in accordance with 16.2.5.7.2, and increased as a function of length in accordance with 16.2.5.7.3.

Exception: If used by not more than four persons, there shall be no minimum clear width requirement for the portion of aisle accessway having a length not exceeding 6 ft (1.8 m) and located farthest from an aisle.

16.2.5.7.2* Where nonfixed seating is located between a table and an aisle accessway, the measurement of required clear width of the aisle accessway shall be made to a line 19 in. (48.3 cm) away from the edge of the table. The 19-in. (48.3-cm) distance shall be measured perpendicularly to the edge of the table.

16.2.5.7.3* The minimum required clear width of an aisle accessway measured in accordance with 16.2.5.4.6 and 16.2.5.7.2 shall be increased beyond the 12-in. (30.10-cm) requirement by 0.5 in. (1.3 cm) for each additional 12 in. (30.5 cm), or fraction thereof, beyond 12 ft (3.7 m) of aisle accessway length, where measured from the center of the seat farthest from an aisle.

16.2.5.7.4 The path of travel along the aisle accessway shall not exceed 36 ft (10.9 m) from any seat to the closest aisle or egress doorway.

16.2.5.8 Aisles Serving Seating at Tables.

16.2.5.8.1* Aisles that contain steps or that are ramped, such as the aisles serving dinner theater–style configurations, shall comply with the requirements of 16.2.5.6.

16.2.5.8.2* The minimum width of aisles serving seating at tables shall be 44 in. (112 cm) where serving an occupant load greater than 50, and 36 in. (91 cm) where serving an occupant load of 50 or fewer.

16.2.5.8.3* Where nonfixed seating is located between a table and an aisle, the measurement of required clear width of the aisle shall be made to a line 19 in. (48.3 cm) away from the edge of the table. The 19-in. (48.3-cm) distance shall be measured perpendicularly to the edge of the table.

16.2.5.9 Approval of Layouts. Where required by the authority having jurisdiction, plans drawn to scale showing the arrangement of furnishings or equipment shall be submitted to the authority by the building owner, manager, or authorized agent to substantiate conformance with the provisions of this section and shall constitute the only acceptable arrangement until revised or additional plans are submitted and approved.

Exception: Temporary deviations from the specifications of the approved plans shall be permitted, provided that the occupant load is not increased and the intent of 16.2.5.9 is maintained.

16.2.6 Travel Distance to Exits. Exits shall be arranged so that the total length of travel from any point to reach an exit does not exceed 200 ft (60 m) in any assembly occupancy.

Exception No. 1: The travel distance shall not exceed 250 ft (75 m) in assembly occupancies protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

Exception No. 2: The requirement of 16.2.6 shall not apply to smoke-protected assembly seating as permitted by 16.4.2.8 and its exception.

16.2.7 Discharge from Exits.

16.2.7.1 Exit discharge shall comply with Section 11.7.

16.2.7.2 The level of exit discharge shall be measured at the point of principal entrance to the building.

16.2.7.3 Where the principal entrance to an assembly occupancy is via a terrace, either raised or depressed, such terrace shall be permitted to be considered to be the level of exit discharge for the purposes of the construction requirements of Chapter 7 if all of the following criteria are met:

(1) The terrace is at least as long (measured parallel to the building) as the total width of the exit(s) it serves, but not less than 5 ft (1.5 m) long.
(2) The terrace is at least as wide (measured perpendicularly to the building) as the exit(s) it serves, but not less than 10 ft (3 m) wide.
(3) Required stairs leading from the terrace to grade are protected in accordance with 11.2.2.7.3 or are a minimum of 10 ft (3 m) from the building.

16.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

Exception: The requirement of 16.2.8 shall not apply to private party tents not larger than 1200 ft^2 (111.5 m^2).

16.2.9 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 11.9.

Exception: The requirement of 16.2.9 shall not apply to private party tents not larger than 1200 ft^2 (111.5 m^2).

16.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

Exception: Exit markings shall not be required on the seating side of vomitories from seating areas where exit marking is provided in the concourse and such marking is readily apparent from the vomitories.

16.2.11 Special Means of Egress Features—Guards and Railings.

16.2.11.1* Sightline–Constrained Rail Heights. Unless subject to the requirements of 16.2.11.2, a fasciae or railing system complying with the guard requirements of 11.2.2.4 and having a minimum height of 26 in. (66 cm) shall be provided where the floor or footboard elevation is more than 30 in. (76 cm) above the floor or grade below and the fasciae or railing system would otherwise interfere with sight lines of immediately adjacent seating.

16.2.11.2 Fasciae or Railing System at Foot of Aisles. A fasciae or railing system complying with the guard requirements of 11.2.2.4 shall be provided for the full width of the aisle where the foot of the aisle is more than 30 in. (76 cm) above the floor or grade below. The fasciae or railing shall be a minimum of 36 in. (91 cm) high and shall provide a minimum diagonal measurement of 42 in. (107 cm) between the top of the rail and the nosing of the nearest tread.

16.2.11.3 Railing Systems at Cross Aisles.

(A) Cross aisles located behind seating rows shall be provided with railings not less than 26 in. (66 cm) above the adjacent floor.

Exception: The requirement of 16.2.11.3(A) shall not apply where the backs of seats located at the front of the aisle project 24 in. (61 cm) or more above the adjacent floor of the aisle.

(B) Where cross aisles are more than 30 in. (76 cm) above the floor or grade below, guards shall be provided in accordance with 11.2.2.4.

16.2.11.4 Guards at Side and Back of Seating Areas. Guards complying with the guard requirements of 11.2.2.4 shall be provided and shall be of a height not less than 42 in. (107 cm) above the aisle, aisle accessway, or footboard where the floor elevation is more than 30 in. (76 cm) above the floor or grade to the side or back of seating.

16.2.11.5 Openings Below Seating. Openings between footboards and seat boards shall be provided with intermediate construction so that a 4-in. (10.2-cm) diameter sphere cannot pass through the opening.

16.2.11.6 Locations Not Requiring Guards.

(A) Guards shall not be required on the audience side of stages; raised platforms; and other raised floor areas such as runways, ramps, and side stages used for entertainment or presentations.

(B) Permanent guards shall not be required at vertical openings in the performance area of stages.

(C) Guards shall not be required where the side of an elevated walking surface is required to be open for the normal functioning of special lighting or for access and use of other special equipment.

16.3 Protection.

16.3.1* Protection of Vertical Openings. Any vertical opening shall be enclosed or protected in accordance with Section 8.12.

Exception No. 1: Stairs or ramps shall be permitted to be unenclosed between balconies or mezzanines and main assembly areas located below, provided that the balcony or mezzanine is open to the main assembly area.

Exception No. 2: Exit access stairs from lighting and access catwalks, galleries, and gridirons shall not be required to be enclosed.

Exception No. 3: Assembly occupancies protected by an approved, supervised automatic sprinkler system in accordance with Section 55.3 shall be permitted to have unprotected vertical openings in accordance with 8.12.4.2.

16.3.2 Hazardous Area Protection.

16.3.2.1 Service Equipment, Hazardous Operations or Processes, and Storage Facilities.

16.3.2.1.1 Rooms containing high-pressure boilers, refrigerating machinery of other than domestic refrigerator type, large transformers, or other service equipment subject to possible explosion shall not be located directly under or abutting required exits. All such rooms shall be separated from other parts of the building by fire barriers in accordance with Section 8.4 having a fire resistance rating of not less than 1 hour or shall be protected by automatic extinguishing systems in accordance with Section 55.3.

16.3.2.1.2 Rooms or spaces shall be protected in accordance with the following:

(1) Separation from the remainder of the building by fire barriers having a fire resistance rating of not less than 1 hour or protection of such rooms by automatic extinguishing systems as specified in Section 8.15 in the following areas:
   (a) Boiler and furnace rooms, unless otherwise permitted by the following:
      i. The requirement of 16.3.2.1.2 (1)(a) shall not apply to rooms enclosing furnaces, heating and air-handling equipment, or compressor equipment with a total aggregate input rating less than 200,000 Btu (211 MJ).
      ii. The rooms specified in 16.3.2.1.2(1)(a)(i) shall not be used for storage unless otherwise protected as required.
      iii. For installations in attics, the draftstopping requirements of Section 8.14 shall apply.
   (b) Rooms or spaces used for the storage of combustible supplies in quantities deemed hazardous by the authority having jurisdiction
   (c) Rooms or spaces used for the storage of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards
(2) Separation from the remainder of the building by fire barriers having a fire resistance rating of not less than 1 hour and protection of such rooms by automatic extinguishing systems as specified in Section 8.15 in the following areas:
   (a) Laundries
   (b) Maintenance shops, including woodworking and painting areas
   (c) Rooms or spaces used for processing or use of combustible supplies deemed hazardous by the authority having jurisdiction
   (d) Rooms or spaces used for processing or use of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards
(3) Where automatic extinguishing is used to meet the requirements of 16.3.2.1.2, the protection shall be permitted to be in accordance with 55.3.1.2.

16.3.2.2 Cooking Equipment.

16.3.2.2.1 Cooking equipment shall be protected in accordance with Section 55.10.

Exception No. 1: The requirement of 16.3.2.2 shall not apply to outdoor equipment.

Exception No. 2: The requirement of 16.3.2.2 shall not apply to portable cooking equipment that is not flue connected.

Exception No. 3: The requirement of 16.3.2.2 shall not apply to equipment used only for food warming.

16.3.2.2.2 Openings shall not be required to be protected between food preparation areas and dining areas.

16.3.3 Interior Finish.

16.3.3.1 Interior finish shall be in accordance with Chapter 10.

16.3.3.2 Interior wall and ceiling finish materials complying with Chapter 10 shall be Class A or Class B in all corridors and lobbies and shall be Class A in enclosed stairways.

16.3.3.3 Interior wall and ceiling finish materials complying with Chapter 10 shall be Class A or Class B in general assembly areas having occupant loads of more than 300 and shall be Class A, Class B, or Class C in assembly areas having occupant loads of 300 or fewer.

16.3.3.4 Screens on which pictures are projected shall comply with requirements of Class A or Class B interior finish in accordance with Chapter 10.

16.3.3.5 Interior floor finish in exit enclosures in exit access corridors, and in spaces not separated from such enclosures and corridors by walls complying with 16.3.6 shall be not less than Class II in accordance with 10.6.4. In all other spaces, interior floor finish shall comply with 10.6.1 and 10.6.2.

16.3.4 Detection, Alarm, and Communications Systems.

16.3.4.1 General. Assembly occupancies with occupant loads greater than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with Section 55.2 and 16.3.4.2 through 16.3.4.3.4.

Exception No. 1: Assembly occupancies that are a part of a mixed occupancy shall be permitted to be served by a common fire alarm system, provided that the individual requirements of each occupancy are met.

Exception No. 2: Voice communication or public address systems complying with 16.3.4.3.3 shall not be required to comply with Section 55.2.

16.3.4.2 Initiation.

16.3.4.2.1 Initiation of the required fire alarm system shall be by manual means in accordance with 55.2.2, which shall be provided with an emergency power source. The initiating device shall be capable of transmitting an alarm to a receiving station, located within the building, that is constantly attended when the assembly occupancy is occupied.

Exception No. 1: The requirement of 16.3.4.2.1 shall not apply where initiation is by means of an approved automatic fire detection system in accordance with Section 55.2 that provides fire detection throughout the building.

Exception No. 2: The requirement of 16.3.4.2.1 shall not apply where initiation is by means of an approved automatic sprinkler system in accordance with Section 55.3 that provides fire detection and protection throughout the building.

16.3.4.2.2* In assembly occupancies with occupant loads greater than 300, automatic detection shall be provided in all hazardous areas that are not normally occupied.

Exception: The requirement of 16.3.4.2.2 shall not apply to areas that are protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3.

16.3.4.3 Notification.

16.3.4.3.1 The required fire alarm system shall sound an audible alarm in a constantly attended receiving station within the building when occupied for purposes of initiating emergency action. Positive alarm sequence in accordance with 55.2.3.4 shall be permitted.

16.3.4.3.2 Occupant notification shall be by means of visible signals and voice announcements, either live or prerecorded, initiated by the person in the constantly attended location.

16.3.4.3.3 The announcement shall be made via an approved voice communication or public address system that is provided with an emergency power source and that is audible above the ambient noise level of the assembly occupancy.

16.3.4.3.4 Where the authority having jurisdiction determines that it is impractical to have a constantly attended location, a fire alarm system in accordance with Section 55.2 that is initiated by manual stations in accordance with 55.2.2 or other approved means of initiation and that automatically provides prerecorded evacuation instructions in accordance with 55.2.3 shall be used.

16.3.5 Extinguishment Requirements.

16.3.5.1 Sprinkler Systems.

16.3.5.1.1* Buildings containing assembly occupancies with occupant loads greater than 300 shall be protected by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3 as follows:

(1) Throughout the story containing the assembly occupancy
(2) Throughout all stories below the story containing the assembly occupancy
(3) In the case of an assembly occupancy located below the level of exit discharge, throughout all stories intervening between that story and the level of exit discharge, including the level of exit discharge

Exception No. 1: The requirements of 16.3.5.1.1 shall not apply to assembly occupancies used primarily for worship with fixed seating and not part of a mixed occupancy.

Exception No. 2: The requirements of 16.3.5.1.1 shall not apply to assembly occupancies consisting of a single multipurpose room of less than 12,000 ft^2 (1100 m^2) that are not used for exhibition or display and are not part of a mixed occupancy.

Exception No. 3: The requirements of 16.3.5.1.1 shall not apply to gymnasiums, skating rinks, and swimming pools used exclusively for participant sports with no audience facilities for more than 300 persons.

Exception No. 4: In stadia and arenas, sprinklers shall not be required over the floor area used for contest, performance, or entertainment; over the seating areas; and over open-air concourses where an approved engineering analysis substantiates the ineffectiveness of sprinkler protection due to building height and combustible loading.

Exception No. 5: In unenclosed stadia and arenas, sprinklers shall not be required in the following areas:

(1) Press boxes less than 1000 ft^2 (93 m^2)
(2) Storage facilities less than 1000 ft^2 (93 m^2), if enclosed with not less than 1-hour fire resistance–rated construction
(3) Enclosed areas underneath grandstands that comply with 16.4.8.5

16.3.5.1.2 Where another provision of this chapter requires an automatic sprinkler system to be supervised, the sprinkler system shall be electrically supervised in accordance with 55.3.2.

16.3.5.2 Standpipes.

16.3.5.2.1 Class I standpipe systems shall be provided in buildings four or more stories in height, or having four or more basement levels, as specified in 55.4.1.

16.3.5.2.2 Class I standpipe systems shall be provided in buildings where at least one occupiable level is more than 30 ft (10 m) above or below the level of fire department access.

16.3.5.2.3 Class I standpipe systems shall be provided in buildings not protected throughout by an approved, supervised sprinkler system in accordance with Section 55.3 where an occupiable area is more than 150 ft (45 m) from the closest point of fire department entry into the building.

16.3.5.2.4 Standpipes or hose connections shall be provided on stages in accordance with 16.4.5.10.

16.3.5.3 Portable Fire Extinguishers. Portable fire extinguishers shall be installed in assembly occupancies in accordance with Section 55.6.

Exception No. 1: The requirement of 16.3.5.3 shall not apply to seating areas.

Exception No. 2: The requirement of 16.3.5.3 shall not apply to floor areas used for contest, performance, or entertainment.

Exception No. 3: The requirement of 16.3.5.3 shall not apply to outside assembly occupancy areas.

Exception No. 4: Portable extinguishers shall be permitted to be located in secure locations accessible to staff.

16.3.6 Corridors. Interior corridors and lobbies shall be constructed in accordance with Section 8.4 and 11.1.3.1.

Exception No. 1: Corridor and lobby protection shall not be required where assembly rooms served by the corridor or lobby have at least 50 percent of their exit capacity discharging directly to the outside, independent of corridors and lobbies.

Exception No. 2: Corridor and lobby protection shall not be required in buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3.

Exception No. 3: Lobbies serving only one assembly area that meet the requirements for intervening rooms (see 11.5.1.8) shall not be required to have a fire resistance rating.

Exception No. 4: Where the corridor ceiling is an assembly having a 1-hour fire resistance rating where tested as a wall, the corridor walls shall be permitted to terminate at the corridor ceiling.

Exception No. 5: Corridor and lobby protection shall not be required in buildings protected throughout by an approved, total (complete) coverage smoke detection system (see 55.2.2.3) that provides occupant notification and is installed in accordance with Section 55.2.

16.4 Special Provisions.

16.4.1 Life Safety Evaluation.

16.4.1.1* Where a life safety evaluation is required by other provisions of the *Code*, it shall be done by persons acceptable to the authority having jurisdiction. The life safety evaluation shall include a written assessment of safety measures for conditions listed in 16.4.1.2. The life safety evaluation shall be approved annually by the authority having jurisdiction and shall be updated for special or unusual conditions.

16.4.1.2 Life safety evaluations shall include an assessment of the following conditions and the related appropriate safety measures:

(1) Nature of the events and the participants and attendees
(2) Access and egress movement, including crowd density problems
(3) Medical emergencies
(4) Fire hazards
(5) Permanent and temporary structural systems
(6) Severe weather conditions
(7) Earthquakes
(8) Civil or other disturbances
(9) Hazardous materials incidents within and near the facility
(10) Relationships among facility management, event participants, emergency response agencies, and others having a role in the events accommodated in the facility

16.4.1.3* Life safety evaluations shall include assessments of both building systems and management features upon which reliance is placed for the safety of facility occupants. Such assessments shall consider scenarios appropriate to the facility.

16.4.2* Smoke-Protected Assembly Seating.

16.4.2.1 To be considered smoke protected, an assembly seating facility shall comply with the following:

(1) All enclosed areas with walls and ceilings in buildings or structures containing smoke-protected assembly seating shall be protected with an approved, supervised automatic sprinkler system installed in accordance with Section 55.3.
(2) The requirement of 16.4.2.1(1) shall not apply to the floor area used for the contest, performance, or entertainment, provided that the roof construction is more than 50 ft (15 m) above the floor level and use is restricted to low fire hazard uses.
(3)*Sprinklers, as specified in 16.4.2.1(1), shall not be required over the floor area used for contest, performance, or entertainment and over the seating areas where an approved engineering analysis substantiates the ineffectiveness of sprinkler protection due to building height and combustible loading.
(4) All means of egress serving a smoke-protected assembly seating area shall be provided with smoke-actuated ventilation facilities or natural ventilation designed to maintain the level of smoke at least 6 ft (1.8 m) above the floor of the means of egress.

16.4.2.2 For facilities to utilize the provisions of smoke-protected assembly seating, a life safety evaluation shall be done in accordance with 16.4.1.

16.4.2.3 In Table 16.4.2.3, the number of seats specified shall be within a single assembly space, and interpolation shall be permitted between the specific values shown. A single assembly space shall be permitted to have multiple levels, floors, or mezzanines. The minimum clear widths shown shall be modified in accordance with all of the following:

(1) If risers exceed 7 in. in height, the stair width in the table shall be multiplied by factor *A*, where *A* equals the following:

$$A = 1 + \frac{\text{riser height} - 7}{5}$$

(2) If risers exceed 178 mm in height, the stair width in the table shall be multiplied by factor *A*, where *A* equals the following:

$$A = 1 + \frac{\text{riser height} - 178}{125}$$

(3) Stairs not having a handrail within a 30-in. (760 mm) horizontal distance shall be 25 percent wider than otherwise calculated; that is, their width shall be multiplied by factor *B*, where *B* equals the following:

$$B = 1.25$$

(4) Ramps steeper than 1 in 10 slope where used in ascent shall have their width increased by 10 percent; that is, their width shall be multiplied by factor *C*, where *C* equals the following:

$$C = 1.10$$

Table 16.4.2.3 Capacity Factors for Smoke-Protected Assembly Seating

No. of Seats	Clear Width per Seat Served			
	Stairs		Passageways, Ramps, and Doorways	
	in.	mm	in.	mm
2,000	0.300 *AB*	7.6 *AB*	0.220 *C*	5.6 *C*
5,000	0.200 *AB*	5.1 *AB*	0.150 *C*	3.8 *C*
10,000	0.130 *AB*	3.3 *AB*	0.100 *C*	2.5 *C*
15,000	0.096 *AB*	2.4 *AB*	0.070 *C*	1.8 *C*
20,000	0.076 *AB*	1.9 *AB*	0.056 *C*	1.4 *C*
≥25,000	0.060 *AB*	1.5 *AB*	0.044 *C*	1.1 *C*

16.4.2.4 Where smoke-protected assembly seating conforms to the requirements of 16.4.2, for rows of seats served by aisles or doorways at both ends, there shall be not more than 100 seats per row, and the minimum clear width of 12 in. (30.5 cm) for aisle accessways shall be increased by 0.3 in. (7.6 mm) for every additional seat beyond the number stipulated in Table 16.4.2.4, but the minimum clear width shall not be required to exceed 22 in. (55.9 cm).

16.4.2.5 Where smoke-protected assembly seating conforms to the requirements of 16.4.2, for rows of seats served by an aisle or doorway at one end only, the aisle accessway minimum clear width of 12 in. (30.5 cm) shall be increased by 0.6 in. (15 mm) for every additional seat beyond the number stipulated in Table 16.4.2.4, but the minimum clear width shall not be required to exceed 22 in. (55.9 cm).

Table 16.4.2.4 Smoke-Protected Assembly Seating Aisle Accessways

	No. of Seats per Row Permitted to Have a Minimum 12-in. (30.5-cm) Clear Width Aisle Accessway	
Total No. of Seats in Space	**Aisle or Doorway at Both Ends of Row**	**Aisle or Doorway at One End of Row**
<4,000	14	7
4,000–6,999	15	7
7,000–9,999	16	8
10,000–12,999	17	8
13,000–15,999	18	9
16,000–18,999	19	9
19,000–21,999	20	10
≥22,000	21	11

16.4.2.6 Smoke-protected assembly seating conforming with the requirements of 16.4.2 shall be permitted to have a common path of travel of 50 ft (15 m) from any seat to a point where a person has a choice of two directions of egress travel.

16.4.2.7 Where smoke-protected assembly seating conforms to the requirements of 16.4.2, the dead ends in aisle stairs shall not exceed a distance of 21 rows.

Exception: A longer dead-end aisle shall be permitted for smoke-protected assembly seating where seats served by the dead-end aisle are not more than 40 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 in. (30.5 cm) plus 0.3 in. (7.6 mm) for each additional seat above seven in the row.

16.4.2.8 Where smoke-protected assembly seating conforms to the requirements of 16.4.2, the travel distance from each seat to the nearest entrance to an egress vomitory portal or egress concourse shall not exceed 400 ft (122 m). The travel distance from the entrance to a vomitory portal or from an egress concourse to an approved egress stair, ramp, or walk at the building exterior shall not exceed 200 ft (60 m).

Exception: In outdoor assembly seating facilities of Type I or Type II construction, where all portions of the means of egress are essentially open to the outside, the distance shall not be limited.

16.4.3 Limited Access or Underground Buildings.

16.4.3.1 Limited access or underground buildings shall comply with 16.4.3.2 through 16.4.3.5.

16.4.3.2 Underground buildings or portions of buildings having a floor level more than 30 ft (9.1 m) below the level of exit discharge shall comply with the requirements of 16.4.3.3 through 16.4.3.5.

Exception No. 1: The requirement of 16.4.3.2 shall not apply to areas within buildings used only for service to the building, such as boiler/heater rooms, cable vaults, and dead storage.

Exception No. 2: The requirement of 16.4.3.2 shall not apply to auditoriums without intervening occupiable levels complying with the requirements of this chapter.

16.4.3.3 Each level more than 30 ft (9.1 m) below the level of exit discharge shall be divided into not less than two smoke compartments by a smoke barrier complying with Section 8.11 and having a 1-hour fire resistance rating.

16.4.3.3.1 Each smoke compartment shall have access to at least one exit without passing through the other required compartment. Any doors connecting required compartments shall be tight-fitting, minimum 1-hour-rated fire door assemblies designed and installed to minimize smoke leakage and to close and latch automatically upon detection of smoke.

16.4.3.3.2 Each smoke compartment shall be provided with a mechanical means of moving people vertically, such as an elevator or escalator.

16.4.3.3.3 Each smoke compartment shall have an independent air supply and exhaust system capable of smoke control or smoke exhaust functions that provides a minimum smoke exhaust rate of six air changes per hour.

16.4.3.3.4 Each smoke compartment shall be provided with an automatic smoke detection system throughout. The system shall be designed such that the activation of any two detectors causes the smoke control system to operate and the building voice alarm to sound.

16.4.3.4 Any required smoke control or exhaust system shall be provided with a standby power system complying with Article 701 of NFPA 70, *National Electrical Code.*

16.4.3.5 The building shall be provided with an approved, supervised voice alarm system in accordance with Section 55.2. The voice alarm system shall comply with 55.2.3. A prerecorded evacuation message shall be provided.

16.4.4 High-Rise Buildings. High-rise assembly occupancy buildings and high-rise mixed occupancy buildings that house assembly occupancies in the high-rise portions of the building shall comply with Chapter 33.

16.4.5 Stages and Platforms.

16.4.5.1 Platform Construction. Temporary platforms shall be permitted to be constructed of any materials. The space between the floor and the platform above shall not be used for any purpose other than electrical wiring to platform equipment.

(A) Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located, except that the finished floor shall be permitted to be of wood in all types of construction.

(B) Where the space beneath the platform is used for storage or any purpose other than equipment wiring or plumbing, the floor shall not be of less than 1-hour fire-resistive construction.

16.4.5.2 Stage Construction.

16.4.5.2.1 Regular stages shall be constructed of materials as required for the type of construction of the building in which they are located. In all cases, the finished floor shall be permitted to be of wood.

16.4.5.2.2 Legitimate stages shall be constructed of materials required for Type I buildings, except that the area extending from the proscenium opening to the back wall of the stage, and for a distance of 6 ft (183 cm) beyond the proscenium opening on each side, shall be permitted to be constructed of steel or heavy timber covered with a wood floor not less than 1½ in. (3.8 cm) in actual thickness.

16.4.5.2.3 Openings through stage floors (traps) shall be equipped with tight-fitting trap doors of wood that have approved safety locks and an actual thickness of not less than

1½ in. (38 mm). Other materials for such trap doors shall be acceptable where they provide fire and heat resistance equivalent to that of the wooden doors specified in this paragraph.

16.4.5.3 Accessory Rooms. Workshops, storerooms, permanent dressing rooms, and other accessory spaces contiguous to stages shall be separated from each other and other building areas by 1-hour fire resistance–rated construction and protected openings.

Exception: A separation shall not be required for stages having a floor area not exceeding 1000 ft^2 (93 m^2).

16.4.5.4 Ventilators. Regular stages greater than 1000 ft^2 (93 m^2) and legitimate stages shall be provided with emergency ventilation to provide a means of removing smoke and combustion gases directly to the outside in the event of a fire. Ventilation shall be by one or a combination of the methods specified in 16.4.5.4.1 through 16.4.5.4.3.

16.4.5.4.1 Smoke Control.

(A) A means shall be provided to maintain the smoke level at not less than 6 ft (183 cm) above the highest level of assembly seating or above the top of the proscenium opening where a proscenium wall and opening protection are provided.

(B) The smoke control system shall be activated independently by each of the following:

(1) Activation of the sprinkler system in the stage area
(2) Activation of smoke detectors over the stage area
(3) Manually operated switch at an approved location

(C) The emergency ventilation system shall be supplied by both normal and standby power.

(D) The fan(s) power wiring and ducts shall be located and properly protected to ensure a minimum of 20 minutes of operation in the event of activation.

16.4.5.4.2 Roof Vents.

(A) Two or more vents shall be located near the center of, and above the highest part of, the stage area.

(B) The vents shall be raised above the roof and shall provide a net-free vent area equal to 5 percent of the stage area.

(C) Vents shall be constructed to open automatically by approved heat-activated devices.

(D) Supplemental means shall be provided for manual operation and periodic testing of the ventilator from the stage floor.

(E) Vents shall be labeled.

16.4.5.4.3 Other Means. Approved, alternate means of removing smoke and combustion gases shall be permitted.

16.4.5.5 Proscenium Walls. Legitimate stages shall be completely separated from the seating area by a proscenium wall of not less than 2-hour fire-resistive noncombustible or limited-combustible construction. The proscenium wall shall extend at least 4 ft (122 cm) above the roof of the auditorium in combustible construction. All openings in the proscenium wall of a legitimate stage shall be protected by a fire assembly having a 1½-hour fire protection rating.

Exception No. 1: The main proscenium opening used for viewing performances shall be provided with an automatic-closing fire-resistive curtain as described in 16.4.5.6.

Exception No. 2: Proscenium walls shall not be required in smoke-protected assembly seating facilities constructed and operated in accordance with 16.4.2.

16.4.5.6 Proscenium Opening Protection. Where required by 16.4.5.5, the proscenium opening shall be protected by a fire curtain or an approved water curtain complying with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

16.4.5.6.1 The fire curtain or water curtain shall be designed to activate upon automatic detection of a fire and upon manual activation.

16.4.5.6.2 A fire curtain shall be a listed opening protective assembly or shall be constructed as described in 16.4.5.6.2.1 through 16.4.5.6.2.5.

16.4.5.6.2.1 Fabrics.

(A) Curtains shall be made of one or more thicknesses of a noncombustible or limited-combustible fabric that shall be permitted to be given a coating, provided that the modified fabric meets the criteria of 16.4.5.6.2.

(B) Curtain fabrics shall have a minimum weight of 2⅜ lb/yd^2 (1.3 kg/m^2).

16.4.5.6.2.2 Tensile Strength Requirements. Curtain fabric shall have minimum tensile strength requirements of 400 lbf/in. (70 N/mm) in both the warp and fill directions.

16.4.5.6.2.3 Wire-Insertion Reinforcement Requirements.

(A) The fabric shall be reinforced with noncorrosive wire intertwined with the base fiber at a minimum rate of one wire per yarn.

(B) Wire shall not be required, and fabric weight shall be permitted to be less than 2⅜ lb/yd^2 (1.3 kg/m^2) if it can be substantiated by approved tests that such fabric is equivalent in strength and durability.

16.4.5.6.2.4 Fire Test. A sample curtain with a minimum of two vertical seams shall be subjected to the standard fire test specified in NFPA 251, *Standard Methods of Test of Fire Endurance of Building Construction and Materials*, as applicable to nonbearing walls and partitions for a period of 30 minutes.

(A) The curtain shall overlap the furnace edges by an amount that is appropriate to seal the top and sides.

(B) The curtain shall have a bottom pocket containing a minimum of 4 lb/linear ft (5 kg/linear m) of batten.

(C) The unexposed surface of the curtain shall not glow, and neither flame nor smoke shall penetrate the curtain during the test period.

(D) Unexposed surface temperature and hose stream test requirements shall not be applicable to this proscenium fire safety curtain test.

16.4.5.6.2.5 Smoke Test. Curtain fabrics shall have a smoke density of not greater than 25 where tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials.* The curtain fabric shall be tested in the condition in which it is to be used.

16.4.5.6.3 The complete installation of every proscenium curtain shall be subjected to operating tests, and any theater in which a proscenium curtain is placed shall not be open to public performance until after the proscenium curtain has been accepted and approved by the authority having jurisdiction.

16.4.5.6.4 The curtain shall be kept in the normally closed position when each day's performances are completed.

16.4.5.6.5 The curtain shall be automatic closing without the use of applied power.

16.4.5.6.6 The curtain also shall be capable of manual operation.

16.4.5.7 Gridiron, Fly Galleries, and Pinrails. Structural framing designed only for the attachment of portable or fixed theater equipment, gridirons, galleries, and catwalks shall be constructed of materials consistent with the building type of construction, and a fire resistance rating shall not be required.

Exception: Combustible materials shall be permitted for use as floors of galleries and catwalks of all types of construction.

16.4.5.8 Catwalks. The minimum clear width of lighting and access catwalks and the means of egress from galleries and gridirons shall be 22 in. (56 cm).

16.4.5.9 Fire Protection. Every stage shall be protected by an approved, supervised automatic sprinkler system installed in compliance with Section 55.3. The protection shall be provided throughout the stage and in storerooms, workshops, permanent dressing rooms, and other accessory spaces contiguous to such stages.

Exception No. 1: Sprinklers shall not be required for stages of 1000 ft^2 (93 m^2) or less and of 50 ft (15 m) or less in height where curtains, scenery, or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs, and a single backdrop.

Exception No. 2: Sprinklers shall not be required under stage areas less than 4 ft (1.2 m) in clear height used exclusively for chair or table storage and lined on the inside with 5/8-in. (1.6-cm) Type X gypsum wallboard or an approved equivalent.

16.4.5.10* Standpipes or Hose Connections. Regular stages over 1000 ft^2 (93 m^2) in area and all legitimate stages shall be equipped with 1½-in. (38-mm) hose lines for first aid fire fighting at each side of the stage. Hose connections shall be in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, unless Class II or Class III standpipes in accordance with NFPA 14, *Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems*, are used.

16.4.6 Projection Rooms.

16.4.6.1 Projection rooms shall comply with 16.4.6.2 through 16.4.6.8. Where cellulose nitrate film is used, the projection room shall comply with NFPA 40, *Standard for the Storage and Handling of Cellulose Nitrate Film.*

16.4.6.2 Film or video projectors or spotlights utilizing light sources that produce particulate matter, or toxic gases or light sources that produce hazardous radiation without protective shielding, shall be located within a projection room complying with 16.3.2.1.2.

16.4.6.3 Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located.

(A) Openings shall not be required to be protected.

(B) The room shall have a floor area of not less than 80 ft^2 (7.4 m^2) for a single machine and not less than 40 ft^2 (3.7 m^2) for each additional machine.

(C) Each motion picture projector, floodlight, spotlight, or similar piece of equipment shall have a clear working space of not less than 30 in. (76 cm) on each side and at its rear, but only one such space shall be required between adjacent projectors.

(D) The projection room and the rooms appurtenant to it shall have a ceiling height of not less than 7½ ft. (2.3 m).

16.4.6.4 Each projection room shall have at least one outswinging, self-closing door not less than 30 in. (76 cm) wide and 6⅔ ft (2 m) high.

16.4.6.5 The aggregate of ports and openings for projection equipment shall not exceed 25 percent of the area of the wall between the projection room and the auditorium. All openings shall be provided with glass or other approved material so as to completely close the opening.

16.4.6.6 Projection room ventilation shall not be less than that described in 16.4.6.6.1 and 16.4.6.6.2.

16.4.6.6.1 Supply Air.

(A) Each projection room shall be provided with adequate air supply inlets arranged to provide well-distributed air throughout the room.

(B) Air inlet ducts shall provide an amount of air equivalent to the amount of air being exhausted by projection equipment.

(C) Air shall be permitted to be taken from the outside; from adjacent spaces within the building, provided that the volume and infiltration rate is sufficient; or from the building air-conditioning system, provided that it is arranged to supply sufficient air regardless of whether other systems are in operation.

16.4.6.6.2 Exhaust Air.

(A) Projection booths shall be permitted to be exhausted through the lamp exhaust system.

(B) The lamp exhaust system shall be positively interconnected with the lamp, so that the lamp will not operate unless there is sufficient airflow required for the lamp.

(C) Exhaust air ducts shall terminate at the exterior of the building in such a location that the exhaust air cannot be readily recirculated into any air supply system.

(D) The projection room ventilation system shall be permitted to also serve appurtenant rooms, such as the generator room and the rewind room.

16.4.6.7 Each projection machine shall be provided with an exhaust duct that will draw air from each lamp and exhaust it directly to the outside of the building, and the following shall apply:

(1) The lamp exhaust shall be permitted to exhaust air from the projection room to provide room air circulation.
(2) Such ducts shall be of rigid materials, except for a flexible connector approved for the purpose.
(3) The projection lamp and projection room exhaust systems shall be permitted to be combined but shall not be interconnected with any other exhaust or return-air system within the buildings.

16.4.6.7.1 Electric Arc Projection Equipment.

16.4.6.7.1.1 The exhaust capacity shall be 200 ft^3/min (0.09 m^3/s) for each lamp connected to the lamp exhaust system, or as recommended by the equipment manufacturer.

16.4.6.7.1.2 Auxiliary air shall be permitted to be introduced into the system through a screened opening to stabilize the arc.

16.4.6.7.2 Xenon Projection Equipment. The lamp exhaust system shall exhaust not less than 300 ft^3/min (0.14 m^3/s) per lamp, or not less than that exhaust volume required or recommended by the equipment manufacturer, whichever is greater.

16.4.6.8 Miscellaneous equipment and storage shall be protected as follows:

(1) Each projection room shall be provided with rewind and film storage facilities.
(2) A maximum of four containers for flammable liquids of not greater than 16 oz (0.5 L) capacity and of a nonbreakable type shall be permitted in each projection booth.
(3) Appurtenant electrical equipment, such as rheostats, transformers, and generators, shall be permitted to be located within the booth or in a separate room of equivalent construction.

16.4.7* Special Amusement Buildings.

16.4.7.1* General. Special amusement buildings, regardless of occupant load, shall meet the requirements for assembly occupancies in addition to the requirements of 16.4.7, unless the special amusement building is a multilevel play structure that is not more than 10 ft (3 m) in height and has aggregate horizontal projections not exceeding 160 ft^2 (14.9 m^2).

16.4.7.2* Automatic Sprinkler Protection. Every special amusement building, other than buildings or structures not exceeding 10 ft (3 m) in height and not exceeding 160 ft^2 (14.9 m^2) in aggregate horizontal projection, shall be protected throughout by an approved, supervised automatic sprinkler system installed and maintained in accordance with Section 55.3.

16.4.7.3 Water Supply for Movable or Portable Buildings. Where the special amusement building required to be sprinklered by 16.4.7.2 is movable or portable, the sprinkler water supply shall be permitted to be provided by an approved, temporary means.

16.4.7.4 Smoke Detection and Alarm Systems. Where the nature of the special amusement building is such that it operates in reduced lighting levels, the building shall be protected throughout by an approved, automatic smoke detection system in accordance with Section 55.2. Actuation of any smoke detection system device shall sound an alarm at a constantly attended location on the premises. Actuation of the automatic sprinkler system, or any other suppression system, or actuation of a smoke detection system having an approved verification or cross zoning operation capability shall do the following:

(1) Cause illumination in the means of egress to increase to that required by Section 11.8.
(2) Stop any conflicting or confusing sounds and visuals

16.4.7.5 Exit Marking.

16.4.7.5.1 Exit marking shall be in accordance with Section 11.10.

16.4.7.5.2 Exit marking in mobile special amusement buildings shall be of the luminescent, self-luminous, or electroluminescent type.

16.4.7.5.3* Floor proximity exit signs shall be provided in accordance with 11.10.1.5.

16.4.7.5.4 In special amusement buildings where mazes, mirrors, or other designs are used to confound the egress path, approved directional exit marking that will become apparent in an emergency shall be provided.

16.4.7.6 Interior Finish. Interior finish shall be Class A throughout in accordance with Chapter 10.

16.4.8 Grandstands.

16.4.8.1 General. Grandstands shall comply with the provisions of this chapter as modified by 16.4.8.

16.4.8.2 Seating.

16.4.8.2.1 Where grandstand seating without backs is used indoors, rows of seats shall be spaced not less than 22 in. (55.9 cm) back-to-back.

16.4.8.2.2 The depth of footboards and seat boards in grandstands shall be not less than 9 in. (22.9 cm). Where the same level is not used for both seat foundations and footrests, footrests independent of seats shall be provided.

16.4.8.2.3 Seats and footrests of grandstands shall be supported securely and fastened in such a manner that they cannot be displaced inadvertently.

16.4.8.2.4 Individual seats or chairs shall be permitted only if secured in rows in an approved manner, unless the seats do not exceed 16 in number and are located on level floors and within railed-in enclosures, such as boxes.

16.4.8.2.5 The maximum number of seats permitted between the farthest seat in an aisle in grandstands and bleachers shall not exceed that shown in Table 16.4.8.2.5.

Table 16.4.8.2.5 Maximum Number of Seats Permitted Between Farthest Seat and an Aisle

Application	Outdoors	Indoors
Grandstands	11	6
Bleachers	20	9
(see 16.2.5.6.1, Exception)		

16.4.8.3 Special Requirements—Wood Grandstands.

16.4.8.3.1 An outdoor wood grandstand shall be erected within not less than two-thirds of its height and, in no case, within not less than 10 ft (3 m) of a building.

Exception No. 1: The distance requirement shall not apply to buildings of not less than 1-hour fire resistance–rated construction with openings protected against the fire exposure hazard created by the grandstand.

Exception No. 2: The distance requirement shall not apply where a wall of not less than 1-hour fire resistance–rated construction separates a wood grandstand from the building.

16.4.8.3.2 An outdoor wood grandstand unit shall not exceed 10,000 ft^2 (929 m^2) in ground area or 200 ft (61 m) in length. Grandstand units of the maximum size shall be placed not less than 20 ft (6.1 m) apart or shall be separated by walls with not less than a 1-hour fire resistance rating. The number of such units erected in any one group shall not exceed three. Each group shall be separated from any other group by a wall of 2-hour fire resistance–rated construction extending 2 ft (0.6 m) above the seat platforms or by an open space of not less than 50 ft (15.2 m).

Exception: Where entirely constructed of labeled fire retardant–treated wood that has passed the standard rain test of ASTM D 2898, Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing, or where constructed of members conforming to dimensions for heavy timber construction [Type IV (2HH)], the ground area or length shall be permitted to be doubled.

16.4.8.3.3 The highest level of seat platforms above the ground or the surface at the front of the grandstand for any wood grandstand shall not exceed 20 ft (6.1 m). For portable

grandstands within tents or membrane structures, the highest level shall not exceed 12 ft (3.7 m).

Exception: Where entirely constructed of labeled fire retardant–treated wood that has passed the standard rain test of ASTM D 2898, Test Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing, or where constructed of members conforming to dimensions for heavy timber construction [Type IV (2HH)], the ground area or length shall be permitted to be doubled.

16.4.8.4 Special Requirements—Portable Grandstands.

16.4.8.4.1 Portable grandstands shall conform to the requirements of 16.4.8 for grandstands and the requirements of 16.4.8.4.2 and 16.4.8.4.3.

16.4.8.4.2 Portable grandstands shall be self-contained and shall have within them all necessary parts to withstand and restrain all forces that might be developed during human occupancy. They shall be designed and manufactured so that, if any structural members essential to the strength and stability of the structure have been omitted during erection, the presence of unused connection fittings shall make the omissions self-evident. The construction shall be skillfully accomplished to produce the strength required by the design.

16.4.8.4.3 Portable grandstands shall be provided with base plates, sills, floor runners, or sleepers of such area that the permitted bearing capacity of the supporting material is not exceeded. Where portable grandstands rest directly on a base of such character that it is incapable of supporting the load without appreciable settlement, mud sills of suitable material, having sufficient area to prevent undue or dangerous settlement, shall be installed under base plates, runners, or sleepers. All bearing surfaces shall be in contact with each other.

16.4.8.5 Spaces Underneath Grandstands. Spaces underneath a grandstand shall be kept free of flammable or combustible materials, unless protected by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

Exception No. 1: This requirement shall not apply to accessory uses of 300 ft^2 (28 m^2) or less where of noncombustible, limited-combustible, or fire-resistive construction, such as ticket booths, toilet facilities, or concession booths, in otherwise nonsprinklered facilities.

Exception No. 2: This requirement shall not apply to rooms enclosed in not less than 1-hour fire resistance–rated construction that are of less than 1000 ft^2 (93 m^2) in otherwise nonsprinklered facilities.

16.4.8.6 Guards and Railings.

16.4.8.6.1 Railings or guards not less than 42 in. (107 cm) above the aisle surface or footrest or not less than 36 in. (91 cm) vertically above the center of the seat or seat board surface, whichever is adjacent, shall be provided along those portions of the backs and ends of all grandstands where the seats are more than 4 ft (1.2 m) above the floor or ground.

Exception: The requirement of 16.4.8.6.1 shall not apply where an adjacent wall or fence affords equivalent safeguard.

16.4.8.6.2 Where the front footrest of any grandstand or folding or telescopic seating is more than 2 ft (0.6 m) above the floor, railings or guards not less than 33 in. (84 cm) above such footrests shall be provided.

Exception: In grandstands, or where the front row of seats includes backrests, the rails shall be not less than 26 in. (66 cm) high.

16.4.8.6.3 Cross aisles located within the seating area shall be provided with rails not less than 26 in. (66 cm) high along the front edge of the cross aisle.

Exception: Where the backs of the seats in front of the cross aisle project 24 in. (61 cm) or more above the surface of the cross aisle, the rail shall not be required.

16.4.8.6.4 Vertical openings between guardrails and footboards or seat boards shall be provided with intermediate construction so that a 4-in. (10.2-cm) diameter sphere cannot pass through the opening.

16.4.8.6.5 An opening between the seat board and footboard located more than 30 in. (76 cm) above grade shall be provided with intermediate construction so that a 4-in. (10.2-cm) diameter sphere cannot pass through the opening.

16.4.9 Folding and Telescopic Seating.

16.4.9.1 General. Folding and telescopic seating shall comply with the provisions of this chapter as modified by 16.4.9.

16.4.9.2 Seating.

16.4.9.2.1 The horizontal distance of seats, measured back-to-back, shall be not less than 22 in. (55.9 cm) for seats without backs. There shall be a space of not less than 12 in. (30.5 cm) between the back of each seat and the front of each seat immediately behind it. If seats are of the chair type, the 12-in. (30.5-cm) dimension shall be measured to the front edge of the rear seat in its normal, unoccupied position. All measurements shall be taken between plumb lines.

16.4.9.2.2 The depth of footboards (footrests) and seat boards in folding and telescopic seating shall be not less than 9 in. (22.9 cm). Where the same level is not used for both seat foundations and footrests, footrests independent of seats shall be provided.

16.4.9.2.3 Individual chair-type seats shall be permitted in folding and telescopic seating only if firmly secured in groups of not less than three.

16.4.9.2.4 The maximum number of seats permitted between the furthest seat in an aisle in folding and telescopic seating shall not exceed that shown in Table 16.4.8.2.5.

16.4.9.3 Guards and Railings.

16.4.9.3.1 Railings or guards not less than 42 in. (107 cm) above the aisle surface or footrest, or not less than 36 in. (91 cm) vertically above the center of the seat or seat board surface, whichever is adjacent, shall be provided along those portions of the backs and ends of all folding and telescopic seating where the seats are more than 4 ft (1.2 m) above the floor or ground.

Exception: This requirement shall not apply where an adjacent wall or fence affords equivalent safeguard.

16.4.9.3.2 Where the front footrest of folding or telescopic seating is more than 2 ft (0.6 m) above the floor, railings or guards not less than 33 in. (84 cm) above such footrests shall be provided.

Exception: Where the front row of seats includes backrests, the rails shall be not less than 26 in. (66 cm) high.

16.4.9.3.3 Cross aisles located within the seating area shall be provided with rails not less than 26 in. (66 cm) high along the front edge of the cross aisle.

Exception: Where the backs of the seats in front of the cross aisle project 24 in. (61 cm) or more above the surface of the cross aisle, the rail shall not be required.

16.4.9.3.4 Vertical openings between guardrails and footboards or seat boards shall be provided with intermediate construction so that a 4-in. (10.2-cm) diameter sphere cannot pass through the opening.

16.4.9.3.5 An opening between the seat board and footboard located more than 30 in. (76 cm) above grade shall be provided with intermediate construction so that a 4-in. (10.2-cm) diameter sphere cannot pass through the opening.

16.4.10 Airport Loading Walkways.

16.4.10.1 Airport loading walkways shall conform with NFPA 415, *Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways*, and the provisions of 16.4.10.2 and 16.4.10.3.

16.4.10.2 Doors in the egress path from the aircraft through the airport loading walkway into the airport terminal building shall meet the following criteria:

(1) They shall swing in the direction of egress from the aircraft.
(2)*They shall not be permitted to have delayed-egress locks.

16.4.10.3 Exit access shall be unimpeded from the airport loading walkway to the nonsecured public areas of the airport terminal building.

16.5 Building Services.

16.5.1 Utilities. Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

16.5.2 Heating, Ventilating, and Air-Conditioning Equipment. Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51.

16.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

16.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

16.6 (Reserved)

Chapter 17 Educational Occupancies

17.1 General Requirements.

17.1.1 Application.

17.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as an educational occupancy.

17.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of an educational occupancy, and changes of use including change of occupancy classification to an educational occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

17.1.1.3 Educational facilities that do not meet the definition of an educational occupancy shall not be required to comply with this chapter but shall comply with the following requirements:

(1) Instructional building—business occupancy *(see Chapter 28)*
(2) Classrooms under 50 persons—business occupancy *(see Chapter 28)*
(3) Classrooms 50 persons and over—assembly occupancy *(see Chapter 16)*
(4) Laboratories, instructional—business occupancy *(see Chapter 28)*
(5) Laboratories, noninstructional—industrial *(see Chapter 29)*

17.1.2 Multiple Occupancies.

17.1.2.1 General. Multiple occupancies shall be in accordance with Section 6.2 and 17.1.2.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

17.1.2.2 Assembly and Educational.

(A) Spaces subject to assembly occupancy shall comply with Chapter 16, including 16.1.2.2, which provides that, where auditorium and gymnasium egress leads through corridors or stairways also serving as egress for other parts of the building, the egress capacity shall be sufficient to allow simultaneous egress from auditorium and classroom sections.

(B) In the case of an assembly occupancy of a type suitable only for use by the school occupant load (and, therefore, not subject to simultaneous occupancy), the same egress capacity shall be permitted to serve both sections.

17.1.2.3 Dormitory and Classrooms. Any building used for both classroom and dormitory purposes shall comply with the applicable provisions of Chapter 24 in addition to complying with this chapter. Where classroom and dormitory sections are not subject to simultaneous occupancy, the same egress capacity shall be permitted to serve both sections.

17.1.3 Classification of Occupancy. Classification of occupancy shall be in accordance with 6.1.3.

17.1.3.1 Educational occupancies shall include all buildings used for educational purposes through the twelfth grade by six or more persons for four or more hours per day or more than 12 hours per week.

17.1.3.2 Educational occupancies include part-day preschools, kindergartens, and other schools whose purpose is primarily educational, even though the children are of preschool age.

17.1.3.3 In cases where instruction is incidental to some other occupancy, the section of this *Code* governing such other occupancy shall apply.

17.1.3.4 Other occupancies associated with educational institutions shall be in accordance with the appropriate parts of this *Code*.

17.1.4 Classification of Hazard of Contents.

17.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

17.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

17.1.5 Minimum Construction Requirements.

17.1.5.1 Construction shall be in accordance with all of the following, except as modified by 17.1.5.2 and 17.1.5.3:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

17.1.5.2* Educational occupancies shall not be located more than one level below the level of exit discharge.

17.1.5.3 In buildings of Type V(000) construction, educational occupancies shall not be located below the level of exit discharge.

17.1.6 Occupant Load.

17.1.6.1 The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

17.1.6.2 The occupant load of an educational occupancy, or a portion thereof, shall be permitted to be modified from that specified in 17.1.6.1 above if the necessary aisles and exits are provided. An approved aisle or seating diagram shall be required by the authority having jurisdiction to substantiate such a modification.

17.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

17.2 Means of Egress Requirements.

17.2.1 General.

17.2.1.1 Means of egress shall be in accordance with Chapter 11 and Section 17.2.

17.2.1.2 Rooms normally occupied by preschool, kindergarten, or first-grade students shall be located on a level of exit discharge. Rooms normally occupied by second-grade students shall not be located more than one story above a level of exit discharge.

17.2.1.3 Rooms or areas located on floor levels other than as specified in 17.2.1.2 shall be permitted to be used where provided with independent means of egress dedicated for use by the preschool, kindergarten, first-grade, or second-grade students.

17.2.2 Means of Egress Components.

17.2.2.1 General. Components of means of egress shall be limited to the types described in 17.2.2.2 through 17.2.2.10.

17.2.2.2 Doors.

17.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

17.2.2.2.2 Any door in a required means of egress from an area having an occupant load of 100 or more persons shall be permitted to be provided with a latch or lock only if such latch or lock is panic hardware or fire exit hardware complying with 11.2.1.7.

17.2.2.2.3 Special locking arrangements complying with 11.2.1.6 shall be permitted.

17.2.2.2.4 Any exit door that is designed to normally be kept closed shall conform with 11.2.1.8.

17.2.2.2.5 Only one locking or latching device shall be permitted on a door or on one leaf of a pair of doors.

17.2.2.3 Stairs. Stairs complying with 11.2.2 shall be permitted.

17.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

17.2.2.5 Horizontal Exits. Horizontal exits complying with 12.2.4 shall be permitted.

17.2.2.6 Ramps. Ramps complying with 10.2.5 shall be permitted.

17.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

17.2.2.8 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

17.2.2.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

17.2.2.10 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

17.2.3 Capacity of Means of Egress.

17.2.3.1 General. Capacity of means of egress shall be in accordance with Section 11.3.

17.2.3.2 Minimum Corridor Width.

17.2.3.2.1 Exit access corridors shall be not less than 6 ft (1.8 m) clear width.

17.2.3.2.2 Drinking fountains or other equipment, fixed or movable, shall not be placed so as to obstruct the required minimum 6-ft (1.8-m) corridor width.

17.2.4 Number of Exits. Not less than two separate exits shall meet the following criteria:

(1) They shall be provided on every story.
(2) They shall be accessible from every part of every story and mezzanine.

17.2.5 Arrangement of Means of Egress.

17.2.5.1 General. Means of egress shall be arranged in accordance with Section 11.5.

17.2.5.2 Dead-End Corridors. No dead-end corridor shall exceed 20 ft (6.1 m), other than in buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, in which case dead-end corridors shall not exceed 50 ft (15 m).

17.2.5.3 Common Path of Travel. No common path of travel shall exceed 75 ft (23 m), other than for the first 100 ft (30 m) in a building protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.2.5.4 Exit Access. Every room that is normally subject to student occupancy shall have an exit access door leading directly to an exit access corridor or exit, unless otherwise permitted by the following:

(1) The requirement of 17.2.5.4 shall not apply where an exit door opens directly to the outside or to an exterior corridor or balcony *(see 17.2.5.7)*.
(2) One room shall be permitted to intervene between a normally occupied student room and an exit access corridor, provided that all of the following criteria are met:
   (a) The travel from a room served by an intervening room to the corridor door or exit shall not exceed 75 ft (23 m).
   (b) Clothing, personal effects, or other materials deemed hazardous by the authority having jurisdiction shall be stored in metal lockers, provided that they do not obstruct the exit access, or the intervening room shall be sprinklered in accordance with Section 55.3.
   (c) One of the following means of protection shall be provided:
      i. The intervening room shall have approved fire detection that activates the building alarm.
      ii. The building shall be protected by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.2.5.5 Corridor Doors. Doors that swing into an exit access corridor shall be arranged to prevent interference with corridor travel. *(See also 11.2.1.4.3.)*

17.2.5.6 Aisles. Aisles shall be not less than 30 in. (91 cm) wide. The space between parallel rows of seats shall not be subject to the minimum aisle width, provided that the number of seats that intervene between any seat and an aisle does not exceed six.

17.2.5.7* Exterior Corridors or Balconies. Exterior exit access shall comply with 11.5.3.

17.2.6 Travel Distance to Exits.

(A) Travel distance to an exit shall not exceed 150 ft (45 m) from any point in a building. (See also Section 11.6.)

(B) Travel distance shall not exceed 200 ft (60 m) in educational occupancies protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3.

17.2.7 Discharge from Exits. Discharge from exits shall be arranged in accordance with Section 11.7.

17.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

17.2.9 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 11.9.

17.2.10 Marking of Means of Egress.

(A) Means of egress shall have signs in accordance with Section 11.10.

(B) Signs shall not be required where locations of exits are otherwise obvious and familiar to all occupants, such as in small elementary school buildings.

17.2.11* Windows for Rescue.

17.2.11.1 Every room or space greater than 250 ft^2 (23.2 m^2) used for classroom or other educational purposes or normally subject to student occupancy shall have at least one outside window for emergency rescue that complies with the following:

(1) The window shall be openable from the inside without the use of tools and shall provide a clear opening with the following dimensions:
   (a) A width not less than 20 in. (51 cm)
   (b) A height of 24 in. (61 cm)
   (c) An area of 5.7 ft^2 (0.53 m^2)
(2) The bottom of the opening shall be not more than 44 in. (112 cm) above the floor, and any latching device shall be capable of being operated from not more than 54 in. (137 cm) above the finished floor.
(3) The clear opening shall allow a rectangular solid, with a width and height that provides not less than the required area of 5.7 ft^2 (0.53 m^2) and a depth of not less than 20 in. (51 cm), to pass fully through the opening.
(4) The window shall be accessible by the fire department and shall open into an area having access to a public way.

17.2.11.2 The requirements of 17.2.11.1 shall not apply to the following locations:

(1) In buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3
(2) Where the room or space has a door leading directly to the outside of the building
(3) Rooms located higher than three stories above grade

17.3 Protection.

17.3.1 Protection of Vertical Openings. Any vertical opening, other than unprotected vertical openings in accordance with 8.12.4.2, shall be enclosed or protected in accordance with Section 8.12. Where the provisions of 8.12.2 are used, the requirements of 17.3.5.5 shall be met.

17.3.2 Hazardous Area Protection.

17.3.2.1 General. Rooms or spaces for the storage, processing, or use of materials specified in the following list shall be protected in accordance with the following:

(1) Separation from the remainder of the building by fire barriers having a fire resistance rating of not less than 1 hour or protection of such rooms by automatic extinguishing systems as specified in Section 8.15 in the following areas:
   (a) Boiler and furnace rooms, other than those enclosing only air-handling equipment
   (b) Rooms or spaces used for the storage of combustible supplies in quantities deemed hazardous by the authority having jurisdiction
   (c) Rooms or spaces used for the storage of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards
   (d) Janitor closets, other than those protected by automatic sprinklers, which are permitted to have doors with ventilating louvers
(2) Separation from the remainder of the building by fire barriers having a fire resistance rating of not less than 1 hour and protection of such rooms by automatic extinguishing systems as specified in Section 8.15 in the following areas:
   (a) Laundries

(b) Maintenance shops, including woodworking and painting areas
(c) Rooms or spaces used for processing or use of combustible supplies deemed hazardous by the authority having jurisdiction
(d) Rooms or spaces used for processing or use of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards

(3) Where automatic extinguishing is used to meet the requirements of 17.3.2.1(1) or 17.3.2.1(2), the protection shall be permitted to be in accordance with 55.3.1.2.

17.3.2.2 Cooking Facilities.

17.3.2.2.1 Cooking facilities shall be protected in accordance with Section 55.10.

17.3.2.2.2 Openings shall not be required to be protected between food preparation areas and dining areas.

17.3.2.3 Laboratories. Laboratories that use chemicals shall comply with NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*.

17.3.2.4 Stages. Stages shall be protected in accordance with 16.4.5.

17.3.3 Interior Finish.

17.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

17.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials in accordance with Chapter 10 shall be permitted as follows:

(1) Exits—Class A
(2) Other than exits—Class A or Class B
(3) Low-height partitions not exceeding 5 ft (1.5 m) used in locations other than exits—Class A, Class B, or Class C

17.3.3.3 Interior Floor Finish. Interior floor finish in exit enclosures and in exit access corridors, and in spaces not separated from them by walls complying with 17.3.6, shall be not less than Class II in accordance with 10.6.4. In all other spaces, interior floor finish shall comply with 10.6.1 and 10.6.2.

17.3.4 Detection, Alarm, and Communications Systems.

17.3.4.1 General. Educational occupancies shall be provided with a fire alarm system in accordance with Section 55.2.

Exception: The requirement of 17.3.4.1 shall not apply to a building with an area of not more than 1000 ft^2 (93 m^2) that contains a single classroom and is located not closer than 50 ft (15.2 m) from another building.

17.3.4.2 Initiation.

17.3.4.2.1 General. Initiation of the required fire alarm system shall be by manual means in accordance with Section 55.2.2.

17.3.4.2.2 Initiation by Automatic Sprinkler System. In buildings provided with automatic sprinkler protection, the operation of the sprinkler system shall automatically initiate the fire alarm system in addition to the initiation means required in 17.3.4.2.1.

17.3.4.2.3 Alternative Protection System. Manual fire alarm boxes shall be permitted to be eliminated in accordance with 17.3.4.2.3.1 or 17.3.4.2.3.2.

17.3.4.2.3.1* Manual fire alarm boxes shall be permitted to be eliminated where all of the following conditions apply:

(1) Interior corridors are protected by smoke detectors using an alarm verification system as described in *NFPA 72, National Fire Alarm Code*.
(2) Areas such as auditoriums, cafeterias, and gymnasiums are protected by heat or other approved detection devices.
(3) Shops and laboratories involving dusts or vapors are protected by heat or other approved detection devices.
(4) Provision is made at a central point to manually activate the evacuation signal, or to evacuate only affected areas.

17.3.4.2.3.2* Manual fire alarm boxes shall be permitted to be eliminated where all of the following conditions apply:

(1) The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.
(2) Provision is made at a central point to manually activate the evacuation signal, or to evacuate only affected areas.

17.3.4.3 Notification.

17.3.4.3.1 Occupant Notification.

17.3.4.3.1.1* Occupant notification shall be accomplished automatically in accordance with 55.2.3. Positive alarm sequence shall be permitted in accordance with 55.2.3.4.

17.3.4.3.1.2 Where acceptable to the authority having jurisdiction, the fire alarm system shall be permitted to be used for other emergency signaling or for class changes, provided that the fire alarm is distinctive in signal and overrides all other use.

17.3.4.3.1.3 In order to prevent students from being returned to a building that is burning, the recall signal shall be separate and distinct from, and incapable of being mistaken for, any other signals. Such signal shall be permitted to be a distinctively colored flag or banner. If the recall signal is electrical, the push buttons or other controls shall be kept under lock, the key for which shall be in the possession of the principal or some other designated person to prevent a recall at a time when there is an actual fire. Regardless of the method of recall, the controls for the signal shall be kept under a lock.

17.3.4.3.2 Emergency Forces Notification. Fire department notification shall be accomplished in accordance with 55.2.4.

17.3.5 Extinguishment Requirements.

17.3.5.1 Educational occupancy buildings with a fire compartment exceeding 20,000 ft^2 (1860 m^2) shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.3.5.2 Fire compartments provided to subdivide the building so as to be exempt from the sprinkler requirement of 17.3.5.1 shall be separated from the rest of the building by fire barrier walls or horizontal assemblies, or both, having a fire resistance rating of not less than 2 hours and shall comply with Chapter 8.

17.3.5.3 Educational occupancy buildings four or more stories in height shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.3.5.4 Every portion of an educational occupancy building below the level of exit discharge shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.3.5.5 Educational occupancy buildings with unprotected openings in accordance with 8.12.2 shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.3.5.6 Where another provision of this chapter requires an automatic sprinkler system to be supervised, the sprinkler system shall be electrically supervised in accordance with 55.3.2.

17.3.5.7 Standpipes shall be in accordance with 17.3.5.7.1 and 17.3.5.7.2.

17.3.5.7.1 Class I standpipe systems shall be provided in buildings four or more stories in height, or having four or more basement levels, as specified in 55.4.1.

17.3.5.7.2 Class I standpipe systems shall be provided in buildings not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 where an occupiable area is more than 150 ft (45 m) from the closest point of fire department entry into the building.

17.3.5.8 Portable fire extinguishers in accordance with the provisions of Section 55.6 shall be installed in hazardous areas as specified in 17.3.2.1.

17.3.6 Corridors. Corridors shall be separated from other parts of the story by walls having a 1-hour fire resistance rating in accordance with Section 8.4, unless otherwise permitted by the following:

(1) Corridor protection shall not be required where all spaces normally subject to student occupancy have not less than one door opening directly to the outside or to an exterior exit access corridor or balcony *(see 17.2.5.7)*.
(2) In buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3, corridor walls shall not be required to be rated, provided that such walls form smoke partitions in accordance with Section 8.10.
(3) Where the corridor ceiling is an assembly having a 1-hour fire resistance rating where tested as a wall, the corridor walls shall be permitted to terminate at the corridor ceiling.
(4) Lavatories shall not be required to be separated from corridors, provided that they are separated from all other spaces by walls having not less than a 1-hour fire resistance rating in accordance with Section 8.4.
(5) Lavatories shall not be required to be separated from corridors, provided that the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.3.7 Subdivision of Building Spaces.

17.3.7.1 Educational occupancies shall be subdivided into compartments by smoke barriers having a 1-hour fire resistance rating and complying with Section 8.4 and Section 8.11 where either of the following conditions exist:

(1) The maximum area of a compartment, including the aggregate area of all floors having a common atmosphere, exceeds 30,000 ft^2 (2800 m^2).
(2) The length or width of the building exceeds 300 ft (91 m).

(A) The requirement of 17.3.7.1 shall not apply where all spaces normally subject to student occupancy have not less than one door opening directly to the outside or to an exterior or exit access balcony or corridor in accordance with 11.5.3.

(B) The requirement of 17.3.7.1 shall not apply to buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

17.3.7.2 The area of a smoke compartment shall not exceed 30,000 ft^2 (2800 m^2), with no dimension exceeding 300 ft (91 m).

17.4 Special Provisions.

17.4.1 Limited-Access or Underground Buildings. Limited-access or underground buildings shall comply with Chapter 31.

17.4.2 High-Rise Buildings. High-rise buildings shall comply with Chapter 33.

17.4.3 Flexible Plan and Open Plan Buildings.

17.4.3.1 Flexible plan and open plan buildings shall comply with the requirements of this chapter, as modified by 17.4.3.2 through 17.4.3.4.

17.4.3.2 Each room occupied by more than 300 persons shall have two or more means of egress entering into separate atmospheres. Where three or more means of egress are required, not more than two such means of egress shall enter into the same common atmosphere.

17.4.3.3 Flexible plan buildings shall be permitted to have walls and partitions rearranged periodically only if revised plans or diagrams have been approved by the authority having jurisdiction.

17.4.3.4 Flexible plan buildings shall be evaluated while all folding walls are extended and in use, as well as when they are in the retracted position.

17.5 Building Services.

17.5.1 Utilities. Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

17.5.2 Heating, Ventilating, and Air-Conditioning Equipment.

17.5.2.1 Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51.

17.5.2.2 Unvented fuel-fired heating equipment shall be prohibited.

17.5.2.3 The requirement of 17.5.2.2 shall not apply to gas space heaters installed in compliance with NFPA 54/ANSI Z223.1, *National Fuel Gas Code*.

17.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

17.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

17.5.5 Furnishings and Decorations.

17.5.5.1 Draperies, curtains, and other similar furnishings and decorations in educational occupancies shall be in accordance with the provisions of Section 10.3 of NFPA *101*, *Life Safety Code*.

17.5.5.2 Clothing and personal effects shall not be stored in corridors, unless one of the following criteria is met:

(1) The corridors are protected by an automatic sprinkler system in accordance with Section 55.3.
(2) The corridor areas are protected by a smoke detection system in accordance with Section 55.2.
(3) Such clothing and personal effects are stored in metal lockers, provided that the required egress width is maintained.

17.6 (Reserved)

Chapter 18 Day-Care Occupancies

18.1 General Requirements.

18.1.1 Application.

18.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as a day-care occupancy.

18.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of a day-care occupancy, and changes of use including change of occupancy classification to a day-care occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

18.1.1.3 Section 18.1 through Section 18.5 establish life safety requirements for day-care occupancies in which more than 12 clients receive care, maintenance, and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day.

18.1.1.4 Section 18.1 (other than 18.1.5) and Section 18.6 establish life safety requirements for day-care homes.

18.1.1.5 Where a facility houses more than one age group of self-preservation capability, the strictest requirements applicable to any group present shall apply throughout the day-care occupancy or building, as applicable, unless the area housing that group is maintained as a separate fire area.

18.1.1.6 Places of religious worship shall not be required to meet the provisions of this chapter when providing day care while services are being held in the building.

18.1.2 Multiple Occupancies.

(A) General. Multiple occupancies shall be in accordance with Section 6.2 and 18.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

(B) Day-Care Occupancies in Apartment Buildings. If the two required exit accesses from a day-care occupancy enter the same corridor as an apartment occupancy, the exit accesses shall be separated in the corridor by a smoke barrier having not less than a 1-hour fire resistance rating constructed in accordance with Section 8.4. The smoke barrier shall be located so that it has an exit on each side.

18.1.3 Classification of Occupancy. Classification of occupancy shall be in accordance with 6.1.4.

18.1.3.1 Occupancies that include part-day preschools, kindergartens, and other schools whose purpose is primarily educational, even though the children are of preschool age, shall comply with the provisions of Chapter 17.

18.1.3.2 Adult day care shall include any building, or portion thereof, used for less than 24 hours per day to house more than three adults requiring care, maintenance, and supervision by other than their relative(s). Clients shall be ambulatory or semiambulatory and shall not be bedridden. They shall not exhibit behavior that is harmful to themselves or others.

18.1.4 Classification of Hazard of Contents.

18.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

18.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

18.1.5 Minimum Construction Requirements.

18.1.5.1 Construction shall be in accordance with all of the following, except as modified by 18.1.5.2 through 18.1.5.4:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

18.1.5.2 Day-care occupancies shall not be located more than one level below the level of exit discharge.

18.1.5.3 Buildings in which day-care occupancies are located one level below the level of exit discharge shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

18.1.5.4 In buildings of Type V(000) construction, day-care occupancies shall not be located below the level of exit discharge.

18.1.6 Occupant Load.

18.1.6.1 The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

18.1.6.2 The occupant load of a day-care occupancy, or a portion thereof, shall be permitted to be modified from that specified in 18.1.6.1 if the necessary aisles and exits are provided. An approved aisle, seating, and exiting diagram shall be required by the authority having jurisdiction to substantiate such a modification.

18.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

18.2 Means of Egress Requirements.

18.2.1 General. Means of egress shall be in accordance with Chapter 11 and Section 18.2.

18.2.2 Means of Egress Components.

18.2.2.1 General. Components of means of egress shall be limited to the types described in 18.2.2.2 through 18.2.2.10.

18.2.2.2 Doors.

18.2.2.2.1 General. Doors complying with 11.2.1 shall be permitted.

18.2.2.2.2 Panic Hardware or Fire Exit Hardware. Any door in a required means of egress from an area having an occupant load of 100 or more persons shall be permitted to be provided with a latch or lock only if such latch or lock is panic hardware or fire exit hardware complying with 11.2.1.7.

18.2.2.2.3 Door Closure. Any exit door designed to normally be kept closed shall comply with 11.2.1.8.

18.2.2.2.4 Locks and Latches. Only one locking or latching device shall be permitted on a door or on one leaf of a pair of doors.

18.2.2.2.5 Special Locking Arrangements. Special locking arrangements complying with 11.2.1.6 shall be permitted.

18.2.2.2.6* Closet Doors. Every closet door latch shall be such that clients can open the door from inside the closet.

18.2.2.2.7 Bathroom Doors. Every bathroom door lock shall be designed to allow opening of the locked door from the outside in an emergency. The opening device shall be readily accessible to the staff.

18.2.2.3 Stairs. Stairs complying with 11.2.2 shall be permitted.

18.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

18.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

18.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

18.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

18.2.2.8 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

18.2.2.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

18.2.2.10 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

18.2.3 Capacity of Means of Egress. Capacity of means of egress shall be in accordance with Section 11.3.

18.2.4 Number of Exits. Not less than two separate exits shall meet the following criteria:

(1) They shall be provided on every story.
(2) They shall be accessible from every part of every story and mezzanine.

18.2.5 Arrangement of Means of Egress.

18.2.5.1 Means of egress shall be arranged in accordance with Section 11.5.

18.2.5.2 No dead-end corridor shall exceed 20 ft (6.1 m), other than in buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, in which case dead-end corridors shall not exceed 50 ft (15 m).

18.2.5.3 No common path of travel shall exceed 75 ft (23 m), other than for the first 100 ft (30 m) in a building protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

18.2.6 Travel Distance to Exits.

18.2.6.1 General. Travel distance shall be measured in accordance with Section 11.6.

18.2.6.2 Travel Distance. Requirements for travel distance shall be as follows:

(1) The travel distance between any room door intended as an exit access and an exit shall not exceed 100 ft (30 m).
(2) The travel distance between any point in a room and an exit shall not exceed 150 ft (45 m).
(3) The travel distance between any point in a sleeping room and an exit access door in that room shall not exceed 50 ft (15 m).
(4) The travel distance specified in 18.2.6.2(1) and 18.2.6.2(2) shall be permitted to be increased by 50 ft (15 m) in buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3.

18.2.7 Discharge from Exits. Discharge from exits shall be arranged in accordance with Section 11.7.

18.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

18.2.9 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 11.9 in the following areas:

(1) Interior stairs and corridors
(2) Assembly use spaces
(3) Flexible and open plan buildings
(4) Interior or windowless portions of buildings
(5) Shops and laboratories

18.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

18.2.11 Windows for Rescue.

18.2.11.1 Every room or space normally subject to client occupancy, other than bathrooms, shall have not less than one outside window for emergency rescue that complies with the following:

(1) The window shall be openable from the inside without the use of tools and shall provide a clear opening with the following dimensions:
    (a) A width not less than 20 in. (51 cm)
    (b) A height not less than 24 in. (61 cm)
    (c) An area of 5.7 ft^2(0.53 m^2)
(2) The bottom of the opening shall be not more than 44 in. (112 cm) above the floor.
(3) The clear opening shall allow a rectangular solid, with a width and height that provides not less than the required area of 5.7 ft^2 (0.53 m^2) and a depth of not less than 20 in. (51 cm), to pass fully through the opening.

18.2.11.2 The requirements of 18.2.11.1 shall not apply to the following locations:

(1) In buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3
(2) Where the room or space has a door leading directly to the outside of the building

18.3 Protection.

18.3.1 Protection of Vertical Openings. Any vertical opening, other than unprotected vertical openings in accordance with 8.12.4.2, shall be enclosed or protected in accordance with Section 8.12.

18.3.2 Hazardous Area Protection.

18.3.2.1 General. Rooms or spaces for the storage, processing, or use of materials specified in the following list shall be protected in accordance with the following:

(1) Separation from the remainder of the building by fire barriers having a fire resistance rating of not less than 1 hour or protection of such rooms by automatic extinguishing systems as specified in Section 8.15 in the following areas:
   (a) Boiler and furnace rooms, other than those enclosing only air-handling equipment
   (b) Rooms or spaces used for the storage of combustible supplies in quantities deemed hazardous by the authority having jurisdiction
   (c) Rooms or spaces used for the storage of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards
   (d) Janitor closets, other than those protected by automatic sprinklers, which are permitted to have doors with ventilating louvers
(2) Separation from the remainder of the building by fire barriers having a fire resistance rating of not less than 1 hour and protection of such rooms by automatic extinguishing systems as specified in Section 8.15 in the following areas:
   (a)*Laundries
   (b) Maintenance shops, including woodworking and painting areas
   (c) Rooms or spaces used for processing or use of combustible supplies deemed hazardous by the authority having jurisdiction
   (d) Rooms or spaces used for processing or use of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards
(3) Where automatic extinguishing is used to meet the requirements of 18.3.2.1(1) or 18.3.2.1(2), the protection shall be permitted to be in accordance with 55.3.1.2.

18.3.2.2 Cooking Facilities.

18.3.2.2.1 Cooking facilities shall be protected in accordance with Section 55.10.

18.3.2.2.2 Openings shall not be required to be protected between food preparation areas and dining areas.

18.3.2.2.3 Where domestic cooking equipment is used for food warming or limited cooking, the protection or segregation of food preparation facilities shall not be required if approved by the authority having jurisdiction.

18.3.3 Interior Finish.

18.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

18.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials in accordance with Chapter 10 shall be permitted as follows:

(1) Stairways, corridors, and lobbies — Class A
(2) All other occupied areas — Class A or Class B

18.3.3.3 Interior Floor Finish. Interior floor finish in exit enclosures and in exit access corridors, and in spaces not separated from them by walls complying with 18.3.6, shall be not less than Class II in accordance with 10.6.4. In all other spaces, interior floor finish shall comply with 10.6.1 and 10.6.2.

18.3.4 Detection, Alarm, and Communications Systems.

18.3.4.1 General.

(A) Day-care occupancies shall be provided with a fire alarm system in accordance with Section 55.2.

(B) The requirement of 18.3.4.1 shall not apply to day-care occupancies housed in one room.

18.3.4.2 Initiation. Initiation of the required fire alarm system shall be by manual means and by operation of any required smoke detectors and required sprinkler systems in accordance with 55.2.2.

18.3.4.3 Occupant Notification.

18.3.4.3.1 Occupant notification shall be in accordance with 55.2.3.

18.3.4.3.2 Positive alarm sequence shall be permitted in accordance with 55.2.3.4.

18.3.4.4 Emergency Forces Notification. Fire department notification shall be accomplished in accordance with 55.2.4.

18.3.4.5 Detection.

18.3.4.5.1 A smoke detection system shall be installed in accordance with Section 55.2, with placement of detectors in each story in front of doors to the stairways and in the corridors of all floors occupied by the day-care occupancy. Detectors also shall be installed in lounges, recreation areas, and sleeping rooms in the day-care occupancy.

18.3.4.5.2 The requirement of 18.3.4.5.1 shall not apply to day-care occupancies housed in one room.

18.3.5 Extinguishment Requirements.

18.3.5.1 Day-care occupancy buildings with a fire compartment exceeding 20,000 ft^2 (1860 m^2) shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

18.3.5.2 Fire compartments provided to subdivide the building so as to be exempt from the sprinkler requirement of 18.3.5.1 shall be separated from the rest of the building by fire barrier walls or horizontal assemblies, or both, having a fire resistance rating of not less than 2 hours and shall comply with Chapter 8.

18.3.5.3 Buildings with day-care occupancies located two or more stories above the level of exit discharge shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

18.3.5.4 Day-care occupancy buildings with clients under 24 months old or clients incapable of self-preservation shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

18.3.5.5 Where another provision of this chapter requires an automatic sprinkler system to be supervised, the sprinkler system shall be electrically supervised in accordance with 55.3.2.

18.3.5.6 Standpipes shall be in accordance with 18.3.5.6.1 and 18.3.5.6.2.

18.3.5.6.1 Class I standpipe systems shall be provided in buildings four or more stories in height, or having four or more basement levels, as specified in 55.4.1.

18.3.5.6.2 Class I standpipe systems shall be provided in buildings not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 where an occupiable area is more than 150 ft (45 m) from the closest point of fire department entry into the building.

18.3.5.7 Portable fire extinguishers in accordance with the provisions of Section 55.6 shall be installed in hazardous areas as specified in 18.3.2.1.

18.3.6 Corridors. Every interior corridor shall be constructed of walls having not less than a 1-hour fire resistance rating in accordance with Section 8.4, unless otherwise permitted by the following:

(1) Corridor protection shall not be required where all spaces normally subject to client occupancy have not less than one door opening directly to the outside or to an exterior exit access balcony or corridor in accordance with 11.5.3.
(2) In buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3, corridor walls shall not be required to be rated, provided that such walls form smoke partitions in accordance with Section 8.10.
(3) Where the corridor ceiling is an assembly having a 1-hour fire resistance rating where tested as a wall, the corridor walls shall be permitted to terminate at the corridor ceiling.
(4) Lavatories shall not be required to be separated from corridors, provided that they are separated from all other spaces by walls having not less than a 1-hour fire resistance rating in accordance with Section 8.4.
(5) Lavatories shall not be required to be separated from corridors, provided that the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

18.3.7 Subdivision of Building Spaces. Where day-care occupancies, other than day-care homes, with clients who are 24 months old or less or who are incapable of self-preservation, are located one or more stories above the level of exit discharge, or where day-care occupancies are located two or more stories above the level of exit discharge, smoke barriers shall be provided to divide such stories into a minimum of two smoke compartments. The smoke barriers shall be constructed in accordance with Section 8.11 but shall not be required to have a fire resistance rating.

18.4 Special Provisions.

18.4.1 Limited-Access or Underground Buildings. Limited-access or underground buildings shall comply with Chapter 31.

18.4.2 High-Rise Buildings. High-rise buildings that house day-care occupancies on floors more than 75 ft (23 m) above the lowest level of fire department vehicle access shall comply with Chapter 33.

18.4.3 Flexible Plan and Open Plan Buildings.

18.4.3.1 Flexible plan and open plan buildings shall comply with the requirements of this chapter, as modified by 18.4.3.2 through 18.4.3.4.

18.4.3.2 Each room occupied by more than 300 persons shall have two or more means of egress entering into separate atmospheres. Where three or more means of egress are required, not more than two such means of egress shall enter into the same common atmosphere.

18.4.3.3 Flexible plan buildings shall be permitted to have walls and partitions rearranged periodically only if revised plans or diagrams have been approved by the authority having jurisdiction.

18.4.3.4 Flexible plan buildings shall be evaluated while all folding walls are extended and in use, as well as when they are in the retracted position.

18.5 Building Services.

18.5.1 Utilities.

18.5.1.1 Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

18.5.1.2 Special protective covers for all electrical receptacles shall be installed in all areas occupied by clients.

18.5.2 Heating, Ventilating, and Air-Conditioning Equipment.

18.5.2.1 Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51.

18.5.2.2 Unvented fuel-fired room heaters shall be prohibited.

18.5.2.3 The requirement of 18.5.2.2 shall not apply to gas space heaters installed in compliance with NFPA 54/ANSI Z223.1, *National Fuel Gas Code*.

18.5.2.4 Any heating equipment in spaces occupied by clients shall be provided with partitions, screens, or other means to protect clients from hot surfaces and open flames. If solid partitions are used to provide such protection, provisions shall be made to ensure adequate air for combustion and ventilation for the heating equipment.

18.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

18.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

18.6 Day-Care Homes.

18.6.1 General Requirements.

18.6.1.1 Application.

18.6.1.1.1 The requirements of Section 18.6 shall apply to all of the following:

(1) New buildings or portions thereof used as day-care homes *(see 18.6.1.4)*

(2) Additions made to, or used as, a day-care home
(3) Alterations, modernizations, or renovations of existing day-care homes
(4) Existing buildings, or portions thereof, upon change of occupancy to a day-care home

18.6.1.1.2 Section 18.6 establishes life safety requirements for day-care homes in which more than three, but not more than 12, clients receive care, maintenance, and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day (generally within a dwelling unit).

18.6.1.1.3 The requirement of 18.6.1.1.2 shall not apply to facilities that supervise clients on a temporary basis with a parent or guardian in close proximity.

18.6.1.1.4 Where a facility houses more than one age group of self-preservation capability, the strictest requirements applicable to any group present shall apply throughout the day-care home or building, as applicable, unless the area housing that group is maintained as a separate area.

18.6.1.1.5 Places of religious worship shall not be required to meet the provisions of Section 18.6 to operate a nursery while services are being held in the building.

18.6.1.2 Multiple Occupancies. Multiple occupancies shall be in accordance with 18.1.2.

18.6.1.3 Special Definitions. See Chapter 3.

18.6.1.4 Classification of Occupancy–Subclassification of Day-Care Homes. Subclassification of day-care homes shall be as follows:

(1) A family day-care home shall be a day-care home in which more than three, but fewer than seven, clients receive care, maintenance, and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day (generally within a dwelling unit).
(2) A group day-care home shall be a day-care home in which at least seven, but not more than 12, clients receive care, maintenance, and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day (generally within a dwelling unit).

18.6.1.5 Classification of Hazard of Contents. Classification of hazard of contents shall be in accordance with 18.1.4.

18.6.1.6 Location. No day-care home shall be located more than one store below the level of exit discharge.

18.6.1.7 Occupant Load.

18.6.1.7.1 In family day-care homes, the minimum staff-to-client ratio shall be not less than one staff person for up to six clients, including the caretaker's own children under age six. There shall be not more than two clients incapable of self-preservation.

18.6.1.7.2 In group day-care homes, the minimum staff-to-client ratio shall be not less than two staff persons for up to 12 clients. There shall be not more than three clients incapable of self-preservation. The staff-to-client ratio shall be permitted to be modified by the authority having jurisdiction where safeguards in addition to those specified by Section 18.6 are provided.

18.6.2 Means of Escape Requirements.

18.6.2.1 General. Means of escape shall comply with Section 22.2.

18.6.2.2 (Reserved)

18.6.2.3 (Reserved)

18.6.2.4 Number of Means of Escape. Number of means of escape shall comply with Section 22.2 and 18.6.2.4.1 through 18.6.2.4.4.

18.6.2.4.1 In group day-care homes, every story occupied by clients shall have not less than two remotely located means of escape.

18.6.2.4.2 Every room used for sleeping, living, or dining purposes shall have at least two means of escape, at least one of which shall be a door or stairway providing a means of unobstructed travel to the outside of the building at street or ground level. The second means of escape shall be permitted to be a window in accordance with 18.2.11. No room or space that is accessible only by a ladder or folding stairs, or through a trap door, shall be occupied for living or sleeping purposes.

18.6.2.4.3 In group day-care homes, where spaces on the story above the story of exit discharge are used by clients, at least one means of escape shall be an exit discharging directly to the outside. The second means of escape shall be permitted to be a window in accordance with 18.2.11.

18.6.2.4.4 Where clients are occupying a story below the level of exit discharge, at least one means of escape shall be an exit discharging directly to the outside, and the vertical travel to ground level shall not exceed 8 ft (244 cm). The second means of escape shall be permitted to be a window in accordance with 18.2.11.

18.6.2.5 Arrangement of Means of Egress.

18.6.2.5.1 Where a story above or below the level of exit discharge is used, the requirements of 18.6.2.4 shall apply.

18.6.2.5.2 For group day-care homes, means of egress shall be arranged in accordance with Section 11.5.

18.6.2.5.3 Dead-end corridors shall not exceed 20 ft (6.1 m).

18.6.2.6 Travel Distance. Requirements for travel distances shall be as follows:

(1) The travel distance between any room door intended as an exit access and an exit shall not exceed 100 ft (30 m).
(2) The travel distance between any point in a room and an exit shall not exceed 150 ft (45 m).
(3) The travel distance between any point in a sleeping room and an exit access to that room shall not exceed 50 ft (15 m).
(4) The travel distance specified in 18.6.2.6(1) and 18.6.2.6(2) shall be permitted to be increased by 50 ft (15 m) in buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3.

18.6.2.7 Discharge from Exits. Discharge from exits shall be in accordance with 18.6.2.4.

18.6.2.8 Illumination of Means of Egress. Illumination of the means of egress shall be provided in accordance with Section 11.8.

18.6.2.9 Emergency Lighting. (No requirements.)

18.6.2.10 Marking of Means of Egress. (No requirements.)

18.6.3 Protection.

18.6.3.1 Protection of Vertical Openings. For group day-care homes, the doorway between the level of exit discharge and any story below shall be equipped with a door assembly having a 20-minute fire protection rating. Where the story above the level of exit discharge is used for sleeping purposes, there shall be a door assembly having a 20-minute fire protection rating at the top or bottom of each stairway.

18.6.3.2 Hazardous Area Protection. (No requirements.)

18.6.3.3 Interior Finish.

18.6.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

18.6.3.3.2 Interior Wall and Ceiling Finish.

(A) In group day-care homes, interior wall and ceiling finish materials in accordance with Chapter 10 shall be Class A or Class B in corridors, stairways, lobbies, and exits. In family day-care homes, interior wall and ceiling finish materials in accordance with Chapter 10 shall be Class A or Class B in exits.

(B) Interior wall and ceiling finish materials in accordance with Chapter 10 shall be Class A, Class B, or Class C in occupied spaces.

18.6.3.3.3 Interior Floor Finish. (No requirements.)

18.6.3.4 Detection, Alarm, and Communications Systems.

18.6.3.4.1 Smoke detectors shall be installed within day-care homes in accordance with Section 55.2.

18.6.3.4.2 Where the day-care home is located within a building of another occupancy, such as in an apartment building or office building, any corridors serving the day-care home shall be provided with a smoke detection system in accordance with Section 55.2.

18.6.3.4.3 Single-station or multiple-station smoke alarms in accordance with 55.2.2.6 and powered by the building electrical system or system detectors with integral sounding devices in accordance with Section 55.2 shall be provided in all rooms used for sleeping.

Chapter 19 Health Care Occupancies

19.1 General Requirements.

19.1.1 Application.

19.1.1.1 General.

19.1.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as a health care occupancy.

19.1.1.1.2* The requirements of this chapter shall not apply to facilities where the authority having jurisdiction has determined equivalent safety has been provided in accordance with Section 1.5.

19.1.1.1.3 Repairs, renovations, modifications, additions, and reconstruction of a health care occupancy, and changes of use, including change of occupancy classification to a health care occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

(A) The requirements of this chapter, where referenced by Chapter 15, shall not apply to additions classified as occupancies other than health care that are separated from the health care occupancy in accordance with 19.1.1.4.1 and conform to the requirements for the specific occupancy in accordance with Chapter 16 through Chapter 18 and Chapter 20 through Chapter 30, as appropriate.

(B) The requirements of 19.1.1.1.3 shall not apply to facilities where the authority having jurisidiction has determined that equivalent safety has been provided in accordance with Section 1.5.

19.1.1.1.4 Health care facilities regulated by this chapter shall be understood to be those facilities that provide sleeping accommodations for their occupants and are occupied by persons who are mostly incapable of self-preservation because of age, because of physical or mental disability, or because of security measures not under the occupants' control.

19.1.1.1.5 Buildings, or sections of buildings, that primarily house patients who, in the opinion of the governing body of the facility and the governmental agency having jurisdiction, are capable of judgment and appropriate physical action for self-preservation under emergency conditions shall be permitted to comply with chapters of this *Code* other than this chapter.

19.1.1.1.6 It shall be recognized that, in buildings housing certain types of patients or having detention rooms or a security section, it might be necessary to lock doors and bar windows to confine and protect building inhabitants. In such instances, the authority having jurisdiction shall make appropriate modifications to those sections of this *Code* that would otherwise require means of egress to be kept unlocked.

19.1.1.1.7 Buildings, or sections of buildings, that house older persons and that provide activities that foster continued independence, but that do not include services distinctive to health care occupancies, shall be permitted to comply with the requirements of other chapters of this *Code*.

19.1.1.1.8 Facilities that do not provide housing on a 24-hour basis for their occupants shall be classified as other occupancies and shall be covered by other chapters of this *Code*.

19.1.1.1.9* It shall be recognized that the requirements of this chapter are based on the assumption that staff is available in all patient-occupied areas to perform certain fire safety functions.

19.1.1.2* Goals and Objectives. The goals and objectives of Section 4.1 shall be met with due consideration for functional requirements.

19.1.1.3 Total Concept. All health care facilities shall be designed and constructed to minimize the possibility of a fire emergency requiring the evacuation of occupants. Because the safety of health care occupants cannot be ensured adequately by dependence on evacuation of the building, their protection from fire shall be provided by appropriate arrangement of facilities; adequate, trained staff; and development of operating and maintenance procedures composed of the following:

(1) Design, construction, and compartmentation
(2) Provision for detection, alarm, and extinguishment
(3) Fire prevention; and planning, training, and drilling in programs for the isolation of fire, transfer of occupants to areas of refuge, or evacuation of the building

19.1.1.4 Additions, Conversions, Modernization, Renovation, and Construction Operations.

19.1.1.4.1 Additions. Additions shall be separated from any existing structure not conforming to the requirements for health care occupancies by a fire barrier having not less than a 2-hour fire resistance rating and constructed of materials as required for the addition.

19.1.1.4.1.1 Communicating openings in dividing fire barriers required by 19.1.1.4.1 shall be permitted only in corridors and shall be protected by approved, self-closing fire door assemblies.

19.1.1.4.1.2 Doors in barriers required by 19.1.1.4.1 shall normally be kept closed.

19.1.1.4.1.3 Doors in barriers required by 19.1.1.4.1 shall be permitted to be held open if they meet the requirements of 19.2.2.2.7.

19.1.1.4.2 Changes of Occupancy. Changes of occupancy shall comply with 4.5.6. A change from one health care occupancy subclassification to another shall require compliance with the requirements of 4.5.6, unless otherwise permitted by the following:

(1) A change from a hospital to a nursing home or from a nursing home to a hospital shall not be considered a change in occupancy or occupancy subclassification.
(2) A change from a hospital or nursing home to a limited care facility shall not be considered a change in occupancy or occupancy subclassification.
(3) A change from a hospital or nursing home to an ambulatory health care facility shall not be considered a change in occupancy or occupancy subclassification.

19.1.1.4.3* Building Rehabilitation. Where Chapter 15 requires compliance with this paragraph, the automatic sprinkler requirements of 19.3.5 shall apply to a smoke compartment undergoing the rehabilitation. However, in cases where the building is not protected throughout by an approved automatic sprinkler system, the requirements for nonsprinklered buildings contained in 19.4.3 shall also apply.

19.1.2 Multiple Occupancies.

19.1.2.1 Multiple occupancies shall be in accordance with Section 6.2 and 19.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

19.1.2.2* Sections of health care facilities shall be permitted to be classified as other occupancies, provided that they meet both of the following conditions:

(1) They are not intended to serve health care occupants for purposes of housing, treatment, or customary access by patients incapable of self-preservation.
(2) They are separated from areas of health care occupancies by construction having a fire resistance rating of not less than 2 hours.

19.1.2.3* Ambulatory care facilities, medical clinics, and similar facilities that are contiguous to health care occupancies, but that are primarily intended to provide outpatient services, shall be permitted to be classified as business occupancies or ambulatory health care facilities, provided that the facilities are separated from the health care occupancy by not less than 2-hour fire resistance–rated construction and the facility is not intended to provide services simultaneously for four or more inpatients who are litterborne.

19.1.2.4 Health care occupancies in buildings housing other occupancies shall be completely separated from such buildings by construction in accordance with 6.2.4, with communicating openings permitted only in corridors and only by approved, self-closing fire door assemblies.

19.1.2.5 All means of egress from health care occupancies that traverse non-health-care spaces shall conform to the requirements of this *Code* for health care occupancies.

(A) Egress through a horizontal exit into other contiguous occupancies that do not conform with health care egress provisions, but that do comply with requirements set forth in the appropriate occupancy chapter of this *Code*, shall be permitted, provided that the occupancy does not contain high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, other than Level 4 hazardous areas.

(B) The horizontal exit specified in 19.1.2.5(A) shall comply with the requirements of 19.2.2.5.

19.1.2.6 Egress provisions for areas of health care facilities that correspond to other occupancies shall meet the corresponding requirements of this *Code* for such occupancies. Where the clinical needs of the occupant necessitate the locking of means of egress, staff shall be present for the supervised release of occupants during all times of use.

19.1.2.7 Auditoriums, chapels, staff residential areas, or other occupancies provided in connection with health care facilities shall have means of egress provided in accordance with other applicable sections of this *Code*.

19.1.2.8 Any area with a hazard of contents classified higher than that of the health care occupancy and located in the same building shall be protected as required in 19.3.2.

19.1.2.9 Non-health-care-related occupancies classified as containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3 shall not be permitted in buildings housing health care occupancies.

19.1.3 Classification of Occupancy. Classification of occupancy shall be in accordance with 6.1.5.

19.1.4 Classification of Hazard of Contents.

19.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

19.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

19.1.5 (Reserved)

19.1.6 Minimum Construction Requirements.

19.1.6.1 Construction shall be in accordance with all of the following, except as modified by 19.1.6.2 and 19.1.6.3:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design

(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

19.1.6.2 Any building of Type I(442), Type I(332), Type II(222), or Type II(111) construction shall be permitted to include roofing systems involving combustible supports, decking, or roofing, provided that the following criteria are met:

(1) The roof covering meets Class A requirements in accordance with NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*.
(2) The roof is separated from all occupied portions of the building by a noncombustible floor assembly having not less than a 2-hour fire resistance rating that includes not less than 2½ in. (6.4 cm) of concrete or gypsum fill.
(3) Structural elements supporting the 2-hour fire resistance–rated floor assembly specified in 19.1.6.2(2) shall be required to have only the fire resistance rating of the building.

19.1.6.3 Levels below the level of exit discharge shall be separated from the level of exit discharge by not less than Type II(111) construction.

19.1.7 Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

19.1.8 Accessibility. Accessibility shall be in accordance with Chapter 12.

19.2 Means of Egress Requirements.

19.2.1 General. Every aisle, passageway, corridor, exit discharge, exit location, and access shall be in accordance with Chapter 11, unless otherwise modified by 19.2.2 through 19.2.10.

19.2.2* Means of Egress Components.

19.2.2.1 General. Components of means of egress shall be limited to the types described in 19.2.2.2 through 19.2.2.10.

19.2.2.2 Doors.

19.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

19.2.2.2.2 Locks shall not be permitted on patient sleeping room doors, unless otherwise permitted by the following:

(1) Key-locking devices that restrict access to the room from the corridor and that are operable only by staff from the corridor side shall be permitted, and such devices shall not restrict egress from the room.
(2) Door-locking arrangements shall be permitted in health care occupancies, or portions of health care occupancies, where the clinical needs of the patients require specialized security measures for their safety, provided that keys are carried by staff at all times.

19.2.2.2.3 Doors not located in a required means of egress shall be permitted to be subject to locking.

19.2.2.2.4 Doors within a required means of egress shall not be equipped with a latch or lock that requires the use of a tool or key from the egress side, unless otherwise permitted by the following:

(1) Door-locking arrangements without delayed egress shall be permitted in health care occupancies, or portions of health care occupancies, where the clinical needs of the patients require specialized security measures for their safety, provided that staff can readily unlock such doors at all times *(see 19.1.1.1.6 and 19.2.2.2.5)*.
(2)*Delayed-egress locks complying with 11.2.1.6.1 shall be permitted, provided that not more than one such device is located in any egress path.
(3) Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

19.2.2.2.5 Doors located in the means of egress that are permitted to be locked under other provisions of this chapter shall have adequate provisions made for the rapid removal of occupants by means such as remote control of locks, keying of all locks to keys carried by staff at all times, or other such reliable means available to the staff at all times. Only one such locking device shall be permitted on each door.

19.2.2.2.6 The requirements of 19.2.2.2.5 shall not apply to locks in accordance with 19.2.2.2.4(2) and 19.2.2.2.4(3).

19.2.2.2.7* Any door in an exit passageway, stairway enclosure, horizontal exit, smoke barrier, or hazardous area enclosure (except boiler rooms, heater rooms, and mechanical equipment rooms) shall be permitted to be held open only by an automatic release device that complies with 11.2.1.8.2. The automatic sprinkler system and the fire alarm system, and the systems required by 11.2.1.8.2, shall be arranged to initiate the closing action of all such doors throughout the smoke compartment or throughout the entire facility.

19.2.2.2.8 Where doors in a stair enclosure are held open by an automatic release device as permitted in 19.2.2.2.7, initiation of a door-closing action on any level shall cause all doors at all levels in the stair enclosure to close.

19.2.2.2.9 High-rise health care occupancies shall comply with the re-entry provisions of 11.2.1.5.2.

19.2.2.2.10 Horizontal-sliding doors, as permitted by 11.2.1.14, that are not automatic closing shall be limited to a single leaf and shall have a latch or other mechanism that ensures that doors will not rebound into a partially open position if forcefully closed in an emergency.

19.2.2.3 Stairs. Stairs complying with 11.2.2 shall be permitted.

19.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

19.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 and the modifications of 19.2.2.5.1 through 19.2.2.5.6 shall be permitted.

19.2.2.5.1 Not less than 30 net ft^2 (2.8 net m^2) per patient in a hospital or nursing home, or not less than 15 net ft^2 (1.4 net m^2) per resident in a limited care facility, shall be provided within the aggregated area of corridors, patient rooms, treatment rooms, lounge or dining areas, and other similar areas on each side of the horizontal exit. On stories not housing patients confined to beds or litterborne patients, not less than 6 net ft^2 (0.56 net m^2) per occupant shall be provided on each side of the horizontal exit for the total number of occupants in adjoining compartments.

19.2.2.5.2 The total egress capacity of the other exits (stairs, ramps, doors leading outside the building) shall not be reduced below one-third of that required for the entire area of the building.

19.2.2.5.3 A single door shall be permitted in a horizontal exit if the exit serves one direction only. Such door shall be a swinging door or a horizontal-sliding door complying with 11.2.1.14. The door shall have not less than 41.5 in. (105 cm) in clear width.

19.2.2.5.4 A horizontal exit involving a corridor 8 ft (2.4 m) or more in width, serving as a means of egress from both sides of the doorway, shall have the opening protected by a pair of swinging doors arranged to swing in opposite directions from each other, with each door having a clear width of not less than 41.5 in. (105 cm), or by a horizontal-sliding door complying with 11.2.1.14 that provides a clear width of not less than 83 in. (211 cm).

19.2.2.5.5 A horizontal exit involving a corridor 6 ft (1.8 m) or more in width, serving as a means of egress from both sides of the doorway, shall have the opening protected by a pair of swinging doors arranged to swing in opposite directions from each other, with each door having a clear width of not less than 32 in. (81 cm), or by a horizontal-sliding door complying with 11.2.1.14 that provides a clear width of not less than 64 in. (163 cm).

19.2.2.5.6 An approved vision panel shall be required in each horizontal exit. Center mullions shall be prohibited.

19.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

19.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

19.2.2.8 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

19.2.2.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

19.2.2.10 Areas of Refuge. Areas of refuge used as part of a required accessible means of egress shall comply with 11.2.12.

19.2.3 Capacity of Means of Egress.

19.2.3.1 The capacity of any required means of egress shall be in accordance with 11.3.3, as modified by 19.2.3.2 through 19.2.3.5.

19.2.3.2 The capacity of means of egress shall be in accordance with Section 11.3.

19.2.3.3* Aisles, corridors, and ramps required for exit access in a hospital or nursing home shall be not less than 8 ft (2.4 m) in clear and unobstructed width, unless otherwise permitted by the following:

(1) Where ramps are used as exits, the requirement of 19.2.2.6 shall apply.
(2)*Aisles, corridors, and ramps in adjunct areas not intended for the housing, treatment, or use of inpatients shall be not less than 44 in. (112 cm) in clear and unobstructed width.
(3)*The requirement of 19.2.3.3 shall not apply to exit access within a room or suite of rooms complying with the requirements of 19.2.5.

19.2.3.4 Aisles, corridors, and ramps required for exit access in a limited care facility or hospital for psychiatric care shall be not less than 6 ft (1.8 m) in clear and unobstructed width, unless otherwise permitted by the following:

(1)*Aisles, corridors, and ramps in adjunct areas not intended for the housing, treatment, or use of inpatients shall be not less than 44 in. (112 cm) in clear and unobstructed width.
(2)*The requirement of 19.2.3.4 shall not apply to exit access within a room or suite of rooms complying with the requirements of 19.2.5.

19.2.3.5 The minimum clear width for doors in the means of egress from sleeping rooms; diagnostic and treatment areas, such as x-ray, surgery, or physical therapy; and nursery rooms shall be as follows:

(1) Hospitals and nursing homes — 41.5 in. (105 cm)
(2) Psychiatric hospitals and limited care facilities — 32 in. (81 cm)
(3) The requirements of 19.2.3.5(1) and 19.2.3.5(2) shall not apply to the following:
  (a) Doors that are located so as not to be subject to use by any health care occupant shall be not less than 32 in. (81 cm) in clear width.
  (b) Doors in exit stair enclosures shall be not less than 32 in. (81 cm) in clear width.
  (c) Doors serving newborn nurseries shall be not less than 32 in. (81 cm) in clear width.
  (d) Where a pair of doors is provided, not less than one of the doors shall provide not less than a 32-in. (81-cm) clear width opening, and a rabbet, bevel, or astragal shall be provided at the meeting edge, and the inactive leaf shall have an automatic flush bolt to provide positive latching.

19.2.4 Number of Exits.

19.2.4.1 Not less than two exits of the types described in 19.2.2.2 through 19.2.2.10, remotely located from each other, shall be provided for each floor or fire section of the building.

19.2.4.2 Not less than one exit from each floor or fire section shall be one of the following:

(1) Door leading directly outside the building
(2) Stair
(3) Smokeproof enclosure
(4) Ramp
(5) Exit passageway

(A) Any fire section not meeting the requirement of 19.2.4.2 shall be considered part of an adjoining zone.

(B) Egress shall not require return through the zone of fire origin.

19.2.4.3* Not less than two exits of the types described in 19.2.2.2 through 19.2.2.10 shall be accessible from each smoke compartment. Egress shall be permitted through an adjacent compartment(s) but shall not require return through the compartment of fire origin.

19.2.5 Arrangement of Means of Egress.

19.2.5.1 Every habitable room shall have an exit access door leading directly to an exit access corridor, unless otherwise permitted by the following:

(1) The requirement of 19.2.5.1 shall not apply where there is an exit door opening directly to the outside from the room at ground level.
(2) Exit access from a patient sleeping room with not more than eight patient beds shall be permitted to pass through one intervening room to reach the exit access corridor.
(3) Exit access from a sleeping or nursing suite shall be permitted to pass through one intervening room to reach the exit access corridor where the arrangement allows for direct and constant visual supervision by nursing personnel.
(4) Exit access from a suite of rooms, other than patient sleeping rooms, shall be permitted to pass through not more than two adjacent rooms to reach the exit access corridor where the travel distance within the suite is in accordance with 19.2.5.8.

19.2.5.2 Any patient sleeping room, or any suite that includes patient sleeping rooms, of more than 1000 ft^2 (93 m^2) shall have not less than two exit access doors remotely located from each other.

19.2.5.3 Any room or any suite of rooms, other than patient sleeping rooms, of more than 2500 ft^2 (230 m^2) shall have not less than two exit access doors remotely located from each other.

19.2.5.4 Any suite of rooms that complies with the requirements of 19.2.5 shall be permitted to be subdivided with nonfire-rated, noncombustible, or limited-combustible partitions.

19.2.5.5 Intervening rooms shall not be hazardous areas as specified by 19.3.2.

19.2.5.6 Suites of sleeping rooms shall not exceed 5000 ft^2 (460 m^2).

19.2.5.7 Suites of rooms, other than patient sleeping rooms, shall not exceed 10,000 ft^2 (930 m^2).

19.2.5.8 Suites of rooms, other than patient sleeping rooms, shall be permitted to have one intervening room if the travel distance within the suite to the exit access door does not exceed 100 ft (30 m) and shall be permitted to have two intervening rooms where the travel distance within the suite to the exit access door does not exceed 50 ft (15 m).

19.2.5.9 Every corridor shall provide access to not less than two approved exits in accordance with Section 11.4 and Section 11.5 without passing through any intervening rooms or spaces, other than corridors or lobbies.

19.2.5.10 Every exit or exit access shall be arranged so that no corridor, aisle, or passageway has a pocket or dead end exceeding 30 ft (9.1 m).

19.2.6 Travel Distance to Exits.

19.2.6.1 Travel distance shall be measured in accordance with Section 11.6.

19.2.6.2 Travel distance shall comply with 19.2.6.2.1 through 19.2.6.2.4.

19.2.6.2.1 The travel distance between any room door required as an exit access and an exit shall not exceed 150 ft (45 m).

19.2.6.2.2 The travel distance between any point in a room and an exit shall not exceed 200 ft (60 m).

19.2.6.2.3 The travel distance between any point in a health care sleeping room and an exit access door in that room shall not exceed 50 ft (15 m).

19.2.6.2.4 The travel distance between any point in a suite of sleeping rooms, as permitted by 19.2.5, and an exit access door of that suite shall not exceed 100 ft (30 m) and shall meet the requirements of 19.2.6.2.2.

19.2.7 Discharge from Exits. Discharge from exits shall be arranged in accordance with Section 11.7.

19.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

19.2.9 Emergency Lighting.

19.2.9.1 Emergency lighting shall be provided in accordance with Section 11.9.

19.2.9.2 Buildings equipped with, or in which patients require the use of, life-support systems *(see 19.5.1.3)* shall have emergency lighting equipment supplied by the life safety branch of the electrical system as described in NFPA 99, *Standard for Health Care Facilities*.

19.2.10 Marking of Means of Egress.

19.2.10.1 Means of egress shall have signs in accordance with Section 11.10.

19.2.10.2 Buildings equipped with, or in which patients require the use of, life-support systems *(see 19.5.1.3)* shall have illumination of the required exit and directional signs supplied by the life safety branch of the electrical system as described in NFPA 99.

19.2.10.3 The requirement of 19.2.10.2 shall not apply to self-luminous exit signs in accordance with 11.10.7.

19.3 Protection.

19.3.1 Protection of Vertical Openings.

19.3.1.1 Any vertical opening shall be enclosed or protected in accordance with Section 8.12. Unprotected openings in accordance with 8.12.2 shall not be permitted.

19.3.1.2 The requirements of 19.3.1.1 shall not apply where otherwise permitted by the following:

(1) Unprotected vertical openings in accordance with 8.12.4.2 shall be permitted.
(2) The provisions of 8.12.3(1)(a) shall not be permitted to apply to patient sleeping and treatment rooms.
(3) Multilevel patient sleeping areas in psychiatric facilities shall be permitted without enclosure protection between levels, provided that all the following conditions are met:
   (a) The entire normally occupied area, including all communicating floor levels, is sufficiently open and unobstructed, so that a fire or other dangerous condition in any part is obvious to the occupants or supervisory personnel in the area.
   (b) Egress capacity is sufficient to provide simultaneously for all the occupants of all communicating levels and areas, with all communicating levels in the same fire area being considered as a single floor area for purposes of determination of required egress capacity.
   (c) The height between the highest and lowest finished floor levels is not more than 13 ft (4 m) with the number of levels permitted to be unrestricted.

19.3.1.3 A door in a stair enclosure shall be self-closing and shall normally be kept in the closed position.

19.3.1.4 The requirement of 19.3.1.3 shall not apply to doors in stair enclosures held open under the conditions specified by 19.2.2.2.7 and 19.2.2.2.8.

19.3.2 Hazardous Area Protection.

19.3.2.1* Hazardous Areas. Any hazardous area shall be protected in accordance with Section 8.15 and Chapter 34. The areas described in Table 19.3.2.1 shall be protected as indicated.

Table 19.3.2.1 Hazardous Area Protection

Hazardous Area Description	Separation/Protection
Boiler and fuel-fired heater rooms	1 hour
Central/bulk laundries over 100 ft^2 (9.3 m^2) in area	1 hour
Laboratories employing flammable or combustible materials in quantities less than those that would be considered severe	See 19.3.6.3.4
Laboratories that use hazardous materials that would cause classification as severe hazard in accordance with NFPA 99	1 hour
Paint shops employing hazardous substances and materials in quantities less than those that would cause classification as severe hazard	1 hour
Physical plant maintenance shops	1 hour
Soiled linen rooms	1 hour
Storage rooms over 50 ft^2 (4.6 m^2) but not over 100 ft^2 (9.3 m^2) storing combustible material	See 19.3.6.3.4
Storage rooms over 100 ft^2 (9.3 m^2) storing combustible material	1 hour
Trash collection rooms	1 hour

19.3.2.2* Laboratories. Laboratories employing quantities of flammable, combustible, or hazardous materials that are considered as a severe hazard shall be protected in accordance with NFPA 99.

19.3.2.3 Anesthetizing Locations. Anesthetizing locations shall be protected in accordance with NFPA 99.

19.3.2.4 Medical Gas. Medical gas storage and administration areas shall be protected in accordance with NFPA 99.

19.3.2.5 Commercial Cooking Facilities.

(A) Commercial cooking facilities shall be protected in accordance with Section 55.10.

(B)* Where domestic cooking equipment is used for food warming or limited cooking, protection or separation of food preparation facilities shall not be required.

19.3.2.6 Rooftop Heliports. Buildings housing health care occupancies that have rooftop heliports shall be protected in accordance with NFPA 418, *Standard for Heliports*.

19.3.3 Interior Finish.

19.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

19.3.3.2 Interior Wall and Ceiling Finish. Class A or Class B interior wall and ceiling finish materials in accordance with Chapter 10 shall be permitted throughout, except as indicated in 19.3.3.2.1 or 19.3.3.2.2. The provisions of 10.7.1 shall not apply.

19.3.3.2.1 Walls and ceilings shall be permitted to have Class A, Class B, or Class C interior finish in individual rooms having a capacity not exceeding four persons.

19.3.3.2.2 Corridor wall finish not exceeding 4 ft (1.2 m) in height that is restricted to the lower half of the wall shall be permitted to be Class A, Class B, or Class C.

19.3.3.3 Interior Floor Finish. Interior floor finish shall comply with Section 10.6.

19.3.4 Detection, Alarm, and Communications Systems.

19.3.4.1 General. Health care occupancies shall be provided with a fire alarm system in accordance with Section 55.2.

19.3.4.2 Initiation.

(A)* Initiation of the required fire alarm systems shall be by manual means in accordance with 55.2.2 and by means of any required sprinkler system waterflow alarms, detection devices, or detection systems.

(B) Manual fire alarm boxes in patient sleeping areas shall not be required at exits if located at all nurses' control stations or other continuously attended staff location, provided that such manual fire alarm boxes are visible and continuously accessible and that travel distances required by 55.2.2.1.4 are not exceeded.

19.3.4.3 Notification.

19.3.4.3.1 Occupant Notification.

(A) Occupant notification shall be accomplished automatically in accordance with 55.2.3. Use of the provisions of 55.2.3.2.3 shall be prohibited.

(B)* In lieu of audible alarm signals, visible alarm-indicating appliances shall be permitted to be used in critical care areas.

19.3.4.3.2 Emergency Forces Notification.

(A) Fire department notification shall be accomplished in accordance with 55.2.4.

(B) Smoke detection devices or smoke detection systems equipped with reconfirmation features shall not be required to automatically notify the fire department, unless the alarm condition is reconfirmed after a period not exceeding 120 seconds.

19.3.4.3.3 Alarm Annunciation.

(A) Alarm annunciation shall be provided in accordance with 55.2.7.

(B) The alarm zone shall be permitted to coincide with the permitted area for smoke compartments.

19.3.4.4 Emergency Control. Operation of any activating device in the required fire alarm system shall be arranged to accomplish automatically any control functions required to be performed by that device. *(See 55.2.5.)*

19.3.4.5 Detection.

19.3.4.5.1 General. Detection systems, where required, shall be in accordance with Section 55.2.

19.3.4.5.2 Detection in Spaces Open to Corridors. Detection in spaces open to corridors shall be in accordance with 19.3.6.1.

19.3.4.5.3* Nursing Homes. An approved automatic smoke detection system shall be installed in corridors throughout smoke compartments containing patient sleeping rooms and in spaces open to corridors as permitted in nursing homes by 19.3.6.1, unless otherwise permitted by the following:

(1) Corridor systems shall not be required where each patient sleeping room is protected by an approved smoke detection system.
(2) Corridor systems shall not be required where patient room doors are equipped with automatic door-closing devices with integral smoke detectors on the room side installed in accordance with their listing, provided that the integral detectors provide occupant notification.

19.3.5 Extinguishment Requirements.

19.3.5.1* Buildings containing health care facilities shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

19.3.5.2 In Type I and Type II construction, alternative protection measures shall be permitted to be substituted for sprinkler protection required by 19.3.5.1 in specified areas where the authority having jurisdiction has prohibited sprinklers, and such alternative measures shall not be considered as causing a building to be classified as nonsprinklered.

19.3.5.3* Listed quick-response or listed residential sprinklers shall be used throughout smoke compartments containing patient sleeping rooms.

19.3.5.4 Where another provision of this chapter requires an automatic sprinkler system to be supervised, the sprinkler system shall be electrically supervised in accordance with 55.3.2.

19.3.5.5* Sprinklers in areas where cubicle curtains are installed shall be in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

19.3.5.6 Class I standpipes in accordance with Section 55.4 shall be provided in buildings where any of the following conditions exist:

(1) An occupiable area is more than 200 ft (60 m) from the nearest point of fire department vehicle access in other than buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.
(2) An occupiable floor level is more than 30 ft (9.1 m) above or below the level of fire department vehicle access.

19.3.5.7 Portable fire extinguishers shall be provided in all health care occupancies in accordance with Section 55.6.

19.3.6 Corridors.

19.3.6.1 General. Corridors shall be separated from all other areas by partitions complying with 19.3.6.2 through 19.3.6.5 *(see also 19.2.5.9)*, unless otherwise permitted by the following:

(1) Spaces shall be permitted to be unlimited in area and open to the corridor, provided that the following criteria are met:
   (a) The spaces are not used for patient sleeping rooms, treatment rooms, or hazardous areas.
   (b) The corridors onto which the spaces open in the same smoke compartment are protected by an electrically supervised automatic smoke detection system in accordance with 19.3.4, or the smoke compartment in which the space is located is protected throughout by quick-response sprinklers.
   (c) The open space is protected by an electrically supervised automatic smoke detection system in accordance with 19.3.4, or the entire space is arranged and located to allow direct supervision by the facility staff from a nurses' station or similar space.
   (d) The space does not obstruct access to required exits.
(2) Waiting areas shall be permitted to be open to the corridor, provided that the following criteria are met:
   (a) The aggregate waiting area in each smoke compartment does not exceed 600 ft^2 (55.7 m^2).
   (b) Each area is protected by an electrically supervised automatic smoke detection system in accordance with 19.3.4, or each area is arranged and located to allow direct supervision by the facility staff from a nursing station or similar space.
   (c) The area does not obstruct access to required exits.
(3) *The requirement of 19.3.6.1 shall not apply to spaces for nurses' stations.
(4) Gift shops not exceeding 500 ft^2 (46.5 m^2) shall be permitted to be open to the corridor or lobby.
(5) In a limited care facility, group meeting or multipurpose therapeutic spaces shall be permitted to open to the corridor, provided that the following criteria are met:
   (a) The space is not a hazardous area.
   (b) The space is protected by an electrically supervised automatic smoke detection system in accordance with 19.3.4, or the space is arranged and located to allow direct supervision by the facility staff from the nurses' station or similar location.
   (c) The area does not obstruct access to required exits.

19.3.6.2* Construction of Corridor Walls. Corridor walls shall form a barrier to limit the transfer of smoke. Such walls shall be permitted to terminate at the ceiling where the ceiling is constructed to limit the transfer of smoke. No fire resistance rating shall be required for corridor walls.

19.3.6.3* Corridor Doors.

19.3.6.3.1* Doors protecting corridor openings shall be constructed to resist the passage of smoke.

(A) Compliance with NFPA 80, *Standard for Fire Doors and Fire Windows*, shall not be required.

(B) Clearance between the bottom of the door and the floor covering not exceeding 1 in. (2.5 cm) shall be permitted for corridor doors.

(C) The requirements of 19.3.6.3.1 shall not apply to doors to toilet rooms, bathrooms, shower rooms, sink closets, and similar auxiliary spaces that do not contain flammable or combustible materials.

19.3.6.3.2 Doors shall be provided with positive-latching hardware.

(A) Roller latches shall be prohibited.

(B) The requirements of 19.3.6.3.2 and 19.3.6.3.2(A) shall not apply to doors to toilet rooms, bathrooms, shower rooms, sink closets, and similar auxiliary spaces that do not contain flammable or combustible materials.

19.3.6.3.3* Doors shall not be held open by devices other than those that release when the door is pushed or pulled.

19.3.6.3.4 Door-closing devices shall not be required on doors in corridor wall openings, other than those serving required exits, smoke barriers, or enclosures of vertical openings and hazardous areas.

19.3.6.3.5* Nonrated, factory- or field-applied protective plates extending not more than 48 in. (122 cm) above the bottom of the door shall be permitted.

19.3.6.3.6 Dutch doors shall be permitted where they conform to 19.3.6.3. In addition, both the upper leaf and lower leaf shall be equipped with a latching device, and the meeting edges of the upper and lower leaves shall be equipped with an astragal, a rabbet, or a bevel. Dutch doors protecting openings in enclosures around hazardous areas shall comply with NFPA 80, *Standard for Fire Doors and Fire Windows*.

19.3.6.4 Transfer Grilles.

(A) Transfer grilles, regardless of whether they are protected by fusible link operated dampers, shall not be used in these walls or doors.

(B) Doors to toilet rooms, bathrooms, shower rooms, sink closets, and similar auxiliary spaces that do not contain flammable or combustible materials shall be permitted to have ventilating louvers or to be undercut.

19.3.6.5 Openings. In other than smoke compartments containing patient bedrooms, miscellaneous openings, such as mail slots, pharmacy pass-through windows, laboratory pass-through windows, and cashier pass-through windows, shall be permitted to be installed in vision panels or doors without special protection, provided that the aggregate area of openings per room does not exceed 80 in.^{2} (520 cm^2) and the openings are installed at or below one-half the distance from the floor to the room ceiling.

19.3.7* Subdivision of Building Spaces.

19.3.7.1 Buildings containing health care facilities shall be subdivided by smoke barriers as specified in 19.3.7.1(A) through 19.3.7.1(E).

(A) Every story used by inpatients for sleeping or treatment shall be divided into not less than two smoke compartments.

(B) Every story having an occupant load of 50 or more persons, regardless of use, shall be divided into not less than two smoke compartments.

(C) The size of each smoke compartment required by 19.3.7.1(A) and 19.3.7.1(B) shall be limited to an area not exceeding 22,500 ft^2 (2100 m^2).

(D) The area of an atrium separated in accordance with 8.12.3 shall not be limited in size.

(E) The travel distance from any point to reach a door in the required smoke barrier shall be limited to a distance not exceeding 200 ft (60 m).

(F) The requirements of 19.3.7.1(A) through 19.3.7.1(E) shall not apply to the following:

(1) Stories that do not contain a health care occupancy, located totally above the health care occupancy
(2) Areas that do not contain a health care occupancy and that are separated from the health care occupancy by a fire barrier complying with 11.2.4.3
(3) Stories that do not contain health care occupancies and that are more than one story below the health care occupancy
(4) Open-air parking structures protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3

19.3.7.2 Smoke barriers shall be provided on stories that are usable but unoccupied.

19.3.7.3 Any required smoke barrier shall be constructed in accordance with Section 8.11 and shall have a fire resistance rating of not less than 1 hour.

(A) Where an atrium is used, smoke barriers shall be permitted to terminate at an atrium wall constructed in accordance with 8.12.3(1)(b). Not less than two separate smoke compartments shall be provided on each floor.

(B)* Smoke dampers shall not be required in duct penetrations of smoke barriers in fully ducted heating, ventilating, and air conditioning systems for buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

19.3.7.4 Not less than 30 net ft^2 (2.8 net m^2) per patient in a hospital or nursing home, or not less than 15 net ft^2 (1.4 net m^2) per resident in a limited care facility, shall be provided within the aggregate area of corridors, patient rooms, treatment rooms, lounge or dining areas, and other common areas on each side of the smoke barrier. On stories not housing patients confined to beds or litterborne patients, not less than 6 net ft^2 (0.56 net m^2) per occupant shall be provided on each side of the smoke barrier for the total number of occupants in adjoining compartments.

19.3.7.5* Doors in smoke barriers shall be substantial doors, such as 1¾-in. (4.4-cm) thick, solid-bonded wood core doors, or shall be of construction that resists fire for not less than 20 minutes. Nonrated factory- or field-applied protective plates extending not more than 48 in. (122 cm) above the bottom of the door shall be permitted. Cross-corridor openings in smoke barriers shall be protected by a pair of swinging doors or a horizontal-sliding door complying with 11.2.1.14. Swinging doors shall be arranged so that each door swings in a direction opposite from the other.

(A) The minimum clear width for swinging doors shall be as follows:

(1) Hospitals and nursing homes — 41.5 in. (105 cm)
(2) Psychiatric hospitals and limited care facilities — 32 in. (81 cm)

(B) The minimum clear width opening for horizontal-sliding doors shall be as follows:

(1) Hospitals and nursing homes — 83 in. (211 cm)
(2) Psychiatric hospitals and limited care facilities — 64 in. (163 cm)

19.3.7.6* Doors in smoke barriers shall meet the following:

(1) They shall comply with 8.11.4.
(2) They shall be self-closing or automatic closing in accordance with 19.2.2.2.7.

19.3.7.7* Vision panels consisting of fire-rated glazing or wire glass panels in approved frames shall be provided in each cross-corridor swinging door and at each cross-corridor horizontal-sliding door in a smoke barrier.

19.3.7.8 Rabbets, bevels, or astragals shall be required at the meeting edges, and stops shall be required at the head and sides of door frames in smoke barriers. Positive-latching hardware shall not be required. Center mullions shall be prohibited.

19.3.8* Special Protection Features — Outside Window or Door. Every patient sleeping room shall have an outside door or outside window with a sill height not exceeding 36 in. (91 cm) above the floor, unless otherwise permitted by the following:

(1) The requirement of 19.3.8 shall not apply to newborn nurseries and rooms intended for occupancy for less than 24 hours, such as those housing obstetrical labor beds, recovery beds, and observation beds in the emergency department.
(2) Windows in atrium walls shall be considered outside windows for the purposes of the requirement of 19.3.8.
(3) The window sill in special nursing care areas, such as those housing ICU, CCU, hemodialysis, and neonatal patients, shall not exceed 60 in. (152 cm) above the floor.
(4) The window sill in limited care facilities shall not exceed 44 in. (112 cm) above the floor.

19.4 Special Provisions.

19.4.1 Limited-Access Buildings. Limited-access buildings or windowless portions of buildings shall not be used for patient sleeping rooms. Windowless buildings or windowless portions of buildings shall comply with Chapter 31.

19.4.2 High-Rise Buildings. High-rise buildings shall comply with Chapter 33.

19.4.3 Nonsprinklered Existing Building Rehabilitation.

19.4.3.1* General. Where a modification in a nonsprinklered smoke compartment is exempted by the provisions of 15.5.1.2.3 from the sprinkler requirement of 19.1.1.4.3, the requirements of 19.4.3.2 through 19.4.3.6 shall apply.

19.4.3.2 Capacity of Means of Egress (Nonsprinklered Buildings). The capacity of the means of egress serving the modification area shall be as follows:

(1) 0.5 in. (13 mm) per person for horizontal travel, without stairs, by means such as doors, ramps, or level floor surfaces
(2) 0.6 in. (15 mm) per person for travel by means of stairs

19.4.3.3 Travel Distance (Nonsprinklered Buildings).

19.4.3.3.1 The travel distance for the means of egress serving the modification area shall comply with 19.4.3.3.2 and 19.4.3.3.3.

19.4.3.3.2 The travel distance between any room door required as an exit access and an exit shall not exceed 100 ft (30 m).

19.4.3.3.3 The travel distance between any point in a room and an exit shall not exceed 150 ft (45 m).

19.4.3.4* Hazardous Area Protection (Nonsprinklered Buildings). Where the modification involves creating a new hazardous area in an existing nonsprinklered smoke compartment, the hazardous area itself shall be protected with automatic sprinklers in accordance with Section 55.3 in addition to the protection required by Table 19.3.2.1.

19.4.3.5 Interior Finish (Nonsprinklered Buildings).

19.4.3.5.1 General. Interior finish within the modification area shall be in accordance with Chapter 10 and 19.4.3.5.2 through 19.4.3.5.3.

19.4.3.5.2 Interior Wall and Ceiling Finish. Newly installed Class A interior wall and ceiling finish materials in accordance with Chapter 10 shall be permitted throughout nonsprinklered smoke compartments except as otherwise permitted in 19.4.3.5.2.1 or 19.4.3.5.2.2.

19.4.3.5.2.1 Walls and ceilings shall be permitted to have Class A or Class B interior finish in individual rooms having a capacity not exceeding four persons.

19.4.3.5.2.2 Corridor wall finish not exceeding 4 ft (1.2 m) in height that is restricted to the lower half of the wall shall be permitted to be Class A or Class B.

19.4.3.5.3 Interior Floor Finish. Newly installed interior floor finish in accordance with Section 10.6 in corridors and exits of nonsprinklered smoke compartments shall be Class I.

19.4.3.6 Corridors (Nonsprinklered Buildings).

19.4.3.6.1 Construction of Corridor Walls. Where the smoke compartment being modified is not protected throughout by an approved, supervised automatic sprinkler system, corridor walls shall comply with the following:

(1) They shall have a fire resistance rating of not less than ½ hour.
(2) They shall be continuous from the floor to the underside of the floor or roof deck above.
(3) They shall resist the passage of smoke.

19.4.3.6.2 Corridor Doors. Where the smoke compartment being modified is not protected throughout by an approved, supervised automatic sprinkler system, the following shall apply:

(1) Doors protecting corridor openings shall be constructed of 1¾-in. (4.4-cm) thick, solid-bonded core wood or of construction that resists the passage of fire for not less than 20 minutes.
(2) Door frames shall be labeled or of steel construction.
(3) Existing roller latches demonstrated to keep the door closed against a force of 5 lbf (22 N) shall be permitted.

19.5 Building Services.

19.5.1 Utilities.

19.5.1.1 Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

19.5.1.2 Power for alarms, emergency communications systems, and illumination of generator set locations shall be in accordance with the essential electrical system requirements of NFPA 99.

19.5.1.3 Any health care occupancy that normally uses life-support devices, other than for emergency purposes only, shall have electrical systems designed and installed in accordance with NFPA 99.

19.5.2 Heating, Ventilating, and Air-Conditioning.

19.5.2.1 Heating, ventilating, and air-conditioning shall comply with the provisions of Chapter 50 and Chapter 51 and shall be installed in accordance with the manufacturer's specifications, unless otherwise modified by 19.5.2.2.

19.5.2.2* Any heating device, other than a central heating plant, shall be designed and installed so that combustible material is not ignited by the device or its appurtenances and shall comply with 19.5.2.2(A) and 19.5.2.2(B).

(A) If fuel-fired, heating devices shall be chimney connected or vent connected, shall take air for combustion directly from the outside, and shall be designed and installed to provide for complete separation of the combustion system from the atmosphere of the occupied area.

(B) Any heating device shall have safety features to immediately stop the flow of fuel and shut down the equipment in case of either excessive temperatures or ignition failure.

(C) Approved, suspended unit heaters shall be permitted in locations other than means of egress and patient sleeping areas, provided that such heaters are located high enough to be out of the reach of persons using the area and are equipped with the safety features required by 19.5.2.2(A) and 19.5.2.2(B).

(D) Fireplaces shall be permitted and used only in areas other than patient sleeping areas, provided that such areas are separated from patient sleeping spaces by construction having not less than a 1-hour fire resistance rating, and provided that such fireplaces comply with the provisions of Chapter 50, 19.5.2.2(E), and 19.5.2.2(F).

(E) In addition, the fireplace shall be equipped with a hearth that shall be raised not less than 4 in. (10.2 cm) and a fireplace enclosure guaranteed against breakage up to a temperature of 650°F (343°C) and constructed of heat-tempered glass or other approved material.

(F) If, in the opinion of the authority having jurisdiction, special hazards are present, a lock on the enclosure and other safety precautions shall be permitted to be required.

19.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

19.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes.

19.5.4.1 Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

19.5.4.2 Any rubbish chute or linen chute, including pneumatic rubbish and linen systems, shall be provided with automatic extinguishing protection in accordance with Section 55.3. *(See Section 8.17.)*

19.5.4.3 Any trash chute shall discharge into a trash collection room used for no other purpose and protected in accordance with Section 8.15.

19.5.4.4 Incinerators shall not be directly flue-fed, nor shall any floor charging chute directly connect with the combustion chamber.

Chapter 20 Ambulatory Health Care Occupancies

20.1 General Requirements.

20.1.1 Application.

20.1.1.1* General.

20.1.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as an ambulatory health care occupancy.

20.1.1.1.2 Repairs, renovations, modifications, additions and reconstruction of an ambulatory health care occupancy, and changes of use including change of occupancy classification to an ambulatory health care occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

20.1.1.1.3 The requirements of Chapter 20, where referenced by Chapter 15, shall not apply to additions classified as occupancies other than ambulatory health care that are separated from the ambulatory health care occupancy in accordance with 20.1.2.2 and conform to the requirements for the specific occupancy in accordance with Chapter 16 through Chapter 19 and Chapter 21 through Chapter 30, as appropriate.

20.1.1.1.4 Ambulatory health care facilities shall comply with the provisions of Chapter 28 or this chapter, whichever are more stringent.

20.1.1.1.5 Buildings, or sections of buildings, that primarily house patients who, in the opinion of the governing body of the facility and the governmental agency having jurisdiction, are capable of judgment and appropriate physical action for self-preservation under emergency conditions shall be permitted to comply with chapters of this *Code* other than Chapter 20.

20.1.1.1.6 It shall be recognized that the requirements of this chapter are based on the assumption that staff is available in all patient-occupied areas to perform certain fire safety functions.

20.1.1.2 Changes of Occupancy. A change from a hospital or nursing home to an ambulatory health care occupancy shall not be considered a change in occupancy or occupancy subclassification.

20.1.2 Multiple Occupancies.

20.1.2.1 Multiple occupancies shall be in accordance with Section 6.2 and 20.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

20.1.2.2* Sections of ambulatory health care facilities shall be permitted to be classified as other occupancies, provided that they meet both of the following conditions:

(1) They are not intended to serve ambulatory health care occupants for purposes of treatment or customary access by patients incapable of self-preservation.
(2) They are separated from areas of ambulatory health care occupancies by construction having a fire resistance rating of not less than 1 hour.

20.1.2.3 All means of egress from ambulatory health care occupancies that traverse nonambulatory health care spaces shall conform to requirements of this *Code* for ambulatory health care occupancies.

20.1.2.4 Egress through a horizontal exit into other contiguous occupancies that do not conform with ambulatory health care egress provisions, but that do comply with requirements set forth in the appropriate occupancy chapter of this *Code*, shall be permitted, provided that the occupancy does not contain high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, other than Level 4 hazardous areas.

20.1.2.5 Egress provisions for areas of ambulatory health care facilities that correspond to other occupancies shall meet the corresponding requirements of this *Code* for such occupancies. Where the clinical needs of the occupant necessitate the locking of means of egress, staff shall be present for the supervised release of occupants during all times of use.

20.1.2.6 Any area with a hazard of contents classified higher than that of the ambulatory health care occupancy and located in the same building shall be protected as required in 20.3.2.

20.1.2.7 Non-health-care-related occupancies classified as containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3 shall not be permitted in buildings housing ambulatory health care occupancies.

20.1.3 Classification of Occupancy. Classification of occupancy shall be in accordance with 6.1.6.

20.1.4 Classification of Hazard of Contents.

20.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

20.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

20.1.5 (Reserved)

20.1.6 Minimum Construction Requirements.

20.1.6.1 Construction shall be in accordance with all of the following, except as modified by 20.1.6.2 and 20.1.6.3:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

20.1.6.2 A single level below the level of exit discharge shall be permitted if it complies with one of the following:

(1) The level is separated from the level of exit discharge by not less than Type II(111), Type III(211), or Type V(111) construction.
(2) The level is under the control of the ambulatory health care facility and any hazardous areas on the level are protected in accordance with Chapter 34.

20.1.6.3 Buildings with more than one level below the level of exit discharge shall have all such lower levels separated from the level of exit discharge by not less than Type II(111) construction.

20.1.7 Occupant Load. Occupant load shall be in accordance with 28.1.6.

20.1.8 Accessibility. Accessibility shall be in accordance with Chapter 12.

20.2 Means of Egress Requirements.

20.2.1 General. Every aisle, passageway, corridor, exit discharge, exit location, and access shall be in accordance with Chapter 11, unless otherwise modified by 20.2.2 through 20.2.10.

20.2.2 Means of Egress Components.

20.2.2.1 General. Components of means of egress shall be limited to the types described in 28.2.2.

20.2.2.2 Doors.

20.2.2.2.1 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted, provided that not more than one device is located in any egress paths.

20.2.2.2.2 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

20.2.2.2.3 Door-locking arrangements shall be permitted where the clinical needs of the patients require specialized security measures for their safety, provided that keys are carried by staff at all times.

20.2.2.2.4 Any door required to be self-closing shall be permitted to be held open only by an automatic release device that complies with 11.2.1.8.2. The required manual fire alarm system and the systems required by 11.2.1.8.2 shall be arranged to initiate the closing action of all such doors throughout the smoke compartment or throughout the entire facility.

20.2.2.2.5 Where doors in a stair enclosure are held open by an automatic release device as permitted in 20.2.2.2.4, initiation of a door-closing action on any level shall cause all doors at all levels in the stair enclosure to close.

20.2.3 Capacity of Means of Egress.

20.2.3.1 The capacity of any required means of egress shall be determined in accordance with the provisions of 28.2.3 and Section 11.3.

20.2.3.2 The clear width of any corridor or passageway required for exit access shall be not less than 44 in. (112 cm).

20.2.3.3 Doors in the means of egress from diagnostic or treatment areas, such as x-ray, surgical, or physical therapy, shall provide a clear width of not less than 32 in. (81 cm).

20.2.4 Number of Exits.

20.2.4.1 Not less than two exits of the types described in 28.2.2 that are remotely located from each other shall be provided for each floor or fire section of the building.

20.2.4.2 Any room, or any suite of rooms, of more than 2500 ft^2 (230 m^2) shall have not less than two exit access doors remotely located from each other.

20.2.4.3 Not less than two exits of the types described in 28.2.2 shall be accessible from each smoke compartment. Egress shall

be permitted through adjacent compartments but shall not require return through the compartment of fire origin.

20.2.5 Arrangement of Means of Egress. Arrangement of means of egress shall be in accordance with 28.2.5.

20.2.6 Travel Distance to Exits.

20.2.6.1 Travel distance shall be measured in accordance with Section 11.6.

20.2.6.2 Travel Distance. Travel distance shall be as follows:

(1) The travel distance between any room door required as an exit access and an exit shall not exceed 100 ft (30 m).
(2) The travel distance between any point in a room and an exit shall not exceed 150 ft (45 m).
(3) The maximum travel distance in 20.2.6.2(1) or (2) shall be permitted to be increased by 50 ft (15 m) in buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

20.2.7 Discharge from Exits. Discharge from exits shall be in accordance with 28.2.7.

20.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

20.2.9 Emergency Lighting and Essential Electrical Systems.

20.2.9.1 Emergency lighting shall be provided in accordance with Section 11.9.

20.2.9.2 Where general anesthesia or life-support equipment is used, each ambulatory health care facility shall be provided with an essential electrical system in accordance with NFPA 99, *Standard for Health Care Facilities,* unless one of the following conditions exists:

(1) Where battery-operated equipment is provided and is acceptable to the authority having jurisdiction.
(2) Where the facility uses life-support equipment for emergency purposes only.

20.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

20.3 Protection.

20.3.1 Protection of Vertical Openings. Protection of vertical openings shall be in accordance with 28.3.1.

20.3.2 Hazardous Area Protection. Hazardous area protection shall be in accordance with 28.3.2.

20.3.2.1 Laboratories. Laboratories employing quantities of flammable, combustible, or hazardous materials that are considered as a severe hazard shall be protected in accordance with NFPA 99.

20.3.2.2 Anesthetizing Locations. Anesthetizing locations shall be protected in accordance with NFPA 99.

20.3.2.3 Commercial Cooking Facilities.

(A) Commercial cooking facilities shall be protected in accordance with Section 55.10.

(B)* Where domestic cooking equipment is used for food warming or limited cooking, protection or separation of food preparation facilities shall not be required.

20.3.3 Interior Finish.

20.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

20.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials in accordance with Chapter 10 shall be Class A or Class B in exits and in enclosed corridors furnishing access to exits; and Class A, Class B, or Class C in office areas.

20.3.3.3 Interior Floor Finish.

20.3.3.3.1 Interior floor finish shall comply with Section 10.6.

20.3.3.3.2 Interior floor finish in exit enclosures and corridors shall be Class I or Class II.

20.3.3.3.3 In all other spaces, interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

20.3.4 Detection, Alarm, and Communications Systems.

20.3.4.1 General. Ambulatory health care facilities shall be provided with fire alarm systems in accordance with Section 55.2, except as modified by 20.3.4.2 through 20.3.4.5.

20.3.4.2 Initiation. Initiation of the required fire alarm systems shall be by manual means in accordance with 55.2.2 and by means of any detection devices or detection systems required.

20.3.4.3 Occupant Notification. Occupant notification shall be accomplished automatically, without delay, in accordance with 55.2.3 upon operation of any fire alarm initiating device.

20.3.4.4 Emergency Forces Notification.

(A) Fire department notification shall be accomplished in accordance with 55.2.4.

(B) Smoke detection devices or smoke detection systems equipped with reconfirmation features shall not be required to automatically notify the fire department, unless the alarm condition is reconfirmed after a period not exceeding 120 seconds.

20.3.4.5 Emergency Control. Operation of any activating device in the required fire alarm system shall be arranged to accomplish automatically any control functions required to be performed by that device. *(See 55.2.5.)*

20.3.5 Extinguishment Requirements. Extinguishment requirements shall be in accordance with 20.3.5.1, 20.3.5.2, and 28.3.5.

20.3.5.1 Automatic Sprinklers. Buildings two or more stories in height of Type II (000), Type III(200), or Type V(000) construction shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

20.3.5.2 Where another provision of this chapter requires an automatic sprinkler system to be supervised, the sprinkler system shall be electrically supervised in accordance with 55.3.2.

20.3.5.3 Isolated hazardous areas shall be permitted to be protected in accordance with 55.3.1.2. Where more than two sprinklers are installed in a single area, waterflow detection shall be provided to sound the building fire alarm, or to notify by a signal, any constantly attended location, such as PBX, security, or emergency room, at which the necessary corrective action shall be taken.

20.3.5.4 Class I standpipe systems shall be provided where required by 55.4.1.

20.3.5.5 Portable fire extinguishers shall be provided in ambulatory health care facilities in accordance with Section 55.6.

20.3.6 Exit Access Corridors.

20.3.6.1* General. Corridors used for exit access within the ambulatory health care occupancy shall comply with the following:

(1) They shall be smoke partitions in accordance with Section 8.10.
(2) They shall have not less than a 1-hour fire resistance rating in accordance with Section 8.4 in other than smoke compartments protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

20.3.6.2 Doors. In smoke compartments protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, corridor doors, other than fire protection–rated doors serving hazardous areas; exit enclosures; or vertical openings shall meet the following:

(1) They shall be self-latching.
(2) They shall comply with 8.10.3.1 through 8.10.3.4.
(3) They shall be self-closing or automatic closing in accordance with 8.10.3.5 where the non-rated door serves a sprinklered hazardous area.

20.3.6.3 Openings.

(A) Miscellaneous openings, such as mail slots, pharmacy pass-through windows, laboratory pass-through windows, and cashier pass-through windows shall be permitted to be installed in vision panels or doors without special protection, provided that the aggregate area of openings per room does not exceed 20 in.^{2} (135 cm^2) and the openings are installed at or below one-half the distance from the floor to the room ceiling.

(B) For rooms protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, the aggregate area of openings per room specified in 20.3.6.3(A) shall not exceed 80 in.^{2} (520 cm^2).

20.3.7 Subdivision of Building Spaces.

20.3.7.1 Ambulatory health care facilities shall be separated from other tenants and occupancies by walls having not less than a 1-hour fire resistance rating. Such walls shall extend from the floor slab below to the floor or roof slab above. Doors shall have a 20-minute fire protection rating. Any windows in these barriers shall be of fixed fire window assemblies in accordance with 8.7.5.

20.3.7.2 Every story of the ambulatory health care facility shall be divided into not less than two smoke compartments, unless one of the following conditions exists:

(1) Facilities of less than 5000 ft^2 (465 m^2) and protected by an approved automatic smoke detection system
(2) Facilities of less than 10,000 ft^2 (930 m^2) and protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3
(3) An area in an adjoining occupancy, which is permitted to serve as a smoke compartment for the ambulatory health care facility where the following criteria are met:
    (a) The separating wall and both compartments meet the requirements of 20.3.7.
    (b) The ambulatory health care facility is less than 22,500 ft^2 (2100 m^2).
    (c) Access from the ambulatory health care facility to the other occupancy is unrestricted.

20.3.7.3 Smoke compartments, other than the area of an atrium separated in accordance with 8.12.3, shall not exceed an area of 22,500 ft^2 (2100 m^2), and the travel distance from any point to reach a door in a smoke barrier shall not exceed 200 ft (60 m).

20.3.7.4 Any required smoke barrier shall be constructed in accordance with Section 8.11.

(A) Any required smoke barrier shall have a fire resistance rating of not less than 1 hour.

(B) Smoke dampers shall not be required in duct penetrations of smoke barriers in fully ducted heating, ventilating, and air-conditioning systems for buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

20.3.7.5 Windows in the smoke barrier shall be of fixed fire window assemblies in accordance with 8.7.5.

20.3.7.6 Not less than 15 net ft^2 (1.4 net m^2) per ambulatory health care facility occupant shall be provided within the aggregate area of corridors, patient rooms, treatment rooms, lounges, and other common areas on each side of the smoke compartment for the total number of occupants in adjoining compartments.

20.3.7.7* Doors in smoke barriers shall comply with the following:

(1) They shall be not less than 1¾-in. (4.4-cm) thick, solid-bonded wood core or the equivalent.
(2) They shall be self-closing or automatic closing in accordance with 20.2.2.2.4.
(3) They shall be provided with positive-latching hardware on other than cross-corridor doors.
(4) They shall be provided with a vision panel of fire-rated glazing or wire glass panels in approved frames if the door is a cross-corridor door.

20.3.7.8 Rabbets, bevels, or astragals shall be required at the meeting edges, and stops shall be required at the head and sides of door frames in smoke barriers.

20.4 Special Provisions.

20.4.1 The provisions of Section 28.4 shall apply.

20.4.2 Limited-access or underground buildings shall comply with Chapter 31.

20.5 Building Services.

20.5.1 Utilities. Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

20.5.2 Heating, Ventilating, and Air-Conditioning.

20.5.2.1 Heating, ventilating, and air-conditioning shall comply with the provisions of Chapter 50 and Chapter 51 and shall be in accordance with the manufacturer's specifications, unless otherwise modified by 20.5.2.2.

20.5.2.2 Any heating device, other than a central heating plant, shall be designed and installed so that combustible material will not be ignited by the device or its appurtenances and shall comply with 20.5.2.2(A) and 20.5.2.2(B).

(A) If fuel-fired, heating devices shall be chimney connected or vent connected, shall take air for combustion directly from the outside, and shall be designed and installed to provide for

complete separation of the combustion system from the atmosphere of the occupied area.

(B) Any heating device shall have safety features to immediately stop the flow of fuel and shut down the equipment in case of either excessive temperature or ignition failure.

(C) Approved, suspended unit heaters shall be permitted in locations other than means of egress and patient treatment areas, provided that such heaters are located high enough to be out of the reach of persons using the area and are equipped with the safety features required by 20.5.2.2(A) and 20.5.2.2(B).

20.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

20.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

Chapter 21 Detention and Correctional Occupancies

21.1 General Requirements.

21.1.1 Application.

21.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as a detention and correctional occupancy, unless otherwise permitted by the following:

(1) The requirements of this chapter shall not apply to Use Condition I facilities protected as residential occupancies in accordance with 21.1.3.3.
(2) The requirements of this chapter shall not apply to facilities where the authority having jurisdiction has determined equivalent safety has been provided in accordance with Section 1.5.

21.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of a detention and correctional occupancy, and changes of use including change of occupancy classification to a detention and correctional occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

(A) The requirements of this chapter, where referenced by Chapter 15, shall not apply to Use Condition I facilities protected as residential occupancies in accordance with 21.1.3.3.

(B)* The requirements of 21.1.1.2 shall not apply to facilities where the authority having jurisdiction has determined equivalent safety has been provided in accordance with Section 1.5.

21.1.1.3 Detention and correctional occupancies shall be those used for purposes such as correctional institutions, detention facilities, community residential centers, training schools, work camps, and substance abuse centers where occupants are confined or housed under some degree of restraint or security.

21.1.1.4 Detention and correctional occupancies shall be understood to be those occupancies that provide sleeping facilities for four or more residents and are occupied by persons who are generally prevented from taking self-preservation action because of security measures not under the occupants' control.

21.1.1.5 All detention and correctional facilities shall be designed, constructed, maintained, and operated to minimize the possibility of a fire emergency. Because the safety of all occupants in detention and correctional facilities cannot be adequately ensured solely by dependence on evacuation of the building, their protection from fire shall be provided by appropriate arrangement of facilities; adequate, trained staff; and development of operating, security, and maintenance procedures composed of the following:

(1) Design, construction, and compartmentation
(2) Provision for detection, alarm, and extinguishment
(3) Fire prevention; and planning, training, and drilling in programs for the isolation of fire, transfer of occupants to areas of refuge, evacuation of the building, or protection of occupants in place
(4) Provision of security to the degree necessary for the safety of the public and the occupants of the facility

21.1.2* Multiple Occupancies.

21.1.2.1 Multiple occupancies shall be in accordance with Section 6.2 and 21.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

21.1.2.2 Egress provisions for areas of detention and correctional facilities that correspond to other occupancies shall meet the corresponding requirements of this *Code* for such occupancies, as modified by 21.1.2.2.1 and 21.1.2.2.2.

21.1.2.2.1 Where security operations necessitate the locking of required means of egress, staff in the building shall be provided with the means for the supervised release of occupants during all times of use.

21.1.2.2.2* Where security operations necessitate the locking of required means of egress, detention-grade hardware meeting ASTM F 1577, *Standard Test Method for Detention Locks for Swinging Doors*, shall be provided on swinging doors within the required means of egress. Sliding doors within the required means of egress shall be designed and engineered for detention and correctional use, and lock cylinders shall meet the cylinder test requirements of ASTM F 1577.

21.1.2.3 Sections of detention and correctional facilities shall be permitted to be classified as other occupancies, provided that they meet both of the following conditions:

(1) They are not intended to serve residents for sleeping purposes.
(2) They are separated from areas of detention or correctional occupancies by construction having a minimum 2-hour fire resistance rating.

21.1.2.4 All means of egress from detention and correctional occupancies that traverse other use areas shall, as a minimum, conform to the requirements of this *Code* for detention and correctional occupancies.

(A) Egress through a horizontal exit into other contiguous occupancies that do not conform to detention and correctional occupancy egress provisions, but that do comply with requirements set forth in the appropriate occupancy chapter of this *Code*, shall be permitted provided that the occupancy

does not contain high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3.

(B) The horizontal exit specified in 21.1.2.4(A) shall comply with the requirements of 21.2.2.5.

21.1.2.5 Any area with a hazard of contents classified higher than that of the detention or correctional occupancy and located in the same building shall be protected as required in 21.3.2.

21.1.2.6 Nondetention- or noncorrectional-related occupancies classified as containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3 shall not be permitted in buildings housing detention or correctional occupancies.

21.1.3 Classification of Occupancy.

21.1.3.1* For application of the safety requirements that follow, the resident use condition is divided into five groups and shall be as specified in 21.1.3.1(A) through 21.1.3.1(E).

(A) Use Condition I — Free Egress. Use Condition I shall be that use condition for which free movement is allowed from sleeping areas and other spaces where access or occupancy is permitted to the exterior via means of egress that meet the requirements of this *Code*.

(B) Use Condition II — Zoned Egress. Use Condition II shall be that use condition for which free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments.

(C) Use Condition III — Zoned Impeded Egress. Use Condition III shall be that use condition for which free movement is allowed within individual smoke compartments, such as within a residential unit comprised of individual sleeping rooms and group activity space, with egress impeded by remote-controlled release of means of egress from such smoke compartment to another smoke compartment.

(D) Use Condition IV — Impeded Egress. Use Condition IV shall be that use condition for which free movement is restricted from an occupied space. Remote-controlled release is provided to allow movement from all sleeping rooms, activity spaces, and other occupied areas within the smoke compartment to another smoke compartment.

(E) Use Condition V — Contained. Use Condition V is that use condition for which free movement is restricted from an occupied space. Staff-controlled manual release at each door is provided to allow movement from all sleeping rooms, activity spaces, and other occupied areas within the smoke compartment to another smoke compartment.

21.1.3.2* To classify as Use Condition III or Use Condition IV, the arrangement, accessibility, and security of the release mechanism(s) used for emergency egress shall be such that the minimum available staff, at any time, can promptly release the locks.

21.1.3.3 Areas housing occupancies corresponding to Use Condition I shall conform to one of the following:

(1) The requirements of residential occupancies under this *Code*
(2)*The requirements of this chapter for Use Condition II facilities

21.1.4 Classification of Hazard Contents.

21.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

21.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

21.1.5 (Reserved)

21.1.6 Minimum Construction Requirements.

21.1.6.1 Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

21.1.6.2 Detention and correctional occupancy residential housing units shall not be located more than one level below the level of exit discharge.

21.1.7 Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

21.1.8 Accessibility. Accessibility shall be in accordance with Chapter 12.

21.2 Means of Egress Requirements.

21.2.1 General. Means of egress shall comply with Chapter 11, unless otherwise provided or modified by Section 21.2.

21.2.2 Means of Egress Components.

21.2.2.1 General. Components of means of egress shall be limited to the types described in 21.2.2.2 through 21.2.2.10.

21.2.2.2 Doors. Doors complying with 11.2.1 shall be permitted, unless otherwise provided by 21.2.11.

21.2.2.3 Stairs.

21.2.2.3.1 Stairs shall comply with the following:

(1) Stairs complying with 11.2.2 shall be permitted.
(2) Noncombustible grated stair treads and landing floors shall be permitted.

21.2.2.3.2 Spiral stairs complying with 11.2.2.2.3 shall be permitted for access to and between staff locations.

21.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

21.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 and the modifications of 21.2.2.5.1 through 21.2.2.5.3 shall be permitted.

21.2.2.5.1 At least 6 ft^2 (0.56 m^2) of accessible space per occupant shall be provided on each side of the horizontal exit for the total number of people in adjoining compartments.

21.2.2.5.2 Horizontal exits shall be permitted to comprise 100 percent of the exits required, provided that an exit, other than a horizontal exit, is accessible in some other (not necessarily adjacent) fire compartment without requiring return through the compartment of fire origin.

21.2.2.5.3 Ducts shall be permitted to penetrate horizontal exits in accordance with Exception No. 2 to 11.2.4.3.3 if protected by combination fire dampers/smoke leakage–rated dampers that meet the smoke damper actuation requirements of 8.11.6.7.

21.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

21.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

21.2.2.8 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

21.2.2.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

21.2.2.10 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

21.2.3 Capacity of Means of Egress.

21.2.3.1 The capacity of any required means of egress shall be in accordance with Section 11.3.

21.2.3.2 Aisles, corridors, and ramps required for egress shall be a minimum of 4 ft (1.2 m) in width.

21.2.3.3 Residents' sleeping room door widths shall comply with 21.2.11.4.

21.2.4 Number of Exits. The number of exits shall be in accordance with 21.2.4.1 and 21.2.4.2 and Section 11.4.

21.2.4.1 A minimum of two separate exits shall meet the following conditions:

(1) They shall be provided on every story.
(2) They shall be accessible from every part of every story, fire compartment, or smoke compartment, but exit access travel shall be permitted to be common for the distances permitted as common path of travel by 21.2.5.3.

21.2.4.2* A minimum of one approved exit shall be accessible from each fire compartment and each required smoke compartment into which residents are potentially moved in a fire emergency, with the exits arranged so that egress shall not require return through the zone of fire origin.

21.2.5 Arrangement of Means of Egress. Arrangement of means of egress shall be in accordance with 21.2.5.1 through 21.2.5.4 and Section 11.5.

21.2.5.1 Every sleeping room shall have a door leading directly to an exit access corridor.

(A) The requirement of 21.2.5.1 shall not apply where an exit door opens directly to the outside from the room at the ground level.

(B) One adjacent room, such as a day room, group activity space, or other common space shall be permitted to intervene. Where sleeping rooms directly adjoin a day room or group activity space that is utilized for access to an exit, such sleeping rooms shall be permitted to open directly to the day room or space and shall be permitted to be separated in elevation by a one-half or full-story height.

21.2.5.2 No exit or exit access shall contain a corridor, hallway, or aisle having a pocket or dead end exceeding 50 ft (15 m) for Use Condition II, Use Condition III, or Use Condition IV and exceeding 20 ft (6.1 m) for Use Condition V.

21.2.5.3 No common path of travel shall exceed 100 ft (30 m).

21.2.5.4 A sally port shall be permitted in a means of egress where there are provisions for continuous and unobstructed travel through the sally port during an emergency egress condition.

21.2.6 Travel Distance to Exits. Travel distance shall comply with 21.2.6.1 through 21.2.6.3.

21.2.6.1 The travel distance between any room door required as an exit access and an exit shall not exceed 150 ft (30 m).

21.2.6.2 The travel distance between any point in a room and an exit shall not exceed 200 ft (45 m).

21.2.6.3 The travel distance between any point in a sleeping room to the door in that room shall not exceed 50 ft (15 m).

(A) The maximum permitted travel distance specified in 21.2.6.3 shall be increased to 100 ft (30 m) in open dormitories where the enclosing walls of the dormitory space are of smoke-tight construction.

(B) Where travel distance to the exit access door from any point within the dormitory exceeds 50 ft (15 m) as permitted by 21.2.6.3(A), a minimum of two exit access doors remotely located from each other shall be provided.

21.2.7 Discharge from Exits.

21.2.7.1 Exits shall be permitted to discharge into a fenced or walled courtyard, provided that not more than two walls of the courtyard are the building walls from which egress is being made. Enclosed yards or courts shall be of sufficient size to accommodate all occupants at a minimum distance of 50 ft (15 m) from the building while providing a net area of 15 ft^2 (1.4 m^2) per person.

21.2.7.2 All exits shall be permitted to discharge through the level of exit discharge. The requirements of 11.7.2 shall be waived, provided that not more than 50 percent of the exits discharge into a single fire compartment separated from other compartments by construction having a minimum 1-hour fire resistance rating.

21.2.8 Illumination of Means of Egress. Illumination shall be provided in accordance with Section 11.8.

21.2.9 Emergency Lighting. Emergency lighting shall be provided in accordance with Section 11.9.

21.2.10 Marking of Means of Egress.

(A) Exit marking shall be provided in areas accessible to the public in accordance with Section 11.10.

(B) Exit signs shall not be required in residential housing areas.

21.2.11 Special Features.

21.2.11.1 Doors within means of egress shall be as required in Chapter 12, unless otherwise provided in 21.2.11.2 through 21.2.11.12.

21.2.11.2 Where security operations necessitate the locking of required means of egress, detention-grade hardware meeting ASTM F 1577, *Standard Test Method for Detention Locks for Swinging Doors,* shall be provided on swinging doors within the required means of egress. Sliding doors within the required means of egress shall be designed and engineered for detention and correctional use, and lock cylinders shall meet the cylinder test requirements of ASTM F 1577.

21.2.11.3 Doors shall be permitted to be locked in accordance with the applicable use condition.

21.2.11.4* Doors to resident sleeping rooms shall be a minimum of 28 in. (71 cm) in clear width.

21.2.11.5 Doors in a means of egress shall be permitted to be of the horizontal-sliding type, provided that the force to slide the door to its fully open position does not exceed 50 lbf (222 N) where a force of 50 lbf (222 N) is simultaneously applied perpendicular to the door.

21.2.11.6 Doors from areas of refuge to the exterior shall be permitted to be locked with key locks in lieu of the locking methods described in 21.2.11.7. The keys to unlock such doors shall be maintained and available at the facility at all times, and the locks shall be operable from the outside.

21.2.11.7* Any remote control release used in a means of egress shall be provided with a reliable means of operation, remotely located from the resident living areas, to release locks on all doors. The remote location shall have sight and sound supervision of the resident living areas.

(A) Provisions for remote control locking and unlocking of occupied rooms in Use Condition IV shall not be required, provided that not more than 10 locks need to be unlocked to move all occupants from one smoke compartment to an area of refuge as promptly as required to relocate occupants when remote control unlocking is used.

(B) Unlocking of all locks, as specified in 21.2.11.7(A), shall be accomplished with not more than two separate keys. *(See 21.3.7.7 for requirements for smoke barrier doors.)*

21.2.11.8 All remote control release–operated doors shall be provided with a redundant means of operation as follows:

(1) Power-operated sliding doors or power-operated locks shall be constructed so that, in the event of power failure, a manual mechanical means to release and open the doors is provided at each door, and either emergency power arranged in accordance with 11.9.2.2 is provided for the power operation or a remote control manual mechanical release is provided.
(2) Mechanically operated sliding doors or mechanically operated locks shall be provided with a manual mechanical means at each door to release and open the door.

21.2.11.9 The provision of 11.2.1.5.2 for stairway re-entry shall not apply.

21.2.11.10 Doors unlocked by means of remote control under emergency conditions shall not automatically relock when closed, unless specific action is taken at the remote control location to enable doors to relock.

21.2.11.11 Emergency power shall be provided for all electrically power-operated sliding doors and power-operated locks. Power shall be arranged to automatically operate within 10 seconds upon failure of normal power and to maintain the necessary power source for a minimum of 1½ hours.

21.2.11.12 The provisions of 21.2.11.11 shall not apply to facilities with 10 or fewer locks complying with 21.2.11.7(A) and 21.2.11.7(B).

21.3 Protection.

21.3.1 Protection of Vertical Openings. Any vertical opening shall be enclosed or protected in accordance with Section 8.12, unless otherwise permitted by the following:

(1) Unprotected vertical openings in accordance with 8.12.4.2 shall be permitted.
(2)*In residential housing area smoke compartments protected throughout by an approved, automatic sprinkler system, unprotected vertical openings shall be permitted in accordance with the conditions of 8.12.2, provided that the height between the lowest and highest finished floor levels does not exceed 23 ft (7 m) and the following also shall apply:
   (a) The number of levels shall not be restricted.
   (b) Residential housing areas subdivided in accordance with 21.3.8.1 shall be permitted to be considered as part of the communicating space.
   (c) The separation specified in 21.3.1(2)(b) shall not be required to have a fire resistance rating *[see 8.12.2(4)(b)].*

21.3.2 Hazardous Area Protection.

21.3.2.1* Any hazardous area shall be protected in accordance with Section 8.15. The areas described in the Table 21.3.2.1 shall be protected as indicated.

Table 21.3.2.1 Hazardous Area Protection

Hazardous Area Description	Separation/Protection
Areas not incidental to resident housing	2 hours
Boiler and fuel-fired heater rooms	2 hours or 1 hour and sprinklers
Central or bulk laundries over 100 ft^2 (9.3 m^2)	1 hour and sprinklers
Commercial cooking equipment	In accordance with Section 55.10
Commissaries	1 hour or sprinklers
Employee locker rooms	1 hour or sprinklers
Hobby/handicraft shops	1 hour or sprinklers
Maintenance shops	1 hour or sprinklers
Padded cells	1 hour and sprinklers
Soiled linen rooms	1 hour and sprinklers
Storage rooms over 50 ft^2 (4.6 m^2) but less than or equal to 100 ft^2 (9.3 m^2) storing combustible material	1 hour or sprinklers
Storage rooms over 100 ft^2 (9.3 m^2) storing combustible materials	1 hour and sprinklers
Trash collection rooms	1 hour and sprinklers

21.3.2.2 Hazardous areas determined by the authority having jurisdiction as not incidental to residents' housing shall be separated by 2-hour fire resistance–rated barriers in conjunction with automatic sprinkler protection.

21.3.2.3 Where cooking facilities are protected in accordance with NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, kitchens shall not be required to be provided with room-wide protection.

21.3.3 Interior Finish.

21.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

21.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish in accordance with Chapter 10 shall be Class A or Class B in corridors, in exits, and in any space not separated from corridors and exits by partitions capable of retarding the passage of smoke; and Class A, Class B, or Class C in all other areas. The provisions of 10.7.1 shall not apply.

21.3.3.3 Interior Floor Finish.

21.3.3.3.1 Interior floor finish shall comply with Section 10.6.

21.3.3.3.2 Interior floor finish in exit enclosures and in corridors shall be Class I or Class II.

21.3.3.3.3 In all other spaces, interior floor finish shall comply with 10.6.1 and 10.6.2, as applicable.

21.3.4 Detection, Alarm, and Communications Systems.

21.3.4.1 General.

21.3.4.1.1 Detention and correctional occupancies shall be provided with a fire alarm system in accordance with Section 55.2, except as modified by 21.3.4.1.2 through 21.3.4.4.3.

21.3.4.1.2 All fire alarm systems and detection systems required by 21.3.4 shall be provided with a secondary power supply, and the installation shall be in accordance with *NFPA 72, National Fire Alarm Code*.

21.3.4.2 Initiation. Initiation of the required fire alarm system shall be by manual means in accordance with 55.2.2, by means of any required detection devices or detection systems, and by means of waterflow alarm in the sprinkler system required by 21.3.5.2, unless otherwise permitted by the following:

(1) Manual fire alarm boxes shall be permitted to be locked, provided that staff is present within the subject area when occupied and staff has keys readily available to unlock the boxes.
(2) Manual fire alarm boxes shall be permitted to be located in a staff location, provided that the staff location is attended when the building is occupied and that the staff attendant has direct supervision of the sleeping area.

21.3.4.3 Notification.

21.3.4.3.1 Occupant Notification. Occupant notification shall be accomplished automatically in accordance with 55.2.3.

(A) A positive alarm sequence shall be permitted in accordance with 55.2.3.4.

(B)* Any smoke detectors required by this chapter shall be permitted to be arranged to alarm at a constantly attended location only and shall not be required to accomplish general alarm indication.

21.3.4.3.2 Emergency Forces Notification. Fire department notification shall be accomplished in accordance with 55.2.4.

(A) A positive alarm sequence shall be permitted in accordance with 55.2.3.4.

(B) Any smoke detectors required by this chapter shall not be required to transmit an alarm to the fire department.

(C) This requirement of 21.3.4.3.2 shall not apply where staff is provided at a constantly attended location that has the capability to promptly notify the fire department or has direct communication with a control room having direct access to the fire department.

21.3.4.4* Detection. An approved automatic smoke detection system shall be installed in accordance with Section 55.2, as modified by 21.3.4.4.1 through 21.3.4.4.3, throughout all resident sleeping areas and adjacent day rooms, activity rooms, or contiguous common spaces.

21.3.4.4.1 Smoke detectors shall not be required in sleeping rooms with four or fewer occupants.

21.3.4.4.2 Other arrangements and positioning of smoke detectors shall be permitted to prevent damage or tampering, or for other purposes. Such arrangements shall be capable of detecting any fire, and the placement of detectors shall be such that the speed of detection is equivalent to that provided by the spacing and arrangements required by the installation standards referenced in Section 55.2. Detectors shall be permitted to be located in exhaust ducts from cells, behind grilles, or in other locations. The equivalent performance of the design, however, shall be acceptable to the authority having jurisdiction in accordance with the equivalency concepts specified in Section 1.5.

21.3.4.4.3* Smoke detectors shall not be required in Use Condition II open dormitories where staff is present within the dormitory whenever the dormitory is occupied.

21.3.5 Extinguishment Requirements.

21.3.5.1 High-rise buildings shall comply with 21.4.3.

21.3.5.2 All buildings classified as Use Condition II, Use Condition III, Use Condition IV, or Use Condition V shall be protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 55.3.1.1(1).

21.3.5.3 The automatic sprinkler system required by 21.3.5.2 shall comply with the following:

(1) It shall be in complete accordance with Section 55.3.
(2) It shall be electrically connected to the fire alarm system.
(3) It shall be electrically supervised in accordance with 55.3.2.

21.3.5.4 Portable fire extinguishers shall be provided in accordance with Section 55.6, unless otherwise permitted by the following:

(1)*Access to portable fire extinguishers shall be permitted to be locked.
(2) Portable fire extinguishers shall be permitted to be located at staff locations only.

21.3.5.5 Standpipes shall be in accordance with 21.3.5.5.1 and 21.3.5.5.2.

21.3.5.5.1 A Class I standpipe system shall be provided in accordance with Section 55.4 where any of the following conditions exist:

(1) A minimum of one floor level is more than 30 ft (9 m) above or below the level of fire department access.

(2) Any point on a floor in a building is more than 200 ft (60 m) from its nearest point of fire department entry into the building.
(3) The building is four or more stories in height or has four or more basement levels as specified in 55.4.1.

21.3.5.5.2 Standpipe system roof outlets shall not be required in other than high-rise buildings.

21.3.6 Corridors. Corridors shall be in accordance with 21.3.8.1.

21.3.7 Subdivision of Building Spaces.

21.3.7.1 Smoke barriers shall be provided to divide every story used for sleeping by residents, or any other story having an occupant load of 50 or more persons, into a minimum of two compartments.

(A) Protection shall be permitted to be accomplished with horizontal exits. *(See 21.2.2.5.)*

(B)* The requirement for subdivision of building space shall be permitted to be fulfilled by one of the following:

(1) Smoke compartments having exit to a public way where such exit serves only one area and has no openings to other areas
(2) A building separated from the resident housing area by a 2-hour fire resistance rating or 50 ft (15 m) of open space
(3) A secured, open area having a holding space located 50 ft (15 m) from the housing area that provides 15 ft^2 (1.4 m^2) or more of refuge area of each person (resident, staff, visitors) potentially present at the time of a fire

(C) Doors used to access the areas specified in 21.3.7.1(B)(1) through 21.3.7.1(B)(3) shall meet the requirements for doors at smoke barriers for the applicable use condition.

21.3.7.2 Where smoke barriers are required by 21.3.7.1, they shall be provided as follows:

(1) They shall limit the occupant load to not more than 200 residents in any smoke compartment.
(2) They shall limit the travel distance to a door in a smoke barrier as follows:
   (a) The distance from any room door required as exit access shall not exceed 150 ft (30 m).
   (b) The distance from any point in a room shall not exceed 200 ft (45 m).

21.3.7.3* Any required smoke barrier shall be constructed in accordance with Section 8.11. Barriers shall be of substantial construction and shall have structural fire resistance.

21.3.7.4 Openings in smoke barriers shall be protected in accordance with 8.4.2, unless otherwise permitted by the following:

(1)*There shall be no restriction on the total number of vision panels in any barrier.
(2) Sliding doors in smoke barriers that are designed to normally be kept closed and are remotely operated from a continuously attended location shall not be required to be self-closing.

21.3.7.5 At least 6 net ft^2 (0.56 net m^2) per occupant shall be provided on each side of the smoke barrier for the total number of occupants in adjoining compartments. This space shall be readily available wherever occupants are moved across the smoke barrier in a fire emergency.

21.3.7.6 Doors shall resist the passage of smoke when installed in smoke barriers in accordance with 21.3.7.4. Swinging doors shall be self-latching, or the opening resistance of the door shall be a minimum of 5 lbf (22 N).

21.3.7.7 Doors in smoke barriers shall conform with the requirements for doors in means of egress as specified in 21.2.2 and shall have locking and release arrangements according to the applicable use condition. The provisions of 21.2.11.7(A) and 21.2.11.7(B) shall not be used for smoke barrier doors serving a smoke compartment containing more than 20 persons.

21.3.7.8 Vision panels shall be provided in smoke barriers at points where the barrier crosses an exit access corridor.

21.3.7.9 Smoke dampers shall be provided in accordance with 8.11.6, and the following also shall apply:

(1) Other arrangements and positioning of smoke detectors shall be permitted to prevent damage or tampering, or for other purposes.
(2) Such other arrangements shall be capable of detecting any fire, and the placement of detectors shall be such that the speed of detection is equivalent to that provided by the spacing and arrangement required by *NFPA 72*, as referenced in 8.11.6.7.

21.3.8* Special Protection Features — Subdivision of Resident Housing Spaces.

21.3.8.1 Subdivision of facility spaces shall comply with Table 21.3.8.1.

21.4 Special Provisions.

21.4.1 Limited-Access Buildings. The provisions of Section 31.3 for limited-access buildings shall not apply.

21.4.2 Underground Buildings. Underground buildings shall be in accordance with Section 31.2.

21.4.3* High-Rise Buildings. High-rise buildings shall comply with Section 33.2.

21.4.4 Nonsprinklered Existing Building Rehabilitation.

21.4.4.1 General. Rehabilitation of nonsprinklered existing buildings shall be permitted to meet the requirements of this chapter, as modified by 21.4.4.2 through 21.4.4.13 in lieu of the sprinkler requirement of 21.3.5.2.

21.4.4.2 Minimum Construction Requirements (Nonsprinklered Buildings). Detention and correctional occupancies in nonsprinklered buildings shall be limited to the types of building construction permitted by Chapter 15.

21.4.4.3* Horizontal Exit Duct Penetrations (Nonsprinklered Buildings). Ducts shall be permitted to penetrate horizontal exits in accordance with Exception No. 2 to 11.2.4.3.3 if protected by combination fire dampers/smoke leakage–rated dampers that meet the smoke damper actuation requirements of 8.11.6.7.

21.4.4.4 Common Path of Travel (Nonsprinklered Buildings). A common path of travel shall not exceed 50 ft (15 m).

21.4.4.5 Travel Distance to Exits (Nonsprinklered Buildings).

21.4.4.5.1 The travel distance between any room door required as an exit access and an exit shall not exceed 100 ft (30 m).

21.4.4.5.2 The travel distance between any point in a room and an exit shall not exceed 150 ft (45 m).

Table 21.3.8.1 Subdivision of Resident Housing Spaces

Feature	Use Condition			
	II	III	IV	V
Room to room separation	NR	NR	NR	SR
Room face to corridor separation	NR	NR	NR	SR
Room face to common space separation	NR	NR if ≤50 ft (≤15 m)[b]; SR if >50 ft (>15 m)[b]	NR if ≤50 ft (≤15 m)[b]; SR if >50 ft (>15 m)[b]	SR
Common space to corridor separation	NR	NR	NR	SR
Total openings in solid room face where room face is required to be smoke resistant or fire rated[a]	120 in.^{2} (0.08 m^2)	120 in.^{2} (0.08 m^2)	120 in.^{2} (0.08 m^2)	120 in.^{2} (0.08 m^2) where openings meet one of the following: (1) Closed, except when in use by staff (2) Closable from the inside (3) Smoke control provided

Notes:

1. NR = No requirement.
2. SR = Smoke resistant.
3. Doors in openings in partitions required to be smoke resistant (SR) in accordance with Table 21.3.8.1 are to be substantial doors of construction that resists the passage of smoke. Latches and door closers are not required on cell doors.
4. Under Use Condition II, Use Condition III, or Use Condition IV, a space subdivided by open construction (any combination of grating doors and grating walls or solid walls) is permitted to be considered one room if housing not more than 16 persons. The perimeter walls of such space are to be of smoke-resistant construction. Smoke detection is to be provided in such space. Under Use Condition IV, common walls between sleeping areas within the space are to be smoke resistant, and grating doors and fronts are to be permitted to be used. Under Use Condition II and Use Condition III, open dormitories are permitted to house more than 16 persons, as permitted by other sections of this chapter.
5. Where barriers are required to be smoke resistant (SR), the provisions of Section 8.11 do not apply.

[a] "Total openings in solid room face" includes all openings (for example, undercuts, food passes, grilles), the total of which is not to exceed 120 in.^{2} (0.08 m^2). All openings are to be 36 in. (91 cm) or less above the floor.

[b] Travel distance through the common space to the exit access corridor.

21.4.4.6 Protection of Vertical Openings (Nonsprinklered Buildings).

21.4.4.6.1 Multilevel residential housing areas without enclosure protection between levels shall be permitted, provided that the conditions of 21.4.4.6.2 through 21.4.4.6.4 are met.

21.4.4.6.2* The entire normally occupied area, including all communicating floor levels, shall be sufficiently open and unobstructed so that a fire or other dangerous condition in any part is obvious to the occupants or supervisory personnel in the area.

21.4.4.6.3 Egress capacity shall simultaneously accommodate all occupants of all communicating levels and areas, with all communicating levels in the same fire area considered as a single floor area for purposes of determining required egress capacity.

21.4.4.6.4* The height between the highest and lowest finished floor levels shall not exceed 13 ft (4 m). The number of levels shall not be restricted.

21.4.4.7 Hazardous Area Protection (Nonsprinklered Buildings). Any hazardous area shall be protected in accordance with Section 8.15. The areas described in Table 21.4.4.7 shall be protected as indicated.

21.4.4.8 Interior Finish (Nonsprinklered Buildings).

21.4.4.8.1 Interior Wall and Ceiling Finish. Interior wall and ceiling finish in accordance with Chapter 10 shall be Class A in corridors, in exits, and in any space not separated from corridors and exits by partitions capable of resisting the passage of smoke; and Class A, Class B, or Class C in all other areas.

21.4.4.8.2 Interior Floor Finish. Interior floor finish in accordance with Chapter 10 shall be Class I in corridors and exits.

21.4.4.9 Detection, Alarm, and Communications Systems (Nonsprinklered Buildings).

21.4.4.9.1 Initiation. Initiation of the fire alarm system required by 21.3.4.1.1 shall be by manual means in accordance with 55.2.2 and by means of any required detection devices or detection systems, unless otherwise permitted by the following:

(1) Manual fire alarm boxes shall be permitted to be locked, provided that staff is present within the area when it is occupied and staff has keys readily available to unlock the boxes.

Table 21.4.4.7 Hazardous Area Protection (Nonsprinklered Buildings)

Hazardous Area Description	Separation/Protection
Areas not incidental to resident housing	2 hours
Boiler and fuel-fired heater rooms	2 hours or 1 hour and sprinklers
Central or bulk laundries over 100 ft^2 (9.3 m^2)	2 hours or 1 hour and sprinklers
Commercial cooking equipment	In accordance with Section 11.10
Commissaries	1 hour or sprinklers
Employee locker rooms	1 hour or sprinklers
Hobby/handicraft shops	1 hour or sprinklers
Maintenance shops	1 hour or sprinklers
Padded cells	2 hours or 1 hour and sprinklers
Soiled linen rooms	2 hours or 1 hour and sprinklers
Storage rooms over 50 ft^2 (4.6 m^2) but less than or equal to 100 ft^2 (9.3 m^2) in area storing combustible material	1 hour or sprinklers
Storage rooms over 100 ft^2 (9.3 m^2) storing combustible materials	2 hours or 1 hour and sprinklers
Trash collection rooms	2 hours or 1 hour and sprinklers

(2) Manual fire alarm boxes shall be permitted to be located in a staff location, provided that the staff location is attended when the building is occupied and that the staff attendant has direct supervision of the sleeping area.

21.4.4.9.2 Detection. An approved automatic smoke detection system shall be in accordance with Section 55.2 as modified by 21.4.4.9.2.1 and 21.4.4.9.2.2, throughout all resident sleeping areas and adjacent day rooms, activity rooms, or contiguous common spaces.

21.4.4.9.2.1 Smoke detectors shall not be required in sleeping rooms with four or fewer occupants in Use Condition II or Use Condition III.

21.4.4.9.2.2 Other arrangements and positioning of smoke detectors shall be permitted to prevent damage or tampering, or for other purposes. Such arrangements shall be capable of detecting any fire, and the placement of detectors shall be such that the speed of detection is equivalent to that provided by the spacing and arrangements required by the installation standards referenced in Section 55.2. Detectors shall be permitted to be located in exhaust ducts from cells, behind grilles, or in other locations. The equivalent performance of the design, however, shall be acceptable to the authority having jurisdiction in accordance with the equivalency concepts specified in Section 1.5.

21.4.4.10 Standpipes (Nonsprinklered Buildings).

21.4.4.10.1 A Class III standpipe and hose system shall be provided in accordance with 55.4.2 in all nonsprinklered buildings over two stories in height.

21.4.4.10.2 Separate Class I and Class II standpipe systems shall be permitted in lieu of the Class III system required by 21.4.4.10.1.

21.4.4.10.3 One-inch (25-mm) diameter formed hose on reels shall be permitted to provide the Class II service permitted by 21.4.4.10.2.

21.4.4.11 Subdivision of Building Spaces (Nonsprinklered Buildings). Where smoke barriers are required by 21.3.7.1, they shall be provided as follows:

(1) They shall limit the occupant load to not more than 200 residents in any smoke compartment.
(2) They shall limit the travel distance to a door in a smoke barrier as follows:
   (a) The distance from any room door required as exit access shall not exceed 100 ft (30 m).
   (b) The distance from any point in a room shall not exceed 150 ft (45 m).

21.4.4.12* Subdivision of Resident Housing Spaces (Nonsprinklered Buildings). Subdivision of facility spaces shall comply with Table 21.4.4.12.

21.4.4.13 Limited-Access Buildings (Nonsprinklered Buildings).

21.4.4.13.1 Limited-access buildings used as detention and correctional occupancies shall comply with 21.4.4.13.2. The provisions of Section 31.3 for limited-access buildings shall not apply.

21.4.4.13.2 Means shall be provided to evacuate smoke from the smoke compartment of fire origin. Any of the following means shall be acceptable:

(1) Operable windows on not less than two sides of the building, spaced not more than 30 ft (9.1 m) apart, that provide openings with dimensions of not less than 22 in. (56 cm) in width and 24 in. (61 cm) in height
(2)*Manual or automatic smoke vents
(3) Engineered smoke control system
(4) Mechanical exhaust system providing not less than six air changes per hour
(5) Other method acceptable to the authority having jurisdiction

21.5 Building Services.

21.5.1 Utilities.

21.5.1.1 Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

21.5.1.2 Alarms, emergency communications systems, and the illumination of generator set locations shall be provided with emergency power in accordance with NFPA 70, *National Electrical Code*.

21.5.2 Heating, Ventilating, and Air-Conditioning.

21.5.2.1 Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51 and shall be installed in accordance with the manufacturer's specifications, unless otherwise modified by 21.5.2.2.

21.5.2.2 Portable space heating devices shall be prohibited. Any heating device, other than a central heating plant, shall be designed and installed so that combustible material is not ignited by the device or its appurtenances and shall comply with 21.2.5.2(A) and 21.2.5.2(B).

Table 21.4.4.12 Subdivision of Resident Housing Spaces—Nonsprinklered Buildings

Feature	Use Condition			
	II	**III**	**IV**	**V**
Room to room separation	NR	NR	SR	FR(½)
Room face to corridor separation	SR	SR	SR	FR
Room face to common space separation	NR	NR if ≤50 ft (≤15 m)[b] / SR if >50 ft (>15 m)[b]	SR	FR
Common space to corridor separation	FR	FR	FR	FR
Total openings in solid room face where room face is required to be smoke resistant or fire rated[a]	120 in.^{2} (0.08 m^2)	120 in.^{2} (0.08 m^2)	120 in.^{2} (0.08 m^2)	120 in.^{2} (0.08 m^2) where openings meet one of the following: (1) Closed, except when in use by staff (2) Closable from the inside (3) Smoke control provided

Notes:

1. NR = No requirement.
2. SR = Smoke resistant.
3. FR = Fire rated — 1 hour.
4. FR (½) = Fire rated — ½ hour.
5. Doors in openings in partitions required to be smoke resistant (SR) in accordance with Table 21.4.4.12 are to be substantial doors of construction that resists the passage of smoke. Latches and door closers are not required on cell doors.
6. Under Use Condition II, Use Condition III, or Use Condition IV, a space subdivided by open construction (any combination of grating doors and grating walls or solid walls) is permitted to be considered one room if housing not more than 16 persons. The perimeter walls of such space are to be of smoke-resistant construction. Smoke detection is to be provided in such space. Under Use Condition IV, common walls between sleeping areas within the space are to be smoke resistant, and grating doors and fronts are to be permitted to be used. Under Use Condition II and Use Condition III, open dormitories are permitted to house more than 16 persons, as permitted by other sections of this chapter.
7. Where barriers are required to be smoke resistant (SR), the provisions of Section 8.11 do not apply.

[a] "Total openings in solid room face" includes all openings (for example, undercuts, food passes, grilles), the total of which is not to exceed 120 in.^{2} (0.08 m^2). All openings are to be 36 in. (91 cm) or less above the floor.

[b] Travel distance through the common space to the exit access corridor.

(A) If fuel-fired, heating devices shall be chimney or vent connected, shall take air for combustion directly from the outside, and shall be designed and installed to provide for complete separation of the combustion system from the atmosphere of the occupied area.

(B) Any heating device shall have safety devices to immediately stop the flow of fuel and shut down the equipment in case of either excessive temperatures or ignition failure.

(C) Approved, suspended unit heaters shall be permitted in locations other than means of egress and sleeping areas, provided such heaters are located high enough to be out of the reach of persons using the area and are vent connected and equipped with the safety devices required by 21.5.2.2(A) and 21.5.2.2(B).

21.5.2.3 Combustion and ventilation air for boiler, incinerator, or heater rooms shall be taken directly from, and discharged directly to, the outside air.

21.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

21.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes.

21.5.4.1 Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

21.5.4.2 Any rubbish chute or linen chute, including pneumatic rubbish and linen systems, shall be provided with automatic extinguishing protection in accordance with Section 8.17.

21.5.4.3 Any trash chute shall discharge into a trash collection room used for no other purpose and protected in accordance with Section 8.17.

21.5.4.4 Incinerators shall not be directly flue-fed, nor shall any floor chute directly connect with the combustion chamber.

Chapter 22 One- and Two-Family Dwellings

22.1 General Requirements.

22.1.1 Application.

22.1.1.1 This chapter shall establish life safety requirements for all one- and two-family dwellings.

22.1.1.2* One- and two-family dwellings shall be limited to buildings containing not more than two dwelling units in which each dwelling unit is occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms.

22.1.1.3 The requirements of this chapter shall apply to new buildings, or portions thereof, used as a one- or two-family dwelling.

22.1.1.4 Repairs, renovations, modifications, additions, and reconstruction of a one- or two-family dwelling, and changes of use including change of occupancy classification to a one- and two-family dwelling, shall comply with one of the following:

(1) The provisions of this chapter
(2) The provisions of Chapter 15

22.1.2 Multiple Occupancies.

22.1.2.1 All multiple occupancies shall be in accordance with Section 6.2 and 22.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

22.1.2.2 No dwelling unit of a residential occupancy shall have its sole means of egress pass through any nonresidential occupancy in the same building.

22.1.2.3 Multiple dwelling units of a residential occupancy shall be permitted to be located above a nonresidential occupancy only where one of the following conditions exists:

(1) Where the dwelling unit of the residential occupancy and exits therefrom are separated from the nonresidential occupancy by construction having a fire resistance rating of not less than 1 hour
(2) Where the nonresidential occupancy is protected throughout by an approved automatic sprinkler system in accordance with Section 55.3 that is electrically supervised in accordance with 55.3.2
(3) Where the nonresidential occupancy is protected by an automatic fire detection system in accordance with Section 55.2

22.1.3 Classification of Occupancy. One- and two-family dwellings shall be classified in accordance with 6.1.8.1.1.

22.1.4 Classification of Hazard of Contents. The contents of residential occupancies shall be classified as ordinary hazard in accordance with Section 6.3.

22.1.5 Minimum Construction Requirements. Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

22.1.6 Occupant Load. (No requirements.)

22.2* Means of Escape Requirements.

22.2.1 General. The provisions of Chapter 11 shall not apply to means of escape, unless specifically referenced in this chapter.

22.2.2 Number and Types of Means of Escape.

22.2.2.1 In dwellings or dwelling units of two rooms or more, every sleeping room and every living area shall have not less than one primary means of escape.

22.2.2.2 In dwellings or dwelling units of two rooms or more, every sleeping room and every living area shall have not less than one secondary means of escape, unless one of the following conditions is met:

(1) The bedroom or living area has a door leading directly to the outside of the building at or to grade level.
(2) The dwelling unit is protected throughout by an approved automatic sprinkler system in accordance with 22.3.5.

22.2.2.3 The primary means of escape shall be a door, stairway, or ramp providing a means of unobstructed travel to the outside of the dwelling unit at street or ground level.

22.2.2.4* The secondary means of escape shall be as described in 22.2.2.4.1 or 22.2.2.4.2, or in 22.2.2.4.3.

22.2.2.4.1 The secondary means of escape shall be a door, stairway, passage, or hall providing a way of unobstructed travel to the outside of the dwelling at street or ground level that is independent of, and remote from, the primary means of escape.

22.2.2.4.2 The secondary means of escape shall be a passage through an adjacent nonlockable space, independent of and remote from the primary means of escape, to any approved means of escape.

22.2.2.4.3* The secondary means of escape shall be an outside window or door operable from the inside without the use of tools, keys, or special effort and shall provide a clear opening of not less than 5.7 ft^2 (0.53 m^2).

(A) The width of the opening described in 22.2.2.4.3 shall be not less than 20 in. (510 mm), the height shall be not less than 24 in. (610 mm), and the bottom of the opening shall be not more than 44 in. (1120 mm) above the floor.

(B) The means of escape, as described in 22.2.2.4.3, shall be acceptable where one of the following criteria is met:

(1) The window shall be within 240 in. (6100 mm) of grade.
(2) The window shall be directly accessible to fire department rescue apparatus as approved by the authority having jurisdiction.
(3) The window or door shall open onto an exterior balcony.
(4) Windows having a sill height below the adjacent ground level shall be provided with a window well meeting the following criteria:
    (a) The window well shall have horizontal dimensions that allow the window to be fully opened.
    (b) The window well shall have an accessible net clear opening of not less than 9 ft^2 (0.82 m^2), with a length and width of not less than 36 in. (915 mm).
    (c) A window well with a vertical depth of more than 44 in. (1120 mm) shall be equipped with an ap-

proved, permanently affixed ladder or with steps meeting the following criteria:

i. The ladder or steps shall not encroach more than 6 in. (150 mm) into the required dimensions of the window well.
ii. The ladder or steps shall not be obstructed by the window.
iii. Ladders or steps that comply with the requirements of 22.2.2.4.3(B)(4)(c)(i) and 22.2.2.4.3(B)(4)(c)(ii) shall be exempt from the requirements of 11.2.2.

22.2.2.5 In buildings, other than those protected throughout by an approved automatic sprinkler system in accordance with 22.3.5 that is electrically supervised in accordance with 55.3.2, every story having an area greater than 2000 ft^2 (185 m^2) within the dwelling unit shall be provided with two primary means of escape remotely located from each other.

22.2.3 Arrangement of Means of Escape. Any required path of travel in a means of escape from any room to the outside shall not pass through another room or apartment not under the immediate control of the occupant of the first room or through a bathroom or other space subject to locking.

22.2.4 Doors.

22.2.4.1 Doors in the path of travel of a means of escape, other than bathroom doors in accordance with 22.2.4.2, shall be not less than 28 in. (710 mm) wide.

22.2.4.2 Bathroom doors shall be not less than 24 in. (610 mm) wide.

22.2.4.3 Doors shall be not less than 78 in. (1980 mm) in nominal height.

22.2.4.4 Every closet door latch shall be such that the door can be opened from inside the closet.

22.2.4.5 Every bathroom door shall be designed to allow opening from the outside during an emergency when locked.

22.2.4.6 Doors shall be swinging or sliding.

22.2.4.7* All locking devices on doors in any means of escape that impede or prohibit egress, or that cannot be easily disengaged, shall be prohibited.

22.2.4.8 Floor levels at doors shall comply with 11.2.1.3.

22.2.4.9 Forces to open doors shall comply with 11.2.1.4.4.

22.2.4.10 Latching devices for doors shall comply with 11.2.1.5.4.

22.2.5 Stairs, Ramps, Guards, and Handrails.

22.2.5.1 Stairs, ramps, guards, and handrails shall be in accordance with 11.2.2 for stairs, 11.2.5 for ramps, and 11.2.2.4 for guards and handrails.

22.2.5.1.1 The provisions of 11.2.2.5, 11.2.5.5, and 11.7.3 shall not apply.

22.2.5.1.2 If serving as a secondary means of escape, stairs complying with the fire escape requirements of Table 7.2.8.4.1(a) or Table 7.2.8.4.1(b) of NFPA *101, Life Safety Code*, shall be permitted.

22.2.5.1.3 If serving as secondary means of escape, ramps complying with Table 22.2.5.1.3 shall be permitted.

Table 22.2.5.1.3 Secondary Means of Escape Ramp Criteria

Feature	Class A	Class B
Minimum width	44 in. (1120 mm)	30 in. (760 mm)
Maximum slope	1 in 10	1 in 8
Maximum height between landings	144 in. (3660 mm)	144 in. (3660 mm)

22.2.5.2 The clear width of stairs, landings, ramps, balconies, and porches shall be not less than 36 in. (910 mm), measured in accordance with 11.3.2.

22.2.5.3 Spiral stairs and winders in accordance with 11.2.2.2.3.2 and 11.2.2.2.4 shall be permitted within a single dwelling unit.

22.2.5.4 No sleeping rooms or living areas shall be accessible only by a ladder, a stair ladder, an alternating tread device, or folding stairs or through a trap door.

22.2.6 Hallways.

22.2.6.1 The width of hallways shall be not less than 36 in. (910 mm).

22.2.6.2 The height of hallways shall be not less than 84 in. (2135 mm) nominal, with clearance below projections from the ceiling of not less than 80 in. (2030 mm) nominal.

22.2.7 Bulkheads.

22.2.7.1 Where provided, bulkhead enclosures shall provide direct access to the basement from the exterior.

22.2.7.2 Stairways serving bulkhead enclosures, not part of the required primary means of escape, that provide access from the outside grade level to the basement shall be exempt from the provisions of 22.2.5.1 when the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed 96 in. (2440 mm) and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

22.3 Protection.

22.3.1 Protection of Vertical Openings. (No requirements.)

22.3.2 (Reserved)

22.3.3 Interior Finish.

22.3.3.1 Interior finish shall be in accordance with Chapter 10.

22.3.3.2 Interior finish on walls and ceilings of occupied spaces shall be Class A, Class B, or Class C.

22.3.3.3 Interior Floor Finish.

22.3.3.3.1 Interior floor finish shall comply with Section 10.6.

22.3.3.3.2 There is no requirement for Class I or Class II interior floor finish.

22.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

22.3.4 Detection, Alarm, and Communications Systems. Smoke alarms shall be provided in accordance with either 22.3.4.1 or 22.3.4.2.

22.3.4.1 Smoke alarms shall be installed in accordance with 55.2.2.6 in the following locations:

(1) In all sleeping rooms
(2) Outside of each separate sleeping area, in the immediate vicinity of the sleeping rooms
(3) On each level of the dwelling unit, including basements

22.3.4.2 Dwelling units shall protected by an approved smoke detection system in accordance with Section 55.2 and equipped with an approved means of occupant notification.

22.3.5* Extinguishment Requirements.

22.3.5.1* Unless otherwise specified in Chapter 7, where modifications are permitted by this *Code* based on the installation of an automatic sprinkler system, such modifications shall be permitted when the automatic sprinkler system complies with 55.3.1.1(1), 55.3.1.1(2), or 55.3.1.1(3).

22.3.5.2 Where an automatic sprinkler system is provided, either for total or partial building coverage, the system shall be in accordance with 55.3.1.1(1), 55.3.1.1(2), or 55.3.1.1(3).

22.4 Separation Between Townhouses. Each townhouse shall be considered a separate building when separated from adjoining townhouses by the use of exterior walls located on the property line as required for the type of construction, or by a single wall meeting the requirements of 22.4.1 through 22.4.6.

22.4.1 Walls used to create separate buildings shall provide not less than a 2-hour fire resistance rating.

22.4.2 Plumbing, piping, ducts, electrical, or other building services shall be installed in accordance with Section 8.8.

22.4.3 Walls shall be continuous from the foundation to the underside of the roof sheathing.

22.4.4 Roof sheathing shall be one of the following:

(1) Noncombustible material
(2) Exterior grade fire retardant–treated wood
(3) One ⅝-in. (15.9-mm) layer of Type X gypsum wallboard attached to the underside of the roof decking for not less than a 48 in. (1220 mm) width on each side of such wall

22.4.5 Each dwelling unit sharing walls creating separate buildings shall be designed and constructed to maintain its structural integrity independent of the unit on the opposite side of the wall, unless the conditions of 22.4.6 are met.

22.4.6 Walls creating separate buildings shall be permitted to be penetrated by roof and floor structural members, provided that the fire resistance rating and the structural integrity of the wall are maintained.

22.5 Building Services. Heating, ventilating, and air-conditioning equipment shall comply with Chapter 50 and Chapter 51.

Chapter 23 Lodging or Rooming House Occupancies

23.1 General Requirements.

23.1.1 Application.

23.1.1.1* This chapter shall apply to buildings that provide sleeping accommodations for a total of 16 or fewer persons on either a transient or permanent basis, with or without meals, but without separate cooking facilities for individual occupants, except as provided in Chapter 22.

23.1.1.2 The requirements of this chapter shall apply to new buildings, or portions thereof, used as a lodging or rooming house.

23.1.1.3 Repairs, renovations, modifications, additions, and reconstruction of a lodging or rooming house, and changes of use including change of occupancy classification to a lodging or rooming house, shall comply with one of the following:

(1) The provisions of this chapter
(2) The provisions of Chapter 15

23.1.2 Multiple Occupancies.

23.1.2.1 All multiple occupancies shall be in accordance with Section 6.2 and 23.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

23.1.2.2 No lodging or rooming house shall have its sole means of egress pass through any nonresidential occupancy in the same building.

23.1.2.3 Lodging or rooming houses shall be permitted to be located above a nonresidential occupancy only where one of the following conditions exists:

(1) Where the lodging or rooming house and exits therefrom are separated from the nonresidential occupancy by construction having a fire resistance rating of not less than 1 hour
(2) Where the nonresidential occupancy is protected throughout by an approved automatic sprinkler system in accordance with Section 55.3 that is electrically supervised in accordance with 55.3.2
(3) Where a lodging or rooming house is located above a nonresidential occupancy, and the nonresidential occupancy is protected by an automatic fire detection system in accordance with Section 55.2

23.1.3 Classification of Occupancy. Lodging and rooming house occupancies shall be classified in accordance with 6.1.8.1.2.

23.1.4 Classification of Hazard of Contents.

23.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2 and 23.1.4.

23.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

23.1.5 Minimum Construction Requirements. Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

23.1.6 Occupant Load. Occupant load shall be determined in accordance with 23.1.1.1.

23.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

23.2 Means of Escape Requirements.

23.2.1 Number and Types of Means of Escape.

23.2.1.1 Every sleeping room and living area shall have access to a primary means of escape complying with 22.2.2.3 and located to provide a safe path of travel to the outside.

23.2.1.2 Where sleeping rooms are above or below the level of exit discharge, the primary means of escape shall be an interior stair in accordance with 23.2.2, an exterior stair, or a horizontal exit in accordance with 11.2.4.

23.2.1.3 In addition to the primary route, each sleeping room and living area shall have a secondary means of escape in accordance with 22.2.2.4, unless the sleeping room or living area has a door leading directly outside the building with access to grade or to a stairway that meets the requirements for exterior stairs in 23.2.1.1.

23.2.1.4 In buildings, other than those protected throughout by an approved automatic sprinkler system in accordance with 23.3.6 that is electrically supervised in accordance with 55.3.2, every story having an area greater than 2000 ft^2 (185 m^2), or with travel distance to the primary means of escape more than 75 ft (23 m), shall be provided with two primary means of escape remotely located from each other.

23.2.2 Interior Stairways.

23.2.2.1 Interior stairways, other than those in accordance with 23.2.2.3 or 23.2.2.4, shall be enclosed by ½-hour fire barriers, with all openings protected with smoke-actuated automatic-closing or self-closing doors having a fire resistance comparable to that required for the enclosure.

23.2.2.2 Interior stairways shall comply with 11.2.2.5.3.

23.2.2.3 Where an interior stair connects the street floor with the story next above or below only, but not with both, the interior stair shall be required to be enclosed only on the street floor.

23.2.2.4 Stairways shall be permitted to be unenclosed in accordance with the options of 23.3.1.

23.2.3 Doors.

23.2.3.1 Doors in a means of escape, other than bathroom doors in accordance with 23.2.3.2, and paths of travel in a means of escape shall be not less than 28 in. (710 mm) wide.

23.2.3.2 Bathroom doors shall be not less than 24 in. (610 mm) wide.

23.2.3.3 Every closet door latch shall be such that it can be readily opened from the inside in case of emergency.

23.2.3.4 Every bathroom door shall be designed to allow opening from the outside during an emergency when locked.

23.2.3.5 Winders in accordance with 11.2.2.2.4 shall be permitted.

23.2.3.6 Door locking arrangements shall comply with either 23.2.3.6.1 or 23.2.3.6.2.

23.2.3.6.1* No door in any means of escape shall be locked against egress when the building is occupied.

23.2.3.6.2 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted, provided that not more than one such device is located in any one escape path.

23.2.3.7 Doors serving a single dwelling unit shall be permitted to be provided with a lock in accordance with Exception No. 3 to 11.2.1.5.1.

23.3 Protection.

23.3.1 Protection of Vertical Openings. Vertical openings shall be protected in accordance with 23.3.1.1, 23.3.1.2, or 23.3.1.3.

23.3.1.1 Vertical openings shall meet the following requirements:

(1) Vertical openings shall be protected so that no primary escape route is exposed to an unprotected vertical opening.
(2) Vertical openings shall be considered protected if they are cut off and enclosed in a manner that provides a smoke- and fire-resisting capability of not less than ½ hour.
(3) Any doors or openings shall have a smoke- and fire-resisting capability equivalent to that of the enclosure and shall be automatic closing on detection of smoke or shall be self-closing.

23.3.1.2 In buildings not more than three stories in height protected throughout by an approved automatic sprinkler system in accordance with 23.3.6 that is electrically supervised in accordance with 55.3.2, unprotected vertical openings shall be permitted, provided that both of the following criteria are met:

(1) A primary means of escape from each sleeping area meeting 23.3.1.2(2) shall be provided.
(2) The primary means of escape shall not pass through a portion of a lower floor, unless such portion is separated from all spaces on that floor by construction having a ½-hour fire resistance rating.

23.3.1.3 Stair enclosures shall not be required in buildings not more than two stories in height protected throughout by an approved automatic sprinkler system in accordance with 23.3.6.1 that is electrically supervised in accordance with 55.3.2. The omission of secondary means of escape in accordance with 22.2.2.2(2) shall not be permitted.

23.3.2* Exterior Stairs. Exterior stairs shall be protected against blockage caused by fire within the building.

23.3.3 Interior Finish. Interior finish shall be in accordance with Chapter 10, 23.3.3.1, and 23.3.3.2.

23.3.3.1 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be Class A, Class B, or Class C in occupied spaces.

23.3.3.2 Interior Floor Finish.

23.3.3.2.1 Interior floor finish shall comply with Section 10.6.

23.3.3.2.2 There is no requirement for Class I or Class II interior floor finish.

23.3.3.2.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

23.3.4 Detection, Alarm, and Communications Systems.

23.3.4.1 General. Lodging or rooming houses shall be provided with a fire alarm system in accordance with Section 55.2.

23.3.4.2 Initiation. Initiation of the required fire alarm system shall be by manual means in accordance with 55.2.2 or by alarm initiation in accordance with 55.2.2.2 in buildings protected throughout by an approved automatic sprinkler system in accordance with 23.3.6.

23.3.4.3 Notification. Occupant notification shall be provided automatically in accordance with 55.2.3, as modified by 23.3.4.3.1 and 23.3.4.3.2.

23.3.4.3.1* Visible signals for the hearing impaired shall not be required where the proprietor resides in the building and there are five or fewer rooms for rent.

23.3.4.3.2 Positive alarm sequence in accordance with 55.2.3.4 shall be permitted.

23.3.4.4 Detection (Reserved).

23.3.4.5 Smoke Alarms.

23.3.4.5.1 Smoke alarms shall be installed in every sleeping room in accordance with 55.2.2.6.

23.3.4.5.2 Smoke alarms, as required by 23.3.4.5.1, shall not be required to be interconnected.

23.3.5 Separation of Sleeping Rooms.

23.3.5.1 All sleeping rooms shall be separated from escape route corridors by smoke partitions in accordance with Section 8.10.

23.3.5.2 There shall be no louvers or operable transoms in smoke partitions required by 23.3.5.1.

23.3.5.3 Air passages shall not penetrate the wall, unless they are properly installed heating and utility installations other than transfer grilles.

23.3.5.4 Transfer grilles shall be prohibited.

23.3.5.5 Doors shall be provided with latches or other mechanisms to keep the doors closed.

23.3.5.6 Doors shall not be arranged to prevent the occupant from closing the door.

23.3.5.7 In buildings, other than those protected throughout by an approved automatic sprinkler system in accordance with 23.3.6, doors shall be self-closing or automatic closing upon detection of smoke.

23.3.6 Extinguishment Requirements.

23.3.6.1* Unless otherwise specified in Chapter 7, where modifications are permitted by this *Code*, based on the installation of an automatic sprinkler system, such modifications shall be permitted when the automatic sprinkler system complies with 55.3.1.1(1), 55.3.1.1(2), or 55.3.1.1(3).

23.3.6.2* Where an automatic sprinkler system is required or is used as an alternative method of protection, either for total or partial building coverage, the following requirements shall be met:

(1) The system shall be in accordance with Section 55.3 and shall actuate the fire alarm system in accordance with Section 55.2.
(2) In buildings up to and including four stories in height above grade, systems in accordance with 55.3.1.1(2) shall be permitted.
(3) The use of automatic sprinkler systems in accordance with 55.3.1.1(3) shall be permitted where the lodging or rooming house is not part of a mixed occupancy.
(4) Entrance foyers shall be sprinklered where automatic sprinkler systems in accordance with 55.3.1.1(3) are utilized.
(5) Lodging or rooming houses with sleeping accommodations for more than eight occupants shall be treated as two-family dwellings with regard to the water supply where automatic sprinkler systems in accordance with 55.3.1.1(3) are utilized.

Exception: In buildings sprinklered in accordance with 55.3.1.1(1), closets having an area of less than 12 ft^2 (1.1 m^2) in individual dwelling units shall not be required to be sprinklered. Closets that contain equipment such as washers, dryers, furnaces, or water heaters shall be sprinklered regardless of size.

23.3.6.3 All lodging or rooming houses, other than those meeting 23.3.6.4, shall be protected throughout by an approved automatic sprinkler system in accordance with 23.3.6.

23.3.6.4 In buildings, other than those meeting 23.3.6.5, an approved automatic sprinkler system shall not be required where every sleeping room has a door opening directly to the outside of the building at street or ground level, or has a door opening directly to the outside leading to an exterior stairway that meets the requirements of 23.2.1.1.

23.3.6.5 An approved automatic sprinkler system shall be installed throughout buildings, other than these meeting 23.3.6.6, having a floor level located 55 ft (17 m) or more above the lowest level of fire department vehicle access.

23.3.6.6 An automatic sprinkler system shall not be required in buildings where all floors located 55 ft (17 m) or more above the lowest level of fire department vehicle access have an occupant load of less than 30, unless required by another section of this *Code*.

23.3.7 Commercial Cooking Equipment. Commercial cooking equipment shall be protected in accordance with Section 55.10.

23.4 (Reserved)

23.5 Building Services.

23.5.1 Utilities. Utilities shall comply with Chapter 49, Chapter 52 and Chapter 53.

23.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with Chapter 50 and Chapter 51.

23.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

Chapter 24 Hotels and Dormitory Occupancies

24.1 General Requirements.

24.1.1 Application.

24.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as a hotel or dormitory.

24.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of a hotel or dormitory, and changes of use

including change of occupancy classification to a hotel or dormitory, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

24.1.2 Apartment-Style Dormitories. Any dormitory divided into suites of rooms, with one or more bedrooms opening into a living room or study that has a door opening into a common corridor serving a number of suites, shall be classified as an apartment building.

24.1.3 Multiple Occupancies.

24.1.3.1 All multiple occupancies shall be in accordance with Section 6.2 and 24.1.3. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

24.1.3.2 No guest room or guest suite of a hotel or dormitory occupancy shall have its sole means of egress pass through any nonresidential occupancy in the same building.

24.1.4 Classification of Hazard of Contents.

24.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2 and 24.1.4.

24.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

24.1.5 Classification of Occupancy. Hotels and dormitories shall be classified in accordance with 6.1.8.1.3 and 6.1.8.1.4.

24.1.6 Minimum Construction Requirements.

24.1.6.1 Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

24.1.7 Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

24.1.8 Accessibility. Accessibility shall be in accordance with Chapter 12.

24.2 Means of Egress Requirements.

24.2.1 General.

24.2.1.1 Means of egress from guest rooms or guest suites to the outside of the building shall be in accordance with Chapter 11 and this chapter.

24.2.1.2 Means of escape within the guest room or guest suite shall comply with the provisions of Section 22.2 for one- and two-family dwellings.

24.2.1.3 For the purpose of application of the requirements of Section 22.2, the terms *guest room* and *guest suite* shall be synonymous with the terms *dwelling* and *living unit*.

24.2.2 Means of Egress Components.

24.2.2.1 General.

24.2.2.1.1 Components of means of egress shall be limited to the types described in 24.2.2.2 through 24.2.2.12.

24.2.2.1.2 In buildings, other than high-rise, protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, exit enclosures shall have a fire resistance rating of not less than 1 hour, and the fire protection rating of doors shall be not less than 1 hour.

24.2.2.2 Doors.

24.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

24.2.2.2.2 Door-locking arrangements shall comply with 24.2.2.2.2.1, 24.2.2.2.2.2, or 24.2.2.2.2.3.

24.2.2.2.2.1 No door in any means of egress shall be locked against egress when the building is occupied.

24.2.2.2.2.2 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted, provided that not more than one such device is located in any one egress path.

24.2.2.2.2.3 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

24.2.2.2.3 Revolving doors complying with 11.2.1.10 shall be permitted.

24.2.2.2.4 Horizontal-sliding doors, as permitted by 11.2.1.14, shall not be used across corridors.

24.2.2.3 Stairs. Stairs complying with 11.2.2 shall be permitted.

24.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

24.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

24.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

24.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

24.2.2.8 (Reserved)

24.2.2.9 (Reserved)

24.2.2.10 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

24.2.2.11 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

24.2.2.12 Areas of Refuge.

24.2.2.12.1* Areas of refuge complying with 11.2.12 shall be permitted, as modified by 24.2.2.12.2.

24.2.2.12.2 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, the two accessible rooms or spaces separated from

each other by smoke-resistive partitions in accordance with the definition of area of refuge *(see 3.3.33, Area of Refuge)* shall not be required.

24.2.3 Capacity of Means of Egress.

24.2.3.1 The capacity of means of egress shall be in accordance with Section 11.3.

24.2.3.2 Street floor exits shall be sized to accommodate the occupant load of the street floor plus the required capacity of stairs and ramps discharging onto the street floor.

24.2.3.3* Corridors, other than those within individual guest rooms or individual guest suites, shall be of such width so as to accommodate the required occupant load and shall be not less than 44 in. (112 cm).

24.2.4 Number of Exits.

24.2.4.1 In buildings, other than those complying with 24.2.4.2, not less than two separate exits shall be provided on each story. *(See also Section 11.4.)*

24.2.4.2 Buildings of four stories or less protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, with not more than four guest rooms or guest suites per floor, shall be permitted to have a single exit under the following conditions:

(1) The stairway is completely enclosed or separated by barriers having a fire resistance rating of not less than 1 hour, with self-closing, 1-hour fire protection–rated doors protecting all openings between the stairway enclosure and the building.
(2) The stairway does not serve more than one-half of a story below the level of exit discharge.
(3) All corridors serving as access to exits have not less than a 1-hour fire resistance rating.
(4) The travel distance from the entrance door of any guest room or guest suite to an exit does not exceed 35 ft (10.7 m).
(5) Horizontal and vertical separation with a fire rating of not less than ½ hour is provided between guest rooms or guest suites.

24.2.5 Arrangement of Means of Egress.

24.2.5.1 Access to all required exits shall be in accordance with Section 11.5, as modified by 24.2.5.2 through 24.2.5.8.

24.2.5.2 The distance between exits addressed by 11.5.1.4 shall not apply to common nonlooped exit access corridors in buildings that have corridor doors from the guest room or guest suite that are arranged such that the exits are located in opposite directions from such doors.

24.2.5.3 In buildings not protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, common paths of travel shall not exceed 35 ft (10.7 m).

24.2.5.4 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, common paths of travel shall not exceed 50 ft (15 m).

24.2.5.5 Travel within a guest room or guest suite shall not be included when determining the length of common path of travel.

24.2.5.6 In buildings not protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, dead-end corridors shall not exceed 35 ft (10.7 m).

24.2.5.7 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, dead-end corridors shall not exceed 50 ft (15 m).

24.2.5.8 Any guest room or any guest suite of rooms in excess of 2000 ft^2 (185 m^2) shall be provided with not less than two exit access doors remotely located from each other.

24.2.6 Travel Distance to Exits.

24.2.6.1 Travel distance within a guest room or guest suite to a corridor door shall not exceed 75 ft (23 m) in buildings not protected by an approved, supervised automatic sprinkler system in accordance with 24.3.5.

24.2.6.2 Travel distance within a guest room or guest suite to a corridor door shall not exceed 125 ft (38 m) in buildings protected by an approved, supervised automatic sprinkler system in accordance with 24.3.5.

24.2.6.3 Travel distance from the corridor door of any guest room or guest suite to the nearest exit shall comply with 24.2.6.3.1, 24.2.6.3.2, or 24.2.6.3.3.

24.2.6.3.1 Travel distance from the corridor door of any guest room or guest suite to the nearest exit, measured in accordance with Section 11.6, shall not exceed 100 ft (30 m).

24.2.6.3.2 Travel distance from the door of any guest room or guest suite to the nearest exit, measured in accordance with Section 11.6, shall not exceed 200 ft (60 m) for exterior ways of exit access arranged in accordance with 11.5.3.

24.2.6.3.3 Travel distance from the corridor door of any guest room or guest suite to the nearest exit, measured in accordance with Section 11.6, shall meet the following requirements:

(1) Travel distance shall not exceed 200 ft (60 m) where the exit access and any portion of the building that is tributary to the exit access are protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5.
(2) The portion of the building in which the 200-ft (60-m) travel distance is permitted shall be separated from the remainder of the building by construction having a fire resistance rating of not less than 1 hour for buildings not more than three stories in height, and not less than 2 hours for buildings more than three stories in height.

24.2.7 Discharge from Exits.

24.2.7.1 Exit discharge shall comply with Section 11.7.

24.2.7.2* Any required exit stair that is located so that it is necessary to pass through a lobby or other open space to reach the outside of the building shall be continuously enclosed down to a level of exit discharge or to a mezzanine within a lobby at a level of exit discharge.

24.2.7.3 The distance of travel from the termination of the exit enclosure to an exterior door leading to a public way shall not exceed 100 ft (30 m).

24.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

24.2.9 Emergency Lighting. Emergency lighting in accordance with Section 11.9 shall be provided in all buildings with more than 25 rooms, unless each guest room or guest suite has an exit direct to the outside of the building at street or ground level.

24.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

24.2.11 Special Means of Egress Features. (Reserved)

24.3 Protection.

24.3.1 Protection of Vertical Openings.

24.3.1.1 Vertical openings shall comply with 24.3.1.1.1, 24.3.1.1.2, or 24.3.1.1.3.

24.3.1.1.1 Vertical openings shall be enclosed or protected in accordance with Section 8.12.

24.3.1.1.2 Vertical openings in accordance with 8.12.4.2 shall be permitted.

24.3.1.1.3 In buildings, other than high-rise, protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, the fire resistance of walls enclosing vertical openings shall be not less than 1 hour, and the fire protection rating of doors shall be not less than 1 hour.

24.3.1.2 No floor below the level of exit discharge used only for storage, heating equipment, or purposes other than residential occupancy shall have unprotected openings to floors used for residential purposes.

24.3.2 Protection from Hazards.

24.3.2.1 Any room containing high-pressure boilers, refrigerating machinery, transformers, or other service equipment subject to possible explosion shall meet the following requirements:

(1) Such rooms shall not be located directly under or directly adjacent to exits.
(2) All such rooms shall be effectively cut off from other parts of the building as specified in Section 8.15.

24.3.2.2 Any hazardous area shall be protected in accordance with Section 8.15.

24.3.2.3 The areas described in Table 24.3.2.3 shall be protected as indicated.

24.3.2.4 Where sprinkler protection without fire-rated separation is used, hazardous areas shall be separated from other spaces by smoke partitions complying with Section 8.10.

24.3.3 Interior Finish.

24.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

24.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be permitted as follows:

(1) Exit enclosures—Class A
(2) Lobbies and corridors—Class A or Class B
(3) Other spaces—Class A, Class B, or Class C

24.3.3.3 Interior Floor Finish.

24.3.3.3.1 Interior floor finish shall comply with Section 10.6.

24.3.3.3.2 Interior floor finish in exit enclosures and in exit access corridors, and in spaces not separated from them by walls complying with 24.3.6, shall be not less than Class II.

24.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

Table 24.3.2.3 Hazardous Area Protection

Hazardous Area Description	Separation/Protection
Boiler and fuel-fired heater rooms serving more than a single guest room or guest suite	1 hour and sprinklers
Employee locker rooms	1 hour or sprinklers
Gift or retail shops	1 hour or sprinklers
Bulk laundries	1 hour and sprinklers
Guest laundries not more than 100 ft^2 (9.3 m^2) outside of guest rooms or guest suites	1 hour or sprinklers[1]
Guest laundries more than 100 ft^2 (9.3 m^2) outside of guest rooms or guest suites	1 hour and sprinklers
Maintenance shops	1 hour and sprinklers
Storage rooms [2]	1 hour or sprinklers
Trash rooms	1 hour and sprinklers

[1] Where automatic sprinkler protection is provided, no enclosure is required.
[2] Where storage areas not exceeding 24 ft^2 (2.2 m^2) are directly accessible from the guest room or guest suite, no separation or protection is required.

24.3.4 Detection, Alarm, and Communications Systems.

24.3.4.1 A fire alarm system shall be provided in accordance with Section 55.2, as modified by 24.3.4.2 through 24.3.4.9.

24.3.4.2 The required fire alarm system shall be initiated by each of the following:

(1) Manual means in accordance with 55.2.2
(2) A manual fire alarm box located at the hotel desk or other convenient central control point under continuous supervision by responsible employees
(3) Any automatic sprinkler system
(4) Any required automatic detection system, other than sleeping room smoke detectors

24.3.4.3* Occupant notification shall meet the following requirements:

(1) Occupant notification shall be provided automatically in accordance with 55.2.3.
(2) Positive alarm sequence in accordance with 55.2.3.4 shall be permitted.

24.3.4.4* Guest rooms and guest suites specifically required and equipped to accommodate hearing-impaired individuals shall be provided with a visible notification appliance.

24.3.4.5 In occupiable areas, other than guest rooms and guest suites, visible notification appliances shall be provided.

24.3.4.6 Annunciation in accordance with 55.2.7 shall be provided in buildings exceeding two stories in height or having more than 50 rooms.

24.3.4.7* Provisions shall be made for the immediate notification of the public fire department by telephone or other means, unless there is no public fire department, in which case notification shall be made to the private fire brigade.

24.3.4.8 A corridor smoke detection system in accordance with Section 55.2 shall be provided in buildings other than

those protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5.

24.3.4.9* Smoke alarms shall be installed in accordance with 55.2.2.6 in every guest room and every living area and sleeping room within a guest suite.

24.3.5 Extinguishment Requirements.

24.3.5.1* Unless otherwise specified in Chapter 7, where modifications are permitted by this *Code*, based on the installation of an automatic sprinkler system, such modifications shall be permitted when the automatic sprinkler system complies with 55.3.1.1(1) or 55.3.1.1(2).

24.3.5.2 All buildings, other than those complying with 24.3.5.3, shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5.4.

24.3.5.3 Automatic sprinkler protection shall not be required in buildings where all guest sleeping rooms have a door opening directly to either of the following:

(1) Outside at street or grade level
(2) Exterior exit access arranged in accordance with 11.5.3 in buildings up to and including three stories in height above grade

24.3.5.4 Where an automatic sprinkler system is installed, either for total or partial building coverage, it shall meet the following requirements:

(1) The system shall be in accordance with Section 55.3, as modified by 24.3.5.5.
(2) In buildings up to and including four stories in height above grade, systems in accordance with 55.3.1.1(2) shall be permitted.

24.3.5.5 Where an automatic sprinkler system is required by this chapter, it shall be electrically supervised in accordance with 55.3.2.

24.3.5.6 The provisions for draft stops and closely spaced sprinklers in NFPA 13, *Standard for the Installation of Sprinkler Systems*, shall not apply to openings complying with 8.12.4.2 where the opening is within the guest room or guest suite.

24.3.5.7 Listed quick-response or listed residential sprinklers shall be used throughout guest rooms and guest room suites.

24.3.5.8 Open parking structures complying with Section 30.8 that are contiguous with hotels or dormitories shall be exempt from the sprinkler requirements of 24.3.5.2.

24.3.5.9 In buildings, other than those protected throughout with an approved, supervised automatic sprinkler system in accordance with 24.3.5, portable fire extinguishers shall be provided as specified in Section 55.6 in hazardous areas addressed by 24.3.2.

24.3.5.10 Standpipes shall comply with the following:

(1) Class I standpipe systems shall be provided where required by 55.4.1.
(2) Roof outlets shall not be required on roofs having slopes of 3 in 12 or greater.

24.3.6 Corridors.

24.3.6.1 Exit access corridor walls shall consist of fire barriers in accordance with Section 8.4 that have not less than a 1-hour fire resistance rating, unless the building complies with 24.3.6.2.

24.3.6.2 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, corridor walls shall have not less than a ½-hour fire resistance rating.

24.3.6.3 Doors that open onto exit access corridors shall have not less than a 20-minute fire protection rating in accordance with 8.7.5 and shall be self-closing and positive-latching.

24.3.6.4 Unprotected openings, other than those from spaces complying with 24.3.6.5, shall be prohibited in exit access corridor walls and doors.

24.3.6.5 Spaces shall be permitted to be unlimited in area and open to the corridor, provided that the following criteria are met:

(1) The spaces are not used for guest rooms or guest suites or hazardous areas.
(2) The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5.
(3) The space does not obstruct access to required exits.

24.3.6.6 Transoms, louvers, or transfer grilles shall be prohibited in walls and doors serving exit access corridors.

24.3.7 Subdivision of Building Spaces. Buildings shall be subdivided in accordance with 24.3.7.1 or 24.3.7.2.

24.3.7.1 In buildings not meeting 24.3.7.2, each hotel guest room, including guest suites, and dormitory room shall be separated from other guest rooms or dormitory rooms by walls and floors constructed as fire barriers having fire resistance ratings of not less than 1 hour.

24.3.7.2 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 24.3.5, each hotel guest room, including guest suites, and dormitory room shall be separated from other guest rooms or dormitory rooms by walls and floors constructed as fire barriers having fire resistance ratings of not less than ½ hour.

24.3.8 Special Protection Features. (Reserved)

24.4 Special Provisions.

24.4.1 Limited-Access or Underground Buildings. Limited-access or underground buildings shall comply with Chapter 31.

24.4.2 High-Rise Buildings. High-rise buildings shall comply with Chapter 33.

24.5 Building Services.

24.5.1 Utilities. Utilities shall comply with Chapter 49, Chapter 52, and Chapter 53.

24.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with Chapter 50 and Chapter 51, except as otherwise required in this chapter.

24.5.3 Elevators, Escalators, and Conveyors.

24.5.3.1 Elevators, escalators, and conveyors shall comply with Chapter 54.

24.5.3.2* In high-rise buildings, one elevator shall be provided with a protected power supply and shall be available for use by the fire department in case of emergency.

24.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with Section 8.17.

Chapter 25 Apartment Buildings

25.1 General Requirements.

25.1.1 Application.

25.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as an apartment building.

25.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of an apartment building, and changes of use including change of occupancy classification to an apartment building, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

25.1.1.3 Townhouses shall comply with the following requirements:

(1) Townhouses shall be permitted to be designed in accordance with Chapter 25 where the dwelling units are separated by 1-hour fire resistance–rated construction in accordance with Section 8.4.
(2) Townhouses shall comply with Chapter 22 where property lines exist between units.

25.1.2 Multiple Occupancies.

25.1.2.1 All multiple occupancies shall be in accordance with Section 6.2 and 25.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

25.1.2.2 No dwelling unit of a residential occupancy shall have its sole means of egress pass through any nonresidential occupancy in the same building.

25.1.2.3 Multiple dwelling units of a residential occupancy shall be permitted to be located above a nonresidential occupancy only where one of the following conditions exists:

(1) Where the dwelling unit of the residential occupancy and exits therefrom are separated from the nonresidential occupancy by construction having a fire resistance rating of not less than 1 hour
(2) Where the nonresidential occupancy is protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5

25.1.3 Classification of Occupancy. Apartment buildings shall be classified in accordance with 6.1.8.1.5.

25.1.4 Classification of Hazard of Contents.

25.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

25.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

25.1.5 Minimum Construction Requirements. Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

25.1.6 Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

25.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

25.2 Means of Egress Requirements.

25.2.1 General.

25.2.1.1 Means of egress from dwelling units to the outside of the building shall be in accordance with Chapter 11 and this chapter.

25.2.1.2 Means of escape within dwelling units shall comply with the provisions of Section 22.2 for one- and two-family dwellings.

25.2.2 Means of Egress Components.

25.2.2.1 General.

25.2.2.1.1 Components of means of egress shall be limited to the types described in 25.2.2.2 through 25.2.2.10.

25.2.2.1.2 In buildings, other than high-rise, protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5, exit enclosures shall have a fire resistance rating of not less than 1 hour, with doors having a fire protection rating of not less than 1 hour.

25.2.2.2 Doors.

25.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

25.2.2.2.2 Door-locking arrangements shall comply with 25.2.2.2.2.1, 25.2.2.2.2.2, or 25.2.2.2.2.3.

25.2.2.2.2.1* No door in any means of egress shall be locked against egress when the building is occupied.

25.2.2.2.2.2 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted, provided that not more than one such device is located in any one egress path.

25.2.2.2.2.3 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

25.2.2.2.3 Revolving doors complying with 11.2.1.10 shall be permitted.

25.2.2.2.4 Horizontal sliding doors, as permitted by 11.2.1.14, shall not be used across corridors.

25.2.2.2.5 Apartment buildings shall be exempt from the reentry provisions of 11.2.1.5.2 where the exit enclosure serves directly only one dwelling unit per floor and such exit is a smokeproof enclosure in accordance with 11.2.3.

25.2.2.3 Stairs.

25.2.2.3.1 Stairs complying with 11.2.2 shall be permitted.

25.2.2.3.2 Within any individual dwelling unit, unless protected by an approved automatic sprinkler system in accordance with

25.3.5, stairs more than one story above or below the entrance floor level of the dwelling unit shall not be permitted.

25.2.2.3.3 Spiral stairs complying with 11.2.2.2.3.2 shall be permitted within a single dwelling unit.

25.2.2.3.4 Winders complying with 11.2.2.2.4 shall be permitted within a single dwelling unit.

25.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

25.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

25.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

25.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

25.2.2.8 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

25.2.2.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

25.2.2.10 Areas of Refuge.

25.2.2.10.1* Areas of refuge complying with 11.2.12 shall be permitted, as modified by 25.2.2.10.2.

25.2.2.10.2 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5, the two accessible rooms or spaces separated from each other by smoke-resistive partitions in accordance with the definition of area of refuge *(see 3.3.33, Area of Refuge)* shall not be required.

25.2.3 Capacity of Means of Egress.

25.2.3.1 The capacity of means of egress shall be in accordance with Section 11.3.

25.2.3.2 Street floor exits shall be sized to accommodate the occupant load of the street floor plus the required capacity of stairs and ramps discharging onto the street floor.

25.2.3.3 Corridors with a required capacity of more than 50 persons, as specified in Section 11.3, shall be of such width as to accommodate the required occupant load but shall have a width of not less than 44 in. (1120 mm).

25.2.3.4 Corridors with a required capacity of not more than 50 persons as specified in Section 11.3 shall have a width of not less than 36 in. (910 mm).

25.2.4 Number of Exits. The minimum number of exits shall comply with 25.2.4.1, 25.2.4.2, or 25.2.4.3. *(See also Section 11.4.)*

25.2.4.1 Every dwelling unit shall have access to at least two separate exits remotely located from each other as required by 11.5.1.

25.2.4.2 Any dwelling unit shall be permitted to have a single exit, provided that one of the following conditions exists:

(1) The dwelling unit has an exit door opening directly to the street or yard at ground level.
(2) The dwelling unit has direct access to an outside stair complying with 11.2.2.7 that serves a maximum of two units, both of which are located on the same floor.
(3) The dwelling unit has direct access to an interior stair serving only that unit and separated from all other portions of the building by fire barriers having a minimum 1-hour fire resistance rating with no opening therein.

25.2.4.3 Any building protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5 having four or fewer stories, and with not more than four dwelling units per story, shall be permitted to have a single exit under the following conditions:

(1) The stairway is separated from the rest of the building by barriers having not less than a 1-hour fire resistance rating with self-closing doors having not less than a 1-hour fire protection rating protecting all openings between the stairway enclosure and the building.
(2) The stairway does not serve more than one-half story below the level of exit discharge.
(3) All corridors serving as access to exits have not less than a 1-hour fire resistance rating.
(4) There is not more than 35 ft (10.7 m) of travel distance from the entrance door of any dwelling unit to an exit.
(5) One-half-hour fire-rated horizontal and vertical separation between dwelling units is provided.

25.2.5 Arrangement of Means of Egress.

25.2.5.1 Access to all required exits shall be in accordance with Section 11.5, as modified by 25.2.5.2 through 25.2.5.4.

25.2.5.2 The distance between exits addressed by 11.5.1.4 shall not apply to common nonlooped exit access corridors in buildings that have corridor doors from the dwelling units that are arranged such that the exits are located in opposite directions from such doors.

25.2.5.3 Common paths of travel shall comply with 25.2.5.3.1 or 25.2.5.3.2.

25.2.5.3.1 No common path of travel shall exceed 35 ft (10.7 m) in buildings not protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5.

25.2.5.3.2 No common path of travel shall exceed 50 ft (15 m) in buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5.

25.2.5.3.3 Travel within a dwelling unit shall not be included when determining the length of common path of travel.

25.2.5.4 Dead-end corridors shall be limited in accordance with either 25.2.5.4.1 or 25.2.5.4.2.

25.2.5.4.1 Dead-end corridors shall not exceed 35 ft (10.7 m) in buildings not protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5.

25.2.5.4.2 Dead-end corridors shall not exceed 50 ft (15 m) in buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5.

25.2.6 Travel Distance to Exits.

25.2.6.1 Travel distance within a dwelling unit (apartment) to a corridor door shall not exceed 75 ft (23 m) in buildings not protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5.

25.2.6.2 Travel distance within a dwelling unit (apartment) to a corridor door shall not exceed 125 ft (38 m) in buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5.

25.2.6.3 The travel distance from a dwelling unit (apartment) entrance door to the nearest exit shall be limited in accordance with 25.2.6.3.1, 25.2.6.3.2, or 25.2.6.3.3.

25.2.6.3.1 The travel distance from a dwelling unit (apartment) entrance door to the nearest exit shall not exceed 100 ft (30 m).

25.2.6.3.2 In buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5, the travel distance from a dwelling unit (apartment) entrance door to the nearest exit shall not exceed 200 ft (60 m).

25.2.6.3.3 The travel distance from a dwelling unit (apartment) entrance door to the nearest exit shall not exceed 200 ft (60 m) for exterior ways of exit access arranged in accordance with 11.5.3.

25.2.6.4 The travel distance from areas, other than those within living units, to the exit, measured in accordance with Section 11.6, shall not exceed 200 ft (60 m), or 250 ft (83 m) in buildings protected throughout by an approved, supervised, automatic sprinkler system installed in accordance with Section 55.3.

25.2.7 Discharge from Exits. Exit discharge shall comply with Section 11.7.

25.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

25.2.9 Emergency Lighting. Emergency lighting in accordance with Section 11.9 shall be provided in all buildings with more than 12 dwelling units or buildings of more than three stories in height, unless every dwelling unit has a direct exit to the outside of the building at grade level.

25.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10 in all buildings requiring more than one exit.

25.2.11 Special Means of Egress Features (Reserved).

25.3 Protection.

25.3.1 Protection of Vertical Openings.

25.3.1.1 Vertical openings shall comply with 25.3.1.1 through 25.3.1.3.

25.3.1.1.1 Vertical openings shall be enclosed or protected in accordance with Section 8.12.

25.3.1.1.2 Where the provisions of 8.12.2 are used, the requirements of 25.3.5.10 shall be met.

25.3.1.1.3 Vertical openings in accordance with 8.12.4.2 shall be permitted.

25.3.1.1.4 In buildings, other than high-rise, protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5, the fire resistance of walls enclosing vertical openings shall be not less than 1 hour, and the fire protection rating of doors shall be not less than 1 hour.

25.3.1.2 No floor below the level of exit discharge used only for storage, heating equipment, or purposes other than residential occupancy open to the public shall have unprotected openings to floors used for residential purposes.

25.3.1.3 No unenclosed vertical opening shall be permitted in any building or fire section with only one exit.

25.3.2 Protection from Hazards.

25.3.2.1 Hazardous areas shall be protected in accordance with Section 8.15.

25.3.2.2 The areas described in Table 25.3.2.2 shall be protected as indicated.

Table 25.3.2.2 Hazardous Area Protection

Hazardous Area Description	Separation/Protection
Boiler and fuel-fired heater rooms serving more than a single dwelling unit	1 hour and sprinklers
Employee locker rooms	1 hour or sprinklers
Gift or retail shops	1 hour or sprinklers
Bulk laundries	1 hour and sprinklers
Laundries not more than 100 ft^2 (9.3 m^2) outside of dwelling units	1 hour or sprinklers*
Laundries more than 100 ft^2 (9.3 m^2) outside of dwelling units	1 hour and sprinklers
Maintenance shops	1 hour and sprinklers
Storage rooms outside of dwelling units	1 hour or sprinklers
Trash rooms	1 hour and sprinklers

*Where sprinklers are provided, separation is not required.

25.3.2.3 Where sprinkler protection without fire-rated separation is used, areas shall be separated from other spaces by smoke partitions complying with Section 8.10.

25.3.3 Interior Finish.

25.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

25.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be permitted as follows:

(1) Exit enclosures—Class A
(2) Lobbies and corridors—Class A or Class B
(3) Other spaces—Class A, Class B, or Class C

25.3.3.3 Interior Floor Finish.

25.3.3.3.1 Interior floor finish shall comply with Section 10.6.

25.3.3.3.2 Interior floor finish in exit enclosures and in exit access corridors, and in spaces not separated from them by walls complying with 25.3.6, shall be not less than Class II.

25.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

25.3.4 Detection, Alarm, and Communication Systems.

25.3.4.1 General. Apartment buildings with more than three stories or with more than 11 dwelling units, other than those meeting 25.3.4.1.1 or 25.3.4.1.2, shall be provided with a fire alarm system in accordance with Section 55.2, as modified by 25.3.4.2 through 25.3.4.4.

25.3.4.1.1 A fire alarm system shall not be required where each dwelling unit is separated from other contiguous dwelling units by fire barriers *(see Section 8.4)* having a fire resistance rating of not less than 1 hour, and where each dwelling unit

has either its own independent exit or its own independent stairway or ramp discharging at grade.

25.3.4.1.2 A fire alarm system shall not be required in buildings of not more than four stories that are protected throughout by an approved, automatic sprinkler system installed in accordance with 25.3.5 and that do not contain more than 16 dwelling units.

25.3.4.1.3 A fire alarm system shall not be required in buildings protected by an approved, electrically supervised automatic sprinkler system installed in accordance with 25.3.5, provided that dwelling units meet one of the following criteria:

(1) They are provided with a means of egress door opening directly to an exterior exit access in accordance with 11.5.3.
(2) They are served by corridors that are open on each end and that connect to outside stairs.

25.3.4.2 Initiation.

25.3.4.2.1 Initiation of the required fire alarm system shall be by manual means in accordance with 55.2.2.

25.3.4.2.2 In buildings protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5, required fire alarm systems shall be initiated upon operation of the automatic sprinkler system.

25.3.4.3 Notification.

25.3.4.3.1 Occupant notification shall comply with the following requirements:

(1) Occupant notification shall be provided automatically in accordance with 55.2.3.
(2) Visible signals shall be installed in units designed for the hearing impaired.
(3) Positive alarm sequence in accordance with 55.2.3.4 shall be permitted.

25.3.4.3.2 Annunciation in accordance with 55.2.7 shall be provided, unless the building complies with 25.3.4.3.3.

25.3.4.3.3 Annunciation shall not be required in buildings not exceeding two stories in height and having not more than 50 dwelling units.

25.3.4.4 Detection (Reserved).

25.3.4.5 Smoke Alarms.

25.3.4.5.1* Smoke alarms shall be installed in accordance with 55.2.2.6 outside every sleeping area in the immediate vicinity of the bedrooms and on all levels of the dwelling unit, including basements.

25.3.4.5.2 In buildings other than those protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5, smoke alarms shall be installed in every sleeping room in accordance with 55.2.2.6.

25.3.5 Extinguishment Requirements.

25.3.5.1* Unless otherwise specified in Chapter 7, where modifications are permitted by this *Code,* based on the installation of an automatic sprinkler system, such modifications shall be permitted when the automatic sprinkler system complies with 55.3.1.1(1) or 55.3.1.1(2).

25.3.5.2 All buildings, other than those complying with 25.3.5.3, shall be protected throughout by an approved, supervised automatic sprinkler system installed in accordance with 25.3.5.4.

25.3.5.3 Sprinkler systems shall not be required in buildings where every dwelling unit is provided with one of the following:

(1) Exit door opening directly to the street or yard at ground level
(2) Direct access to an outside stair complying with 11.2.2 that serves a maximum of two units, both of which are located on the same floor
(3) Direct access to an interior stair serving only that unit and separated from all other portions of the building by fire barriers having a 1-hour fire resistance rating with no openings therein

25.3.5.4 Where an automatic sprinkler system is installed, either for total or partial building coverage, the following requirements shall apply:

(1) The system shall be installed in accordance with Section 55.3, as modified by 25.3.5.5 through 25.3.5.7.
(2) In buildings up to and including four stories in height above grade, systems in accordance with 55.3.1.1(2) shall be permitted.

25.3.5.5 In buildings sprinklered in accordance with 55.3.1.1(1), closets shall meet the following requirements:

(1) Closets of less than 12 ft^2 (1.1 m^2) in individual dwelling units shall not be required to be sprinklered.
(2) Closets that contain equipment such as washers, dryers, furnaces, or water heaters shall be sprinklered, regardless of size.

25.3.5.6 Where an automatic sprinkler system is required by this chapter, it shall be electrically supervised in accordance with 55.3.2.

25.3.5.7 The draft stop and closely spaced sprinkler requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems,* shall not be required for convenience openings complying with 8.12.4.2 where the convenience opening is within the dwelling unit.

25.3.5.8 Listed quick-response or listed residential sprinklers shall be used throughout all dwelling units.

25.3.5.9 Open parking structures complying with Section 30.8 that are contiguous with apartment buildings shall be exempt from the sprinkler requirements of 25.3.5.2.

25.3.5.10 Buildings with unprotected openings in accordance with 8.12.2 shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5.

25.3.5.11 Portable fire extinguishers in accordance with Section 55.6 shall be provided in hazardous areas addressed by 25.3.2, unless the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5.

25.3.5.12 Standpipes shall comply with the following:

(1) Class I standpipe systems shall be provided where required by 55.4.1.
(2) Roof outlets shall not be required on roofs having slopes of 3 in 12 or greater.

25.3.6 Corridors.

25.3.6.1 Exit access corridor walls shall consist of fire barriers in accordance with Section 8.4 that have not less than a 1-hour fire resistance rating, or, in buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5, corridor walls shall have not less than a ½-hour fire resistance rating.

25.3.6.2 Doors that open onto exit access corridors shall have a minimum 20-minute fire protection rating in accordance with 8.7.5.

25.3.6.3 Doors that open onto exit access corridors shall be self-closing and positive-latching.

25.3.6.4 Unprotected openings, other than those from spaces complying with 25.3.6.5, shall be prohibited in exit access corridor walls and doors.

25.3.6.5 Spaces, other than dwelling units, shall be permitted to be unlimited in area and open to the corridor, provided that the following criteria are met:

(1) The space is not a hazardous area.
(2) The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with 25.3.5.
(3) The space does not obstruct access to required exits.

25.3.6.6 Transoms, louvers, or transfer grilles shall be prohibited in walls or doors of exit access corridors.

25.3.7 Subdivision of Building Spaces. Buildings shall be subdivided in accordance with 25.3.7.1 or 25.3.7.2.

25.3.7.1 Where buildings do not meet 25.3.7.2, dwelling units shall be separated from each other by walls and floors constructed as fire barriers having fire resistance ratings of not less than 1 hour.

25.3.7.2 In buildings protected throughout by an approved, electrically supervised automatic sprinkler system in accordance with 25.3.5, dwelling units shall be separated from each other by walls and floors constructed as fire barriers having fire resistance ratings of not less than ½ hour.

25.3.8 Special Protection Features (Reserved).

25.3.9 Commercial Cooking Equipment. Commercial cooking equipment shall be protected in accordance with Section 55.10.

25.4 Special Provisions.

25.4.1 Limited-Access or Underground Buildings. Limited-access or underground buildings shall comply with Chapter 31.

25.4.2 High-Rise Buildings.

25.4.2.1 High-rise buildings shall comply with Chapter 33.

25.4.2.2 The sprinkler system modifications in 25.3.5.5 and 25.3.5.7 shall be permitted.

25.5 Building Services.

25.5.1 Utilities. Utilities shall comply with Chapter 49, Chapter 52, and Chapter 53.

25.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with Chapter 50 and Chapter 51.

25.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with Chapter 54.

25.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with Section 8.17.

Chapter 26 Residential Board and Care Occupancies

26.1 General Requirements.

26.1.1 Application.

26.1.1.1* The requirements of this chapter shall apply to new buildings, or portions thereof, used as a residential board and care occupancy.

26.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of a residential board and care occupancy, and changes of use including change of occupancy classification to a residential board and care occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

26.1.2 Multiple Occupancies.

26.1.2.1 All multiple occupancies shall be in accordance with Section 6.2 and 26.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

26.1.2.2 No board and care occupancy shall have its sole means of egress or means of escape pass through any nonresidential or non-health-care occupancy in the same building.

26.1.2.3 No board and care occupancy shall be located above a nonresidential or non-health-care occupancy, unless such board and care occupancy and exits therefrom are separated from the nonresidential or non-health-care occupancy by construction having a fire resistance rating of not less than 2 hours.

26.1.3 Acceptability of Means of Egress or Escape. No means of escape or means of egress shall be considered as complying with the minimum criteria for acceptance unless emergency evacuation drills are regularly conducted using such route.

26.1.4 Classification of Hazard of Contents.

26.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

26.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

26.1.5* Fire- and Smoke-Resistant Construction. Construction required by this chapter to have a fire resistance rating or provisions for limiting the migration of smoke shall be in accordance with Chapter 8.

26.2 Small Facilities.

26.2.1 General.

26.2.1.1 Scope.

26.2.1.1.1 Section 26.2 shall apply to residential board and care occupancies providing sleeping accommodations for not more than 16 residents.

26.2.1.1.2 Where there are sleeping accommodations for more than 16 residents, the occupancy shall be classified as a large facility in accordance with Section 26.3.

26.2.1.2 Minimum Construction Requirements. Building construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

26.2.1.3 Accessibility. Accessibility shall be in accordance with Chapter 12.

26.2.2 Means of Escape.

26.2.2.1 Primary Means of Escape.

26.2.2.1.1 Every sleeping room and living area shall have access to a primary means of escape located to provide a safe path of travel to the outside.

26.2.2.1.2 Where sleeping rooms or living areas are above or below the level of exit discharge, the primary means of escape shall be an interior stair in accordance with 26.2.2.3, an exterior stair, a horizontal exit, or a fire escape stair.

26.2.2.2 Secondary Means of Escape. Sleeping rooms and living areas in facilities without a sprinkler system installed in accordance with 26.2.3.5 shall have a second means of escape consisting of one of the following:

(1) Door, stairway, passage, or hall providing a way of unobstructed travel to the outside of the dwelling at street or ground level that is independent of, and remotely located from, the primary means of escape
(2) Passage through an adjacent, nonlockable space, independent of and remotely located from the primary means of escape, to any approved means of escape
(3)*Outside window or door that is operable from the inside, without the use of tools, keys, or special effort, and that provides a clear opening of not less than 5.7 ft^2 (0.53 m^2), with the width not less than 20 in. (510 mm), the height not less than 24 in. (610 mm), and the bottom of the opening not more than 44 in. (1120 mm) above the floor, where one of the following criteria also is met:
   (a) The window is within 240 in. (6100 mm) of grade.
   (b) The window is directly accessible to fire department rescue apparatus as approved by the authority having jurisdiction.
   (c) The window or door opens onto an exterior balcony.

Exception: If the sleeping room has a door leading directly to the outside of the building, with access to grade or to an exterior stairway meeting 26.2.2.5.2, that means of escape shall be considered as meeting all the escape requirements for the sleeping room.

26.2.2.3 Interior Stairs Used for Primary Means of Escape. Interior stairs shall be protected in accordance with 26.2.2.3.1 through 26.2.2.3.4, unless they meet 26.2.2.3.5, 26.2.2.3.6, or 26.2.2.3.7.

26.2.2.3.1 Interior stairs shall be enclosed with ½-hour fire barriers with all openings equipped with smoke-actuated, automatic-closing or self-closing doors having a fire protection rating comparable to that required for the enclosure.

26.2.2.3.2 Stairs shall comply with 11.2.2.5.3.

26.2.2.3.3 The entire primary means of escape shall be arranged so that occupants are not required to pass through a portion of a lower story, unless that route is separated from all spaces on that story by construction having a minimum ½-hour fire resistance rating.

26.2.2.3.4 In buildings of construction other than Type II(000), Type III(200), or Type V(000), the supporting construction shall be protected to afford the required fire resistance rating of the supported wall.

26.2.2.3.5 Stairs that connect a story at street level to only one other story shall be permitted to be open to the story that is not at street level.

26.2.2.3.6 In buildings not exceeding three stories in height that are protected by an approved automatic sprinkler system in accordance with 26.2.3.5, stair enclosures shall not be required, provided that a primary means of escape from each sleeping area is maintained that does not require occupants to pass through a portion of a lower floor, unless that route is separated from all spaces on that floor by construction having a ½-hour fire resistance rating.

26.2.2.3.7 Stairs serving a maximum of two stories in buildings protected by an approved automatic sprinkler system in accordance with 26.2.3.5 shall not be required to be enclosed.

26.2.2.4 Doors.

26.2.2.4.1 Doors, other than those meeting 26.2.2.4.2, and paths of travel to a means of escape shall be at least 32 in. (81 cm) wide.

26.2.2.4.2 Bathroom doors shall be at least 24 in. (61 cm) wide.

26.2.2.4.3 Doors shall be swinging or sliding.

26.2.2.4.4 Every closet door latch shall be readily openable from the inside.

26.2.2.4.5 Every bathroom door shall be designed to allow opening from the outside during an emergency when locked.

26.2.2.4.6 No door in any means of escape, other than those meeting 26.2.2.4.6.1 or 26.2.2.4.6.2, shall be locked against egress when the building is occupied.

26.2.2.4.6.1 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted, provided that not more than one such device is located in any escape path.

26.2.2.4.6.2 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

26.2.2.4.7 Forces to open doors shall comply with 11.2.1.4.4.

26.2.2.4.8 Door-latching devices shall comply with 11.2.1.5.4.

26.2.2.5 Stairs.

26.2.2.5.1 Stairs shall comply with 11.2.2.

26.2.2.5.2* Exterior stairs shall be protected against blockage caused by fire within the building.

26.2.3 Protection.

26.2.3.1 Protection of Vertical Openings.

26.2.3.1.1 Vertical openings, other than those meeting 26.2.3.1.4, shall be separated by smoke partitions in accordance with Section 8.10 that prevent the passage of smoke from one story to another story.

26.2.3.1.2 Smoke partitions described in 26.2.3.1.1 shall have a fire resistance rating of not less than ½ hour.

26.2.3.1.3 Any doors or openings to the vertical opening shall be capable of resisting fire for not less than 20 minutes.

26.2.3.1.4 Stairs shall be permitted to be open where complying with 26.2.2.3.6 or 26.2.2.3.7.

26.2.3.2 Hazardous Areas.

26.2.3.2.1* Any space where there is storage or activity having fuel conditions exceeding that of a one- or two-family dwelling and that possesses the potential for a fully involved fire shall be protected in accordance with 26.2.3.2.2 and 26.2.3.2.3.

26.2.3.2.2 Spaces described in 26.2.3.2.1 shall include, but shall not be limited to, areas for cartoned storage, food or household maintenance items in wholesale or institutional-type quantities and concentrations, or mass storage of residents' belongings.

26.2.3.2.3 When the hazardous area is on the same floor as, and is located within or abuts, a primary means of escape or a sleeping room, it shall be protected by one of the following means:

(1) Enclosure with a fire resistance rating of not less than 1 hour with a self-closing or automatic-closing fire door in accordance with 11.2.1.8 having a fire protection rating of at least ¾ hour and protected by an automatic fire detection system connected to the fire alarm system required by 26.2.3.4.1
(2) Automatic sprinkler system, in accordance with 26.2.3.5, and a smoke partition, in accordance with Section 8.10, located between the space and the sleeping area or primary escape route, provided that any doors in such separation are self-closing or automatic closing in accordance with 11.2.1.8

26.2.3.2.4 Other hazardous areas shall be protected by one of the following:

(1) Enclosure having a fire resistance rating of at least ½ hour, with a self-closing or automatic closing door in accordance with 11.2.1.8, equivalent to at least a 1¾-in. (44 mm) thick, solid-bonded wood core construction and protected by an automatic fire detection system connected to the fire alarm system required by 26.2.3.4.1
(2) Automatic sprinkler protection in accordance with 26.2.3.5, regardless of enclosure

26.2.3.3 Interior Finish.

26.2.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

26.2.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be Class A, Class B, or Class C.

26.2.3.3.3 Interior Floor Finish.

26.2.3.3.3.1 Interior floor finish shall comply with Section 10.6.

26.2.3.3.3.2 There is no requirement for Class I or Class II interior floor finish.

26.2.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

26.2.3.4 Detection, Alarm, and Communications Systems.

26.2.3.4.1 A manual fire alarm system shall be provided in accordance with Section 55.2.

26.2.3.4.2 Occupant notification shall be provided automatically, without delay, in accordance with 55.2.3.

26.2.3.4.3 Smoke alarms shall meet the following requirements:

(1) Approved smoke alarms shall be provided in accordance with 55.2.2.6 on all levels, including basements, but excluding crawl spaces and unfinished attics.
(2) Additional smoke alarms shall be installed in all living areas *(see 3.3.32.11, Living Area)*.
(3) Each sleeping room shall be provided with an approved smoke alarm in accordance with 55.2.2.6.

26.2.3.5 Extinguishment Requirements.

26.2.3.5.1* All facilities shall be protected throughout by an approved automatic sprinkler system installed in accordance with 26.2.3.5.2 using quick-response or residential sprinklers.

26.2.3.5.2 Where an automatic sprinkler system is installed, for either total or partial building coverage, the following requirements shall be met:

(1) The system shall be in accordance with 55.3.1.1(1) and shall initiate the fire alarm system in accordance with 26.2.3.4.1.
(2) The adequacy of the water supply shall be documented to the authority having jurisdiction.

26.2.3.5.2.1 An automatic sprinkler system in accordance with 55.3.1.1(2) shall be permitted in facilities up to and including four stories in height. All habitable areas and closets shall be sprinklered.

26.2.3.5.2.2* An automatic sprinkler system complying with 55.3.1.1(3), with a 30-minute water supply, shall be permitted. All habitable areas and closets shall be sprinklered. Facilities with more than eight residents shall be treated as two-family dwellings with regard to water supply.

26.2.3.5.3 Automatic sprinkler systems installed in accordance with 55.3.1.1(1) and 55.3.1.1(2) shall be provided with electrical supervision in accordance with 55.3.2.

26.2.3.5.4 Automatic sprinkler systems installed in accordance with 55.3.1.1(3) shall be provided with valve supervision by one of the following methods:

(1) Single, listed control valve that shuts off both domestic and sprinkler systems, and separate shutoff for the domestic system only
(2) Electrical supervision in accordance with 55.3.2
(3) Valve closure that causes the sounding of an audible signal in the facility

26.2.3.5.5 Sprinkler piping serving not more than six sprinklers for any isolated hazardous area shall be permitted to be installed in accordance with 55.3.1.2 and shall meet the following requirements:

(1) In new installations, where more than two sprinklers are installed in a single area, waterflow detection shall be provided to initiate the fire alarm system required by 26.2.3.4.1.
(2) The duration of water supplies shall be as required by 26.2.3.5.2.

26.2.3.6 Construction of Corridor Walls.

26.2.3.6.1 Corridor walls, other than those meeting 26.2.3.6.2, shall meet the following criteria:

(1) The separation walls of sleeping rooms shall be capable of resisting fire for at least ½ hour, which is considered to be achieved if the partitioning is finished on both sides with lath and plaster or material providing a 15-minute thermal barrier.
(2) Sleeping room doors shall be substantial doors, such as those of 1¾-in. (44-mm) thick, solid-bonded wood core construction or other construction of equal or greater stability and fire integrity.
(3) Any vision panels shall be fixed fire window assemblies in accordance with 8.7.5 or shall be wired glass not exceeding 1296 in.^{2}(0.84 m^2) each installed in approved frames.

26.2.3.6.2 The requirements of 26.2.3.6.1 shall not apply to corridor walls that are smoke partitions in accordance with Section 8.10 where the facility is protected in accordance with 26.2.3.5. In such instances, there shall be no limitation on the type or size of glass panels. Door closing shall comply with 26.2.3.6.5.

26.2.3.6.3 There shall be no louvers, operable transoms, or other air passages penetrating the wall other than properly installed heating and utility installations, as modified by 26.2.3.6.4.

26.2.3.6.4 Transfer grilles shall not be permitted in corridor walls.

26.2.3.6.5 Doors shall meet the following requirements:

(1) Doors shall be provided with latches or other mechanisms to keep the doors closed.
(2) No doors shall be arranged to prevent the occupant from closing the door.
(3) Doors shall be self-closing or automatic closing in accordance with 11.2.1.8 in buildings other than those protected throughout by an approved automatic sprinkler system in accordance with 26.2.3.5.

26.2.4 (Reserved)

26.2.5 Building Services.

26.2.5.1 Utilities. Utilities shall comply with Chapter 49, Chapter 52, and Chapter 53.

26.2.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with Chapter 50 and Chapter 51, unless otherwise required in this chapter.

26.2.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with Chapter 54.

26.3 Large Facilities.

26.3.1 General.

26.3.1.1 Scope.

26.3.1.1.1 Section 26.3 shall apply to residential board and care occupancies providing sleeping accommodations for more than 16 residents.

26.3.1.1.2 Facilities having sleeping accommodations for not more than 16 residents shall comply with Section 26.2.

26.3.1.2 Minimum Construction Requirements. Building construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

26.3.1.3 Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

26.3.1.4 Accessibility. Accessibility shall be in accordance with Chapter 12.

26.3.2 Means of Egress. Means of egress shall be in accordance with Chapter 11.

26.3.2.1 Means of Egress Components.

26.3.2.1.1 Means of Egress Components. Components of means of egress shall be limited to the types described in 26.3.2.1.2 through 26.3.2.1.10.

26.3.2.1.2 Doors. Doors in means of egress shall be as follows:

(1) Doors complying with 11.2.1 shall be permitted.
(2) Doors within individual rooms and suites of rooms shall be permitted to be swinging or sliding.
(3) No door, other than a door meeting 26.3.2.1.2(4) or 26.3.2.1.2(5), shall be equipped with a lock or latch that requires the use of a tool or key from the egress side.
(4) Delayed-egress locks in accordance with 11.2.1.6.1 shall be permitted, provided that not more than one device is located in any egress path.
(5) Access-controlled egress doors in accordance with 11.2.1.6.2 shall be permitted.
(6) Revolving doors complying with 11.2.1.10 shall be permitted.
(7) Every bathroom door shall be designed to allow opening from the outside during an emergency when locked.

26.3.2.1.3 Stairs. Stairs complying with 11.2.2 shall be permitted.

26.3.2.1.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

26.3.2.1.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

26.3.2.1.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

26.3.2.1.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

26.3.2.1.8 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

26.3.2.1.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

26.3.2.1.10 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

26.3.2.2 Capacity of Means of Egress.

26.3.2.2.1 The capacity of means of egress shall be in accordance with Section 11.3.

26.3.2.2.2 Street floor exits shall be sized to accommodate the occupant load of the street floor plus the required capacity of stairs and ramps discharging onto the street floor.

26.3.2.2.3 The width of corridors shall be sized to accommodate the occupant load served but shall not be less than 60 in. (1525 mm).

26.3.2.3 Number of Exits. The minimum number of exits as required by Section 11.4 shall be provided on every story.

26.3.2.4 Arrangement of Means of Egress.

26.3.2.4.1 Access to all required exits shall be in accordance with Section 11.5.

26.3.2.4.2 No common path of travel shall exceed 125 ft (38.1 m).

26.3.2.4.3 No dead-end corridor shall exceed 30 ft (15 m).

26.3.2.4.4 Any room or any suite of rooms exceeding 2000 ft^2 (185 m^2) shall be provided with not less than two exit access doors located remotely from each other.

26.3.2.5 Travel Distance to Exits. Travel distance from any point in a room to the nearest exit, measured in accordance with Section 11.6, shall not exceed 250 ft (76 m).

26.3.2.6 Discharge from Exits. Exit discharge shall comply with Section 11.7.

26.3.2.7 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

26.3.2.8 Emergency Lighting. Emergency lighting in accordance with Section 11.9 shall be provided, unless each sleeping room has a direct exit to the outside at ground level.

26.3.2.9 Marking of Means of Egress. Means of egress shall be marked in accordance with Section 11.10.

26.3.2.10 Special Means of Egress Features (Reserved).

26.3.3 Protection.

26.3.3.1 Protection of Vertical Openings.

26.3.3.1.1 Vertical openings shall be enclosed or protected in accordance with Section 8.12.

26.3.3.1.2 Unenclosed vertical openings in accordance with 8.12.4.2 shall be permitted.

26.3.3.1.3 No floor below the level of exit discharge used only for storage, heating equipment, or purposes other than residential occupancy shall have unprotected openings to floors used for residential occupancy.

26.3.3.2 Protection from Hazards.

26.3.3.2.1 Hazardous areas shall be protected in accordance with Section 8.15.

26.3.3.2.2 The areas described in Table 26.3.3.2.2 shall be protected as indicated.

Table 26.3.3.2.2 Hazardous Area Protection

Hazardous Area Description	Separation/Protection
Boiler and fuel-fired heater rooms	1 hour
Central/bulk laundries larger than 100 ft^2 (9.3 m^2)	1 hour
Paint shops employing hazardous substances and materials in quantities less than those that would be classified as a severe hazard	1 hour
Physical plant maintenance shops	1 hour
Soiled linen rooms	1 hour
Storage rooms larger than 50 ft^2 (4.6 m^2), but not exceeding 100 ft^2 (9.3 m^2), storing combustible material	Smoke partition
Storage rooms larger than 100 ft^2 (9.3 m^2) storing combustible material	1 hour
Trash collection rooms	1 hour

26.3.3.3* Interior Finish.

26.3.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

26.3.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be in accordance with the following:

(1) Exit enclosures—Class A
(2) Lobbies and corridors—Class A or Class B
(3) Rooms and enclosed spaces—Class A or Class B

26.3.3.3.3 Interior Floor Finish.

26.3.3.3.3.1 Interior floor finish shall comply with Section 10.6.

26.3.3.3.3.2 Interior floor finish in exit enclosures and in exit access corridors, and in spaces not separated from them by walls complying with 26.3.3.6.2, shall be not less than Class II.

26.3.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

26.3.3.4 Detection, Alarm, and Communications Systems.

26.3.3.4.1 General. A fire alarm system shall be provided in accordance with Section 55.2.

26.3.3.4.2 Initiation. The required fire alarm system shall be initiated by each of the following:

(1) Manual means in accordance with 55.2.2
(2) Manual fire alarm box located at a convenient central control point under continuous supervision of responsible employees
(3) Automatic sprinkler system
(4) Any required detection system

26.3.3.4.3 Annunciator Panel. An annunciator panel connected to the fire alarm system shall be provided in a location approved by the authority having jurisdiction.

26.3.3.4.4 Occupant Notification. Occupant notification shall be provided automatically, without delay, in accordance with 55.2.3.

26.3.3.4.5 High-Rise Buildings. High-rise buildings shall be provided with an approved means of voice communication in accordance with 33.2.1 or a public address system.

26.3.3.4.6 Emergency Forces Notification. Emergency forces notification shall meet the following requirements:

(1) Fire department notification shall be accomplished in accordance with 55.2.4.
(2) Smoke detection devices or smoke detection systems equipped with reconfirmation features shall not be required to automatically notify the fire department, unless the alarm condition is reconfirmed after a period not exceeding 120 seconds.

26.3.3.4.7 Smoke Alarms. Approved smoke alarms shall be installed in accordance with 55.2.2.6 inside every sleeping room, outside every sleeping area in the immediate vicinity of the bedrooms, and on all levels within a resident unit.

26.3.3.4.8 Smoke Detection Systems.

26.3.3.4.8.1 Corridors and spaces open to corridors, other than those meeting 26.3.3.4.8.2, shall be provided with smoke detectors in accordance with *NFPA 72, National Fire Alarm Code,* that are arranged to initiate an alarm that is audible in all sleeping areas.

26.3.3.4.8.2 Smoke detection systems shall not be required in unenclosed corridors, passageways, balconies, colonnades, or other arrangements in which one or more sides along the long dimension are fully or extensively open to the exterior at all times.

26.3.3.5 Extinguishment Requirements.

26.3.3.5.1* General. All buildings shall be protected throughout by an approved automatic sprinkler system installed in accordance with 55.3.1.1(1), and quick-response or residential sprinklers shall be provided throughout.

26.3.3.5.2 (Reserved)

26.3.3.5.3 Supervision. Automatic sprinkler systems shall be provided with electrical supervision in accordance with 55.3.2.

26.3.3.5.4 (Reserved)

26.3.3.5.5 Portable Fire Extinguishers. Portable fire extinguishers shall be provided in accordance with Section 55.6.

26.3.3.6* Corridors and Separation of Sleeping Rooms.

26.3.3.6.1 Access shall be provided from every resident use area to at least one means of egress that is separated from all sleeping rooms by walls complying with 26.3.3.6.3 through 26.3.3.6.6.

26.3.3.6.2 Sleeping rooms shall be separated from corridors, living areas, and kitchens by walls complying with 26.3.3.6.3 through 26.3.3.6.6.

26.3.3.6.3 Walls required by 26.3.3.6.1 or 26.3.3.6.2 shall be smoke partitions in accordance with Section 8.10.

26.3.3.6.4 Doors protecting corridor openings shall be constructed to resist the passage of smoke.

26.3.3.6.5 Door-closing devices shall not be required on doors in corridor wall openings other than those serving required exits, smoke barriers, or enclosures of vertical openings or hazardous areas.

26.3.3.6.6 No louvers, transfer grilles, operable transoms, or other air passages shall penetrate the walls or doors specified in 26.3.3.6, except properly installed heating and utility installations.

26.3.3.7 Subdivision of Building Spaces. Buildings shall be subdivided by smoke barriers in accordance with 26.3.3.7.1 through 26.3.3.7.21.

26.3.3.7.1 Every story shall be divided into not less than two smoke compartments, unless it meets 26.3.3.7.2, 26.3.3.7.3, 26.3.3.7.4, or 26.3.3.7.5.

26.3.3.7.2 Smoke barriers shall not be required on stories that do not contain a residential board and care occupancy where such stories are located totally above the residential board and care occupancy.

26.3.3.7.3 Smoke barriers shall not be required in areas that do not contain a residential board and care occupancy and that are separated from the residential board and care occupancy by a fire barrier complying with Section 8.4.

26.3.3.7.4 Smoke barriers shall not be required on stories that do not contain residential board and care occupancies and that are more than one story below the residential board and care occupancy.

26.3.3.7.5 Smoke barriers shall not be required in open-air parking structures protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3.

26.3.3.7.6 Each smoke compartment shall have an area of not more than 22,500 ft^2 (2100 m^2).

26.3.3.7.7 The travel distance from any point to reach a door in the required smoke barrier shall be limited to 200 ft (60 m).

26.3.3.7.8 Smoke barriers shall be constructed in accordance with Section 8.11 and shall have a fire resistance rating of not less than 1 hour, unless they meet 26.3.3.7.9 or 26.3.3.7.10.

26.3.3.7.9 In buildings containing atria, smoke barriers shall be permitted to terminate at an atrium wall constructed in accordance with 8.12.3(1)(b), provided that not less than two separate smoke compartments are provided on each floor.

26.3.3.7.10* Dampers shall not be required in duct penetrations of smoke barriers in fully ducted heating, ventilating, and air-conditioning systems.

26.3.3.7.11 Not less than 15 net ft^2 (1.4 net m^2) per resident shall be provided within the aggregate area of corridors, lounges or dining areas, and other common areas on each side of the smoke barrier.

26.3.3.7.12 On stories that do not house residents, not less than 6 net ft^2 (0.56 net m^2) per occupant shall be provided on each side of the smoke barrier for the total number of occupants in adjoining compartments.

26.3.3.7.13 Doors in smoke barriers shall be substantial doors, such as 1¾-in. (44-mm) thick, solid-bonded wood core doors, or shall be of construction that resists fire for not less than 20 minutes.

26.3.3.7.14 Nonrated factory- or field-applied protective plates extending not more than 48 in. (1220 mm) above the bottom of the doors specified in 26.3.3.7.13 shall be permitted.

26.3.3.7.15* Cross-corridor openings in smoke barriers shall be protected by a pair of swinging doors or a horizontal-sliding door complying with 11.2.1.14.

26.3.3.7.16 Swinging doors shall be arranged so that each door swings in a direction opposite from the other.

26.3.3.7.17* Doors in smoke barriers shall comply with 8.11.4 and shall be self-closing or automatic closing in accordance with 11.2.1.8.

26.3.3.7.18* Vision panels consisting of fire-rated glazing or wire glass panels in approved frames shall be provided in each cross-corridor swinging door and at each cross-corridor horizontal-sliding door in a smoke barrier.

26.3.3.7.19 Rabbets, bevels, or astragals shall be required at the meeting edges, and stops shall be required at the head and sides of door frames in smoke barriers.

26.3.3.7.20 Positive-latching hardware shall not be required on smoke barrier doors.

26.3.3.7.21 Center mullions shall be prohibited on smoke barrier doors.

26.3.3.8* Cooking Facilities. Cooking facilities, other than those within individual residential units, shall be protected in accordance with Section 55.10.

26.3.3.9 Standpipes.

26.3.3.9.1 Class I standpipe systems shall be provided where required by 55.4.1.

26.3.3.9.2 Roof outlets shall not be required on roofs having a slope of 3 in 12 or greater.

26.3.4 Special Provisions.

26.3.4.1 Limited-Access or Underground Buildings. Limited-access or underground buildings shall comply with Chapter 31.

26.3.5 (Reserved)

26.3.6 Building Services.

26.3.6.1 Utilities. Utilities shall comply with Chapter 49, Chapter 52, and Chapter 53.

26.3.6.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with Chapter 50 and Chapter 51.

26.3.6.3 Elevators, Dumbwaiters, and Vertical Conveyors.

26.3.6.3.1 Elevators, dumbwaiters, and vertical conveyors shall comply with Chapter 54.

26.3.6.3.2* In high-rise buildings, one elevator shall be provided with a protected power supply and shall be available for use by the fire department in case of emergency.

26.3.6.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with Section 8.17.

Chapter 27 Mercantile Occupancies

27.1 General Requirements.

27.1.1 Application.

27.1.1.1 The requirements of this chapter shall apply to new buildings, or portions thereof, used as a mercantile occupancy.

27.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of a mercantile occupancy, and changes of use including change of occupancy classification to a mercantile occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

27.1.1.3 This chapter shall establish requirements for all buildings, or portions thereof, used as mercantile occupancies. Suboccupancy groups such as Class A, Class B, and Class C mercantile occupancies; malls; and bulk merchandising retail buildings shall comply with the requirements of the paragraphs pertaining thereto.

27.1.1.4 When a mercantile occupancy changes from Class C to Class A or Class B, or from Class B to Class A, the provisions of this chapter shall apply.

27.1.2 Multiple Occupancies.

27.1.2.1 General. All multiple occupancies shall be in accordance with Section 6.2 and 27.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

27.1.2.2 Combined Mercantile Occupancies and Parking Structures.

27.1.2.2.1 The wall separating a parking structure from a building classified as a mercantile occupancy shall be a fire barrier having a fire resistance rating of not less than 2 hours.

27.1.2.2.2 Openings in the fire barrier shall not be required to be protected with fire protection–rated opening protectives in enclosed parking structures that are protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, or in open parking structures, provided that all of the following conditions are met:

(1) The openings do not exceed 25 percent of the area of the fire barrier in which they are located.
(2) The openings are used as a public entrance and for associated sidelight functions.
(3) The buildings containing the mercantile occupancy are protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.
(4)*Means are provided to prevent spilled fuel from accumulating adjacent to the openings and entering the building.
(5) Physical means are provided to prevent vehicles from being parked or driven within 10 ft (3 m) of the openings.
(6) The openings are protected as required for a smoke partition in accordance with Section 8.10, with no minimum fire protection rating required.

27.1.3 Classification of Occupancy.

27.1.3.1 General. Mercantile occupancies shall include all buildings and structures, or parts thereof with mercantile occupancy, as defined in 6.1.10.

27.1.3.2 Subclassification of Occupancy.

27.1.3.2.1 Mercantile occupancies shall be subclassified as follows:

(1) Class A — All mercantile occupancies having an aggregate gross area of more than 30,000 ft^2 (2800 m^2) or occupying more than three stories for sales purposes
(2) Class B — All mercantile occupancies of more than 3000 ft^2(280 m^2), but not more than 30,000 ft^2 (2800 m^2), aggregate gross area occupying not more than three stories for sales purposes
(3) Class C — All mercantile occupancies of not more than 3000 ft^2 (280 m^2) gross area used for sales purposes occupying one story only

27.1.3.2.2 For the purpose of the classification required in 27.1.3.2.1, the aggregate gross area shall be the total gross area of all floors used for mercantile purposes. Where a mercantile occupancy is divided into sections, regardless of fire separation, the aggregate gross area shall include the area of all sections used for sales purposes. Areas of floors not used for sales purposes, such as an area used only for storage and not open to the public, shall not be counted for the purposes of the classifications in 27.1.3.2.1(1) through 27.1.3.2.1(3). However, means of egress shall be provided for such nonsales areas in accordance with their occupancy, as specified by other chapters of this *Code*.

27.1.3.2.3 Mezzanines shall comply with 8.13.

27.1.3.2.4 Where a number of tenant spaces under different management are located in the same building, the aggregate gross area for subclassification shall be determined in accordance with any of the following:

(1) Where tenant spaces are not separated, the aggregate gross floor area of all such tenant spaces shall be used in determining classification per 27.1.3.2.1.
(2) Where individual tenant spaces are separated by fire barriers with a 2-hour fire resistance rating, each tenant space shall be individually classified.
(3) Where tenant spaces are separated by fire barriers with a 1-hour fire resistance rating and the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, each tenant space shall be individually classified.
(4) The tenant spaces in a mall building in accordance with 27.4.4 shall be classified individually.

27.1.4 Classification of Hazard of Contents.

27.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

27.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

27.1.5 Minimum Construction Requirements. Construction types and heights and area requirements shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

27.1.6 Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

27.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

27.2 Means of Egress Requirements.

27.2.1 General.

27.2.1.1 All means of egress shall be in accordance with Chapter 11 and this chapter.

27.2.1.2 No inside open stairway or inside open ramp shall be permitted to serve as a component of the required means of egress system for more than one floor.

27.2.1.3 Where there are two or more floors below the street floor, the same stair or other exit shall be permitted to serve all floors, but all required exits from such areas shall be independent of any open stairways between the street floor and the floor below.

27.2.1.4 Special considerations for high hazard contents shall be in accordance with 6.3.2.

27.2.2 Means of Egress Components.

27.2.2.1 General. Components of means of egress shall be limited to the types described in 27.2.2.2 through 27.2.2.12.

27.2.2.2 Doors.

27.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

27.2.2.2.2* Locks complying with Exception No. 2 to 11.2.1.5.1 shall be permitted only on principal entrance/exit doors.

27.2.2.2.3 (Reserved)

27.2.2.2.4 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted.

27.2.2.2.5 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted in buildings protected throughout by an approved, supervised fire detection system in accordance with Section 55.2 or an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.

27.2.2.2.6 Where horizontal or vertical security grilles or doors are used as a part of the required means of egress from a tenant space, such grilles or doors shall comply with Exception No. 2 to 11.2.1.4.1.

27.2.2.2.7 All doors at the foot of stairs from upper floors or at the head of stairs leading to floors below the street floor shall swing in the direction of egress travel.

27.2.2.2.8 Revolving doors complying with 11.2.1.10 shall be permitted.

27.2.2.3 Stairs.

27.2.2.3.1 Stairs complying with 11.2.2 shall be permitted.

27.2.2.3.2 Spiral stairs complying with 11.2.2.2.3 shall be permitted.

27.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

27.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

27.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

27.2.2.7 Exit Passageways.

27.2.2.7.1 Exit passageways complying with 11.2.6 shall be permitted.

27.2.2.7.2* An exit passageway in a mall building shall be permitted to accommodate the following independently:

(1) Portion of the occupant load assigned to the exit passageway from only the mall
(2) Largest occupant load assigned to the exit passageway from a single tenant space

27.2.2.8 (Reserved)

27.2.2.9 (Reserved)

27.2.2.10 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

27.2.2.11 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

27.2.2.12 Areas of Refuge.

27.2.2.12.1 Areas of refuge complying with 11.2.12 shall be permitted.

27.2.2.12.2 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, two rooms or spaces separated from each other by smoke-resistant partitions in accordance with the definition of area of refuge shall not be required. *(See 3.3.33, Area of Refuge.)*

27.2.3 Capacity of Means of Egress.

27.2.3.1 The capacity of means of egress shall be in accordance with Section 11.3.

27.2.3.2 In Class A and Class B mercantile occupancies, street floor exits shall be sufficient for the occupant load of the street floor plus the required capacity of stairs and ramps discharging through the street floor.

27.2.4 Number of Exits. The number of exits shall comply with the following:

(1) The number of exits shall be in accordance with Section 11.4, and not less than two separate exits accessible from every part of every story shall be provided. Exit access travel shall be permitted to be common for the distances permitted as common paths of travel by 27.2.5.3.
(2) A single means of egress shall be permitted in a Class C mercantile occupancy, provided that the travel distance to the exit or to a mall does not exceed 75 ft (23 m).
(3) A single means of egress shall be permitted in a Class C mercantile occupancy, provided that the travel distance to the exit or to a mall does not exceed 100 ft (30 m), and the story on which the occupancy is located and all communicating levels that are traversed to reach the exit or mall are protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.
(4) A single means of egress to an exit or to a mall shall be permitted from a mezzanine within any Class A, Class B, or Class C mercantile occupancy, provided that the common path of travel does not exceed 75 ft (23 m), or does not exceed 100 ft (30 m) if protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.

27.2.5 Arrangement of Means of Egress.

27.2.5.1 General. Means of egress shall be arranged in accordance with Section 11.5.

27.2.5.2 Dead Ends.

27.2.5.2.1 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, dead-end corridors shall not exceed 50 ft (15 m).

27.2.5.2.2 In all other buildings, dead-end corridors shall not exceed 20 ft (6.1 m).

27.2.5.3 Common Paths of Travel. Common paths of travel shall be limited as follows:

(1) They shall not exceed 75 ft (23 m) in mercantile occupancies.
(2) They shall not exceed 100 ft (30 m) in mercantile occupancies where the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.

27.2.5.4 Aisles.

27.2.5.4.1 Aisles leading to each exit shall be required. The aggregate width of such aisles shall be not less than the required width of the exit.

27.2.5.4.2 Required aisles shall be not less than 36 in. (915 mm) in clear width.

27.2.5.4.3 In Class A mercantile occupancies, not less than one aisle of a minimum 5-ft (1525-mm) width shall lead directly to an exit.

27.2.5.5 Egress Width. In other than bulk merchandising retail buildings, if the only means of customer entrance is through one exterior wall of the building, two-thirds of the required egress width shall be located in such wall.

27.2.5.6 Checkout Stands. Not less than one-half of the required exits shall be located so as to be reached without passing through checkout stands. In no case shall checkout stands or associated railings or barriers obstruct exits or required aisles, or approaches thereto.

27.2.5.7* Carts and Buggies. Where wheeled carts or buggies are used by customers, adequate provision shall be made for the transit and parking of such carts to minimize the possibility that they might obstruct means of egress.

27.2.5.8 Exit Access through Storerooms. Exit access in Class A and Class B mercantile occupancies that are protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, and exit access in all Class C mercantile occupancies, shall be permitted to pass through storerooms, provided that the following conditions are met:

(1) Not more than 50 percent of exit access shall be provided through the storeroom.

(2) The storeroom shall not be subject to locking.
(3) The main aisle through the storeroom shall be not less than 44 in. (1120 mm) wide.
(4) The path of travel through the storeroom, defined with fixed barriers, shall be direct and continuously maintained in an unobstructed condition.

27.2.6 Travel Distance to Exits. Travel distance shall be as specified in 27.2.6.1 or 27.2.6.2 and shall be measured in accordance with Section 11.6.

27.2.6.1 Travel distance in mercantile occupancies shall not exceed 150 ft (45 m).

27.2.6.2 Travel distance in mercantile occupancies in buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2 shall not exceed 250 ft (75 m).

27.2.7 Discharge from Exits.

27.2.7.1 Exit discharge shall comply with Section 11.7 and 27.2.7.2.

27.2.7.2* Fifty percent of the exits shall be permitted to discharge through the level of exit discharge in accordance with 11.7.2, provided that the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2 and the distance of travel from the termination of the exit enclosure to an outside street door does not exceed 50 ft (15 m).

27.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

27.2.9 Emergency Lighting. Class A and Class B mercantile occupancies and malls shall have emergency lighting facilities in accordance with Section 11.9.

27.2.10 Marking of Means of Egress. Where an exit is not immediately apparent from all portions of the sales area, means of egress shall have signs in accordance with Section 11.10.

27.2.11 Special Means of Egress Features (Reserved).

27.3 Protection.

27.3.1 Protection of Vertical Openings. Any vertical opening shall be enclosed or protected in accordance with Section 8.12, except under the following conditions:

(1) In Class A or Class B mercantile occupancies protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, unprotected vertical openings shall be permitted at one of the following locations:
   (a) Between any two floors
   (b) Among the street floor, the first adjacent floor below, and adjacent floor (or mezzanine) above
(2) In Class C mercantile occupancies, unprotected openings shall be permitted between the street floor and the mezzanine.
(3) The draft stop and closely spaced sprinkler requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*, shall not be required for unenclosed vertical openings permitted in 27.3.1(1) and 27.3.1(2).

27.3.2 Hazardous Area Protection.

27.3.2.1* Storage Areas.

27.3.2.1.1* Hazardous areas shall be protected in accordance with Section 8.15.

27.3.2.1.2 In general storage and stock areas protected by an automatic extinguishing system in accordance with Section 55.3 and 55.3.2, an enclosure, if provided, shall be exempt from the provisions of 8.15.1.2.

27.3.2.2* Commercial Cooking Facilities. Commercial cooking facilities shall be protected in accordance with Section 55.10.

27.3.3 Interior Finish.

27.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

27.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be Class A or Class B.

27.3.3.3 Interior Floor Finish.

27.3.3.3.1 Interior floor finish shall comply with Section 10.6.

27.3.3.3.2 Interior floor finish in exit enclosures shall be not less than Class II.

27.3.4 Detection, Alarm, and Communications Systems.

27.3.4.1 General. Class A mercantile occupancies shall be provided with a fire alarm system in accordance with Section 55.2.

27.3.4.2 Initiation. Initiation of the required fire alarm system shall be by any one of the following:

(1) Manual means in accordance with 55.2.2(1)
(2) An approved automatic fire detection system in accordance with 55.2.2(2) throughout the building and in accordance with 55.2.2.1.5
(3) An approved, supervised automatic sprinkler system complying with Section 55.3 and 55.3.2 and in accordance with 55.2.2(3) throughout the building and in accordance with 55.2.2.1.5

27.3.4.3 Notification.

27.3.4.3.1 Occupant Notification. During all times that the mercantile occupancy is occupied, the required fire alarm system, once initiated, shall perform one of the following functions:

(1) It shall activate an alarm in accordance with 55.2.3 throughout the mercantile occupancy, except a positive alarm sequence in accordance with 55.2.3.4 shall be permitted.
(2) It shall activate an alarm signal in a continuously attended location for the purpose of initiating emergency action by personnel trained to respond to emergencies, and such emergency action shall be initiated by means of live voice public address system announcements originating from the attended location where the alarm signal is received. The live voice public address system shall be permitted to be used for other announcements, provided that the emergency use takes precedence over any other use.
(3) In lieu of live voice public address system announcements, any other occupant notification means in accordance with 55.2.3 shall be permitted.

27.3.4.3.2 Emergency Forces Notification. Emergency forces notification shall be provided and shall include notifying the following:

(1) Fire department in accordance with 55.2.4
(2) Approved local emergency organization, if provided

27.3.5 Extinguishment Requirements.

27.3.5.1 Mercantile occupancies shall be protected by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2 as follows:

(1) Throughout all mercantile occupancies three or more stories in height
(2) Throughout all mercantile occupancies exceeding 12,000 ft ^{2}(1115 m^2) in gross area
(3) Throughout stories below the level of exit discharge where such stories have an area exceeding 2500 ft^2 (230 m^2) and are used for the sale, storage, or handling of combustible goods and merchandise
(4) Throughout mixed occupancies in accordance with 6.2.2 where the conditions of 27.3.5.1(1), 27.3.5.1(2), or 27.3.5.1(3) apply to the mercantile occupancy

27.3.5.2 Automatic sprinkler systems in Class A mercantile occupancies shall be supervised in accordance with 55.3.2.

27.3.5.3 Portable fire extinguishers shall be provided in all mercantile occupancies in accordance with Section 55.6.

27.3.5.4 Class 1 standpipe systems shall be provided when required by 55.4.1.

27.3.6 Corridors.

27.3.6.1* Where access to exits is provided by corridors, such corridors shall be separated from use areas by walls having a fire resistance rating of not less than 1 hour in accordance with Section 8.4 unless one of the following conditions exists:

(1) Where exits are available from an open floor area
(2) Within a space occupied by a single tenant
(3) Within buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2

27.3.6.2 Openings in corridor walls required by 27.3.6.1 to have a fire resistance rating shall be protected in accordance with Table 8.7.2.

27.3.7 Subdivision of Building Spaces. (No special requirements.)

27.4 Special Provisions.

27.4.1 Underground or Limited-Access Buildings. Underground or limited-access buildings shall be in accordance with Section 31.2 and Section 31.3.

27.4.2 High-Rise Buildings. High-rise buildings shall comply with the automatic sprinkler requirements of 33.2.2.

27.4.3 Open-Air Mercantile Operations.

27.4.3.1 Open-air mercantile operations, such as open-air markets, gasoline filling stations, roadside stands for the sale of farm produce, and other outdoor mercantile operations, shall be arranged and conducted to maintain free and unobstructed ways of travel at all times. Such ways of travel shall allow prompt escape from any point of danger in case of fire or other emergency, with no dead ends in which persons might be trapped due to display stands, adjoining buildings, fences, vehicles, or other obstructions.

27.4.3.2 If mercantile operations are conducted in roofed-over areas, they shall be treated as mercantile buildings, provided that canopies over individual small stands to protect merchandise from the weather are not construed as constituting buildings for the purpose of this *Code*.

27.4.4 Mall Buildings.

27.4.4.1 Scope. Subsection 27.4.4 shall establish the minimum requirements for mall buildings having not more than three stories and anchor building.

27.4.4.2 Definitions.

27.4.4.2.1* Anchor Building. A building housing assembly, business, and mercantile occupancies other than bulk merchandise retail having low or ordinary hazard contents and having direct access to a mall building, but having all required means of egress independent of the mall.

27.4.4.2.2* Mall Building. A single building enclosing a number of tenants and occupants wherein two or more tenants have a main entrance into one or more malls. For the purpose of this chapter, anchor buildings shall not be considered as a part of the mall building.

27.4.4.2.3 Food Court. A public seating area located in a mall that serves adjacent food preparation tenant spaces.

27.4.4.2.4 Gross Leasable Area. The total floor area designed for tenant occupancy and exclusive use. The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls. All tenant areas, including areas used for storage, shall be included in calculating gross leasable area.

27.4.4.2.5 Mall. A roofed or covered common pedestrian area within a mall building that serves as access for two or more tenants and does not exceed three levels that are open to each other.

27.4.4.3 Minimum Construction Requirements. Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

27.4.4.3.1 Types of Construction. The area of any mall building, and anchor buildings three stories or less in height, of Type I, Type II, or Type IV construction, or anchor buildings of two stories or less in height of Type III construction, shall not be limited, provided that the mall building and attached anchor buildings and parking structures are surrounded on all sides by a permanent open space of not less than 60 ft (18.3 m).

27.4.4.3.2 Anchor Building Separations.

27.4.4.3.2.1 Each anchor building three stories or less in height of Type I, Type II, or Type IV construction, or two stories or less in height of Type III construction, shall be separated from the mall building and other anchor buildings by a fire barrier having a fire resistance rating determined in accordance with Table 6.2.4.1 for the uses being separated but with a rating of not less than 2 hours.

27.4.4.3.2.2 Anchor buildings constructed more than three stories in height or of Type V construction shall be separated from the mall building and other anchor buildings by fire walls.

27.4.4.3.3 Anchor Building Openings. Openings in the fire barrier provided in accordance with 27.4.4.3.2.1 between an anchor building and the pedestrian area of the mall shall not be required to be protected for those anchor buildings housing assembly, business, and mercantile occupancies other than bulk merchandising retail buildings.

27.4.4.3.4 Parking Structures. Parking structures within 60 ft (18.3 m) of the mall building or anchor building shall meet all of the following criteria:

(1) They shall be of Type I or II construction.
(2) They shall be limited in height in accordance with Section 30.8.
(3) They shall be separated in accordance with 27.1.2.

27.4.4.3.5 Tenant Separations.

27.4.4.3.5.1 Each tenant space shall be separated from other tenant spaces by partitions having a fire resistance rating of not less than 1 hour.

27.4.4.3.5.2* The partition shall extend to the underside of the ceiling.

27.4.4.3.5.3 No separation shall be required between the tenant space and the mall.

27.4.4.4 Mixed Occupancies. Assemblies other than stadiums and arenas, business, and mercantile occupancies located in mall buildings shall not be required to comply with the provisions of 6.2.4.

27.4.4.5 Means of Egress.

27.4.4.5.1 All means of egress shall be in accordance with Chapter 11 and this chapter.

27.4.4.5.2 The mall shall be permitted to be considered a pedestrian way.

27.4.4.5.2.1 The travel distance within a tenant space to an exit or to the mall shall not exceed 200 ft (60 m) or the maximum travel distance permitted by the occupancy chapter.

27.4.4.5.2.2 An additional 200 ft (60 m) shall be permitted for travel through the mall space if both of the following requirements are met:

(1) The mall shall be of a clear width not less than that needed to accommodate egress requirements as set forth in other sections of this chapter but shall be not less than 20 ft (6.1 m) wide in its narrowest dimension.
(2)*On each side of the mall floor area, the mall shall be provided with an unobstructed exit access of not less than 10 ft (3 m) in clear width parallel to, and adjacent to, the mall tenant front.

27.4.4.5.3 Exit access from a mall shall lead to an exit having a width of not less than 66 in. (1675 mm).

27.4.4.5.4 Dead ends not exceeding a length equal to twice the width of the mall, measured at the narrowest location within the dead-end portion of the mall, shall be permitted.

27.4.4.5.5 Each assembly occupancy with an occupant load of 500 or more shall have not less than one-half of its required means of egress independent of the mall.

27.4.4.5.6 Every story of a mall building shall be provided with the number of means of egress specified by Section 11.4 and as modified by 27.4.4.5.6.1 or 27.4.4.5.6.2.

27.4.4.5.6.1 Exit access travel shall be permitted to be common for the distances permitted as common paths of travel by 27.2.5.3.

27.4.4.5.6.2 A single means of egress shall be permitted in a Class C mercantile occupancy or a business occupancy, provided that the travel distance to the exit or to a mall does not exceed 100 ft (30 m).

27.4.4.5.7* Each individual anchor building shall have means of egress independent of the mall.

27.4.4.5.8 Each individual tenant space shall have means of egress to the outside or to the mall based on occupant load calculated in accordance with Table 11.3.1.2.

27.4.4.5.9 Where horizontal or vertical security grilles or doors are used as a part of the required means of egress from a tenant space, such grilles or doors shall comply with Exception No. 2 to 11.2.1.4.1.

27.4.4.5.10 Exit passageways shall comply with 27.4.4.5.10.1 and 27.4.4.5.10.2.

27.4.4.5.10.1 Exit passageways in a mall building shall be permitted to accommodate the following independently:

(1) Portion of the occupant load assigned to the exit passageway from only the mall
(2) Largest occupant load assigned to the exit passageway from a single tenant space

27.4.4.5.10.2* Rooms housing building service equipment, janitor closets, and service elevators shall be permitted to open directly onto exit passageways, provided that the following criteria are met:

(1) The required fire resistance rating between such rooms or areas and the exit passageway shall be maintained in accordance with 11.1.3.2.
(2) Such rooms or areas shall be protected by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2; however, the exceptions in NFPA 13 that permit the omission of sprinklers from such rooms are not permitted.
(3) Service elevators opening into the exit passageway shall not open into areas other than exit passageways.
(4) Where exit stair enclosures discharge into the exit passageway, the provisions of 11.2.1.5.2 shall apply, regardless of the number of stories served.

27.4.4.6 Mall Exit Capacity. The capacity of the required exits from the mall shall accommodate the occupant load calculated as the sum of 27.4.4.6.1 and 27.4.4.6.2.

27.4.4.6.1 The gross leasable area of the mall building (not including anchor buildings) shall be divided by the appropriate lowest whole number occupant load factor (OLF) from Figure 11.3.1.2. The occupant load factor shall not be less than 30 and shall not exceed 55.

27.4.4.6.2 For any food court or other assembly occupancy areas located in the mall that are not included as a portion of the gross leasable area of the mall building, an occupant load shall be calculated based on the occupant load factor for the appropriate use, as specified in Table 11.3.1.2. The remaining mall area shall not be assigned an occupant load.

27.4.4.7 Fire Protection Systems.

27.4.4.7.1 Automatic Extinguishing Systems.

27.4.4.7.1.1 The mall building and all anchor buildings shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3, 55.3.2, and 27.4.4.7.1.

27.4.4.7.1.2 The system shall be installed in such a manner that any portion of the system serving tenant spaces can be taken out of service without affecting the operating of the portion of the system serving the mall.

27.4.4.7.2 Hose Connections.

27.4.4.7.2.1 There shall be a hose outlet connected to a system sized to deliver 250 gal/min (946 L/min) at the most hydraulically remote outlet.

27.4.4.7.2.2 The outlet shall be supplied from the mall zone sprinkler system and shall be hydraulically calculated.

27.4.4.7.2.3 Hose outlets shall be provided at each of the following locations:

(1) Within the mall at the entrance to each exit passage or corridor
(2) At each floor level landing within enclosed stairways opening directly onto the mall
(3) At exterior public entrances to the mall

27.4.4.8* Smoke Control. A smoke control system complying with 8.12.3(5) shall be provided in a mall with floor openings connecting more than two levels.

27.4.4.9 Fire Department Access to Equipment. Rooms or areas containing controls for air-conditioning systems; automatic fire-extinguishing systems; or other detection, suppression, or control elements shall be identified for use by the fire department.

27.4.4.10 Alarm Systems.

27.4.4.10.1 General. Malls shall be provided with a fire alarm system in accordance with Section 55.2, as modified by 27.4.4.10.

27.4.4.10.2 Initiation. Initiation of the required fire alarm system shall be by means of the required automatic sprinkler system in accordance with 55.2.2(3) and by manual means in accordance with 55.2.2.1.5 and 55.2.2.1.6.

27.4.4.10.3 Notification.

27.4.4.10.3.1 Occupant Notification. During all times that the mall is occupied, the required fire alarm system, once initiated, shall perform one of the following functions:

(1) It shall activate a general alarm in accordance with 55.2.3 throughout the mall, except a positive alarm sequence in accordance with 55.2.3.4 shall be permitted.
(2) It shall activate an alarm signal in a continuously attended location for the purpose of initiating emergency action by personnel trained to respond to emergencies. Emergency action shall be initiated by means of live voice public address system announcements originating from the attended location where the alarm signal is received. The live voice public address system shall be permitted to be used for other announcements, provided that the emergency use takes precedence over any other use.
(3) In lieu of live voice public address system announcements, any other occupant notification means shall be permitted by 55.2.3.

27.4.4.10.3.2 Emergency Forces Notification. Emergency forces notification shall be provided and shall include notifying the following:

(1) Fire department in accordance with 55.2.4
(2) Approved local emergency organization, if provided

27.4.4.11 Plastic Signs. Within every store or level, and from sidewall to sidewall of each tenant space facing the mall, plastic signs shall be limited as follows:

(1) Plastic signs shall not exceed 20 percent of the wall area facing the mall.
(2) Plastic signs shall not exceed a height of 36 in. (915 mm), except, if the sign is vertical, the height shall not exceed 96 in. (2440 mm), and the width shall not exceed 36 in. (915 mm).
(3) Plastic signs shall be located a minimum distance of 18 in. (460 mm) from adjacent tenants.
(4) Plastics, other than foam plastics, shall meet one of the following criteria:
    (a) They shall be light-transmitting plastics.
    (b) They shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929, *Standard Test Method for Determining Ignition Temperatures of Plastics*, and a flame spread index not greater than 75 and a smoke developed index not greater than 450 when tested in the manner intended for use in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.
(5) Edges and backs of plastic signs in the mall shall be fully encased in metal.
(6) If foam plastics are used, the sign shall have a maximum heat-release rate of 150 kW when tested in accordance with UL 1975, *Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes*, and shall have physical characteristics in accordance with the following:
    (a) The minimum density of foam plastic signs shall not be less than 20 lb/ft^3 (320 kg/m^3).
    (b) The thickness of foam plastic signs shall not be greater than ½ in. (13 mm).

27.4.4.12 Kiosks.

27.4.4.12.1 Kiosks and similar structures shall be constructed of noncombustible or limited-combustible materials, or of combustible materials meeting any of the following:

(1) Fire retardant–treated wood complying with the requirements for fire retardant–impregnated wood in NFPA 703, *Standard for Fire Retardant Impregnated Wood and Fire Retardant Coatings for Building Materials*
(2) Light-transmitting plastics complying with Chapter 48
(3) Foam plastics having a maximum heat-release rate not greater than 100 kW when tested in accordance with UL 1975
(4) Aluminum composite material (ACM) meeting the requirements of Class A interior finish in accordance with Chapter 10 when tested as an assembly in the maximum thickness intended for use
(5) Textiles and films determined to be flame resistant in accordance with NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*

27.4.4.12.2 Kiosks or similar structures located within the mall shall be protected with approved fire suppression and detection devices.

27.4.4.12.3 The minimum horizontal separation between kiosks, or groups of kiosks, and other structures within the mall shall be 20 ft (6.1 m).

27.4.4.12.4 Each kiosk, or group of kiosks, or similar structure shall have a maximum area of 300 ft^2 (28 m^2).

27.4.5 Bulk Merchandising Retail Buildings. New bulk merchandising retail buildings exceeding 12,000 ft^2 (1100 m^2) in area shall comply with the requirements of this chapter, as modified by 27.4.5.1 through 27.4.5.5.

27.4.5.1 Minimum Story Height. Bulk merchandising retail buildings shall have a distance of not less than 16 ft (4.9 m) from the floor to the ceiling, from the floor to the floor above, or from the floor to the roof of any story.

27.4.5.2 Means of Egress Requirements. All means of egress shall be in accordance with Chapter 11 and this chapter. Not less than 50 percent of the required egress capacity shall be located independent of the main entrance/exit doors.

27.4.5.3 Storage, Arrangement, Protection, and Quantities of Hazardous Commodities. The storage, arrangement, protection, and quantities of hazardous commodities shall be in accordance with the applicable portions of the following:

(1) NFPA 13, *Standard for the Installation of Sprinkler Systems*
(2) NFPA 30, *Flammable and Combustible Liquids Code*
(3) NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*
(4) NFPA 230, *Standard for the Fire Protection of Storage*
(5) NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers*
(6) NFPA 432, *Code for the Storage of Organic Peroxide Formulations*
(7) NFPA 434, *Code for the Storage of Pesticides*

27.4.5.4 Detection, Alarm, and Communications Systems.

27.4.5.4.1 General. Bulk merchandising retail buildings shall be provided with a fire alarm system in accordance with Section 55.2.

27.4.5.4.2 Initiation. Initiation of the required fire alarm system shall be by means of the required approved automatic sprinkler system in accordance with 55.2.2(3) and by manual means in accordance with 55.2.2.1.5 and 55.2.2.1.6.

27.4.5.4.3 Occupant Notification. During all times that the building is occupied, the required fire alarm system, once initiated, shall perform one of the following functions:

(1) It shall activate a general alarm in accordance with 55.2.3 throughout the building, except a positive alarm sequence in accordance with 55.2.3.4 shall be permitted.
(2) It shall activate an alarm signal in a continuously attended location for the purpose of initiating emergency action by personnel trained to respond to emergencies. Emergency action shall be initiated by means of live voice public address system announcements originating from the attended location where the alarm signal is received. The live voice public address system shall be permitted to be used for other announcements, provided that the emergency use takes precedence over any other use.
(3) In lieu of live voice public address system announcements, any other occupant notification means shall be permitted by 55.2.3.

27.4.5.4.4 Emergency Forces Notification. Emergency forces notification shall be provided and shall include notifying the following:

(1) Fire department in accordance with 55.2.4
(2) Approved local emergency organization, if provided

27.4.5.5 Extinguishment Requirements. Bulk merchandising retail buildings shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2 and the applicable provisions of the following:

(1) NFPA 13, *Standard for the Installation of Sprinkler Systems*
(2) NFPA 30, *Flammable and Combustible Liquids Code*
(3) NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*
(4) NFPA 230, *Standard for the Fire Protection of Storage*

27.5 Building Services.

27.5.1 Utilities. Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

27.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51.

27.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

27.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

27.6 (Reserved)

Chapter 28 Business Occupancies

28.1 General Requirements.

28.1.1 Application.

28.1.1.1 The requirements of this chapter shall apply to the following:

(1) New buildings, or portions thereof, used as business occupancies
(2) Additions made to, or used as, a business occupancy
(3)*Alterations, modernizations, or renovations of existing business occupancies
(4) Existing buildings, or portions thereof, upon change of occupancy to a business occupancy

28.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of a business occupancy, and changes of use including change of occupancy classification to a business occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

28.1.1.3 This chapter shall establish requirements for all buildings, or portions thereof, used as business occupancies.

28.1.2 Multiple Occupancies.

28.1.2.1 General. All multiple occupancies shall be in accordance with Section 6.2 and 28.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in

6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

28.1.2.2 Combined Business Occupancies and Parking Structures.

28.1.2.2.1 The wall separating a parking structure from a building classified as a business occupancy shall be a fire barrier having a fire resistance rating of not less than 2 hours.

28.1.2.2.2 Openings in the fire barrier shall not be required to be protected with fire protection–rated opening protectives in enclosed parking structures that are protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, or in open parking structures, provided that all of the following conditions are met:

(1) The openings do not exceed 25 percent of the area of the fire barrier in which they are located.
(2) The openings are used as a public entrance and for associated sidelight functions.
(3) The buildings containing the business occupancy are protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.
(4)*Means are provided to prevent spilled fuel from accumulating adjacent to the openings and entering the building.
(5) Physical means are provided to prevent vehicles from being parked or driven within 10 ft (3 m) of the openings.
(6) The openings are protected as required for a smoke partition in accordance with Section 8.10, with no minimum fire protection rating required.

28.1.3 Classification of Occupancy. Business occupancies shall include all buildings and structures, or parts thereof, with business occupancy, as defined in 6.1.11.

28.1.4 Classification of Hazard of Contents.

28.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

28.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

28.1.5 Minimum Construction Requirements. Construction types and height and area requirements shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

28.1.6 Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

28.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

28.2 Means of Egress Requirements.

28.2.1 General.

28.2.1.1 All means of egress shall be in accordance with Chapter 11 and this chapter.

28.2.1.2 If, owing to differences in grade, any street floor exits are located at points above or below the street or ground level, such exits shall comply with the provisions for exits from upper floors or floors below the street floor.

28.2.1.3 Multiple floors shall comply with 28.2.1.3.1 and 28.2.1.3.2.

28.2.1.3.1 Where two or more floors below the street floor are occupied for business use, the same stairs or ramps shall be permitted to serve each floor.

28.2.1.3.2 An open stairway or inside open ramp shall be permitted to serve as a component of the required means of egress system from no more than one floor level below the street floor.

28.2.1.4 Floor levels below the street floor used only for storage, heating, and other service equipment, and not subject to business occupancy, shall have means of egress in accordance with Chapter 30.

28.2.2 Means of Egress Components.

28.2.2.1 General. Means of egress components shall be limited to the types described in 28.2.2.2 through 28.2.2.12.

28.2.2.2 Doors.

28.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

28.2.2.2.2* Locks complying with Exception No. 2 to 11.2.1.5.1 shall be permitted only on principal entrance/exit doors.

28.2.2.2.3 (Reserved)

28.2.2.2.4 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted.

28.2.2.2.5 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

28.2.2.2.6 Where horizontal or vertical security grilles or doors are used as part of the required means of egress from a tenant space, such grilles or doors shall comply with Exception No. 2 to 11.2.1.4.1.

28.2.2.2.7 (Reserved)

28.2.2.2.8 Revolving doors complying with 11.2.1.10 shall be permitted.

28.2.2.3 Stairs.

28.2.2.3.1 Stairs complying with 11.2.2 shall be permitted.

28.2.2.3.2 Spiral stairs complying with 11.2.2.2.3 shall be permitted.

28.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

28.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

28.2.2.6 Ramps. Ramps complying with 11.2.5 shall be permitted.

28.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

28.2.2.8 (Reserved)

28.2.2.9 (Reserved)

28.2.2.10 Fire Escape Ladders. Fire escape ladders complying with 11.2.9 shall be permitted.

28.2.2.11 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

28.2.2.12 Areas of Refuge.

28.2.2.12.1 Areas of refuge complying with 11.2.12 shall be permitted.

28.2.2.12.2 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, two rooms or spaces separated from each other by smoke-resistant partitions in accordance with the definition of area of refuge shall not be required. *(See 3.3.33, Area of Refuge.)*

28.2.3 Capacity of Means of Egress.

28.2.3.1 The capacity of means of egress shall be in accordance with Section 11.3.

28.2.3.2* The clear width of any corridor or passageway serving an occupant load of 50 or more shall be not less than 44 in. (1120 mm).

28.2.3.3 Street floor exits shall be sufficient for the occupant load of the street floor plus the required capacity of stairs and ramps discharging through the street floor.

28.2.4 Number of Exits.

28.2.4.1 (Reserved)

28.2.4.2 The number of exits shall comply with any one of the following:

(1) The minimum number of exits shall be in accordance with Section 11.4, and not less than two separate exits that are accessible from every part of every story shall be provided. Exit access travel shall be permitted to be common for the distances permitted as common paths of travel by 28.2.5.3.
(2) A single exit shall be permitted for a room or area with a total occupant load of fewer than 100 persons, provided that the following criteria are met:
    (a) The exit shall discharge directly to the outside at the level of exit discharge for the building.
    (b) The total distance of travel from any point, including travel within the exit, shall not exceed 100 ft (30 m).
    (c) The total distance of travel specified in 28.2.4.2(2)(b) shall be on the same floor level or, if traversing of stairs is necessary, such stairs shall not exceed 15 ft (4.5 m) in height, and the stairs shall be provided with complete enclosures to separate them from any other part of the building, with no door openings therein.
    (d) A single outside stair in accordance with 11.2.2 shall be permitted to serve all floors permitted within the 15 ft (4.5 m) vertical travel limitation.
(3) Any business occupancy not exceeding three stories, and not exceeding an occupant load of 30 people per floor, shall be permitted a single separate exit to each floor, provided that the following criteria are met:
    (a) The total travel distance to the outside of the building shall not exceed 100 ft (30 m).
    (b) The exit shall be enclosed in accordance with 11.1.3.2, shall serve no other levels, and shall discharge directly to the outside.
    (c) A single outside stair in accordance with 11.2.2 shall be permitted to serve all floors.
(4) A single means of egress shall be permitted from a mezzanine within a business occupancy, provided that the common path of travel does not exceed 75 ft (23 m), or 100 ft (30 m) if protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.
(5) A single exit shall be permitted for a maximum two-story, single-tenant space/building protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and Section 55.3.2 where the total travel to the outside does not exceed 100 ft (30 m).

28.2.5 Arrangement of Means of Egress.

28.2.5.1 General. Means of egress shall be arranged in accordance with Section 11.5.

28.2.5.2 Dead Ends. Dead ends shall be permitted in accordance with 28.2.5.2.1 or 28.2.5.2.2.

28.2.5.2.1 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, dead-end corridors shall not exceed 50 ft (15 m).

28.2.5.2.2 In all other buildings, dead-end corridors shall not exceed 20 ft (6.1 m).

28.2.5.3 Common Paths of Travel.

28.2.5.3.1 A common path of travel shall be permitted for the first 100 ft (30 m) in a building protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.

28.2.5.3.2 A common path of travel shall be permitted for the first 100 ft (30 m) within a single tenant space having an occupant load not exceeding 30 persons.

28.2.5.3.3 In all other buildings, the common paths of travel shall not exceed 75 ft (23 m).

28.2.6 Travel Distance to Exits.

28.2.6.1 In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, the travel distance shall not exceed 300 ft (91 m).

28.2.6.2 In all other buildings, the travel distance to exits, measured in accordance with Section 11.6, shall not exceed 200 ft (60 m).

28.2.7 Discharge from Exits. Exit discharge shall comply with Section 11.7.

28.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8.

28.2.9 Emergency Lighting.

28.2.9.1 Emergency lighting shall be provided in accordance with Section 11.9 in any building where any one of the following conditions exists:

(1) The building is two or more stories in height above the level of exit discharge.
(2) The occupancy is subject to 50 or more occupants above or below the level of exit discharge.
(3) The occupancy is subject to 300 or more total occupants.

28.2.9.2 Emergency lighting in accordance with Section 11.9 shall be provided for all underground and limited-access structures.

28.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

28.2.11 Special Means of Egress Features (Reserved).

28.3 Protection.

28.3.1 Protection of Vertical Openings.

28.3.1.1 Any vertical opening shall comply with 28.3.1.1.1 and 28.3.1.1.2.

28.3.1.1.1 Any vertical opening shall be enclosed or protected in accordance with Section 8.12. Unenclosed vertical openings in accordance with 8.12.4.2 shall be permitted.

28.3.1.1.2 Exit access stairs shall be permitted to be unenclosed in two-story, single-tenant spaces that are provided with a single exit in accordance with 28.2.4.2(5).

28.3.1.2 Floors below the street floor used for storage or other than business occupancy shall have no unprotected openings to business occupancy floors.

28.3.2 Hazardous Area Protection.

28.3.2.1* General. Hazardous areas including, but not limited to, areas used for general storage, boiler or furnace rooms, and maintenance shops that include woodworking and painting areas shall be protected in accordance with Section 8.15.

28.3.2.2* Commercial Cooking Facilities. Commercial cooking facilities shall be protected in accordance with Section 55.10.

28.3.3 Interior Finish.

28.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

28.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be Class A or Class B in exits and in enclosed corridors furnishing access to exits; and Class A, Class B, or Class C in office areas.

28.3.3.3 Interior Floor Finish.

28.3.3.3.1 Interior floor finish shall comply with Section 10.6.

28.3.3.3.2 Interior floor finish in exit enclosures shall be not less than Class II.

28.3.4 Detection, Alarm, and Communications Systems.

28.3.4.1 General. A fire alarm system in accordance with Section 55.2 shall be provided in any business occupancy where any one of the following conditions exists:

(1) The building is two or more stories in height above the level of exit discharge.
(2) The occupancy is subject to 50 or more occupants above or below the level of exit discharge.
(3) The occupancy is subject to 300 or more total occupants.

28.3.4.2 Initiation. Initiation of the required fire alarm system shall be by any one of the following:

(1) Manual means in accordance with 55.2.2(1)
(2) Approved automatic fire detection system in accordance with 55.2.2(2) that provides protection throughout the building and in accordance with 55.2.2.1.5
(3) Approved, supervised automatic sprinkler system complying with Section 55.3 and 55.3.2 in accordance with 55.2.2(3) that provides protection throughout the building and in accordance with 55.2.2.1.5

28.3.4.3 Notification.

28.3.4.3.1 Occupant Notification. During all times that the building is occupied, the required fire alarm system, once initiated, shall perform one of the following functions:

(1) It shall activate an alarm in accordance with 55.2.3 throughout the business occupancy, except a positive alarm sequence in accordance with 55.2.3.4 shall be permitted.
(2) It shall activate an alarm signal in a continuously attended location for the purpose of initiating emergency action by personnel trained to respond to emergencies, and such emergency action shall be initiated by means of live voice public address system announcements originating from the attended location where the alarm signal is received.
(3) In lieu of live voice public address system announcements, any other occupant notification means in accordance with 55.2.3 shall be permitted.

28.3.4.3.2 Emergency Forces Notification. Emergency forces notification shall be provided and shall include notifying the following:

(1) Fire department in accordance with 55.2.4
(2) Approved local emergency organization, if provided

28.3.5 Extinguishment Requirements.

28.3.5.1 Portable fire extinguishers shall be provided in every business occupancy in accordance with Section 55.6.

28.3.5.2 Class 1 standpipe systems shall be provided when required by 55.4.1.

28.3.6 Corridors.

28.3.6.1 Where access to exits is provided by corridors, such corridors shall be separated from use areas by walls having a fire resistance rating of not less than 1 hour in accordance with Section 8.4, unless one of the following conditions exists:

(1) Where exits are available from an open floor area
(2)*Within a space occupied by a single tenant
(3) Within buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2

28.3.6.2* Unenclosed exits available from an open floor area or unenclosed exits that serve a space occupied by a single tenant shall not be required to be protected in accordance with 28.3.6.1.

28.3.6.3 Openings in corridor walls required by 28.3.6.1 to have a fire resistance rating shall be protected in accordance with Table 8.7.2.

28.3.7 Subdivision of Building Spaces.

28.3.7.1 Partitions within office spaces occupied by a single tenant shall be permitted to be of partial height, movable or nonpermanent, in locations where partitions are not required to have a fire resistance rating using any material permitted by this *Code* for any construction types, provided that such partitions comply with all the following:

(1) They do not enclose a hazardous area.
(2) Combustible materials used in prefabricated nonpermanent partitions shall have a Class C rating when tested as a composite assembly in the form intended for use, including any trim exceeding the limits specified in Section 18.2 of UL 1286, *Standard for Office Furnishings*. Trim not exceeding those specified limits shall be tested in accordance with Section 18.4 or 18.5 of UL 1286 and meet the requirements specified herein.

28.4 Special Provisions.

28.4.1 Underground or Limited-Access Buildings. Underground or limited-access buildings shall be in accordance with Section 31.2 and Section 31.3.

28.4.2* High-Rise Buildings. High-rise buildings shall comply with Chapter 33.

28.5 Building Services.

28.5.1 Utilities. Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

28.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51.

28.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

28.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

Chapter 29 Industrial Occupancies

29.1 General Requirements.

29.1.1 Application.

29.1.1.1* The requirements of this chapter shall apply to new buildings, or portions thereof, used as an industrial occupancy.

29.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of an industrial occupancy, and changes of use including change of occupancy classification to an industrial occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

29.1.2 Multiple Occupancies. All multiple occupancies shall be in accordance with Section 6.2 and 29.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

29.1.3 Classification of Occupancy. Classification of occupancy shall be in accordance with 6.1.12.

29.1.3.1 Subclassification of Occupancy. Each industrial occupancy shall be subclassified according to its use as described in 29.1.3.1(A) and 29.1.3.1(B).

(A) General Industrial Occupancy. General industrial occupancies shall include the following:

(1) An industrial occupancy that conducts ordinary and low hazard industrial operations in buildings of conventional design that is usable for various types of industrial processes
(2) An industrial occupancy that includes multistory buildings where floors are occupied by different tenants or buildings that are usable for such occupancy and, therefore, subject to possible use for types of industrial processes with a high density of employee population

(B) Special-Purpose Industrial Occupancy. Special-purpose industrial occupancies shall include the following:

(1) An industrial occupancy that conducts ordinary and low hazard industrial operations in buildings designed for, and that are usable only for, particular types of operations
(2) An industrial occupancy that is characterized by a relatively low density of employee population, with much of the area occupied by machinery or equipment

29.1.3.2 Incidental Operations. Incidental high hazard operations in low or ordinary hazard occupancies that are protected in accordance with Section 8.15 and 29.3.2 shall not be the basis for overall occupancy classification.

29.1.3.3 Change of Subclassification. A change from one subclassification of industrial occupancy to another shall be permitted only if the structure, building, or portion thereof conforms with the requirements of this chapter applying to new construction for the new use.

29.1.4 Classification of Hazard of Contents.

29.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

29.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

29.1.5 Minimum Construction Requirements. Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

29.1.6* Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined as the maximum probable

population of the space under consideration, whichever is greater.

29.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

29.2 Means of Egress Requirements.

29.2.1 General. Each required means of egress shall be in accordance with the applicable portions of Chapter 11.

29.2.2 Means of Egress Components.

29.2.2.1 General. Components of means of egress shall be limited to the types described in 29.2.2.2 through 29.2.2.12.

29.2.2.2 Doors.

29.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

29.2.2.2.2 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted.

29.2.2.2.3 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

29.2.2.3 Stairs.

29.2.2.3.1 Stairs shall comply with 11.2.2 and be permitted to be modified by 29.2.2.3.1(1) and 29.2.2.3.1(2):

(1) Noncombustible, grated stair treads and noncombustible, grated landing floors
(2) Industrial equipment access in accordance with 29.2.5.3

29.2.2.3.2 Spiral stairs complying with 11.2.2.2.3 shall be permitted.

29.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

29.2.2.5 Horizontal Exits.

29.2.2.5.1 Horizontal exits complying with 11.2.4 shall be permitted.

29.2.2.5.2* In horizontal exits, where the opening is protected by a fire door assembly on each side of the wall in which it is located, one fire door shall be of the swinging type, as provided in 11.2.4.3.6, and the other shall be permitted to be an automatic-sliding fire door that shall be kept open whenever the building is occupied.

29.2.2.6 Ramps. Ramps complying with any of the following shall be permitted:

(1) Ramps in accordance with 11.2.5
(2) Industrial equipment access in accordance with 29.2.5.3

29.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

29.2.2.8 (Reserved)

29.2.2.9 Fire Escape Ladders. Fire escape ladders complying with the following shall be permitted:

(1) Fire escape ladders in accordance with 11.2.9.
(2) Fixed industrial stairs in accordance with the minimum requirements for fixed stairs in ANSI A1264.1, *Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems*, shall be permitted where fire escape ladders are permitted in accordance with 11.2.9.1.

29.2.2.10 Slide Escapes.

29.2.2.10.1 Approved slide escapes complying with 11.2.10 shall be permitted as components in 100 percent of the required means of egress for high hazard industrial occupancies.

29.2.2.10.2 Slide escapes shall be counted as means of egress only where regularly used in emergency egress drills so that occupants are familiar with their use through practice.

29.2.2.11 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

29.2.2.12 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

29.2.3 Capacity of Means of Egress. The capacity of means of egress shall comply with either of the following:

(1) The capacity of means of egress shall be in accordance with Section 11.3.
(2) In special-purpose industrial occupancies, means of egress shall be sized to accommodate the occupant load as determined in accordance with Table 11.3.1.2, and spaces not subject to human occupancy because of the presence of machinery or equipment shall not be included.

29.2.4 Number of Means of Egress.

29.2.4.1 The number of means of egress shall comply with 29.2.4.1.1 or 29.2.4.1.2.

29.2.4.1.1 Not less than two means of egress shall be provided from every story or section, and not less than one exit shall be reached without traversing another story.

29.2.4.1.2 A single means of egress shall be permitted from any story or section in low and ordinary hazard industrial occupancies, provided that the exit can be reached within the distance permitted as common path of travel.

29.2.4.2 Floors, or portions thereof, with an occupant load of more than 500 shall have the minimum number of separate and remote means of egress as specified by 11.4.1.2.

29.2.5 Arrangement of Means of Egress.

29.2.5.1 General. Means of egress shall be arranged in accordance with Section 11.5 and shall not exceed that provided by Table 29.2.5.1.

29.2.5.2 Ancillary Facilities.

29.2.5.2.1* Ancillary facilities shall be arranged to allow travel in independent directions after leaving the ancillary facility, so that both means of egress paths do not become compromised by the same fire or similar emergency.

29.2.5.2.2* Ancillary facilities in special-purpose industrial occupancies, where delayed evacuation is anticipated, shall have not less than a 2-hour fire resistance–rated separation from the predominant industrial occupancy and shall have one means of egress that is separated from the predominant industrial occupancy by 2-hour fire resistance–rated construction.

29.2.5.3 Industrial Equipment Access. Requirements for industrial equipment access walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment shall be as follows:

(1) They shall be permitted in accordance with the applicable provisions of Chapter 11, as modified by Table 29.2.5.3.
(2) They shall serve not more than 20 people.

Table 29.2.5.1 Arrangement of Means of Egress

Arrangement	Industrial Occupancy	Low Hazard Industrial Occupancy
Dead-End Corridor Limits		
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	50 ft (15 m)	50 ft (15 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	50 ft (15 m)	50 ft (15 m)
Common Path of Travel Limits		
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	100 ft (30 m)	100 ft (30 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	50 ft (15 m)	50 ft (15 m)

Table 29.2.5.3 Equipment Access Dimensional Criteria

Component	Dimension
Minimum horizontal dimension of any walkway, landing, or platform	22 in. (560 mm) clear
Minimum stair or ramp width	22 in. (560 mm) clear between rails
Minimum tread width	22 in. (560 mm) clear
Minimum tread depth	10 in. (255 mm)
Maximum riser height*	9 in. (230 mm)
Maximum height between landings	12 ft (3600 mm)
Minimum headroom	6 ft 8 in. (2030 mm)

*Handrails shall be permitted to terminate, at the required height, to a point directly above the top and bottom risers.

Table 29.2.6 Maximum Travel Distance to Exits

Arrangement	General Industrial Occupancy	Special-Purpose Industrial Occupancy
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	250 ft (76 m)*	400 ft (122 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	200 ft (60 m)	300 ft (91 m)

*In single-story buildings, a travel distance of 400 ft (122 m) is permitted, provided that a performance-based analysis demonstrates that safe egress can be accomplished.

29.2.6* Travel Distance to Exits. Travel distance, measured in accordance with Section 11.6, shall not exceed that provided by Table 29.2.6.

29.2.7 Discharge from Exits. Discharge from exits shall be in accordance with Section 11.7.

29.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8 or with natural lighting that provides the required level of illumination in structures occupied only during daylight hours.

29.2.9* Emergency Lighting.

29.2.9.1 Emergency lighting shall be provided in accordance with Section 11.9.

29.2.9.2 Emergency lighting shall not be required for the following:

(1) Special-purpose industrial occupancies without routine human habitation
(2) Structures occupied only during daylight hours, with skylights or windows arranged to provide the required level of illumination on all portions of the means of egress during such hours

29.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

29.2.11 Special Means of Egress Features (Reserved).

29.3 Protection.

29.3.1 Protection of Vertical Openings. Any vertical opening shall be protected in accordance with one of the following:

(1) Openings shall be in accordance with Section 8.12.

(2) In special-purpose industrial and high hazard industrial occupancies, where unprotected vertical openings exist and are necessary to manufacturing operations, such openings shall be permitted beyond the specified limits only where every floor level has direct access to one or more enclosed stairs or other exits protected against obstruction by any fire or smoke in the open areas connected by the unprotected vertical openings.
(3) Openings in accordance with 8.12.4.2 shall be permitted.

29.3.2 Hazardous Area Protection. Hazardous areas in industrial occupancies protected by approved automatic extinguishing systems in accordance with Section 55.3 shall be exempt from the smoke-resisting enclosure requirement of 8.15.1.2.

29.3.3 Interior Finish.

29.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

29.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be Class A, Class B, or Class C in operating areas and shall be as required by 11.1.4 in exit enclosures.

29.3.3.3 Interior Floor Finish.

29.3.3.3.1 Interior floor finish shall comply with Section 10.6.

29.3.3.3.2 Interior floor finish in exit enclosures and in exit access corridors shall be not less than Class II.

29.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

29.3.4 Detection, Alarm, and Communications Systems.

29.3.4.1 General. A fire alarm system shall be required in accordance with Section 55.2 industrial occupancies, unless the total capacity of the building is under 100 persons and fewer than 25 persons are above or below the level of exit discharge.

29.3.4.2 Initiation. Initiation of the required fire alarm system shall be by any one of the following:

(1) Manual means in accordance with 55.2.2(1)
(2) Approved automatic fire detection system in accordance with 55.2.2(2) throughout the building and in accordance with 55.2.2.1.5
(3) Approved, supervised automatic sprinkler system complying with Section 55.3 and 55.3.2 and in accordance with 55.2.2(3) throughout the building and in accordance with 55.2.2.1.5

29.3.4.3 Notification.

29.3.4.3.1 The required fire alarm system shall meet one of the following criteria:

(1) It shall provide occupant notification in accordance with 55.2.3.
(2) It shall sound an audible and visible signal in a constantly attended location for the purposes of initiating emergency action.

29.3.4.3.2 Positive alarm sequence in accordance with 55.2.3.4 shall be permitted.

29.3.5* Extinguishment Requirements.

29.3.5.1 Fire Sprinklers. Industrial occupancies, other than low hazard industrial occupancies, shall be protected by an approved automatic sprinkler system in accordance with Section 55.3 in the following:

(1) Throughout all industrial occupancies three or more stories in height
(2) Throughout all industrial occupancies exceeding 12,000 ft^2 (1115 m^2) in fire area
(3) Where total area of all floors, including mezzanines, exceeds 24,000 ft^2 (2230 m^2)

29.3.5.2 Standpipes. Standpipes shall be provided when required by Section 55.4.1.

29.3.6 Corridors. The provisions of 11.1.3.1 shall not apply.

29.4 Special Provisions.

29.4.1 Limited-Access or Underground Buildings. Limited-access or underground buildings shall comply with Chapter 31.

29.4.2 High-Rise Buildings. The automatic sprinkler requirements of 33.2.2 shall be required for industrial occupancies, except for low hazard industrial occupancies.

29.5 Building Services.

29.5.1 Utilities. Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

29.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51.

29.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

29.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

29.6* Special Provisions for Aircraft-Servicing Hangars.

29.6.1 The requirements of Section 29.1 through Section 29.5 shall be met, except as modified by 29.6.2 through 29.6.4.

29.6.2 Requirements for exits from aircraft-servicing areas shall be as noted in 29.6.2.1 through 29.6.2.4.

29.6.2.1 Exits from aircraft-servicing areas shall be provided at intervals not exceeding 150 ft (45 m) on all exterior walls.

29.6.2.2 There shall be not less than two means of egress from each aircraft-servicing area.

29.6.2.3 If provided, horizontal exits shall be provided at intervals not exceeding 100 ft (30 m).

29.6.2.4 If provided, dwarf, or "smash," doors used in doors that accommodate aircraft shall be permitted for compliance with the requirements of 29.6.1 through 29.6.2.3.

29.6.3 Requirements for means of egress from mezzanine floors in aircraft-servicing areas shall be as noted in 29.6.3.1 and 29.6.3.2.

29.6.3.1 The means of egress shall be arranged so that the travel distance to the nearest exit from any point on the mezzanine does not exceed 75 ft (23 m).

29.6.3.2 The means of egress shall lead directly to a properly enclosed stair discharging directly to the exterior, to a suitable cutoff area, or to outside stairs.

29.6.4 Dead ends shall not exceed 50 ft (15 m) and shall not be permitted in areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3.

Chapter 30 Storage Occupancies

30.1 General Requirements.

30.1.1 Application.

30.1.1.1* The requirements of this chapter shall apply to new buildings, or portions thereof, used as a storage occupancy.

30.1.1.2 Repairs, renovations, modifications, additions, and reconstruction of a storage occupancy, and changes of use including change of occupancy classification to a storage occupancy, shall comply with one of the following:

(1) Provisions of this chapter
(2) Provisions of Chapter 15

30.1.2 Multiple Occupancies. All multiple occupancies shall be in accordance with Section 6.2 and 30.1.2. Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

30.1.3 Classification of Occupancy.

30.1.3.1 Story occupancy classification shall be as follows:

(1) Storage occupancies shall include all buildings and structures, or parts thereof, with occupancy as defined in 6.1.13.
(2) Incidental storage in another occupancy shall not be the basis for overall occupancy classification.

30.1.3.2 Storage occupancies, or areas of storage occupancies that are used for the purpose of packaging, labeling, sorting, special handling, or other operations requiring an occupant load greater than that normally contemplated for storage, shall be classified as industrial occupancies. *(See Chapter 29.)*

30.1.4 Classification of Hazard of Contents.

30.1.4.1 Hazard of contents shall be classified in accordance with 6.3.2.

30.1.4.2 Buildings or areas in which high hazard contents are stored, used, or handled shall comply with Chapter 34.

30.1.5 Minimum Construction Requirements. Construction shall be in accordance with all of the following:

(1) Chapter 7, Construction Types and Height and Area Requirements
(2) Chapter 8, Fire-Resistive Materials and Construction
(3) Chapter 13, Encroachments into the Public Right of Way
(4) Chapter 14, Safeguards During Construction
(5) Chapter 31, Occupancies in Special Structures
(6) Chapter 35, Structural Design
(7) Chapter 36, Soils, Foundations, and Retaining Walls
(8) Chapter 37, Exterior Wall Construction
(9) Chapter 38, Roof Assemblies and Roof Structures
(10) Chapter 39, Flood-Resistant Design and Construction
(11) Chapter 40, Quality Assurance During Construction

30.1.6* Occupant Load. The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 11.3.1.2 that are characteristic of the use of the space, or shall be determined on the basis of the maximum probable population of the space under consideration, whichever is greater.

30.1.7 Accessibility. Accessibility shall be in accordance with Chapter 12.

30.2 Means of Egress Requirements.

30.2.1 General. Each required means of egress shall be in accordance with the applicable portions of Chapter 11.

30.2.2 Means of Egress Components.

30.2.2.1 General. Components of means of egress shall be limited to the types described in 30.2.2.2 through 30.2.2.10.

30.2.2.2 Doors.

30.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

30.2.2.2.2 Delayed-egress locks complying with 11.2.1.6.1 shall be permitted.

30.2.2.2.3 Access-controlled egress doors complying with 11.2.1.6.2 shall be permitted.

30.2.2.3 Stairs.

30.2.2.3.1 Stairs shall comply with 11.2.2 and be permitted to be modified by 30.2.2.3.1(1) and 30.2.2.3.1(2).

(1) Noncombustible, grated stair treads and noncombustible, grated landing floors
(2) Industrial equipment access in accordance with 29.2.5.3

30.2.2.3.2 Spiral stairs complying with 11.2.2.2.3 shall be permitted.

30.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

30.2.2.5 Horizontal Exits.

30.2.2.5.1 Horizontal exits complying with 11.2.4 shall be permitted.

30.2.2.5.2* In horizontal exits, where the opening is protected by a fire door assembly on each side of the wall in which it is located, one fire door shall be of the swinging type as provided in 11.2.4.3.6, and the other shall be permitted to be an automatic-sliding fire door that shall be kept open whenever the building is occupied.

30.2.2.6 Ramps. Ramps complying with any of the following shall be permitted:

(1) Ramps in accordance with 11.2.5
(2) Industrial equipment access in accordance with 29.2.5.3

30.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

30.2.2.8 Fire Escape Ladders. Fire escape ladders complying with the following shall be permitted:

(1) Fire escape ladders in accordance with 11.2.9.
(2) Fixed industrial stairs in accordance with the minimum requirements for fixed stairs in ANSI A1264.1, *Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems*, shall be permitted where fire escape ladders are permitted in accordance with 11.2.9.1.

30.2.2.9 Alternating Tread Devices. Alternating tread devices complying with 11.2.11 shall be permitted.

30.2.2.10 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

30.2.3 Capacity of Means of Egress. The capacity of means of egress shall be in accordance with Section 11.3.

30.2.4 Number of Means of Egress. The number of means of egress shall comply with 30.2.4.1 and 30.2.4.2 and Section 11.4.

30.2.4.1 Means of egress shall be provided in accordance with 30.2.4.1(1), 30.2.4.1(2), or 30.2.4.1(3).

(1) In low hazard storage occupancies, a single means of egress shall be permitted from any story or section.
(2) In storage occupancies not classified as low hazard, a single means of egress shall be permitted from any story or section, provided that the exit can be reached within the distance permitted as common path of travel.
(3) In buildings or structures not complying with 30.2.4.1(1) or 30.2.4.1(2) and used for storage, every section thereof considered separately shall have not less than two separate means of egress as remotely located from each other as practicable.

30.2.4.2 Floors, or portions thereof, with an occupant load of more than 500 persons shall have the minimum number of separate and remote means of egress as specified by 11.4.1.2.

30.2.5 Arrangement of Means of Egress. Means of egress shall be arranged in accordance with Section 11.5 and shall not exceed that provided by Table 30.2.5.

Table 30.2.5 Arrangement of Means of Egress

Arrangement	Low Hazard Storage Occupancy	Storage Occupancy
Dead-End Corridor		
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	No limits	100 ft (30 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	No limits	50 ft (15 m)
Common Path of Travel		
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	No limits	100 ft (30 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	No limits	50 ft (15 m)

30.2.6 Travel Distance to Exits. Travel distance, measured in accordance with 11.6, shall not exceed that provided by Table 30.2.6.

Table 30.2.6 Maximum Travel Distance to Exits

Arrangement	Low Hazard Storage Occupancy	Storage Occupancy
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	Unlimited	400 ft (122 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	Unlimited	200 ft (60 m)

30.2.7 Discharge from Exits. Discharge from exits shall be in accordance with Section 11.7.

30.2.8 Illumination of Means of Egress.

30.2.8.1 Means of egress shall be illuminated in accordance with Section 11.8.

30.2.8.2 Means of egress shall be permitted to be illuminated with windows arranged to provide the required level of illumination on all portions of the means of egress during daylight hours, in structures occupied only during such hours, where approved by the authority having jurisdiction.

30.2.9 Emergency Lighting. Emergency lighting shall be provided in normally occupied storage occupancies in accordance with Section 11.9, except for spaces occupied only during daylight hours that are provided with natural illumination in accordance with 30.2.8.2.

30.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

30.2.11 Special Means of Egress Features (Reserved).

30.3 Protection.

30.3.1 Protection of Vertical Openings. Any vertical opening shall be protected in accordance with Section 8.12, and vertical openings in accordance with 8.12.4.2 shall be permitted.

30.3.2 Hazardous Area Protection. (No requirements.) *(See also Section 8.15.)*

30.3.3 Interior Finish.

30.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

30.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be Class A, Class B, or Class C in storage areas and shall be as required by 11.1.4 in exit enclosures.

30.3.3.3 Interior Floor Finish.

30.3.3.3.1 Interior floor finish shall comply with Section 10.6.

30.3.3.3.2 Interior floor finish in exit enclosures and in exit access corridors shall be not less than Class II.

30.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

30.3.4 Detection, Alarm, and Communications Systems.

30.3.4.1 General. Storage occupancies shall be provided with a fire alarm system in accordance with Section 55.2, except as modified by the following:

(1) Storage occupancies limited to low hazard contents
(2) Storage occupancies with ordinary hazard contents not exceeding an aggregate floor area of 100,000 ft^2 (9300 m^2)
(3) Storage occupancies protected throughout by approved an automatic sprinkler system in accordance with Section 55.3

30.3.4.2 Initiation. Initiation of the required fire alarm system shall be by one of the following:

(1) Manual means in accordance with 55.2.2(1)
(2) Approved automatic fire detection system in accordance with 55.2.2(2) throughout the building and in accordance with 55.2.2.1.5

30.3.4.3 Notification.

30.3.4.3.1 The required fire alarm system shall meet one of the following criteria:

(1) It shall provide occupant notification in accordance with 55.2.3.
(2) It shall sound an audible and visible signal in a constantly attended location for the purposes of initiating emergency action.

30.3.4.3.2 Positive alarm sequence in accordance with 55.2.3.4 shall be permitted.

30.3.5* Extinguishment Requirements.

30.3.5.1 General. Storage occupancies, other than low hazard storage occupancies, shall be protected by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2 in the following:

(1) Throughout all storage occupancies three or more stories in height
(2) Throughout all storage occupancies exceeding 12,000 ft^2 (1115 m^2) in fire area
(3) Where the total area of all floors, including mezzanines, exceeds 24,000 ft^2 (2230 m^2)

30.3.5.2 Standpipes. Standpipes shall be provided when required by 55.4.1.

30.3.6 Corridors. Corridors shall not be required to comply with the provisions of 11.1.3.1.

30.4 Special Provisions.

30.4.1 Limited-Access or Underground Buildings. Limited-access or underground buildings shall comply with Chapter 31.

30.4.2 High-Rise Buildings. The automatic sprinkler requirements of 33.2.2 shall be required for new storage occupancies, except for low hazard storage occupancies.

30.5 Building Services.

30.5.1 Utilities. Utilities shall comply with the provisions of Chapter 49, Chapter 52, and Chapter 53.

30.5.2 Heating, Ventilating, and Air-Conditioning. Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50 and Chapter 51.

30.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

30.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

30.6* Special Provisions for Aircraft Storage Hangars.

30.6.1 The requirements of Section 30.1 through Section 30.5 shall be met, except as modified by 30.6.2 through 30.6.4.

30.6.2 Requirements for exits from aircraft storage areas shall comply with 30.6.2.1 through 30.6.2.3.

30.6.2.1 There shall be not less than two means of egress serving each aircraft storage area.

30.6.2.2 Exits from aircraft storage areas shall be provided at intervals not exceeding 150 ft (45 m) on all exterior walls.

30.6.2.3 If provided, horizontal exits through interior fire walls shall be provided at intervals not exceeding 100 ft (30 m).

30.6.2.4 If provided, dwarf, or "smash," doors used in doors that accommodate aircraft shall be permitted for compliance with the requirements of 30.6.1 through 30.6.3.

30.6.3 Requirements for means of egress from mezzanine floors in aircraft storage areas shall be as follows:

(1) They shall be arranged so that the travel distance to the nearest exit from any point on the mezzanine does not exceed 75 ft (23 m).
(2) They shall lead directly to a properly enclosed stair discharging directly to the exterior, to a suitable cutoff area, or to outside stairs.

30.6.4 Dead ends shall not exceed 50 ft (15 m), and dead ends shall not be permitted in areas containing high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3.

30.7* Special Provisions for Grain or Other Bulk Storage Elevators.

30.7.1 General. The requirements of Section 30.1 through Section 30.5 shall be met, except as modified by 30.7.2 through 30.7.4.

30.7.2 Number of Means of Egress. There shall be not less than two means of egress from all working levels of the head house, as modified by 30.7.2.1 and 30.7.2.2.

30.7.2.1 One of the means of egress specified in 30.7.2 shall be a stair to the level of exit discharge that is enclosed by a dust-resistant, 1-hour fire resistance–rated enclosure in accordance with 11.1.3.2.

30.7.2.2 The second means of egress specified in 30.7.2 shall be one of the following:

(1) Exterior stair or basket ladder–type fire escape, accessible from all working levels of the head house, that provides a passage to ground level
(2) Exterior stair or basket ladder–type fire escape, accessible from all working levels of the head house, that provides access to the top of adjoining structures and that provides a continuous path to the means of egress described in 30.7.3

30.7.3 Means of Egress to Ground. An exterior stair or basket ladder–type fire escape shall provide passage to ground level

from the top of the end of an adjoining structure, such as a silo, conveyor, gallery, or gantry.

30.7.4 Extinguishment Requirements. (No requirements.)

30.7.5 Underground Spaces.

30.7.5.1 Underground spaces shall have not less than two means of egress, one of which shall be permitted to be a means of escape. The means of escape shall be arranged to eliminate dead ends.

30.7.5.2 Travel distances, measured in accordance with Section 11.6, shall not exceed those provided by Table 30.7.5.2

Table 30.7.5.2 Maximum Travel Distance to Means of Escape or Exits

Arrangement	Travel distance
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	400 ft (122 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	200 ft (60 m)

30.8 Special Provisions for Parking Structures.

30.8.1 General Requirements.

30.8.1.1* Application. The provisions of 30.8.1 shall apply to parking structures of the closed or open type, above or below ground, but shall not apply to mechanical or exclusively attendant-type parking facilities that are not occupied by customers. The requirements of Section 30.1 through Section 30.7 shall not apply.

30.8.1.2 Mixed Occupancies.

30.8.1.2.1 Where both parking and repair operations are conducted in the same building, the entire building shall comply with Chapter 29, except that, where the parking and repair sections are separated by not less than 1-hour fire–rated construction, the parking and repair sections shall be permitted to be treated separately.

30.8.1.2.2 In areas where repair operations are conducted, the means of egress shall comply with Chapter 29.

30.8.1.3 Special Definition—Open Parking Structure. A parking structure that, at each parking level, has wall openings open to the atmosphere, for an area of not less than 1.4 ft^2 (0.13 m^2) for each linear foot (0.3 m) of its exterior perimeter. Such openings are distributed over 40 percent of the building perimeter or uniformly over two opposing sides. Interior wall lines and column lines are at least 20 percent open, with openings distributed to provide ventilation.

30.8.1.4 Classification of Occupancy. Incidental vehicle parking in another occupancy shall not be the basis for overall occupancy classification.

30.8.1.5 Classification of Hazard of Contents. Parking structures used only for the storage of vehicles shall be classified as ordinary hazard in accordance with Section 6.3.

30.8.1.6 Minimum Construction Requirements.

30.8.1.6.1 Those parts of parking structures located within, immediately below, attached to, or less than 10 ft (3.0 m) from a building used for any other purpose shall be separated by walls, partitions, floors, or floor-ceiling assemblies having a fire resistance rating of not less than 2 hours. [**88A:**3.1.2]

*Exception: No fire-rated separation is required when parts of the parking structure and a building used for any other purpose, separated by 10 ft (3.0 m) or more, are attached only via open pedestrian balconies or bridges or open vehicle bridges. [**88A:**3.1.2, Exception]*

30.8.1.6.2 Those portions of an open parking structure located within or immediately below a building used for another purpose shall have the principal supporting members and bearing walls in all levels of the parking structure protected to provide a fire-resistive rating equivalent to that required for the other occupancy but not less than that required by 30.8.1.6.1. [**88A:**3.1.3]

30.8.1.6.3 Offices or other similar spaces that are related to the operation of the parking structure and are less than 3000 ft^2 (279 m^2) in area shall be separated from parking areas by smoke partitions. [**88A:**3.2]

*Exception: Cashier or attendant booths shall be permitted to be open to the parking structure. [**88A:**3.2, Exception]*

30.8.1.6.4 Floor surfaces shall be of noncombustible material. Where combustible construction is permitted, floor surfaces shall be noncombustible and liquid-tight. [**88A:**3.3.1, 3.3.1.1]

*Exception: Asphalt shall be permitted on grade. [**88A:**3.3.1.2]*

30.8.1.6.5 The maximum height, number of stories, and area limitations for enclosed parking structures shall be in accordance with Chapter 7.

30.8.1.6.6 Open parking structures shall be of Type I or Type II construction. [**88A:**3.7.1]

30.8.1.6.6.1 Heights and floor areas of open parking structures of Type I, Type II(222), or Type II(111) construction shall be permitted to be unlimited. [**88A:**3.7.2]

30.8.1.6.6.2 Open parking structures of Type II(000) construction shall be permitted to be of unlimited area where the following conditions are met:

(1) The height does not exceed 75 ft (22.9 m).
(2) The horizontal distance from any point on any parking level to an exterior wall opening on a street, an alley, a courtyard, or other similar permanent open spaces does not exceed 200 ft (60 m). [**88A:**3.7.3]

30.8.1.7 Occupant Load. (No requirements.)

30.8.2 Means of Egress Requirements.

30.8.2.1 General. Means of egress shall be in accordance with Chapter 11 and 30.8.2.

30.8.2.2 Means of Egress Components.

30.8.2.2.1 General. Components of means of egress shall be limited to the types described in 30.8.2.2.2 through 30.8.2.2.8.

30.8.2.2.2 Doors.

30.8.2.2.2.1 Doors complying with 11.2.1 shall be permitted.

30.8.2.2.2.2 Special locking arrangements complying with 11.2.1.6 shall be permitted.

30.8.2.2.2.3 An opening for the passage of automobiles shall be permitted to serve as an exit from a street floor, provided that no door or shutter is installed therein.

30.8.2.2.3 Stairs.

30.8.2.2.3.1 Stairs complying with 11.2.2 shall be permitted.

30.8.2.2.3.2 Exception No. 2 to 11.2.2.4.5(C) shall not apply to guards for parking garages that are accessible to the general public.

30.8.2.2.4 Smokeproof Enclosures. Smokeproof enclosures complying with 11.2.3 shall be permitted.

30.8.2.2.5 Horizontal Exits. Horizontal exits complying with 11.2.4 shall be permitted.

30.8.2.2.6 Ramps.

30.8.2.2.6.1 Ramps shall be permitted in accordance with any of the following conditions:

(1) Ramps complying with 11.2.5 and not subject to normal vehicular traffic where used as an exit.
(2) In a ramp-type open parking structure with open vehicle ramps not subject to closure, the ramp shall be permitted to serve in lieu of the second means of egress from floors above the level of exit discharge, provided that the ramp discharges directly outside at the street level.
(3) For parking structures extending only one floor level below the level of exit discharge, a vehicle ramp leading directly to the outside shall be permitted to serve in lieu of the second means of egress, provided that no door or shutter is installed therein.

30.8.2.2.6.2 Exception No. 2 to 11.2.2.4.5(C) shall not apply to guards for parking garages that are accessible to the general public.

30.8.2.2.7 Exit Passageways. Exit passageways complying with 11.2.6 shall be permitted.

30.8.2.2.8 Areas of Refuge. Areas of refuge complying with 11.2.12 shall be permitted.

30.8.2.3 Capacity of Means of Egress. *(See also 30.8.2.4 and 30.8.2.5.)*

30.8.2.4 Number of Means of Egress. Number of means of egress shall comply with 30.8.2.4.1 and 30.8.2.4.2 and Section 11.4.

30.8.2.4.1 Not less than two means of egress shall be provided from every floor or section of every parking structure.

30.8.2.4.2 Floors, or portions thereof, with an occupant load of more than 500 persons shall have the minimum number of separate and remote means of egress as specified by 11.4.1.2.

30.8.2.5 Arrangement of Means of Egress.

30.8.2.5.1 A common path of travel shall be permitted for the first 50 ft (15 m) from any point in the parking structure.

30.8.2.5.2 Dead ends shall not exceed 50 ft (15 m).

30.8.2.5.3 If fuel-dispensing devices are located within a parking structure, travel away from the fuel-dispensing device in any direction shall lead to an exit with no dead end in which occupants might be trapped by fire.

30.8.2.5.4 Within enclosed parking structures containing fuel-dispensing devices, exits shall be arranged and located to meet the following additional requirements:

(1) Exits shall lead to the outside of the building on the same level or to stairs; no upward travel shall be permitted unless direct outside exits are available from that floor.
(2) Any story below the story at which fuel is being dispensed shall have exits leading directly to the outside via outside stairs or doors at ground level.

30.8.2.6 Travel Distance to Exits. Travel distance, measured in accordance with Section 11.6, shall not exceed that provided by Table 30.8.2.6.

Table 30.8.2.6 Maximum Travel Distance to Exits

Arrangement	Enclosed Parking Structure	Open Parking Structure	Parking Structure Open Not Less than 50 Percent on All Sides
Protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	200 ft (60 m)	400 ft (122 m)	400 ft (122 m)
Not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2	150 ft (45 m)	300 ft (91 m)	400 ft (122 m)

30.8.2.7 Discharge from Exits. Exit discharge shall comply with Section 11.7.

30.8.2.8 Illumination of Means of Egress. Means of egress shall be illuminated in accordance with Section 11.8 or with natural lighting that provides the required level of illumination in structures occupied only during daylight hours.

30.8.2.9 Emergency Lighting. Parking structures shall be provided with emergency lighting in accordance with Section 11.9, except in structures occupied only during daylight hours and arranged to provide the required level of illumination of all portions of the means of egress by natural means.

30.8.2.10 Marking of Means of Egress. Means of egress shall have signs in accordance with Section 11.10.

30.8.2.11 Special Means of Egress Features (Reserved).

30.8.3 Protection.

30.8.3.1 Protection of Vertical Openings in Enclosed Parking Structures.

(A) Vertical openings through floors in buildings four stories or more in height shall be enclosed with walls or partitions having a fire resistance rating of not less than 2 hours. [**88A**:3.6]

(B) For buildings less than four stories, such walls or partitions shall have a fire resistance rating of not less than 1 hour. [**88A**:3.6]

(C) Ramps in enclosed parking structures shall not be required to be enclosed when an approved, automatic sprinkler system is provided throughout in accordance with Section 55.3 [**88A**:3.6, Exception, subpart (a) only]

30.8.3.2 Hazardous Area Protection.

(A) General. Protection from hazards shall be in accordance with the following:

(1) Areas where flammable and combustible liquids are stored, handled, or dispensed shall be designed in accordance with NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*.
(2) Areas where liquefied petroleum gas is stored, handled, or dispensed shall be designed in accordance with NFPA 58, *Liquefied Petroleum Gas Code*.
(3) Areas where natural gas fuels are stored, handled, or dispensed shall be designed in accordance with NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code*, or NFPA 57, *Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code*.

(B) Floors. In addition to the requirements of 30.8.1.6, floors in areas of parking structures where motor fuels are dispensed shall be designed in accordance with NFPA 30A.

30.8.3.3 Interior Finish.

30.8.3.3.1 General. Interior finish shall be in accordance with Chapter 10.

30.8.3.3.2 Interior Wall and Ceiling Finish. Interior wall and ceiling finish materials shall be Class A, Class B, or Class C in parking structures and shall be as required by 11.1.4 in exit enclosures.

30.8.3.3.3 Interior Floor Finish.

30.8.3.3.3.1 Interior floor finish shall comply with Section 10.6.

30.8.3.3.3.2 Interior floor finish in exit enclosures and in exit access corridors shall be not less than Class II.

30.8.3.3.3.3 Interior floor finish shall comply with 10.6.1 or 10.6.2, as applicable.

30.8.3.4 Detection, Alarm, and Communications Systems.

30.8.3.4.1 General. A fire alarm system shall be required in accordance with Section 55.2 for parking structures, except as modified by the following:

(1) Parking structures not exceeding an aggregate floor area of 100,000 ft^2 (9300 m^2)
(2) Open parking structures
(3) Parking structures protected throughout by an approved automatic sprinkler system in accordance with Section 55.3

30.8.3.4.2 Initiation. Initiation of the required fire alarm system shall be by one of the following:

(1) Manual means in accordance with 55.2.2(1)
(2) Approved automatic fire detection system in accordance with 55.2.2(2) that provides protection throughout the building and 55.2.2.1.5
(3) Approved, supervised automatic sprinkler system complying with Section 55.3 and 55.3.2 and in accordance with 55.2.2(3) that provides protection throughout the building and in accordance with 55.2.2.1.5

30.8.3.4.3 Notification.

30.8.3.4.3.1 The required fire alarm system shall sound an audible alarm in a continuously attended location for purposes of initiating emergency action.

30.8.3.4.3.2 Positive alarm sequence in accordance with 55.2.3.4 shall be permitted.

30.8.3.5 Extinguishment Requirements.

30.8.3.5.1 Automatic sprinkler systems, where required, shall conform to Section 55.3.

30.8.3.5.2 Automatic sprinkler systems shall be installed in basement and underground parking structures, the ceilings of areas less than 2 ft (1.7 m) above grade, and in enclosed parking structures of Type III or Type IV construction over 50 ft (15.2 m) in height. [**88A**:5.1.4]

30.8.3.5.3 Enclosed parking structures located at or above grade, within or immediately below a building used for another occupancy, shall have an approved, automatic sprinkler system throughout the parking structure.

30.8.3.5.4 Standpipes.

30.8.3.5.4.1 Class I standpipe systems shall be provided when required by 55.4.1, as modified by 30.8.3.5.4.2.

30.8.3.5.4.2 In open parking structures of any height, Class I standpipe systems of the manual, dry type shall be permitted.

30.8.3.6 Corridors. Corridors shall not be required to comply with the provisions of 11.1.3.1.

30.8.4 Special Provisions—High-Rise Buildings. (No requirements.)

30.8.5 Building Services.

30.8.5.1 Utilities. Utilities shall comply with the provisions of Chapter 52 and Chapter 53.

30.8.5.2 Heating, Ventilating, and Air-Conditioning.

30.8.5.2.1 General. Heating, ventilating, and air-conditioning equipment shall comply with the provisions of Chapter 50, except as otherwise required in Section 30.8.

30.8.5.2.2 Heating. All open-flame heating equipment shall be located not less than 18 in. (455 mm) above the floor.

30.8.5.2.3 Ventilation. All enclosed parking structures shall be ventilated by a mechanical system capable of providing a minimum of 1.0 cfm/ft^2(0.028 m^3/0.0929 m^2) of floor area per hour during hours of normal operation. [**88A**:4.3.3]

30.8.5.2.4 Ductwork. Ductwork shall be constructed of noncombustible material. [**88A**:4.3.3]

30.8.5.3 Elevators, Escalators, and Conveyors. Elevators, escalators, and conveyors shall comply with the provisions of Chapter 54.

30.8.5.4 Rubbish Chutes, Incinerators, and Laundry Chutes. Rubbish chutes, incinerators, and laundry chutes shall comply with the provisions of Section 8.17.

Chapter 31 Occupancies in Special Structures

31.1 General.

31.1.1 The requirements of this chapter shall apply to occupancies regulated by Chapter 16 through Chapter 30 that are located in a special structure.

31.1.2 Where there are differences in the specific requirements in this chapter and provisions for mixed occupancies or separated occupancies as specified in 6.2.3 and 6.2.4, the requirements of this chapter shall apply. *(See 4.3.2.2.)*

31.2 Underground Structures.

31.2.1 Where underground structures have an occupant load of more than 50 persons in the underground portions of the structure, the underground portions, and all areas and floor levels traversed in traveling to the exit discharge, shall be protected by an approved, supervised automatic sprinkler system installed in accordance with Section 55.3 and 55.3.2.

31.2.2 Underground portions of structures, and all areas traversed in traveling to the exit discharge, shall be provided with emergency lighting in accordance with Section 11.9.

31.2.3 Exits from underground structures having an occupant load of more than 100 persons in the underground portions of the structure and having a floor used for human occupancy more than 30 ft (9.1 m), or more than one level below the lowest level of exit discharge, shall meet the following criteria:

(1) Exits shall be cut off from the level of exit discharge as specified in 11.1.3.2.
(2) Exits shall be provided with outside smoke-venting facilities or other means to prevent the exits from becoming charged with smoke from any fire in the areas served by the exits.

31.2.4 The underground portions of an underground structure shall be provided with approved, automatic smoke control in accordance with Section 55.7 where the underground structure has all of the following:

(1) An occupant load of more than 100 persons in the underground portions of the structure
(2) A floor level used for human occupancy of more than 30 ft (9.1 m) or more than one level below the lowest level of exit discharge
(3) Combustible contents, combustible interior finish, or combustible construction

31.2.5 Exit stair enclosures in underground structures having a floor level used for human occupancy of more than 30 ft (9.1 m), or more than one level below the lowest level of exit discharge, shall be provided with signage in accordance with 11.2.2.6 at each floor level landing traversed in traveling to the exit discharge. The signs shall include a chevron-shaped indicator to show direction to the exit discharge.

31.3 Limited-Access Structures.

31.3.1 Special Provisions for Limited-Access Structures.

31.3.1.1 A structure, or portion of a structure, shall not be considered a limited-access structure under the following conditions:

(1) The structure is a one-story structure, or portion thereof, where the story is provided with grade level doors or emergency access openings on two sides of the building, spaced not more than 125 ft (38 m) apart in the exterior walls.
(2) The structure, or portion thereof, is more than one story in height where the following criteria are met:
    (a) Emergency access openings are provided on the first story as required by 31.3.1.1(1).
    (b) Every story above the first floor is provided with emergency access openings on two sides of the building, spaced not more than 30 ft (9.1 m) apart.

31.3.1.2 Emergency access openings shall consist of a window, panel, or similar opening that complies with all of the following:

(1) The opening shall have dimensions of not less than 22 in. (560 mm) in width and 24 in (610 mm) in height and shall be unobstructed to allow for ventilation and rescue operations from the exterior.
(2) The bottom of the opening shall not be more than 44 in. (1120 mm) above the floor.
(3) The opening shall be readily identifiable from both the exterior and interior.
(4) The opening shall be readily openable from both the exterior and interior.

31.3.1.3 Limited-access structures shall be protected by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2, except for structures meeting the following criteria:

(1) An occupant load of less than 50 persons.
(2) A single-story limited-access structure that is permitted to have a single exit in accordance with Chapter 16 through Chapter 30 and has a common path of travel not exceeding 50 ft (15 m).

31.3.1.4 Limited-access portions of structures, and all areas traversed in traveling to the exit discharge, shall be provided with emergency lighting in accordance with Section 11.9.

31.4 Vehicles and Vessels (Mobile Units).

31.4.1 Vehicles. Where immobile, attached to a building, or permanently fixed to a foundation, and where subject to human occupancy, the following vehicles shall comply with the requirements of this *Code* that are appropriate to buildings of similar occupancy:

(1) Trailers
(2) Railroad cars
(3) Streetcars
(4) Buses
(5) Conveyances similar to those specified in 31.4.1(1) through 31.4.1(4)

31.4.2 Vessels. Any ship, barge, or other vessel permanently fixed to a foundation or mooring, or unable to get underway by means of its own power, and occupied for purposes other than navigation shall be subject to the requirements of this *Code* applicable to buildings of similar occupancy.

31.5 Open Structures (Outdoor Processing Facilities).

31.5.1 Definition—Open Structure. A structure that supports equipment and operations not enclosed within building walls.

31.5.2 Means of Egress. The means of egress provisions of Chapter 11 and the applicable occupancy provisions of Chapter 16 through Chapter 30 shall apply, except as modified by 31.5.2.1 through 31.5.2.8.

31.5.2.1 Means of Egress Components—Fire Escape Ladders. Open structures that are designed for occupancy by not more than three persons shall be permitted to be served by fire escape ladders complying with 11.2.9.

31.5.2.2 Capacity of Means of Egress. Open structures shall be exempt from the requirements for capacity of means of egress.

31.5.2.3 Number of Means of Egress.

31.5.2.3.1 The grade level of open structures, which by their very nature contain an infinite number of means of egress, shall be exempt from the requirements for number of means of egress.

31.5.2.3.2 Open structures occupied by not more than three persons, and with travel distance of not more than 200 ft (60 m), shall be permitted to have a single exit.

31.5.2.4 Travel Distance to Exits. Open structures shall be exempt from travel distance limitations.

31.5.2.5 Discharge from Exits. Open structures permitted to have a single exit per 31.5.2.3.2 shall be permitted to have 100 percent of the exit discharge through areas on the level of exit discharge.

31.5.2.6 Illumination of Means of Egress. Open structures shall be exempt from illumination of means of egress requirements.

31.5.2.7 Emergency Lighting. Open structures shall be exempt from emergency lighting requirements.

31.5.2.8 Marking of Means of Egress. Open structures shall be exempt from marking of means of egress requirements.

31.5.2.9 Protection.

31.5.2.9.1 Protection of Vertical Openings. Open structures shall be exempt from protection of vertical opening requirements.

31.5.2.9.2 Hazardous Area Protection. Every open structure, other than structures with only occasional occupancy, shall have automatic, manual, or other protection as appropriate for the particular hazard that is designed to minimize danger to occupants in case of fire or other emergency before the occupants have time to utilize the means of egress.

31.5.2.10 Detection, Alarm, and Communications Systems. Open structures shall be exempt from requirements for detection, alarm, and communications systems.

31.6 Towers.

31.6.1 Use of Accessory Levels.

31.6.1.1 Sprinklered Towers. In towers protected throughout by an automatic sprinkler system in accordance with Section 55.3, the levels located below the observation level shall be permitted to be occupied only for the following uses that support tower operations:

(1) Electrical and mechanical equipment rooms including emergency power
(2) Radar, communications, and electronics rooms
(3)*Incidental accessory uses

31.6.1.2 Nonsprinklered Towers. The levels located within a tower below the observation level and equipment room for that level in nonsprinklered towers shall not be occupied.

31.6.2 Means of Egress. The means of egress provisions of Chapter 11 and the applicable occupancy provisions of Chapter 16 through Chapter 30 shall apply, except as modified by 31.6.3 through 31.6.10.

31.6.3 Means of Egress Components.

31.6.3.1 Fire Escape Ladders. Towers, such as forest fire observation or railroad signal towers, that are designed for occupancy by not more than three persons shall be permitted to be served by fire escape ladders complying with 11.2.9.

31.6.3.2 Elevators. Towers subject to occupancy by not more than 90 persons shall be permitted to use elevators in the means of egress in accordance with 11.2.13.

31.6.4 Capacity of Means of Egress.

31.6.4.1 Means of egress for towers shall be provided for the number of persons expected to occupy the space.

31.6.4.2 Spaces not subject to human occupancy because of machinery or equipment shall be excluded from consideration.

31.6.5 Number of Means of Egress.

31.6.5.1 Towers shall be permitted to have a single exit if the following conditions are met:

(1) The tower is subject to occupancy by fewer than 25 persons.
(2) The tower is not used for living or sleeping purposes.
(3) The tower is of Type I, Type II, or Type IV construction.
(4) The tower interior wall and ceiling finish is Class A or Class B.
(5) The tower has no combustible materials in, under, or in the immediate vicinity, except necessary furniture.
(6) There are no high hazard occupancies in the tower or in the immediate vicinity.
(7) Where the tower is located above a building, the single exit from the tower shall be provided by one of the following:
    (a) An exit enclosure separated from the building with no door openings to or from the building
    (b) An exit enclosure leading directly to an exit enclosure serving the building with walls and door separating these exit enclosures from each other, and another door allowing access to the top floor of the building, that provides access to a second exit serving that floor

31.6.5.2 Towers with 360-degree line-of-sight requirements shall be permitted to have a single means of egress for a distance of travel not exceeding 75 ft (23 m), or 100 ft (30 m) if the tower is protected throughout by an approved automatic sprinkler system in accordance with Section 55.3.

31.6.6 Travel Distance to Exits. Towers in which ladders are permitted by 31.6.3.1 shall be exempt from travel distance limitations.

31.6.7 Discharge from Exits. Towers permitted to have a single exit per 31.6.5.1 shall be permitted to have 100 percent of the exit discharge through areas on the level of exit discharge.

31.6.8 Illumination of Means of Egress. Towers in which ladders are permitted per 31.6.3.1 shall be exempt from illumination of means of egress requirements.

31.6.9 Emergency Lighting.

31.6.9.1 Towers in which ladders are permitted per 31.6.3.1 shall be exempt from emergency lighting requirements.

31.6.9.2 Locations not routinely inhabited by humans shall be exempt from emergency lighting requirements.

31.6.9.3 Structures occupied only during daylight hours, with windows arranged to provide the required level of illumination of all portions of the means of egress during such hours, shall be exempt from emergency lighting requirements where approved by of the authority having jurisdiction.

31.6.10 Marking of Means of Egress.

31.6.10.1 Towers in which ladders are permitted per 31.6.3.1 shall be exempt from marking of means of egress requirements.

31.6.10.2 Locations not routinely inhabited by humans shall be exempt from marking of means of egress requirements.

31.6.11 Protection.

31.6.11.1 Protection of Vertical Openings.

31.6.11.1.1 Towers in which ladders are permitted per 31.6.3.1 shall be exempt from protection of vertical opening requirements.

31.6.11.1.2 In towers where the support structure is open and no occupancy is located below the top floor level, stairs shall be permitted to be open with no enclosure required, or fire escape stairs shall be permitted.

31.6.11.2 Hazardous Area Protection. Every tower, other than towers with only occasional occupancy, shall have automatic, manual, or other protection, as appropriate for the particular hazard that is designed to minimize danger to occupants in case of fire or other emergency before the occupants have time to utilize the means of egress.

31.6.12 Detection, Alarm, and Communications Systems. Towers designed for occupancy by not more than three persons shall be exempt from requirements for detection, alarm, and communications systems.

31.7 Water-Surrounded Structures.

31.7.1 General. The provisions of Section 31.1 and Section 31.7 shall apply to those structures that are not under the jurisdiction of the U.S. Coast Guard and are designed and arranged in accordance with U.S. Coast Guard regulations.

31.7.2 Means of Egress.

31.7.2.1 General. The means of egress provisions of Chapter 11 shall apply, except as modified by 31.7.2.2 through 31.7.2.5.

31.7.2.2 Capacity of Means of Egress. Spaces not subject to human occupancy because of machinery or equipment shall be exempt from capacity of means of egress requirements.

31.7.2.3 Discharge from Exits. Structures permitted to have a single exit in accordance with Chapter 16 through Chapter 30 shall be permitted to have 100 percent of the exit discharge through areas on the level of exit discharge.

31.7.2.4 Emergency Lighting.

31.7.2.4.1 Locations not routinely inhabited by humans are exempt from emergency lighting requirements.

31.7.2.4.2 Structures occupied only during daylight hours, with windows arranged to provide the required level of illumination of all portions of the means of egress during such hours, shall be exempt from emergency lighting requirements where approved by the authority having jurisdiction.

31.7.2.5 Marking of Means of Egress. Locations not routinely inhabited by humans shall be exempt from marking of means of egress requirements.

31.7.3 Hazardous Area Protection. Every water-surrounded structure, other than structures with only occasional occupancy, shall have automatic, manual, or other protection as appropriate for the particular hazard that is designed to minimize danger to occupants in case of fire or other emergency before the occupants have time to use the means of egress.

31.8 Piers.

31.8.1 Number of Means of Egress. Piers used exclusively to moor cargo vessels and to store material shall be exempt from number of means of egress requirements where provided with proper means of egress from structures thereon to the pier and a single means of access to the mainland, as appropriate with the pier's arrangement.

31.8.2 Arrangement of Means of Egress.

(A) Piers not meeting the requirements of 31.8.1 and occupied for other than cargo handling and storage shall have means of egress arranged in accordance with Chapter 11.

(B) In addition to the requirement of 31.8.2(A), one of the following measures shall be provided on piers extending over 150 ft (45 m) from shore to minimize the possibility that fire under or on the pier will block escape of occupants to shore:

(1) The pier shall be arranged to provide two separate ways to travel to shore, such as two well-separated walkways or independent structures.
(2) The pier deck shall be open, fire resistive, and set on noncombustible supports.
(3) The pier shall be open and unobstructed and shall be 50 ft (15 m) or more in width if less than 500 ft (150 m) long, or its width shall be not less than 10 percent of its length if over 500 ft (150 m) long.
(4) The pier deck shall be provided with an approved automatic sprinkler system in accordance with Section 55.3 that protects the combustible substructure and all superstructures, and the sprinkler system shall be supervised if the applicable occupancy chapter requires supervision of sprinkler systems.

31.9 Helistops.

31.9.1 Requirements for helistops shall be as follows:

(1) Helistops shall be permitted to be erected on buildings or at other locations when constructed in accordance with the requirements of Section 31.9 and NFPA 418, *Standard for Heliports*.
(2) When erected on buildings, helistops shall be designed in accordance with Chapter 35 for design live and dead loads and as specified in Chapter 7 for materials of construction.

31.9.2 Requirements for touchdown or landing areas for helicopters shall be as follows:

(1) The touchdown or landing area for helicopters weighing less than 3500 lb (1587.6 kg) shall be a minimum of 20 ft × 20 ft (6.1 m × 6.1 m) in area.
(2) The landing area shall be surrounded on all sides by a clear area having a minimum average width at roof level of 15 ft (4.6 m), but with no width less than 5 ft (1.5 m).
(3) For helicopters weighing more than 3500 lb (1587.6 kg), special requirements shall be met as determined by the authority having jurisdiction.

31.9.3 Helicopter landing areas, and the supports thereof on the roof of a building, shall be of noncombustible construction.

31.9.4 Landing areas shall be designed to confine any spillage of flammable liquid to the landing area.

31.9.5 Provision shall be made to drain the spillage specified in 31.9.4 away from exits and stairways.

31.9.6 Exits from helistops shall conform to the requirements of Chapter 11.

31.9.7 Guardrails shall be provided around all roofs or decks and shall comply with the requirements of 11.2.2.4.

31.9.8 Before operating helicopters from rooftops is permitted, written approval of the Federal Aviation Agency shall be presented to the authority having jurisdiction.

Chapter 32 Special Construction

32.1 General.

32.1.1 Scope. All special construction, as defined in this chapter, shall be in compliance with this chapter and shall meet all other applicable requirements of this *Code*.

32.1.2 Flood Resistance. Permanent special structures that are located wholly or partly within the flood hazard area established by 39.4.2 shall comply with the provisions of Chapter 39.

32.1.3 Special Definitions.

32.1.3.1 Bleachers. A grandstand in which the seats are not provided with backrests.

32.1.3.2 Folding and Telescopic Seating. A structure that is used for tiered seating of persons and whose overall shape and size can be reduced, without being dismantled, for purposes of moving or storing.

32.1.3.3* Grandstand. A structure that provides tiered or stepped seating.

32.1.3.4* Hot Tub. A spa constructed of wood, with sides and bottoms formed separately, and the whole shaped to be joined together by pressure from the surrounding hoops, bands, or rods.

32.1.3.5 Membrane. For the purposes of membrane structures, a thin, flexible, water-impervious material capable of being supported by an air pressure of 1.5 in. water column (38 mm).

32.1.3.6 Permanent. Any object that is intended to remain in place for more than 180 days.

32.1.3.7 Pool.

32.1.3.7.1 Public Pool. Any pool that is not a residential pool.

32.1.3.7.2 Residential Pool. A swimming pool that is intended for noncommercial use by not more than three owner families and their guests.

32.1.3.7.3 Swimming Pool. Any constructed pool intended for swimming or diving, permanent or nonportable, that is over 24 in. (610 mm) in depth, has a surface area exceeding 250 ft^2 (23 m^2) or a volume over 3250 gal (12,300 L).

32.1.3.8 Spa. A hydrotherapy unit including, but not limited to, a therapeutic or hydrotherapy pool, whirlpool, or hot tub, with a maximum water depth of 4 ft (1.2 m) that may have a therapeutic use but that is not drained, cleaned, or refilled for each individual use.

32.1.3.8.1 Portable Spa. A spa that is not permanent and in which the water circulating equipment can be either an integral or nonintegral part of the product.

32.1.3.8.2 Public Spa. Any spa that is intended to be used for bathing and is operated by an owner, a licensee, or a concessionaire, regardless of whether a fee is charged for use.

32.1.3.8.3* Residential Spa. A permanent spa in which the water heating and water circulation equipment is not an integral part of the product.

32.1.3.9 Structure.

32.1.3.9.1 Air-Inflated Structure. A structure whose shape is maintained by air pressure in cells or tubes forming all or part of the enclosure of the usable area and in which the occupants are not within the pressurized area used to support the structure.

32.1.3.9.2* Air-Supported Structure. A structure where shape is maintained by air pressure and occupants are within the elevated pressure area.

32.1.3.9.3 Membrane Structure. A building or portion of a building incorporating an air-inflated, air-supported, tensioned-membrane structure; a membrane roof; or a membrane-covered rigid frame to protect habitable or usable space.

32.1.3.9.4 Tensioned-Membrane Structure. A membrane structure incorporating a membrane and a structural support system such as arches, columns and cables, or beams wherein the stresses developed in the tensioned membrane interact with those in the structural support so that the entire assembly acts together to resist the applied loads.

32.1.3.10 Temporary. Any object that is in place for a period of 180 consecutive days or less.

32.1.3.11* Tent. A temporary structure, the covering of which is made of pliable material that achieves its support by mechanical means such as beams, columns, poles, or arches, or by rope, or cables, or both.

32.1.3.11.1 Private Party Tent. A tent erected in the yard of a private residence for entertainment, recreation, dining, reception, or similar function.

32.1.3.12 Weathered-Membrane Material. Membrane material that has been subjected to a minimum of 3000 hours in a weatherometer in accordance with ASTM G 155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, or approved equivalent.

32.2 Membrane Structures.

32.2.1 General.

32.2.1.1 Scope. Section 32.2 shall apply to permanent air-supported, air-inflated, and tensioned-membrane structures, collectively known as membrane structures, that are used as complete buildings and as roofs or other portions of buildings or other types of construction, and the following also shall apply:

(1) Membrane structures also shall comply with the applicable provisions of this *Code*.
(2) Temporary membrane structures shall comply with 32.2.5.

32.2.1.1.1 General. Membrane structures that provide the complete enclosure for the occupied space shall be considered as complete buildings and subject to the requirements of Section 32.2.

32.2.1.1.2 Height. Membrane structures shall be limited to one story in height, but height shall not be limited in number of feet.

32.2.1.1.3 Area. For determining allowable area, the construction type for a membrane structure shall be based on the support system.

32.2.1.1.3.1 Air-supported membrane structures shall not exceed the allowable areas listed in Chapter 7 for Type II(000) unprotected construction.

32.2.1.1.3.2 Area increases in accordance with Chapter 7 shall be permitted.

32.2.1.2 Exits. Exits shall be provided in accordance with Chapter 11.

32.2.1.3 Electrical. Electrical wiring shall comply with NFPA 70, *National Electrical Code*.

32.2.1.4 Fire Protection Systems and Equipment. All membrane structures shall be in accordance with Chapter 55.

32.2.1.5 Mechanical.

32.2.1.5.1 Fuel gas heating, ventilation, and air-conditioning installations shall conform to the requirements of NFPA 54, *National Fuel Gas Code*.

32.2.1.5.2 The installation of equipment not covered in 32.2.1.5.1 shall conform to the requirements of the UMC, *Uniform Mechanical Code*.

32.2.1.6 Occupancy Separation. A membrane structure building that is occupied by more than one use group shall comply with Chapter 6 of this *Code*.

32.2.1.7 Mixed Construction.

32.2.1.7.1 Membrane structures shall be permitted to be utilized as a portion of buildings of other types of construction as specified in 32.2.

32.2.1.7.2 Height and area limits shall be as specified for the type of construction and occupancy of the building.

32.2.2 Permanent Membrane Structures.

32.2.2.1 Required Tests. All tests of membrane materials for compliance with this chapter shall be performed on weathered-membrane materials.

32.2.2.2 Use of Membrane Materials. Membrane materials shall not be used where fire resistance ratings are required for walls or roofs, unless otherwise permitted by the following:

(1) Where every part of the roof, including the roof membrane, is not less than 20 ft (6.1 m) above any floor, balcony, or gallery, a noncombustible or limited-combustible membrane shall be permitted to be used as the roof in any type of construction.
(2) With approval of the authority having jurisdiction, membrane materials shall be permitted to be used where every part of the roof membrane is located sufficiently above every significant fire potential so that the imposed temperature will not exceed the capability of the membrane, including seams, to maintain its structural integrity.

32.2.2.3 Flame Spread.

32.2.2.3.1 Flame spread of all membrane materials exposed within the structure shall be Class A, as defined in Chapter 10.

32.2.2.3.2 The requirement of 32.2.2.3.1 shall not apply to plastic less than 20 mil (0.51 mm) in thickness located less than 30 ft (9.1 m) above any floor in greenhouses where occupancy by the general public is prohibited.

32.2.2.4 Flame Resistance.

32.2.2.4.1 All membrane structure fabric shall meet the requirements of Method 2 Test contained in NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*.

32.2.2.4.2 The requirement of 32.2.2.4.1 shall not apply to plastic less than 20 mil (0.51 mm) in thickness located less than 30 ft (9.1 m) above any floor in greenhouses where occupancy by the general public is prohibited.

32.2.2.4.3 The authority having jurisdiction shall require one of the following as evidence that membrane structure fabric materials have the required flame resistance:

(1) Certificate or other evidence of acceptance by an organization acceptable to the authority having jurisdiction
(2) Report of tests made by other inspection authorities or organizations acceptable to the authority having jurisdiction

32.2.2.4.4 Where required by the authority having jurisdiction, confirmatory field tests shall be conducted using test specimens from the original material affixed at the time of manufacture to the exterior of the structure.

32.2.3 Tensioned-Membrane Structures.

32.2.3.1 Protection for Membrane Roofs. Protection for membrane roofs for structures in climates subject to freezing temperatures and ice buildup shall be as specified in 32.2.3.1.1 or 32.2.3.1.2.

32.2.3.1.1 The roof shall be composed of two layers with an air space between the layers through which heated air can be moved to guard against ice accumulation.

32.2.3.1.2 Any approved methods that protect against ice accumulation shall be permitted.

32.2.3.2* Protection for Roof Drains. Protection for roof drains shall be as specified in 32.2.3.2.1 and 32.2.3.2.2 or 32.2.3.2.3.

32.2.3.2.1 Roof drains shall be equipped with listed de-icing and snow-melting equipment to protect against ice buildup, which would prevent the drains from functioning.

32.2.3.2.2 The equipment shall be served by on-site standby electrical power in addition to the normal public service.

32.2.3.2.3 In lieu of de-icing and snow-melting equipment, any other approved methods that protect against ice accumulation shall be permitted.

32.2.4 Air-Supported, Air-Inflated Structures.

32.2.4.1* General. In addition to the requirements of this *Code*, air-supported structures shall be designed and operated in accordance with ASCE 17, *Air Supported Structures*.

32.2.4.2 Maintenance and Operation.

32.2.4.2.1 Instructions in both operation and maintenance shall be transmitted to the owner by the manufacturer of the tensioned-membrane, air-supported, or air-inflated structure.

32.2.4.2.2 An annual inspection and required maintenance of each structure shall be performed.

32.2.4.2.3 At least biannually, the annual inspection shall be performed by a professional engineer or qualified service representative.

32.2.5 Temporary Membrane Structures.

32.2.5.1 General. Membrane structures designed to meet all the requirements of this chapter shall be permitted to be used as temporary buildings subject to the approval of the authority having jurisdiction.

32.2.5.2 Temporary Membrane Structures. Temporary membrane structures shall comply with the requirements of 32.2.5 and 32.2.2.4 and 32.3.5.

32.2.5.3* Temporary Tensioned-Membrane Structures. Temporary tensioned-membrane structures shall be permitted to comply with Section 32.3, provided that the following criteria are met:

(1) Roof drains shall be equipped with listed de-icing and snow-melting equipment.
(2) The de-icing and snow-melting equipment shall be served by on-site standby electrical power in addition to the normal public service.
(3) Any approved methods that protect against ice accumulation shall be permitted.

32.2.5.4 Clearance. There shall be a minimum clearance of 3 ft (0.9 m) between the membrane and the contents or equipment within the building and between the membrane and any exterior object.

32.3 Tents.

32.3.1 General. Tents and membrane structures, other than private party tents, camping tents, and other tents under 400 ft^2 (37.2 m^2), shall comply with NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents and Membrane Structures,* and the requirements of Section 32.3.

32.3.2 Structural Design Load Requirements. Tents and membrane structures shall comply with the requirements of Chapter 35 for structural design loads.

32.3.3 Flame Resistance.

32.3.3.1 All tent fabric shall meet the requirements of the large-scale test contained in NFPA 701.

32.3.3.2 The authority having jurisdiction shall require one of the following as evidence that the fabric materials have the required flame resistance:

(1) Certificate or other evidence of acceptance by an organization acceptable to the authority having jurisdiction
(2) Report of tests made by other inspection authorities or organizations acceptable to the authority having jurisdiction

32.3.3.3 Where required by the authority having jurisdiction, confirmatory field tests shall be conducted using test specimens from the original material affixed at the time of manufacture to the exterior of the tent.

32.3.4 Location and Spacing.

32.3.4.1 There shall be a minimum of 10 ft (3.0 m) between stake lines.

32.3.4.2 Adjacent tents shall meet the requirements of 32.3.4.2.1 and 32.3.4.2.2.

32.3.4.2.1 Adjacent tents shall be no closer to each other than allowed in order to provide an area to be used as a means of emergency egress as calculated by Chapter 11.

32.3.4.2.2 Where 10 ft (3.0 m) between stake lines is not sufficient for means of egress, the distance necessary for means of egress shall govern.

32.3.4.3 Subject to the approval of the authority having jurisdiction, the requirements of 32.3.4.2 shall not apply, provided that the following criteria are met:

(1) Tents not occupied by the public and not used for the storage of combustible material shall be permitted to be erected less than 10 ft (3.0 m) from other structures.
(2) Tents, each not exceeding 1200 ft^2 (110 m^2), and located in fairgrounds or similar open spaces, shall not be required to be separated from each other.

32.3.4.4 The placement of tents relative to other structures shall be at the discretion of the authority having jurisdiction, based on the occupancy, use, opening, exposure, and other similar factors.

32.3.5 Protection.

32.3.5.1 Tents and temporary membrane structures shall be protected as specified in 32.3.5.1.1 through 32.3.5.1.4.

32.3.5.1.1 The ground enclosed by the structure, and the surrounding ground not less than 10 ft (3.0 m) outside of the structure, shall be cleared of all flammable or combustible material and vegetation.

32.3.5.1.2 The requirement of 32.3.5.1.1 shall be accomplished to the satisfaction of the authority having jurisdiction prior to the erection of tents and temporary membrane structures.

32.3.5.1.3 The premises shall be kept free from flammable or combustible materials during the period for which the premises are used by the public.

32.3.5.1.4 The requirements of 32.3.5.1.1 through 32.3.5.1.3 shall not apply to necessary support equipment.

32.3.5.2 Enclosed stadiums, arenas, and similar structures shall be protected throughout by an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems,* unless otherwise permitted by the following:

(1) Where the ceiling or roof, whichever is lower, of the playing (activity) area is more than 55 ft (16.7 m) above the floor, sprinklers shall not be required above the playing (activity) area where permitted by the authority having jurisdiction.
(2) Sprinklers shall not be required above seating areas that view the playing (activity) area.

32.3.5.3 An enclosed area shall be protected by an approved sprinkler system in accordance with NFPA 13, unless such an area is one of the following:

(1) Enclosed stadiums, arenas, and similar structures
(2) Press boxes of less than 1000 ft^2 (93 m^2)
(3) Storage facilities of less than 1000 ft^2 (93 m^2) if enclosed with minimum 1-hour fire resistance–rated construction
(4) Enclosed areas underneath grandstands or bleachers that comply with the exceptions to Section 4.8 of NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures*

32.3.6 Services.

32.3.6.1 Electrical installations shall conform to the requirements of NFPA 70.

32.3.6.2 The requirement of 32.3.6.1 shall not apply where otherwise provided by law, ordinance, or regulation.

32.3.6.3 Fuel-fired heaters and their installation shall be approved by the authority having jurisdiction.

32.3.6.4 Ducts used to convey heated air shall comply with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

32.3.6.5 Containers for liquefied petroleum gases shall be installed not less than 5 ft (1.5 m) from any tent or temporary membrane structure.

32.3.6.6 Heating devices shall comply with the requirements of the following standards:

(1) NFPA 31, *Standard for the Installation of Oil-Burning Equipment*
(2) NFPA 54, *National Fuel Gas Code*
(3) NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*

32.3.6.7 Electric Heaters. Electric heaters shall meet the following criteria:

(1) Heaters used inside a tent or temporary membrane structure shall be approved.
(2) Heaters shall be connected to the power source by an outdoor-rated electric cable sized to handle the electrical load.

32.4 Awnings and Canopies.

32.4.1 General. Awnings and canopies shall comply with the requirements of Section 32.4 and other applicable sections of this *Code*.

32.4.2 Construction Types. Construction shall comply with the requirements of 32.4.2.1 and 32.4.2.2.

32.4.2.1 In Type I and Type II construction, awnings and canopies shall be constructed of rigid frames consisting of one of the following:

(1) Noncombustible material
(2) Wood of Type IV construction sizes
(3) Fire retardant–treated wood
(4) One-hour fire resistance–rated construction with noncombustible covers

32.4.2.2 For Type III, Type IV, and Type V construction, the frame and covering shall be of approved materials.

32.4.3 Coverings. Awnings and canopies shall be permitted to have a combustible covering that is flame resistant, as determined in accordance with NFPA 701, or that has a Class A rating, as specified in Chapter 10.

32.4.4 Plastics. Plastics meeting the requirements of light-transmitting plastics in Section 48.7 shall be permitted in awnings and canopies when constructed in accordance with the requirements for marquees in Section 32.5.

32.4.5 Motor Fuel–Dispensing Facility Canopies. Motor fuel–dispensing facility canopies shall comply with the requirements of 32.4.5.1 through 32.4.5.3.

32.4.5.1 Canopies erected over areas where fuels are dispensed shall have a clear, unobstructed height of not less than 13½ ft (4.1 m) where located above the vehicle drive-through area.

32.4.5.2 Canopies and their supports erected over fuel dispensers shall be constructed of noncombustible materials, fire retardant-treated wood, wood meeting Type IV construction sizes, or construction providing a minimum 1-hour fire resistance rating.

32.4.5.3 Combustible materials used in or on a canopy shall comply with any one of the following:

(1) Combustible materials shall be completely shielded from the fuel dispensers by a noncombustible component of the canopy or by wood meeting Type IV construction sizes.
(2) Plastics shall meet the following criteria:
   (a) They shall be covered by an aluminum skin having a minimum thickness of 0.019 in. (0.5 mm) or a corrosion-resistant steel skin having a minimum base metal thickness of 0.016 in. (0.41 mm).
   (b) They shall have a Class A rating, as specified in Chapter 10, when tested in the form intended for use and a self-ignition temperature of not less then 650°F (343°C) when tested in accordance with ASTM D 1929, *Standard Test Method for Determining Ignition Temperature of Plastics*.
(3) Light-transmitting plastic panels shall meet the following criteria:
   (a) The panels shall be located not less than 10 ft (3.0 m) from any building on the same property, and not less than 40 ft (12.2 m) from the street or open yard to the property line.
   (b) The aggregate area of such panels shall be not greater than 1000 ft^2 (93 m^2).
   (c) The area of any individual plastic panel shall be not greater than 100 ft^2 (9.3 m^2).

32.5 Marquees.

32.5.1 Marquees shall comply with the requirements of Section 32.5 and other applicable sections of this *Code*.

32.5.2 For the purpose of Section 32.5, a marquee shall include any object or decoration attached to a marquee or attached to a part of a marquee.

32.5.3 The horizontal clearance between a marquee and the curb line shall be not less than 2 ft (0.6 m).

32.5.4 The maximum height of a marquee, measured vertically from its lowest to its highest point, shall not exceed 9 ft (2.7 m).

32.5.5 A marquee shall be supported entirely by the building; shall be constructed as specified in Chapter 7; and shall be of Type I, Type II, or Type V(111) construction.

32.5.6 The roof, or any part thereof, shall be permitted to be a skylight in accordance with Section 38.14, Section 46.8, and Section 48.7.

32.5.7 Every roof and skylight of a marquee shall be sloped to downspouts that conduct any drainage from the marquee in an approved manner.

32.6 Outdoor Signs.

32.6.1 The design and materials of construction of outdoor advertising signs and display structures shall be in accordance with the requirements of Chapter 7, Chapter 35, Chapter 38, and Section 32.6.

32.6.2 Electrical signs shall be installed in accordance with the requirements of NFPA 70 and Section 32.6.

32.7 Grandstands and Bleachers.

32.7.1 General. Grandstands and bleachers shall comply with the requirements of Section 32.7.

32.7.2 Location. Grandstands shall be erected or otherwise located only where load-carrying capacities exist to support the loads.

32.7.3 Minimum Construction Requirements.

32.7.3.1 Grandstands and bleachers shall be permitted to be of unlimited area when of Type I or Type II construction.

32.7.3.2 Grandstands and bleachers shall be permitted to be of Type III, Type IV, or Type V construction when designed in accordance with 32.7.5.

32.7.4 Design.

32.7.4.1 Grandstands shall be designed to withstand the structural loading requirements of Chapter 35, unless otherwise permitted by 32.7.4.

32.7.4.2 The manufacturer shall comply with the requirements of 32.7.4.2.1 and 32.7.4.2.2.

32.7.4.2.1 Where required by the authority having jurisdiction, the manufacturer shall submit either of the following:

(1) Calculations verifying the design analysis prepared by a professional engineer or registered architect
(2) Report of load tests conducted by an approved, independent testing laboratory and certified by a professional engineer

32.7.4.2.2 Where required by the authority having jurisdiction, the manufacturer shall certify that the equipment supplied is in accordance with the design.

32.7.5 Special Requirements —Type III, Type IV, and Type V Grandstands.

32.7.5.1 An outdoor grandstand of Type III, Type IV, or Type V construction shall not be erected a distance less than two-thirds of its height from a building, but in no case shall the grandstand be erected less than 10 ft (3.0 m) from a building, unless one of the following criteria is met:

(1) The exterior wall of the building is of at least 1-hour fire resistance–rated construction with all openings protected.
(2) A fire wall of at least 1-hour fire resistance–rated construction is provided between the grandstand and the building.

32.7.5.2 The following shall apply to outdoor grandstand units of Type III, Type IV, or Type V construction:

(1) No outdoor grandstand unit shall exceed 10,000 ft^2 (929 m^2) or 200 ft (61.0 m) in length.
(2) Grandstand units of the maximum size shall be placed not less than 20 ft (6.1 m) apart or shall be separated by walls with a 1-hour fire resistance rating.
(3) Not more than three units shall be erected in any one group.
(4) Each group of less than three units shall be separated from any other group by a wall of 2-hour fire resistance-rated construction extending 2 ft (0.6 m) above the seat platforms or by an open space of not less than 50 ft (15.2 m).
(5) Where entirely constructed of labeled fire retardant–treated wood that has passed the standard rain test in ASTM D 2898, *Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing*, or where constructed of members conforming to dimensions for heavy timber construction [Type IV (2HH)], the area or length specified by 32.7.5.2(1) shall be permitted to be doubled.

32.7.5.3 The highest level of seat platforms above the ground or the surface at the front of the grandstand shall be as follows:

(1) Grandstands of Type III, Type IV, or Type V construction—not more than 20 ft (6.1 m)
(2) Portable grandstands of Type III, Type IV, or Type V construction within tents or membrane structures—not more than 12 ft (3.7 m)

32.7.5.4 Where entirely constructed of labeled fire retardant–treated wood that has passed the standard rain test in ASTM D 2898 or where constructed of members conforming to dimensions for heavy timber construction [Type IV (2HH)], the heights specified by 32.7.5.3 shall be permitted to be doubled.

32.7.6 Special Requirements—Portable Grandstands. Portable grandstands shall conform to the requirements of this chapter for grandstands and the special requirements of this subsection.

32.7.6.1 General. Portable grandstands shall comply with the following:

(1) Portable grandstands shall be self-contained, having within them all necessary parts to withstand and restrain all forces that might be developed during human occupancy.
(2) Portable grandstands shall be designed and manufactured so that, if any structural members required for the strength and stability of the structure have been omitted during erection, the presence of unused connection fittings shall make the omissions self-evident.
(3) The construction shall produce the strength required by the design.
(4) Portable grandstands shall not be used until all parts have been erected, or re-erected, in accordance with the approved design and specifications.
(5) The seating, walkways, railings, bracing, and supporting members shall be structurally sound.

32.7.6.2 Placement. The following shall apply to the placement of portable grandstands:

(1) Portable grandstands shall be provided with base plates, sills, floor runners, or sleepers of such area that the allowable bearing capacity of the supporting material is not exceeded.
(2) Where portable grandstands rest directly on a base where settlement can or does occur beyond that allowed by design, mud sills of suitable material having sufficient area to prevent undue or dangerous settlement shall be installed under base plates, runners, or sleepers.
(3) All bearing surfaces shall be in full contact with each other.

32.7.6.3 Prevention of Displacement. A-frames or other supports and seat stringers for portable grandstands shall be secured to prevent accidental displacement during occupancy.

32.7.6.4 Fasteners. The following shall apply to fasteners for portable grandstands:

(1) The use of nails, lag screws, and wood screws shall be permitted for holding wood parts together, provided that the following criteria are met:
    (a) Nails, lag screws, and wood screws shall not be used for demountable joinings.
    (b) Nails, lag screws, and wood screws shall not be used where their loosening or splitting of surrounding wood would jeopardize the structure or its occupants.

(2) Members in tension shall be connected at each end by not less than two bolts, rivets, or lag screws or by approved connectors or other approved devices.
(3) All ferrous fastenings and fastening devices shall be stainless steel or hot-dipped galvanized in accordance with ASTM A 153, *Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*.

32.7.7 Maintenance. Maintenance shall be provided as follows:

(1) The owner shall provide for not less than annual inspection and required maintenance of each grandstand to ensure safe conditions.
(2) At least biannually, the inspection shall be performed by a professional engineer or registered architect.
(3) Where required by the authority having jurisdiction, the owner shall provide certification that both inspections have been performed.

32.7.8 Folding and Telescopic Seating.

32.7.8.1 Application. Folding and telescopic seating shall be permitted only if the supporting structure has been designed to handle the loading and has the exit facilities to accommodate the occupants of the seating, as well as all other occupants.

32.7.8.2 Design.

32.7.8.2.1 Structural Loading. The design of folding and telescopic seating shall withstand the structural loading requirements of Chapter 35.

32.7.8.2.2 Load Tests. Load tests in accordance with accepted engineering practice shall be permitted in lieu of the design analysis for a seating unit or part thereof.

32.7.8.2.3 Manufacturer Requirements. The manufacturer shall comply with the requirements of 32.7.8.2.3.1 and 32.7.8.2.3.2.

32.7.8.2.3.1 Where required by the authority having jurisdiction, the manufacturer shall submit either of the following:

(1) Calculations verifying the design analysis prepared by a professional engineer or registered architect
(2) Report of load tests conducted by an approved, independent testing laboratory and certified by a professional engineer.

32.7.8.2.3.2 Where required by the authority having jurisdiction, the manufacturer shall certify that the equipment supplied is in accordance with the design or is essentially identical to the structure tested.

32.7.8.2.4 Review and Approval.

32.7.8.2.4.1 Design and installation drawings shall be approved prior to installation, and seating shall be installed in conformance with such drawings.

32.7.8.2.4.2 The drawings shall include the following:

(1) Conformance with approved designs, which are permitted to refer to approved standard drawings, with any variations applicable to the job noted
(2) Location of the folding or telescopic seating units and details of attachments, if any
(3) Location of guards and details thereof

32.7.8.2.4.3 The owner, or the owner's duly authorized representative, shall file with the authority having jurisdiction evidence of the following:

(1) Capability of means of egress to accommodate the occupants of the seating, as well as all other occupants, based on Chapter 11
(2) Structural capacity of the site to support the folding and telescopic seating dead loads when closed and also to support the dead loads and live loads when open

32.8 Swimming Pools and Spas.

32.8.1 Scope. The requirements of this chapter shall apply to residential and public swimming pools and spas.

32.8.2 Criteria.

32.8.2.1 The design of swimming pools, foundations, and walls shall be in accordance with the requirements of Chapter 36.

32.8.2.2 Construction and operation of swimming pools shall comply with the appropriate NSPI standard in 32.8.3.4.

32.8.3 Design and Materials.

32.8.3.1 Concrete used in swimming pools shall have the minimum compressive strength and concrete cover for reinforcement as provided for in ACI 318, *Building Code Requirements for Structural Concrete*.

32.8.3.2 Unit masonry shall comply with the requirements of 32.8.3.2.1 through 32.8.3.2.3.

32.8.3.2.1 Unit masonry used in construction of swimming pools shall conform to ASTM C 90, *Standard Specifications for Loadbearing Concrete Masonry Units*, with a minimum nominal thickness of 8 in. (200 mm).

32.8.3.2.2 All voids shall be filled with grout complying with ASTM C 476, *Specifications for Grout for Masonry*.

32.8.3.2.3 Placement of grout shall comply with ACI 530.1/ASCE 6/TMS 602, *Specification for Masonry Structures*.

32.8.3.3 Pneumatically placed concrete (shotcrete) shall comply with ACI 318 and the following also shall apply:

(1) The walls of swimming pools shall have a minimum thickness of 6 in. (150 mm), with the reinforcement centered.
(2) The concrete cover for reinforcement shall be as provided for in ACI 318.

32.8.3.4 The design, equipment, operation, installation, new construction, and rehabilitation of pools shall be in accordance with the following standards:

(1) ANSI/NSPI-1, *Standard for Public Swimming Pools*
(2) ANSI/NSPI-2, *Standard for Public Spas*
(3) ANSI/NSPI-3, *Standard for Permanently Installed Residential Spas*
(4) ANSI/NSPI-4, *Standard for Aboveground/Onground Residential Swimming Pools*
(5) ANSI/NSPI-5, *Standard for Residential Inground Swimming Pools*
(6) ANSI/NSPI-6, *Standard for Residential Portable Spas*

32.8.3.5 Pools shall be tested as follows:

(1) Complete pools shall pass a test for watertightness before being approved by the authority having jurisdiction.
(2) A pressure relief valve or hydrostatic valve shall be provided when the water table can exert sufficient hydrostatic pressure to cause the pool to be uplifted when empty or drained.

32.8.4 Barriers.

32.8.4.1 Barriers to prevent access to residential pools during use, and at times when not in use, shall be provided in accordance with ANSI/NSPI-8, *Model Barrier Code for Residential Swimming Pool, Spas, and Hot Tubs.*

32.8.4.2 Barriers for public pools shall be in accordance with the requirements of ANSI/NSPI-1.

32.9 Cooling Towers. Cooling towers shall comply with Chapter 35 and NFPA 214, *Standard on Water-Cooling Towers.*

32.10 Temporary Structures.

32.10.1 Scope.

32.10.1.1 Section 32.10 shall apply to temporary structures other than tents and temporary membrane structures.

32.10.1.2 Temporary structures associated with construction, alteration, or demolition operations shall comply with Chapter 14.

32.10.2 Location. Temporary structures as specified in 32.10.1.1 shall be separated from other structures in accordance with Chapter 7, based on the fire resistance rating of the exterior wall of the temporary structure.

32.11 Masonry and Concrete, Chimneys, and Fireplaces. Masonry and concrete, chimneys, and fireplaces shall comply with the requirements of this *Code* and the following standards:

(1) NFPA 31, *Standard for the Installation of Oil-Burning Equipment*
(2) NFPA 54, *National Fuel Gas Code*
(3) NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*

32.12 Masonry Heaters.

32.12.1 General.

32.12.1.1 Masonry heaters shall be defined in accordance with ASTM E 1602, *Standard Guide for Construction of Solid Fuel Burning Masonry Heaters.*

32.12.1.2 Masonry heaters shall be installed as listed or installed in accordance with ASTM E 1602.

32.12.2 Seismic Reinforcing. Seismic reinforcing shall not be required within the body of a masonry heater where both of the following conditions are met:

(1) The height of the masonry heater is equal to or less than 2.5 times its body width.
(2) The masonry chimney serving the heater is not supported by the body of the heater.

32.12.3 Masonry Heater Clearance.

32.12.3.1 Wood or other combustible framing shall not be placed within 4 in. (102 mm) of the outside surface of a masonry heater, unless both of the following criteria are met:

(1) The wall thickness of the firebox is not less than 8 in. (203 mm).
(2) The wall thickness of the heat exchange channels is not less than 5 in. (127 mm).

32.12.3.2 A clearance of not less than 8 in. (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.

32.12.3.3 The required space between the heater and a combustible material shall be fully vented to allow the free flow of air around all heater surfaces.

Chapter 33 High-Rise Buildings

33.1 General Requirements.

33.1.1 Application. The provisions of the applicable occupancy Chapter 16 through Chapter 30 shall apply, except as modified by this chapter.

33.1.2 Multiple Occupancies. See Section 6.2.

33.1.3 Construction Requirements.

33.1.3.1 The reductions permitted in 33.1.3.2 and 33.1.3.3 in the minimum construction type specified in Table 7.2.2 shall be permitted for sprinklered high-rise buildings with exits constructed as smokeproof enclosures and sprinkler control valves equipped with supervisory initiating devices and waterflow initiating devices for each floor.

33.1.3.2 For buildings, other than mercantile occupancies or industrial and storage occupancies with ordinary and high hazard contents exceeding the maximum allowable quantities per control area as set forth in 34.1.3, Type I(442) construction shall be permitted to be reduced to Type I(332), and Type I(332) construction shall be permitted to be reduced to Type II (222).

33.1.3.3 For buildings 120 ft (36.6 m) or less in height containing occupancies other than mercantile occupancies or industrial and storage occupancies with moderate and high hazard contents, Type II(222) construction shall be allowed to be reduced to Type II(111), except that columns supporting more than one floor shall not be less than 2-hour fire resistance–rated construction.

33.2 Protection.

33.2.1 Detection, Alarm, and Communications Systems.

33.2.1.1* A fire alarm system using an approved, emergency voice/alarm communication system shall be installed in accordance with Section 55.2.

33.2.1.2 Two-way telephone communication service shall be in accordance with the follows:

(1) Two-way telephone communication service shall be provided for fire department use as follows:
   (a) The system shall be in accordance with *NFPA 72, National Fire Alarm Code.*
   (b) The system shall operate between the central control station and every elevator car, every elevator lobby, and each floor level of exit stairs.
(2) The requirement of 33.2.1.2(1) shall not apply where the fire department radio system is approved as an equivalent system.

33.2.2* Extinguishment Requirements.

33.2.2.1 High-rise buildings shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 55.3 and 55.3.2.

33.2.2.2 A sprinkler control valve and a waterflow device shall be provided for each floor.

33.2.3 Exit Stair Enclosures.

33.2.3.1 All vertical exit stair enclosures shall be smokeproof enclosures in accordance with 11.2.3.

33.2.3.2 Stair enclosures 75 ft (23 m) or more in height shall include fire doors tested under positive pressure, with

the neutral plane at 40 in. (1016 mm) in accordance with NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*.

33.2.4 Emergency Lighting and Standby Power.

33.2.4.1 Emergency lighting in accordance with Section 11.9 shall be provided.

33.2.4.2* Requirements for standby power shall be as specified in 33.2.4.2(A) through 33.2.4.2(D).

(A) Class 1, Type 60 standby power in accordance with Article 701 of NFPA 70, *National Electrical Code*, as noted in Chapter 52, and NFPA 110, *Standard for Emergency and Standby Power Systems*, shall be provided.

(B) The standby power system shall have a capacity and rating sufficient to supply all required equipment.

(C) Selective load pickup and load shedding shall be permitted in accordance with Chapter 52

(D) The standby power system shall be connected to the following:

(1) Fire alarm system
(2) Electric fire pump
(3) Central control station equipment and lighting
(4) Not less than one elevator serving all floors, with standby power transferable to any elevator
(5) Mechanical equipment for smokeproof enclosures
(6) Mechanical equipment required to conform to requirements of Chapter 50

33.2.5* Central Control Station.

33.2.5.1 A central control station shall be provided in a location approved by the fire department.

33.2.5.2 The control station shall contain the following:

(1) Voice fire alarm system panels and controls
(2) Fire department two-way telephone communication service panels and controls where required by another section of this *Code*
(3) Fire detection and fire alarm system annunciation panels
(4) Elevator floor location and operation annunciators
(5) Sprinkler valve and waterflow annunciators
(6) Emergency generator status indicators
(7) Controls for any automatic stairway door unlocking system
(8) Fire pump status indicators
(9) Telephone for fire department use with controlled access to the public telephone system

Chapter 34 High Hazard Contents

34.1 General Requirements.

34.1.1* Applicability. Occupancies containing high hazard contents shall comply with this chapter in addition to other applicable requirements of this *Code*.

Exception: Buildings, and portions thereof, containing high hazard contents limited to the following shall not be required to comply with this chapter:

(1) Flammable and combustible liquids associated with application of flammable finishes and complying with NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials, and NFPA 34, Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids
(2) Flammable and combustible liquids associated with wholesale and retail sales and storage in mercantile occupancies and complying with NFPA 30, Flammable and Combustible Liquids Code
(3) Class III-A and Class III-B combustible liquid solvents in closed systems employing listed cleaning equipment complying with NFPA 32, Standard for Drycleaning Plants
(4) Refrigerants and refrigerant oil contained within closed-cycle refrigeration systems complying with NFPA 1, Fire Prevention Code, and the Uniform Mechanical Code, as referenced in Chapter 50
(5) Flammable and combustible liquid beverages in liquor stores and distributors without bulk storage
(6) High hazard contents stored or used in farm buildings or similar occupancies for on-premise agricultural use
(7) Corrosive materials in stationary batteries utilized for facility emergency power, uninterrupted power supply, or similar purposes, provided that the batteries are provided with safety venting caps and ventilation is provided in accordance with the NFPA 1
(8) Corrosive materials displayed in original packaging in mercantile occupancies and intended for personal or household use or as building materials
(9) Aerosol products in storage or mercantile occupancies and complying with NFPA 30B, Code for the Manufacture and Storage of Aerosol Products
(10) Flammable and combustible liquids storage tank buildings meeting the requirements of 2.3.4 of NFPA 30
(11) Flammable and combustible liquids storage tank vaults meeting the requirements of 2.2.7 of NFPA 30
(12) Flammable and combustible liquids process buildings meeting the requirements of 5.3 of NFPA 30
(13) Installation of fuel gas distribution systems and associated equipment in accordance with NFPA 54, National Fuel Gas Code, and NFPA 58, Liquefied Petroleum Gas Code, as adopted by Chapter 49 and Chapter 50.

34.1.2 Material Classification.

34.1.2.1 General. Hazardous materials shall be classified in accordance with 6.3.2.4 and the definitions in Chapter 3.

34.1.2.2 Multiple Hazards. Buildings, and portions thereof, containing high hazard contents that are classified in more than one hazard level, as set forth in 6.3.2.4, shall conform to the code requirements for each of the applicable protection levels specified in Section 34.3.

34.1.3 Quantity Limits.

34.1.3.1 General. Maximum allowable quantities of hazardous materials per control area shall be as specified in Table 34.1.3.1, except as modified by 34.1.3.2.

34.1.3.2 Special Occupancy Limits. Maximum allowable quantities of hazardous materials per control area specified in Table 34.1.3.1 shall be subject to the modifications set forth in 34.1.3.2.

34.1.3.2.1 Assembly Occupancies.

34.1.3.2.1.1 Toxic and Highly Toxic Compressed Gases Restricted. Toxic and highly toxic compressed gases shall not be stored or used within assembly occupancies.

Exception: Cylinders not exceeding 20 ft^3 (0.57 m^3) at NTP are allowed within gas cabinets or fume hoods.

34.1.3.2.1.2 Oxidizers Restricted. Class 4 oxidizers shall not be stored or used in assembly occupancies.

34.1.3.2.1.3 Organic Peroxides Restricted. Unclassified detonatable and Class I organic peroxides shall not be stored or used in assembly occupancies.

Table 34.1.3.1 Maximum Allowable Quantity of Hazardous Materials per Control Area[a]

Material	Class	High Hazard Protection Level	Storage[b]			Use—Closed Systems[b]			Use—Open Systems[b]	
			Solid Pounds (ft^3)	Liquid Gallons (lb)	Gas (ft^3)	Solid Pounds (ft^3)	Liquid Gallons (lb)	Gas (ft^3)	Solid Pounds (ft^3)	Liquid Gallons (lb)
Physical Hazard Materials										
Combustible liquid[c]	II IIIA IIIB	2 or 3 2 or 3 NA	NA	120[e,f] 330[e,f] 13,200[f,g]	NA	NA	120[f] 330[f] 13,200[g]	NA	NA	30[f] 80[f] 13,200[e,g]
Combustible fiber	Loose baled	3	(100) (1,000)	NA	NA	(100) (1,000)	NA	NA	(20) (200)	NA
Cryogenic liquid	Flammable oxidizing	2 3	NA	45[f] 45[f]	NA	NA	45[f] 45[f]	NA	NA	10[f] 10[f]
Explosives	NA	1	1[e,h,i,j]	(1)[e,h,j]	NA	1/4[h]	(1/4)[h]	NA	1/4[h]	(1/4)[h]
Flammable gas	Gaseous liquefied	2	NA	NA 30[e,f]	1,000[e,f] NA	NA	NA 30[e,f]	1,000[e,f] NA	NA	NA
Consumer fireworks	1.4G	3	125[c,k,d]	NA	NA	NA	NA	NA	NA	NA
Flammable liquid[c]	IA IB & IC Combination (IA, IB, IC)	2 or 3	NA	30[e,f] 120[e,f] 120[e,f,l]	NA	NA	30[f] 120[e,f] 120[f,l]	NA	NA	10[f] 30[e,f] 30[f,l]
Flammable solid	NA	3	125[e,f]	NA	NA	125[f]	NA	NA	25[e,f]	NA
Organic peroxide	Unclassified detonatable I II II IV V	1 1 2 3 NA NA	1[e,h] 5[e,f] 50[e,f] 125[e,f] NL NL	(1)[e,h] (5)[e,f] (50)[e,f] (125)[e,f] NL NL	NA NA NA NA NA NA	1/4[h] 1[f] 50[f] 125[f] NL NL	(1/4)[h] (1)[f] (50)[f] (125)[f] NL NL	NA NA NA NA NA NA	1/4[h] 1[f] 10[f] 25[f] NL NL	(1/4)[h] (1)[f] (10)[f] (25)[f] NL NL
Oxidizer	4 3[k] 2 1	1 2 or 3 3 NA	1[e,h] 10[e,f] 250[e,f] 4,000[e,g]	(1)[e,h] (10)[e,f] (250)[e,f] (4,000)[e,g]	NA NA NA NA	1/4[h] 2[f] 250[f] 4,000[g]	(1/4)[h] (2)[f] (250)[f] (4,000)[g]	NA NA NA NA	1/4[h] 2[f] 50[f] 1,000[g]	(1/4)[h] (2)[f] (50)[f] (1,000)[g]
Oxidizing gas	Gaseous liquefied	3	NA NA	NA 15[e,f]	1,500[e,f] NA	NA NA	NA 15[e,f]	1500[e,f] NA	NA NA	NA NA
Pyrophoric	NA	2	4[e,h]	(4)[e,h]	50[e,h]	1[h]	(1)[h]	10[e,h]	0	0
Unstable (reactive)	4 3 2 1	1 1 or 2 2 NA	1[e,h] 5[e,f] 50[e,f] NL	(1)[e,h] (5)[e,f] (50)[e,f] NL	10[e,h] 50[e,f] 750[e,f] NL	1/4[h] 1[f] 50[f] NL	(1/4)[h] (1)[f] (50)[f] NL	2[e,h] 10[e,f] 750[e,f] NL	1/4[h] 1[f] 10[f] NL	(1/4)[h] (1)[f] (10)[f] NL
Water-reactive	3 2 1	2 3 NA	5[e,f] 50[e,f] NL	(5)[e,f] (50)[e,f] NL	NA NA NA	5[f] 50[f] NL	(5)[f] (50)[f] NL	NA NA NA	1[f] 10[f] NL	(1)[f] (10)[f] NL

(continues)

Table 34.1.3.1 *Continued*

Material	Class	High Hazard Protection Level	Storage[b]			Use—Closed Systems[b]			Use—Open Systems[b]	
			Solid Pounds (ft^3)	Liquid Gallons (lb)	Gas (ft^3)	Solid Pounds (ft^3)	Liquid Gallons (lb)	Gas (ft^3)	Solid Pounds (ft^3)	Liquid Gallons (lb)
Health Hazard Materials										
Corrosive	NA	4	5,000[e,f]	500[e,f]	810[e,f,m]	5,000[f]	500[f]	810[e,f,m]	1,000[f]	100[f]
Highly toxic	NA	4	10[e,f]	(10)[e,f]	20[f,n]	10[f]	(10)[f]	20[f,n]	3[f]	(3)[f]
Toxic	NA	4	500[e,f]	(500)[e,f]	810[e,f]	500[f]	(500)[f]	810[e,f]	125[f]	(125)[f]

Notes:

1. For SI units, 1 lb = 0.454 kg; 1 gal = 3.785 L; 1 ft^3 = 0.0283 m^3.
2. NA = not applicable.
3. NL = not limited.

[a] See 34.1.3.2 for exceptions to tabular amounts. For use of control areas, see 34.2.4. Table values in parentheses correspond to the unit name in parentheses at the top of the column.

[b] The aggregate quantity in use and storage is not permitted to exceed the quantity listed for storage. In addition, quantities in specific occupancies are not permitted to exceed the limits in 34.1.3.2.

[c] Inside a building, the maximum capacity of a combustible liquid storage system that is connected to a fuel-oil piping system is permitted to be 660 gal, provided that such system conforms to NFPA 31.

[d] Unless the actual weight of the pyrotechnic composition of the consumer fireworks, 1.4G, is known, 25 percent of the gross weight of the fireworks, including packaging, is permitted to be used to determine the weight of the fireworks for the purpose of this table.

[e] Quantities are permitted to be increased 100 percent where stored in approved cabinets, gas cabinets, exhausted enclosures, explosives magazines, or safety cans, as appropriate for the material stored, in accordance with NFPA 1, *Fire Prevention Code*. Where footnote f also applies, the increase for both footnotes is permitted to be applied accumulatively.

[f] Maximum quantities are permitted to be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with NFPA 13. Where footnote e also applies, the increase for both footnotes is permitted to be applied accumulatively.

[g] The permitted quantities are not limited in a building equipped throughout with an automatic sprinkler system in accordance with NFPA 13.

[h] Permitted only in buildings equipped throughout with an automatic sprinkler system in accordance with NFPA 13.

[i] Maximum quantities of black powder, smokeless propellant, and small arms primers stored or displayed in mercantile occupancies or stored in one- or two-family dwellings shall be permitted to exceed the amount specified by this table when such storage complies with the requirements of NFPA 495, Chapter 13.

[j] In lieu of the maximum allowable quantity limit per control area, the maximum aggregate quantity per building of special explosive devices in industrial, mercantile, and storage occupancies shall be 50 lb.

[k] A maximum quantity of 200 lb of solid or 20 gal of liquid Class 3 oxidizers is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.

[l] Containing not more than the maximum allowable quantity per control area of Class I-A, Class I-B, or Class I-C flammable liquids.

[m] A single cylinder containing 150 lb or less of anhydrous ammonia in a single control area in a nonsprinklered building is considered to be the maximum allowable quantity. Two cylinders, each containing 150 lb or less, in a single control area is considered to be the maximum allowable quantity, provided that the building is equipped throughout with an automatic sprinkler system in accordance with NFPA 13.

[n] Allowed only where stored in approved, exhausted gas cabinets or exhausted enclosures, as specified in NFPA 1.

34.1.3.2.1.4 Unstable (Reactive) Materials Restricted. Class 3 and Class 4 unstable (reactive) materials shall not be stored or used in assembly occupancies.

34.1.3.2.1.5 Flammable and Oxidizing Gases Restricted. Flammable and oxidizing gases shall not be stored or used in assembly occupancies.

Exception No. 1: Flammable and oxidizing gases shall be permitted where cylinders do not exceed 250 ft^3 (7.1 m^3) at NTP and the aggregate quantities of gases do not exceed the maximum allowable quantities per control area specified in Table 34.1.3.1.

Exception No. 2: Food service operations using flammable gas in compliance with NFPA 58, Liquefied Petroleum Gas Code, as referenced in Chapter 53.

34.1.3.2.1.6 Flammable and Combustible Liquids Restricted. The quantity of flammable and combustible liquids stored or used in assembly occupancies shall not exceed amounts necessary for demonstration, treatment, laboratory work, maintenance purposes, and operation of equipment and shall not exceed maximum allowable quantities per control area specified in Table 34.1.3.1.

34.1.3.2.2 Business and Industrial Occupancies.

34.1.3.2.2.1 Toxic and Highly Toxic Compressed Gases Restricted. Toxic and highly toxic compressed gases shall not be stored or used in offices or classrooms of business or industrial occupancies.

Exception: When within classrooms of business occupancies, cylinders not exceeding 20 ft^3 (0.57 m^3) at NTP shall be permitted in gas cabinets or fume hoods.

34.1.3.2.2.2 Oxidizers Restricted. Class 4 liquid and solid oxidizers shall not be stored or used in offices or classrooms in business or industrial occupancies.

Exception: Class 4 liquid and solid oxidizers shall be permitted to be stored within classrooms of business and industrial occupancies where stored in hazardous materials storage cabinets complying with NFPA 1 and where such storage cabinets do not contain other storage.

34.1.3.2.2.3 Organic Peroxides Restricted. Unclassified detonatable and Class I organic peroxides shall not be stored or used in offices or classrooms in business or industrial occupancies.

Exception: Unclassified detonatable and Class I organic peroxides shall be permitted where stored within hazardous materials storage cabinets complying with NFPA 1 and where such storage cabinets do not contain other storage.

34.1.3.2.2.4 Unstable (Reactive) Materials Restricted. Class 3 and Class 4 unstable (reactive) materials shall not be stored or used in offices or classrooms in business or industrial occupancies.

Exception: Class 3 and Class 4 unstable (reactive) materials shall be permitted where stored within hazardous materials storage cabinets complying with NFPA 1 and where such storage cabinets do not contain other storage.

34.1.3.2.2.5 Flammable and Oxidizing Gases Restricted. Flammable and oxidizing gases shall not be stored or used in offices or classrooms of business or industrial occupancies.

Exception No. 1: Flammable and oxidizing gases shall be permitted when cylinders do not exceed 250 ft^3 (7.1 m^3) at NTP, the aggregate quantities of gases do not exceed the maximum allowable quantities per control area specified in Table 34.1.3.1, and medical gas system supply cylinders are in accordance with NFPA 99, Standard for Health Care Facilities.

Exception No. 2: Food service operations using flammable gas in compliance with NFPA 58, as referenced in Chapter 53.

34.1.3.2.2.6 Flammable and Combustible Liquids Restricted. The quantity of flammable and combustible liquids stored or used in office portions of business and industrial occupancies shall not exceed amounts necessary for demonstration, treatment, laboratory work, maintenance purposes, and operation of equipment and shall not exceed maximum allowable quantities per control area specified in Table 34.1.3.1.

34.1.3.2.3 Mercantile and Storage Occupancies.

34.1.3.2.3.1 Maximum Allowable Quantity Increase for Mercantile and Storage Occupancies. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single control area of a mercantile or storage occupancy shall be permitted to exceed the maximum allowable quantities specified in Table 34.1.3.1 without complying with Protection Level 2, Protection Level 3, or Protection Level 4, provided that the quantities comply with Table 34.1.3.2.3.1 and that materials are displayed and stored in accordance with the special limitations on storage height, storage density, and other controls specified in NFPA 1.

34.1.3.2.3.2 Maximum Allowable Quantity Increase for Sale of Alcoholic Beverages, Medicines, Foodstuffs and Cosmetics.

(A) Quantities of alcoholic beverages shall not be limited in mercantile occupancies, provided that the liquids are packaged in individual containers not exceeding 1.3 gal (4.9 L).

(B) Quantities of medicines, foodstuffs, and cosmetics containing not more than 50 percent by volume of water-miscible liquids, and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1 gal (3.78 L).

34.1.3.2.3.3 Toxic and Highly Toxic Compressed Gases Restricted. Toxic and highly toxic compressed gases shall not be stored or used in offices or classrooms of mercantile or storage occupancies.

Exception: When within classrooms of mercantile and storage occupancies, cylinders not exceeding 20 ft^3 (0.57 m^3) at NTP are allowed in gas cabinets or fume hoods.

34.1.3.2.3.4 Oxidizers Restricted. Class 4 liquid and solid oxidizers shall not be stored or used in offices or classrooms of mercantile and storage occupancies.

Exception: Class 4 liquid and solid oxidizers shall be permitted to be stored within classrooms of mercantile and storage occupancies where stored in hazardous materials storage cabinets complying with NFPA 1 and where such storage cabinets do not contain other storage.

34.1.3.2.3.5 Organic Peroxides Restricted. Unclassified detonatable and Class I organic peroxides shall not be stored or used in offices or classrooms of mercantile and storage occupancies.

Exception: Unclassified detonatable and Class I organic peroxides shall be permitted where stored within hazardous materials storage cabinets complying with NFPA 1, and where such storage cabinets do not contain other storage.

Table 34.1.3.2.3.1 Maximum Allowable Quantity per Control Area Increases for Selected Hazard Categories in Mercantile and Storage Occupancies

Hazard Category	Maximum Allowable Quantity[a,b]	
	Solids (lb)	Liquids (gal)
Physical Hazard Materials: Nonflammable and Noncombustible Solids and Liquids		
Oxidizers		
Class 3	1,150	115
Class 2	2,250	225
Class 1	18,000[c]	1,800[c]
Unstable (reactive)		
Class 3	550	55
Class 2	1,150	115
Water (reactive)		
Class 3	550	55
Class 2	1,150	115
Health Hazard Materials: Nonflammable and Noncombustible Solids and Liquids		
Corrosive	10,000	1,000
Highly toxic	20	2
Toxic	1,000	100

For SI units; 1 lb = 0.454 kg; 1 gal = 3.785 L.

Note: Maximum quantities for hazard categories not shown are required to be in accordance with Table 34.1.3.1.

[a]Maximum quantities are permitted to be increased 100 percent in buildings that are sprinklered in accordance with NFPA 13. When footnote b also applies, the increase for both footnotes can be applied.

[b]Maximum quantities are permitted to be increased 100 percent where stored in approved storage cabinets, gas cabinets, or exhausted enclosures in accordance with NFPA 1. When footnote a also applies, the increase for both footnotes is permitted to be applied.

[c]Quantities are not limited in buildings protected by an automatic sprinkler system complying with NFPA 13.

34.1.3.2.3.6 Unstable (Reactive) Materials Restricted.

(A) Class 3 and Class 4 unstable (reactive) materials shall not be stored or used in offices or classrooms of mercantile and storage occupancies.

(B) Class 4 unstable (reactive) materials shall not be stored or used in retail sales portions of mercantile occupancies.

Exception: Class 3 and Class 4 unstable (reactive) materials shall be permitted in offices or classrooms in mercantile and storage occupancies where stored within hazardous materials storage cabinets complying with NFPA 1 and where such storage cabinets do not contain other storage.

34.1.3.2.3.7 Flammable and Oxidizing Gases Restricted. Flammable and oxidizing gases shall not be stored or used in offices or classrooms of mercantile and storage occupancies.

Exception No. 1: Flammable and oxidizing gases shall be permitted where cylinders do not exceed 250 ft³ (7.1 m³) at NTP and the aggregate quantities of gases do not exceed the maximum allowable quantities per control area specified in Table 34.1.3.1.

Exception No. 2: Food service operations using flammable gas in compliance with NFPA 58, as referenced in Chapter 53.

34.1.3.2.3.8 Flammable and Combustible Liquids Restricted. The quantity of flammable and combustible liquids stored or used in office portions of mercantile or storage occupancies shall not exceed amounts necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment and shall not exceed maximum allowable quantities per control area specified in Table 34.1.3.1.

34.1.3.2.4 Educational Occupancies.

34.1.3.2.4.1 Toxic and Highly Toxic Compressed Gases Restricted. Toxic and highly toxic compressed gases shall not be stored or used in educational occupancies.

Exception: Cylinders not exceeding 20 ft³ (0.57 m³) at NTP are allowed within gas cabinets or fume hoods.

34.1.3.2.4.2 Oxidizers Restricted. Class 4 oxidizers shall not be stored or used in educational occupancies.

34.1.3.2.4.3 Organic Peroxides Restricted. Unclassified detonatable and Class I organic peroxides shall not be stored or used in educational occupancies.

34.1.3.2.4.4 Unstable (Reactive) Materials Restricted. Class 3 and Class 4 unstable (reactive) materials shall not be stored or used in educational occupancies.

34.1.3.2.4.5 Flammable and Oxidizing Gases Restricted. Flammable and oxidizing gases shall not be stored or used in educational occupancies.

Exception No. 1: Flammable and oxidizing gases shall be permitted when cylinders do not exceed 250 ft³ (7.1 m³) at NTP and the aggregate quantities of gases do not exceed the maximum allowable quantities per control area specified in Table 34.1.3.1.

Exception No. 2: Food service operations using flammable gas in compliance with NFPA 58, as referenced in Chapter 53.

34.1.3.2.4.6 Flammable and Combustible Liquids Restricted. The quantity of flammable and combustible liquids stored or used in educational occupancies shall not exceed amounts necessary for demonstration, treatment, laboratory work, maintenance purposes, and operation of equipment and shall not exceed maximum allowable quantities per control area specified in Table 34.1.3.1.

34.1.3.2.5 Day-Care, Health Care, Ambulatory Health Care, and Detention and Correctional Occupancies.

34.1.3.2.5.1 Toxic and Highly Toxic Compressed Gases Restricted. Toxic and highly toxic compressed gases shall not be stored or used within day-care, health care, ambulatory health care, and detention and correctional occupancies.

Exception: Cylinders not exceeding 20 ft³ (0.57 m³) at NTP are allowed within gas cabinets or fume hoods in health care, ambulatory health care, and detention and correctional occupancies in quantities up to the maximum allowable quantity per control area.

34.1.3.2.5.2 Oxidizers Restricted.

(A) Class 4 oxidizers shall not be stored or used in day-care, health care, ambulatory health care, and detention and correctional occupancies.

(B) A maximum of 200 lb (90.7 kg) of solid or 2 gal (7.57 L) of liquid Class 3 oxidizer shall be permitted in day-care, health care, ambulatory health care, and detention and correctional

occupancies when such materials are necessary for maintenance purposes or operation of equipment.

(C) The oxidizers shall be stored in approved containers and in an approved manner.

34.1.3.2.5.3 Organic Peroxides Restricted. Unclassified detonatable and Class I organic peroxides shall not be stored or used in day-care, health care, ambulatory health care, and detention and correctional occupancies.

34.1.3.2.5.4 Unstable (Reactive) Materials Restricted. Class 3 and Class 4 unstable (reactive) materials shall not be stored or used in day-care, health care, ambulatory health care, and detention and correctional occupancies.

34.1.3.2.5.5 Flammable and Oxidizing Gases Restricted. Flammable and oxidizing gases shall not be stored or used in day-care, health care, ambulatory health care, and detention and correctional occupancies.

Exception No. 1: Flammable and oxidizing gases shall be permitted where cylinders do not exceed 250 ft^3 (7.1 m^3) at NTP, the aggregate quantities of gases do not exceed the maximum allowable quantities per control area specified in Table 34.1.3.1, and medical gas system supply cylinders are in accordance with NFPA 99.

Exception No. 2: Food service operations using flammable gas in compliance with NFPA 58, as referenced in Chapter 53.

34.1.3.2.5.6 Flammable and Combustible Liquids Restricted. The quantity of flammable and combustible liquids stored or used in day-care, health care, ambulatory health care, and detention and correctional occupancies shall not exceed amounts necessary for demonstration, treatment, laboratory work, maintenance purposes, and operation of equipment and shall not exceed maximum allowable quantities per control area specified in Table 34.1.3.1.

34.1.3.2.6 One- and Two-Family Dwellings, Lodging and Rooming Houses, Hotels and Dormitories, Apartment Buildings, and Residential Board and Care Occupancies.

34.1.3.2.6.1 Toxic and Highly Toxic Compressed Gases Restricted. Toxic and highly toxic compressed gases shall not be stored or used in one- and two-family dwellings, lodging and rooming houses, hotels and dormitories, apartment buildings, and residential board and care occupancies.

34.1.3.2.6.2 Oxidizers Restricted. Class 4 oxidizers shall not be stored or used within one- and two-family dwellings, lodging and rooming houses, hotels and dormitories, apartment buildings, and residential board and care occupancies.

34.1.3.2.6.3 Organic Peroxides Restricted. Unclassified detonatable and Class I organic peroxides shall not be stored or used within one- and two-family dwellings, lodging and rooming houses, hotels and dormitories, apartment buildings, and residential board and care occupancies.

34.1.3.2.6.4 Unstable (Reactive) Materials Restricted. Class 3 and Class 4 unstable (reactive) materials shall not be stored or used within one- and two-family dwellings, lodging and rooming houses, hotels and dormitories, apartment buildings, and residential board and care occupancies.

34.1.3.2.6.5 Flammable and Oxidizing Gases Restricted. Flammable and oxidizing gases shall not be stored or used in one- and two-family dwellings, lodging and rooming houses, hotels and dormitories, apartment buildings, and residential board and care occupancies.

Exception No. 1: Flammable and oxidizing gases shall be permitted where cylinders do not exceed 250 ft^3 (7.1 m^3) at NTP, the aggregate quantities of gases do not exceed the maximum allowable quantities per control area specified in Table 34.1.3.1, and medical gas system supply cylinders are in accordance with NFPA 99.

Exception No. 2: Food service operations using flammable gas in compliance with NFPA 58, as referenced in Chapter 53.

34.1.3.2.6.6 Flammable and Combustible Liquids Restricted. The quantity of flammable and combustible liquids stored or used in residential occupancies shall not exceed amounts necessary for maintenance purposes and operation of equipment and shall not exceed maximum allowable quantities per control area specified in Table 34.1.3.1.

34.1.4 Performance Alternative. In lieu of complying with Chapter 34 in its entirety, occupancies containing high hazard Level 1 to high hazard Level 5 contents shall be permitted to comply with 34.1.4.1 and 34.1.4.2.

34.1.4.1 Goal. The goal of performance-based designs for facilities containing high hazard contents shall be to protect people and property from the consequences of unauthorized discharges, fires, or explosions involving hazardous materials.

(A) Such designs shall minimize the risk of such events and shall minimize the consequences of such events if they occur.

(B) Performance-based designs shall also comply with Chapter 4 and Chapter 5.

34.1.4.2 Objectives.

(A) To satisfy the goal established in 34.1.4.1, performance-based designs for facilities containing high hazard contents shall identify the properties of hazardous materials to be stored, used, or handled and shall provide adequate and reliable safeguards to accomplish the following objectives, considering both normal operations and possible abnormal conditions:

(1) Minimize the potential occurrence of unwanted releases, fires, or other emergency incidents resulting from the storage, use, or handling of hazardous materials
(2) Minimize the potential failure of buildings, equipment, or processes involving hazardous materials by ensuring that such buildings, equipment, or processes are reliably designed and are suitable for the hazards present
(3) Minimize the potential exposure of people or property to unsafe conditions or events involving an unintended reaction or release of hazardous materials
(4) Minimize the potential for an unintentional reaction that results in a fire, explosion, or other dangerous condition
(5) Provide a means to contain, treat, neutralize, or otherwise handle plausible releases of hazardous materials to minimize the potential for adverse impacts to persons or property outside of the immediate area of a release
(6) Provide appropriate safeguards to minimize the risk of, and limit the damage and injury that might result from, an explosion involving hazardous materials that present explosion hazards
(7) Detect hazardous levels of gases or vapors that are dangerous to health, and alert appropriate persons or mitigate the hazard when the physiological warning properties for such gases or vapors are inadequate to warn of danger prior to personal injury

(8) Maintain power to provide for continued operation of safeguards and important systems that are relied on to prevent or control an emergency condition involving hazardous materials
(9) Maintain ventilation where ventilation is relied on to minimize the risk of emergency conditions involving hazardous materials
(10) Minimize the potential for exposing combustible hazardous materials to unintended sources of ignition, and for exposing any hazardous material to fire or physical damage that can lead to endangerment of people or property

(B) As part of the design process, a process hazard analysis and off-site consequence analysis shall be conducted where necessary to reasonably ensure that people and property are satisfactorily protected from dangerous conditions involving hazardous materials.

(C) The results of analyses of 34.1.4.2(B) shall be considered when determining active and passive mitigation measures used in accomplishing the objectives set forth in 34.1.4.2(A).

(D) In addition, written procedures for pre-start-up safety reviews, normal and emergency operations, management of change, emergency response, and accident investigation and documentation shall be developed prior to beginning operations at a facility designed in accordance with 34.1.4.

(E) Procedures, as described in 34.1.4.2(D), shall be developed with the participation of affected employees.

34.2 Requirements for All Occupancies Containing High Hazard Contents.

34.2.1 Applicability. Buildings, and portions thereof, containing hazardous materials regulated by this *Code* shall comply with Section 34.2.

34.2.2 Fire Prevention Code. Buildings, and portions thereof, where hazardous materials are stored, used, or handled shall also comply with NFPA 1.

34.2.3 Special Information for Permit Application.

34.2.3.1 Permit applications for buildings, and portions thereof, containing high hazard contents shall be accompanied by the following:

(1) Plan showing the location of storage and use areas
(2) Maximum quantity of each class of hazardous material stored and used in each area

34.2.3.2 When required by the authority having jurisdiction, the permit applicant shall provide, without charge to the jurisdiction, a technical opinion and report prepared by a qualified engineer, specialist, laboratory, or fire safety specialty organization that analyzes the fire safety and life safety properties of the design, operation, or use of the building or facility and demonstrates compliance with this *Code*.

34.2.4 Control Areas. Control areas shall be those spaces within a building where quantities of hazardous contents not exceeding the maximum quantities allowed by this *Code* are stored, dispensed, used, or handled.

34.2.4.1 Construction Requirements. Control areas shall be separated from each other by not less than a 1-hour fire barrier wall constructed in accordance with this *Code*.

(A) Where there is more than one control area in a building, control areas shall be separated from each other by not less than a 1-hour fire resistance separation.

(B) Where only one control area is present in a building, no special construction provisions shall be required.

34.2.4.2 Number. The maximum number of control areas within a building shall be in accordance with Table 34.2.4.2.

Table 34.2.4.2 Design and Number of Control Areas

Floor Level	Maximum Allowable Quantity per Control Area (%)[1]	Number of Control Areas per Floor	Fire Resistance Rating for Fire Barriers[2] (hr)
Above Grade			
>9	5	1	2
7 – 9	5	2	2
4 – 6	12.5	2	2
3	50	2	1
2	75	3	1
1	100	4	1
Below Grade			
1	75	3	1
2	50	2	1
Lower than 2	NA	NA	NA

NA = Not applicable.
[1]Percentages represent the maximum allowable quantities per control area shown in Table 34.1.3.1, with all of the increases permitted in the footnotes of that table.
[2]Fire barriers are required to include floors and walls, as necessary, to provide a complete separation from other control areas.

34.2.4.3 Separation. The required fire resistance rating for fire barrier assemblies shall be in accordance with Table 34.2.4.2.

34.2.5 Weather Protection. Where weather protection is provided for sheltering outside hazardous material storage or use areas, such storage or use areas shall be considered outside storage or use areas, provided that all of the following conditions are met:

(1) Supports and walls shall not obstruct more than one side or more than 25 percent of the perimeter of the storage or use area.
(2) The distance from the structure and the structural supports to buildings, lot lines, public ways, or means of egress to a public way shall not be less than the distance required by NFPA 1 for an outside hazardous material storage or use area without weather protection.
(3) Weather-protection structures constructed in accordance with 34.2.5 shall not contain explosive or detonable materials.

34.3 Requirements for Occupancies Exceeding the Maximum Allowable Quantities per Control Area for High Hazard Contents.

34.3.1 Protection Levels. Buildings, and portions thereof, where high hazard contents are stored, used, or handled shall comply with the protection levels as set forth in Section 34.3.

34.3.1.1 Protection Level 1. Buildings containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 1 contents permitted in control areas shall comply with applicable regulations for Protection Level 1, as set forth in 34.3.3.

34.3.1.2 Protection Level 2. Buildings, and portions thereof, containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 2 contents permitted in control areas shall comply with applicable regulations for Protection Level 2, as set forth in 34.3.4.

34.3.1.3 Protection Level 3. Buildings, and portions thereof, containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 3 contents permitted in control areas shall comply with applicable regulations for Protection Level 3, as set forth in 34.3.5.

34.3.1.4 Protection Level 4. Buildings, and portions thereof, containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 4 contents permitted in control areas shall comply with applicable regulations for Protection Level 4, as set forth in 34.3.6.

34.3.1.5 Protection Level 5. Buildings, and portions thereof, used for fabrication of semiconductors or semiconductor research and development and containing quantities of hazardous materials exceeding the maximum allowable quantities of high hazard Level 5 contents permitted in control areas shall comply with applicable regulations for Protection Level 5, as set forth in 34.3.7.

34.3.2 General Requirements. The requirements set forth in 34.3.2 shall apply to buildings, or portions thereof, that are required to comply with Protection Level 1 through Protection Level 5 where required by 34.3.1.1 through 34.3.1.5.

34.3.2.1 Fire Protection Systems. Buildings, or portions thereof, required to comply with Protection Level 1 through Protection Level 5 shall be protected by an approved automatic fire sprinkler system complying with Section 55.3.

Exception No. 1: Rooms or areas that are of noncombustible construction with wholly noncombustible contents

Exception No. 2: Portable magazines not exceeding 120 ft^2 constructed in accordance with NFPA 495, Explosive Materials Code.

34.3.2.2 Building Height Exception. The height of a single-story building, or portion thereof, containing only tanks or industrial process equipment shall not be limited based on the type of construction.

34.3.2.3 Separation of Occupancies Having High Hazards. The separation of areas containing high hazard contents from each other and from other use areas shall be as required by Table 34.3.2.3 and shall not be permitted to be reduced with the installation of fire protection systems as required by 34.3.2.1.

34.3.2.4 Construction of Liquid Storage Rooms.

34.3.2.4.1 Storage rooms for flammable or combustible liquids shall be constructed in accordance with the requirements for the applicable protection level and the following:

(1) Rooms in excess of 500 ft^2 (46.5m^2) shall have at least one exterior door approved for fire department access.
(2) Rooms shall be separated from other areas by a fire barrier wall or horizontal assembly, or both, having a fire resistance rating of not less than 1 hour for rooms up to 150 ft^2 (13.9 m^2) and not less than 2 hours where the room is more than 150 ft^2 (13.9 m^2).
(3) Shelving, racks, and wainscoting in such areas shall be of noncombustible construction or wood of not less than 1-in. (25-mm) nominal thickness.
(4) Rooms used for the storage of Class I flammable liquids shall not be located in a basement.

34.3.2.4.2 Except for surfacing, floors of liquid storage rooms shall be of noncombustible liquid-tight construction.

34.3.2.4.3 Raised grating over floors shall be of noncombustible materials.

34.3.2.5 Egress. Egress from areas required to comply with Protection Level 1, Protection Level 2, Protection Level 3, or Protection Level 4 shall comply with 34.3.2.5. Egress from areas required to comply with Protection Level 5 shall comply with 34.3.7.

34.3.2.5.1 Travel Distance Limit. Travel distance to an exit from areas required to comply with Protection Level 1 through Protection Level 5 shall not exceed the distance given in Table 34.3.2.5.1, measured as required in 11.6.2.

34.3.2.5.2 Capacity of Means of Egress. Egress capacity for high hazard contents areas shall be based on 0.7 in. (18 mm) per person for stairs or 0.4 in. (10 mm) per person for level components and ramps in accordance with 11.3.3.1.

34.3.2.5.3 Number of Means of Egress. Not less than two means of egress shall be provided from each building, or portion thereof, required to comply with Section 34.3, unless rooms or spaces do not exceed 200 ft^2 (18.6 m^2), have an occupant load not exceeding three persons, and have a travel distance to the room door not exceeding 25 ft (7.6 m).

34.3.2.5.4 Dead Ends. Means of egress, for other than rooms or spaces that do not exceed 200 ft^2 (18.6 m^2), have an occupant load not exceeding three persons, and have a travel distance to the room door not exceeding 25 ft (7.6 m), shall be arranged so that there are no dead ends in corridors.

34.3.2.5.5 Doors. Doors serving high hazard contents areas with occupant loads in excess of five shall be permitted to be provided with a latch or lock only if the latch or lock is panic hardware or fire exit hardware complying with 11.2.1.7.

34.3.2.6 Ventilation.

34.3.2.6.1 Buildings, or portions thereof, in which explosive, flammable, combustible, corrosive, or highly toxic dusts, mists, fumes, vapors, or gases are, or might be, emitted shall be provided with mechanical exhaust ventilation or natural ventilation where natural ventilation can be shown to be acceptable for the materials as stored.

Exception No. 1: Flammable and combustible liquids stored in closed containers in compliance with NFPA 30.

Exception No. 2: Solids and liquids, other than combustible or flammable liquids, stored in closed containers.

34.3.2.6.2 Mechanical exhaust systems shall comply with the *Uniform Mechanical Code,* as referenced in Chapter 50.

34.3.2.6.3 Mechanical ventilation shall be at a rate of not less than 1 ft^3/min/ft^2 (5.1 L/s/m^2) of floor area over areas required to comply with Protection Level 1 through Protection Level 5.

Table 34.3.2.3 Required Separation of Occupancies Containing High Hazard Contents (Hr)

Occupancy	Protection Level 1	Protection Level 2	Protection Level 3	Protection Level 4	Protection Level 5
Apartment buildings	NP	4	3	4	4
Assembly ≤ 300	NP	4	3	2	4
Assembly > 300 and ≤ 1000	NP	4	3	2	4
Assembly > 1000	NP	4	3	2	4
Board and care, small	NP	4	3	4	4
Board and care, large	NP	4	3	4	4
Business	NP	2	1	1	1
Day-care > 12	NP	4	3	4	4
Day-care homes	NP	4	3	4	4
Detention and correctional	NP	4	3	4	4
Dwellings, one- and two-family	NP	4	3	4	4
Educational	NP	4	3	2	3
Hazard Level 1	—	NP	NP	NP	NP
Hazard Level 2	NP	—	1	2	2
Hazard Level 3	NP	1	—	1	1
Hazard Level 4	NP	2	1	—	1
Hazard Level 5	NP	2	1	1	—
Health care, ambulatory	NP	4	4	4	4
Health care, nonambulatory	NP	4	4	4	4
Hotels and dormitories	NP	4	3	4	4
Industrial, general purpose	NP	2	1	1	1
Industrial, special purpose	NP	2	1	1	1
Lodging and rooming houses	NP	4	3	4	4
Mercantile, Class A	NP	2	1	1	1
Mercantile, Class B	NP	2	1	1	1
Mercantile, Class C	NP	2	1	1	1
Mercantile, covered mall	NP	2	1	1	1
Mercantile, bulk retail	NP	2	1	1	1
Storage, low and ordinary hazard	NP	2	1	1	1

NP = Not permitted.

Table 34.3.2.5.1 Travel Distance Limits

Hazard Level	Distance	
	ft	(m)
1	75	(23)
2	100	(30)
3	150	(46)
4	175	(53)
5	200	(61)

34.3.2.6.4 Areas containing Class I liquids, Class II liquids, or Class IIIA liquids at temperatures above their flash points, shall be ventilated at a rate sufficient to maintain the concentration of vapors within the area at or below 25 percent of the lower explosive limit.

34.3.2.6.5 Ventilation requirements shall be determined by calculations based on anticipated fugitive emissions or by sampling of the actual vapor concentration levels under normal operating conditions.

34.3.2.6.6 Make-up air shall be provided, and provision shall be made for locating make-up air openings to avoid short-circuiting the ventilation.

34.3.2.6.7 Ducts conveying explosives or flammable vapors, fumes, or dusts shall extend directly to the exterior of the building without entering other spaces. Exhaust ducts shall not extend into or through ducts and plenums.

Exception: Ducts conveying vapor or fumes having flammable constituents less than 25 percent of their lower flammability limit shall be permitted to pass through other spaces.

34.3.2.6.8 Emissions generated at work stations shall be confined to the area in which they are generated as specified in NFPA 1 and the *Uniform Mechanical Code*, as referenced in Chapter 50.

34.3.2.6.9 The location of supply and exhaust openings, shall be in accordance with the *Uniform Mechanical Code*, as referenced in Chapter 50.

34.3.2.6.10 Exhaust air contaminated by highly toxic material shall be treated when required by NFPA 1.

34.3.2.6.11 Systems shall operate continuously unless alternate designs are approved.

34.3.2.6.12 A manual shutoff control for ventilation equipment required by 34.3.2.6 shall be provided outside the room adjacent to the principal access door to the room.

34.3.2.6.13 The shutoff control described in 34.3.2.6.12 shall be of the break-glass type and shall be labeled as follows:

VENTILATION SYSTEM EMERGENCY SHUTOFF

34.3.2.6.14 Exhaust ventilation shall be arranged to consider the density of the potential fumes or vapors released.

(A) For fumes or vapors that are heavier than air, exhaust shall be taken from a point within 12 in. (305 mm) of the floor.

(B) The location of both the exhaust and inlet air openings shall be arranged to provide air movement across all portions of the floor or room to prevent the accumulation of vapors.

(C) Exhaust ventilation shall not be recirculated within the room or building if the materials stored are capable of emitting hazardous vapors.

34.3.2.7* Explosion Control. Buildings, or portions thereof, required to comply with Protection Level 1 through Protection Level 3 and containing materials shown in Table 34.3.2.7 shall be provided with a means of explosion control.

Table 34.3.2.7 Explosion Control Requirements

Hazard Category	Class	Protection Method
Combustible dust presenting an explosion hazard	Not applicable	Explosion control[1]
Explosives	Detonating	Barricade[2]
	Deflagrating	Explosion control[1]
Flammable gas or cryogen	Not applicable	Explosion control[1]
Flammable liquid	Class I-A	Explosion control[1]
	Class I-B, use-open[3]	
Organic peroxides	Unclassified	Barricade[2]
	Class I	Barricade[2]
Oxidizer liquids and solids	Class 4	Barricade[2]
Pyrophoric gas[4]	Not applicable	Barricade[2]
		Explosion control[1]
Unstable (reactive)	Class 4	Barricade[2]
	Class 3 detonating	Barricade[2]
	Class 3 deflagrating	Explosion control[1]
Water-reactive liquids and solids	Class 3	Explosion control[1]
	Class 2 deflagrating	Explosion control[1]

[1] Explosion control is required to be a deflagration prevention or control method complying with NFPA 69, *Standard on Explosion Prevention Systems*, or an approved engineered deflagration-venting method.
[2] Barricades are required to comply with NFPA 495.
[3] A protection method is required where an explosive environment can occur as a result of the dispensing or use process.
[4] Where gas-air mixtures are capable of detonation, barricade construction is required to be provided.

34.3.2.8 Standby and Emergency Power.

34.3.2.8.1 Where mechanical ventilation, treatment systems, temperature control, alarm, detection, or other electrically operated safety systems are required by this *Code* or NFPA 1, such systems shall be provided with standby power or emergency power as required by 34.3.2.8.

Exception No. 1: The requirement of 34.3.2.8.1 shall not apply to storage areas for Class 1 and Class 2 oxidizers.

Exception No. 2: The requirement of 34.3.2.8.1 shall not apply to storage areas for Class III, Class IV, and Class V organic peroxides.

Exception No. 3: Standby power for mechanical ventilation, exhaust treatment, and temperature control systems shall not be required where such systems are engineered and approved as fail-safe.

34.3.2.8.2 The secondary source of power shall be an approved means of legally required standby power in accordance with NFPA 70, *National Electrical Code*, except for areas containing highly toxic or toxic gases, where a legally required emergency power system in accordance with Chapter 52 and NFPA 55, *Standard for the Storage, Use, and Handling of Compressed and Liquified Gases in Portable Cylinders*, shall be provided to operate safety systems required by this *Code* or NFPA 1.

34.3.2.9 Spill Control and Secondary Containment for Hazardous Materials Liquids and Solids.

34.3.2.9.1 General. Buildings, or portions thereof, required to comply with Protection Level 1 through Protection Level 5 shall be provided with spill control and secondary containment in accordance with 34.3.2.9.2 and 34.3.2.9.3.

34.3.2.9.2 Spill Control.

(A) Buildings, or portions thereof, used for any of the following shall be provided with spill control to prevent the flow of liquids to adjoining areas:

(1) Storage or closed system use of hazardous materials liquids in individual vessels having a capacity of more than 55 gal (208.2 L)
(2) Dispensing of hazardous materials liquids into vessels exceeding a 1.1-gal (4-L) capacity
(3) Open use of hazardous materials in vessels or systems exceeding a 5.3-gal (20-L) capacity

(B) Where spill control is required, floors in indoor locations and similar surfaces in outdoor locations shall be constructed to contain a spill from the largest single vessel by one of the following methods:

(1) Liquid-tight sloped or recessed floors in indoor locations or similar areas in outdoor locations
(2) Liquid-tight floors in indoor locations or similar areas in outdoor locations provided with liquid-tight raised or recessed sills or dikes
(3) Sumps and collection systems

(C) Except for surfacing, the floors, sills, dikes, sumps, and collection systems shall be constructed of noncombustible material, and the liquid-tight seal shall be compatible with the material stored.

(D) Where liquid-tight sills or dikes are provided, they shall not be required at perimeter openings that are provided with an open-grate trench across the opening that connects to an approved collection system.

34.3.2.9.3 Secondary Containment.

(A) Buildings, or portions thereof, used for any of the following shall be provided with secondary containment in accordance with the following:

(1) Storage of liquids where the capacity of an individual vessel exceeds 55 gal (208.2 L) or the aggregate capacity of multiple vessels exceeds 1000 gal (3785 L)
(2) Storage of solids where the capacity of an individual vessel exceeds 550 lb (248.8 kg) or the aggregate capacity of multiple vessels exceeds 10,000 lb (4524.8 kg)
(3) Use-open of liquids where the capacity of an individual vessel or system exceeds 1.1 gal (4 L)
(4) Use-open of liquids where the capacity of multiple vessels or systems exceeds 5.3 gal (20 L)

Exception No. 1: Buildings, or portions thereof, containing only hazardous materials in listed secondary containment tanks or systems

Exception No. 2: Buildings, or portions thereof, containing only flammable solids, combustible fibers, explosive solids, or corrosive solids

(B) The building, room, or area shall contain or drain the hazardous materials and fire protection water through the use of one of the following methods:

(1) Liquid-tight sloped or recessed floors in indoor locations or similar areas in outdoor locations
(2) Liquid-tight floors in indoor locations or similar areas in outdoor locations provided with liquid-tight raised or recessed sills or dikes
(3) Sumps and collection systems
(4) Drainage systems leading to an approved location

(C) Where incompatible materials are present in open containers or systems, such materials shall be separated from each other in the secondary containment system.

(D) Secondary containment for indoor storage areas shall be designed to contain a spill from the largest vessel plus the design flow volume of fire protection water calculated to discharge from the fire-extinguishing system over the minimum required system design area, or area of the room or area in which the storage is located, whichever is smaller, for a period of 20 minutes.

(E) A monitoring method shall be provided to detect hazardous materials in the secondary containment system.

(F) The monitoring method shall be permitted to be visual inspection of the primary or secondary containment, or other approved means.

(G) Where secondary containment is subject to the intrusion of water, a monitoring method for detecting water shall be provided.

(H) Where monitoring devices are provided, they shall be connected to distinct visual or audible alarms.

(I) Where remote containment systems are provided, drainage systems shall be in accordance with the *Uniform Plumbing Code,* as referenced in Chapter 53, and the following:

(1) The slope of floors in indoor locations to drains or similar areas in outdoor locations shall be not less than 1 percent.
(2) Drains from indoor storage areas shall be sized to carry the volume of the fire protection water, as determined by the design density discharged from the automatic fire-extinguishing system over the minimum required system design area, or area of the room or area in which the storage is located, whichever is smaller.
(3) Materials of construction for drainage systems shall be compatible with the materials stored.
(4) Separate drainage systems shall be provided to avoid mixing incompatible materials where such materials are present in an open-use condition.
(5) Drains shall terminate in an approved location away from buildings, valves, means of egress, fire access roadways, adjoining property, and storm drains.

34.3.2.10 Emergency Alarms. Emergency alarms for the detection and notification of an emergency condition shall be provided in accordance with NFPA 1.

34.3.2.11 Floors in Storage Rooms. Floors in storage areas for organic peroxides, oxidizers, pyrophoric materials, unstable (reactive) materials, water-reactive solids and liquids, corrosive materials, and toxic and highly toxic materials shall be of liquid-tight, noncombustible construction.

34.3.2.12 In industrial occupancies required to comply with 34.3.3, where unprotected vertical openings exist and are necessary to manufacturing operations, such openings shall be permitted beyond the specified limits in 29.3.1(1). These unprotected vertical openings shall be permitted only where every floor level has direct access to one or more enclosed stairs or other exits protected against obstruction by any fire or smoke in the open areas connected by the unprotected vertical openings.

34.3.3 Protection Level 1.

34.3.3.1 General. Buildings, or portions thereof, required to comply with Protection Level 1 shall comply with 34.3.2 and 34.3.3.2 and 34.3.3.3.

34.3.3.2 Detached Building Required.

(A) Buildings required to comply with Protection Level 1 shall be used for no other purpose; shall not exceed one story in height; and shall be without basements, crawl spaces, or other under-floor spaces.

(B) Roofs of buildings described in 34.3.3.2(A) shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature.

(C) Buildings required to comply with both Protection Level 1 and Protection Level 4 shall comply with the most restrictive requirements for both protection levels.

34.3.3.3 Minimum Distance to Property Lines. Buildings required to comply with Protection Level 1 shall be set back from property lines by a distance of not less than 75 ft (23 m) and of not less than that required by Table 34.3.3.3.

Exception: Explosives where in accordance with NFPA 495.

34.3.3.3.1 Distances shall be measured from the perimeter wall to property lines, including those on a public way.

34.3.3.3.2 Quantities of explosives used in applying Table 34.3.3.3 shall be based on equivalent pounds (kilograms) of TNT.

34.3.4 Protection Level 2.

34.3.4.1 General. Buildings, or portions thereof, required to comply with Protection Level 2 shall comply with 34.3.2 and 34.3.4.2 through 34.3.4.5.

Table 34.3.3.3 The American Table of Distances for Storage of Explosives (Minimum Separation Distances for Buildings Containing Materials with Explosive Characteristics)

Quantity of Explosive Materials[1,2,3,4]			Inhabited Buildings[9]		Public Highways Class A to Class D[11]		Passenger Railways — Public Highways with Traffic Volume of More than 3000 Vehicles/Day[10,11]		Separation of Magazines[5,12]	
Pounds Over		Pounds Not Over	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded
0	≥	5	70	140	30	60	51	102	6	12
5	≥	10	90	180	35	70	64	128	8	16
10	≥	20	110	220	45	90	81	162	10	20
20	≥	30	125	250	50	100	93	186	11	22
30	≥	40	140	280	55	110	103	206	12	24
40	≥	50	150	300	60	120	110	220	14	28
50	≥	75	170	340	70	140	127	254	15	30
75	≥	100	190	380	75	150	139	278	16	32
100	≥	125	200	400	80	160	150	300	18	36
125	≥	150	215	430	85	170	159	318	19	38
150	≥	200	235	470	95	190	175	350	21	42
200	≥	250	255	510	105	210	189	378	23	46
250	≥	300	270	540	110	220	201	402	24	48
300	≥	400	295	590	120	240	221	442	27	54
400	≥	500	320	640	130	260	238	476	29	58
500	≥	600	340	680	135	270	253	506	31	62
600	≥	700	355	710	145	290	266	532	32	64
700	≥	800	375	750	150	300	278	556	33	66
800	≥	900	390	780	155	310	289	578	35	70
900	≥	1000	400	800	160	320	300	600	36	72
1000	≥	1200	425	850	165	330	318	636	39	78
1200	≥	1400	450	900	170	340	336	672	41	82
1400	≥	1600	470	940	175	350	351	702	43	86
1600	≥	1800	490	980	180	360	366	732	44	88
1800	≥	2000	505	1010	185	370	378	756	45	90
2000	≥	2500	545	1090	190	380	408	816	49	98
2500	≥	3000	580	1160	195	390	432	864	52	104
3000	≥	4000	635	1270	210	420	474	948	58	116
4000	≥	5000	685	1370	225	450	513	1026	61	122
5000	≥	6000	730	1460	235	470	546	1092	65	130
6000	≥	7000	770	1540	245	490	573	1146	68	136
7000	≥	8000	800	1600	250	500	600	1200	72	144
8000	≥	9000	835	1670	255	510	624	1248	75	150
9000	≥	10,000	865	1730	260	520	645	1290	78	156
10,000	≥	12,000	875	1750	270	540	687	1374	82	164
12,000	≥	14,000	885	1770	275	550	723	1446	87	174
14,000	≥	16,000	900	1800	280	560	756	1512	90	180
16,000	≥	18,000	940	1880	285	570	786	1572	94	188
18,000	≥	20,000	975	1950	290	580	813	1626	98	196
20,000	≥	25,000	1055	2000	315	630	876	1752	105	210
25,000	≥	30,000	1130	2000	340	680	933	1866	112	224
30,000	≥	35,000	1205	2000	360	720	981	1962	119	238
35,000	≥	40,000	1275	2000	380	760	1026	2000	124	248
40,000	≥	45,000	1340	2000	400	800	1068	2000	129	258
45,000	≥	50,000	1400	2000	420	840	1104	2000	135	270
50,000	≥	55,000	1460	2000	440	880	1140	2000	140	280
55,000	≥	60,000	1515	2000	455	910	1173	2000	145	290
60,000	≥	65,000	1565	2000	470	940	1206	2000	150	300
65,000	≥	70,000	1610	2000	485	970	1236	2000	155	310
70,000	≥	75,000	1655	2000	500	1000	1263	2000	160	320
75,000	≥	80,000	1695	2000	510	1020	1293	2000	165	330
80,000	≥	85,000	1730	2000	520	1040	1317	2000	170	340

(continues)

Table 34.3.3.3 *Continued*

Quantity of Explosive Materials[1,2,3,4]			Inhabited Buildings[9]		Public Highways Class A to Class D[11]		Passenger Railways — Public Highways with Traffic Volume of More than 3000 Vehicles/Day[10,11]		Separation of Magazines[5,12]	
Pounds Over		Pounds Not Over	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded	Barricaded[6,7,8]	Unbarricaded
85,000	≥	90,000	1760	2000	530	1060	1344	2000	175	350
90,000	≥	95,000	1790	2000	540	1080	1368	2000	180	360
95,000	≥	100,000	1815	2000	545	1090	1392	2000	185	370
100,000	≥	110,000	1835	2000	550	1100	1437	2000	195	390
110,000	≥	120,000	1855	2000	555	1110	1479	2000	205	410
120,000	≥	130,000	1875	2000	560	1120	1521	2000	215	430
130,000	≥	140,000	1890	2000	565	1130	1557	2000	225	450
140,000	≥	150,000	1900	2000	570	1140	1593	2000	235	470
150,000	≥	160,000	1935	2000	580	1160	1629	2000	245	490
160,000	≥	170,000	1965	2000	590	1180	1662	2000	255	510
170,000	≥	180,000	1990	2000	600	1200	1695	2000	265	530
180,000	≥	190,000	2010	2010	605	1210	1725	2000	275	550
190,000	≥	200,000	2030	2030	610	1220	1755	2000	285	570
200,000	≥	210,000	2055	2055	620	1240	1782	2000	295	590
210,000	≥	230,000	2100	2100	635	1270	1836	2000	315	630
230,000	≥	250,000	2155	2155	650	1300	1890	2000	335	670
250,000	≥	275,000	2215	2215	670	1340	1950	2000	360	720
275,000	≥	300,000	2275	2275	690	1380	2000	2000	385	770

[**495:** Table 8.4.1]

Note: For SI units, 1 ft = 0.305 m; 1 lb = 0.454 kg.

Superscript numerals refer to explanatory footnotes.

Explanatory Notes Essential to the Application of the American Table of Distances for Storage of Explosives

Note 1: "Explosive materials" means explosives, blasting agents, and detonators.

Note 2: "Explosives" means any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. A list of explosives determined to be within the coverage of Title 18, United States Code, Chapter 40, "Importation, Manufacture, Distribution and Storage of Explosive Materials," is issued at least annually by the Director of the Bureau of Alcohol, Tobacco, and Firearms of the Department of the Treasury. For quantity and distance purposes, detonating cord of 50 grains per foot should be calculated as equivalent to 8 lb (3.7 kg) of high explosives per 1000 ft (305 m). Heavier or lighter core loads should be rated proportionately.

Note 3: "Blasting agents" means any material or mixture consisting of fuel and oxidizer, intended for blasting, and not otherwise defined as an explosive, provided that the finished product, as mixed for use or shipment, cannot be detonated by means of a No. 8 test blasting cap where unconfined.

Note 4: "Detonator" means any device containing any initiating or primary explosive that is used for initiating detonation. A detonator may not be permitted to contain more than 10 g of total explosives by weight, excluding ignition or delay charges. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord delay connectors, and nonelectric instantaneous and delay blasting caps that use detonating cord, shock tube, or any other replacement for electric leg wires. All types of detonators in strengths through No. 8 cap should be rated at 1½ lb (0.7 kg) of explosives per 1000 caps. For strengths higher than No. 8 cap, the manufacturer should be consulted.

Note 5: "Magazine" means any building, structure, or container, other than an explosives manufacturing building, approved for the storage of explosive materials.

Note 6: "Natural barricade" means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that need protection cannot be seen from the magazine when the trees are bare of leaves.

Note 7: "Artificial barricade" means an artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m).

Note 8: "Barricaded" means the effective screening of a building containing explosive materials from the magazine or another building, a railway, or a highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosive materials to the eave line of any magazine or other building or to a point 12 ft (3.7 m) above the center of a railway or highway shall pass through such barrier.

Note 9: "Inhabited building" means a building regularly occupied in whole or part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other structure where people are accustomed to assemble, but does not include any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosive materials.

Note 10: "Railway" means any steam, electric, or other railroad or railway that carries passengers for hire.

Note 11: "Highway" means any public street, public alley, or public road.

Note 12: Where two or more storage magazines are located on the same property, each magazine shall comply with the minimum distances specified from inhabited buildings, railways, and highways, and, in addition, they should be separated from each other by not less than the distances shown for "separation of magazines," except that the quantity of explosive materials contained in detonator magazines shall govern with regard to the spacing of said detonator magazines from magazines containing other explosive materials. If any two or more magazines are separated from each other by less than the specified "separation of magazines" distances, such magazines, as a group, shall be considered as one magazine, and the total quantity of explosive materials stored in such group shall be treated as if stored in a single magazine located on the site of any magazine of the group, and shall comply with the minimum specified distances from other magazines, inhabited buildings, railways, and highways.

Note 13: Storage in excess of 300,000 lb (136,200 kg) of explosive materials in one magazine generally is not necessary for commercial enterprises.

Note 14: This table applies only to the manufacture and permanent storage of commercial explosive materials. It is not applicable to the transportation of explosives or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles, or other heavily encased explosives.

Note 15: Where a manufacturing building on an explosive materials plant site is designed to contain explosive materials, the building shall be located at a distance from inhabited buildings, public highways, and passenger railways in accordance with the American Table of Distances based on the maximum quantity of explosive materials permitted to be in the building at one time.

34.3.4.2 Exterior Wall Required. Buildings, or portions thereof, required to comply with Protection Level 2 shall be located on property such that not less than 25 percent of the perimeter wall is an exterior wall.

Exception No. 1: Liquid use, dispensing, and mixing rooms having a floor area of not more than 500 ft^2 (46.5 m^2) shall not be required to be located on the outer perimeter of the building where such rooms comply with NFPA 30.

Exception No. 2: Liquid storage rooms having a floor area of not more than 1000 ft^2 (93 m^2) shall not be required to be located on the outer perimeter where such rooms comply with NFPA 30.

34.3.4.3 Minimum Distance to Property Lines.

34.3.4.3.1 Buildings, or portions thereof, required to comply with Protection Level 2 shall be set back from property lines at the following distances:

(1) Not less than 30 ft (9.1 m) where the area of the occupancy exceeds 1000 ft^2 (93 m^2) and a detached building is not required
(2) Not less than 50 ft (15.2 m) where a detached building is required by Table 34.3.4.4.1.
(3) Not less than the distances required by Table 34.3.3.3 for buildings containing materials with explosive characteristics

34.3.4.3.2 Distances shall be measured from the walls enclosing the Protection Level 2 area to property lines, including those on a public way.

34.3.4.4 Detached Building Required.

34.3.4.4.1 Buildings required to comply with Protection Level 2 and containing quantities of high hazard contents exceeding the quantity limits set forth in Table 34.3.4.4.1 shall be used for no other purpose; shall not exceed one story in height; and shall be without basements, crawl spaces, or other under-floor spaces.

Exception: Buildings that contain high hazard Level 2 contents also shall be permitted to contain high hazard Level 3 or high hazard Level 4 contents, provided that the materials are separated as otherwise required by the provisions of this Code and NFPA 1.

34.3.4.4.2 The roof of buildings specified in 34.3.4.4.1 shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature.

34.3.4.5 Water-reactive Materials.

34.3.4.5.1 Rooms or areas containing Class 2 or Class 3 water-reactive materials shall be resistant to water penetration.

34.3.4.5.2 Piping for conveying water, other than fire protection piping, shall not route over or through areas containing Class 2 or Class 3 water-reactive materials, unless isolated by approved liquid-tight construction.

34.3.5 Protection Level 3.

34.3.5.1 General. Buildings, or portions thereof, required to comply with Protection Level 3 shall comply with 34.3.2 and 34.3.5.2 through 34.3.5.5.

34.3.5.2 Exterior Wall Required. Buildings, or portions thereof, required to comply with Protection Level 3 shall be located on property such that not less than 25 percent of the perimeter wall is an exterior wall.

Table 34.3.4.4.1 High Hazard Level 2 and Level 3 Materials—Required Detached Storage

Material		Maximum Quantity Without a Detached Storage Building	
		Solids and Liquids (tons)	Gases (ft^3)
Oxidizers	Class 3	1,200	NA
	Class 2	2,000	NA
Organic peroxides	Class II	25	NA
	Class III	50	NA
Unstable (reactive) materials	Class 3, nondetonable	1	2,000
	Class 2	25	10,000
Water-reactive materials	Class 3	1	NA
	Class 2, deflagrating	25	NA
Pyrophoric gases		NA	2,000

For SI units, 1 ton = 0.9 met tons; 1 ft^3 = 0.0283 m^3.
NA = Not applicable.

Exception No. 1: Liquid use, dispensing, and mixing rooms having a floor area of not more than 500 ft^2 (46.5 m^2) shall not be required to be located on the outer perimeter of the building where they are in accordance with NFPA 30.

Exception No. 2: Liquid storage rooms having a floor area of not more than 1000 ft^2 (93 m^2) shall not be required to be located on the outer perimeter where they are in accordance with NFPA 30.

34.3.5.3 Minimum Distance to Property Lines.

34.3.5.3.1 Buildings, or portions thereof, required to comply with Protection Level 3 shall be set back from property lines at the following distances:

(1) Not less than 30 ft (9.1 m) where the area of the occupancy exceeds 1000 ft^2 (93 m^2) and a detached building is not required
(2) Not less than 50 ft (15.2 m) where a detached building is required by Table 34.3.4.4.1.
(3) Not less than the distances required by Table 34.3.3.3 for buildings containing materials with explosive characteristics

34.3.5.3.2 Distances shall be measured from the walls enclosing the Protection Level 3 area to property lines, including those on a public way.

34.3.5.4 Detached Building Required.

34.3.5.4.1 Buildings required to comply with Protection Level 3 and containing quantities of high hazard contents exceeding the quantity limits set forth in Table 34.3.4.4.1 shall be used for no other purpose; shall not exceed one story in height; and shall be without basements, crawl spaces, or other under-floor spaces.

Exception: Buildings that contain high hazard Level 3 contents also shall be permitted to contain high hazard Level 2 or high hazard Level 4 contents, provided that the materials are separated as otherwise required by the provisions of this Code and NFPA 1.

34.3.5.4.2 The roofs of buildings specified in 34.3.5.4.1 shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature.

34.3.5.5 Water-reactive Materials.

34.3.5.5.1 Rooms or areas containing Class 2 or Class 3 water-reactive materials shall be resistant to water penetration.

34.3.5.5.2 Piping for conveying water, other than fire protection piping, shall not route over or through areas containing Class 2 or Class 3 water-reactive materials, unless isolated by approved liquid-tight construction.

34.3.6 Protection Level 4. Buildings, or portions thereof, required to comply with Protection Level 4 shall comply with 34.3.2, 34.3.6.1, and 34.3.6.2.

34.3.6.1 Gas Rooms.

(A) Gas rooms required by this *Code*, NFPA 1, or NFPA 55 for storage of toxic or highly toxic gases shall be separated from other areas by not less than a 2-hour fire barrier wall and horizontal assembly, or both, where the area is 300 ft^2 (27.9 m^2) or more and by not less than 1-hour fire resistance construction where the area is less than 300 ft^2 (27.9 m^2).

(B) Exhaust ventilation for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding areas and shall direct the exhaust ventilation to an exhaust system.

34.3.6.2 Highly Toxic Solids and Liquids. Highly toxic solids and liquids not stored in approved hazardous materials storage cabinets shall be isolated from other hazardous materials storage by a 1-hour fire barrier.

34.3.7 Protection Level 5.

34.3.7.1 General. In addition to the requirements set forth elsewhere in this *Code*, buildings, and portions thereof, required to comply with Protection Level 5 shall comply with 34.3.2, 34.3.7.1, 34.3.7.2, 34.3.7.3, NFPA 1, and NFPA 318, *Standard for the Protection of Semiconductor Fabrication Facilities*.

34.3.7.1.1 Location of Semiconductor Manufacturing Operations. Semiconductor manufacturing operations shall be conducted in fabrication areas.

34.3.7.1.2 Transporting Hazardous Production Materials to Fabrication Areas.

34.3.7.1.2.1 Hazardous production materials shall be transported from delivery locations or storage areas to fabrication areas through enclosed piping or tubing systems that comply with NFPA 1 or through service corridors complying with 34.3.7.1.2.2(A).

34.3.7.1.2.2 In existing buildings, where an existing fabrication area is altered or modified, hazardous production materials shall also be permitted to be transported from delivery locations or storage areas to fabrication areas through exit access corridors complying with 34.3.7.2.2, subject to the conditions described in 34.3.7.1.2.2(A) through 34.3.7.1.2.2(C).

(A) Exit access corridors adjacent to the fabrication area where the alteration work is to be done shall be fire resistive for a length not less than the following:

(1) Length of the common wall adjoining both the corridor and the fabrication area
(2) Distance to the point of entry of HPM into the exit access corridor serving that fabrication area

(B) An emergency alarm system complying with 34.3.7.3.6 shall be provided.

(C) Requirements for pass-throughs shall be as follows:

(1) Self-closing doors having a fire-protection rating 1 hour or more shall separate pass-throughs from existing exit access corridors.
(2) Pass-throughs shall be constructed as required for the exit access corridor.
(3) Pass-throughs shall be protected by an approved automatic fire extinguishing system.

34.3.7.2 Building Features.

34.3.7.2.1 Fabrication Areas.

34.3.7.2.1.1 Location. Fabrication areas shall be located such that occupied levels are at or above the first story.

34.3.7.2.1.2 Hazardous Materials Quantity Limits.

(A) The aggregate quantity of hazardous materials in storage and in use within a single fabrication area shall not exceed one of the following, whichever is greater:

(1) Quantities set forth in Table 34.3.7.2.1.2
(2) Maximum allowable quantities per control area set forth in Table 34.1.3.1

(B) Storage of hazardous materials classified as hazardous production materials shall be further limited such that the quantity stored within a single fabrication area does not exceed the maximum allowable quantities per control area set forth in Table 34.1.3.1.

34.3.7.2.1.3 Fire-resistive Separation. Fabrication areas shall be separated from other parts of the building, including exit access corridors, by not less than 1-hour fire resistance–rated assemblies.

(A) Doors within the assemblies specified in 34.3.7.2.1.3, including doors to corridors, shall be self-closing fire door assemblies with a ¾ hour or greater fire resistance rating.

(B) Windows between fabrication areas and exit access corridors shall be permitted to be fixed glazing listed and labeled for a fire protection rating of at least ¾ hour.

(C) Where it is necessary to construct multiple adjoining fabrication areas to comply with the hazardous materials quantity limits specified in 34.3.7.2.1.2(A), 1-hour fire resistance–rated assemblies shall be provided to separate the fabrication areas from each other in accordance with Chapter 7.

34.3.7.2.1.4 Floors.

(A) Except for surfacing, floors within fabrication areas shall be of noncombustible construction.

(B) Floors of fabrication areas separating fabrication areas from other uses shall be liquid-tight.

34.3.7.2.1.5 Vertical Openings. Openings through floors of fabrication areas shall be permitted to be unprotected in accordance with 8.12.4.2 where the interconnected levels are used solely for mechanical equipment directly related to such fabrication areas.

Table 34.3.7.2.1.2 Quantity Limits for Hazardous Materials in a Single Fabrication Area[1]

Hazard Category	Solids (lb/ft^2)	Liquids (gal/ft^2)	Gas (ft^3 @ NTP/ ft^2)
Combustible liquid			
II		0.01	
III-A	NA	0.02	NA
III-B		NL	
Combination Classes I, II and III-A		0.04	
Cryogenic			
Flammable	NA	NA	See footnote 2
Oxidizing			1.25
Explosives	See footnote 3	See footnote 3	See footnote 3
Flammable gas			
Gaseous	NA	NA	See footnote 2
Liquefied			See footnote 2
Flammable Liquid			
I-A		0.0025	
I-B		0.025	
I-C	NA	0.025	NA
Combination Classes I-A, I-B, and I-C		0.025	
Combination Classes I, II, and III-A		0.04	
Flammable solid	0.001	NA	NA
Organic peroxide			
Unclassified detonable	See footnote 3	See footnote 3	
I	See footnote 3	See footnote 3	NA
II	0.025	0.0025	
III	0.1	0.01	
IV	NL	NL	
V	NL	NL	
Oxidizing gas			
Gaseous	NA	NA	1.25
Liquefied			1.25
Combination of gaseous and liquefied			1.25
Oxidizer			
4	See footnote 3	See footnote 3	
3	0.003	0.003	NA
2	0.003	0.003	
1	NL	NL	
Combination oxidizer classes 1, 2, and 3	0.003	0.003	
Pyrophoric	See footnote 3	0.00125	See footnotes 2 and 4
Unstable reactive			
4	See footnote 3	See footnote 3	See footnote 3
3	0.025	0.0025	See footnote 3
2	0.1	0.01	See footnote 3
1	NL	NL	NL
Water reactive			
3	See footnote 3	0.00125	NA
2	0.25	0.025	
1	NL	NL	
Corrosive	NL	NL	NL
Highly toxic	NL	NL	See footnote 2
Toxics	NL	NL	See footnote 2

For SI units, 1 lb = 0.454 kg; 1 ft^2 = 0.093 m^2; 1 ft^3 = 0.0283 m^3.

NTP = Normal temperature and pressure.

NA = Not applicable.

NL = Quantity of hazardous materials in a single fabrication area not limited.

[1] Hazardous materials within piping are not permitted to be included in the calculated quantities.

[2] The aggregate quantity of flammable, pyrophoric, toxic, and highly toxic gases is not permitted to exceed 9000 ft^3 (254.9 m^3) at NTP.

[3] The quantity of hazardous materials in a single fabrication is not permitted to exceed maximum allowable quantities per control area in Table 34.1.3.1.

[4] The aggregate quantity of pyrophoric gases in the building shall not exceed quantity limits set forth in Table 34.3.4.4.1.

(A) Mechanical, duct, and piping penetrations within a fabrication area shall not extend through more than two floors.

(B) The annular space around equipment passing through the penetrations shall be sealed at the floor level to restrict the movement of air.

(C) The fabrication area, including levels interconnected with ductwork and piping, shall be regulated as a single conditioned environment.

34.3.7.2.1.6 Egress from Fabrication Areas. In areas required to comply with Protection Level 5, the travel distance within a fabrication area to an exterior exit door, an exit access corridor, a horizontal exit, an exit passageway, or an enclosed exit stairway shall not exceed 200 ft (61 m).

34.3.7.2.2 Exit Access Corridors.

(A) Exit access corridors shall be separated from fabrication areas as specified in 34.3.7.2.1.3.

(B) Exit access corridors shall not contain hazardous production materials (HPM) and shall not be used for transporting HPM, except through closed piping systems complying with 34.3.7.3.1.3.

34.3.7.2.3 Service Corridors. Service corridors shall be permitted to be regulated as part of the Protection Level 5 area.

34.3.7.2.3.1 Minimum Width. The clear width of a service corridor shall not be less than 5 ft (1525 mm) and shall not be less than 33 in. (825 mm) wider than the widest cart or truck used in the corridor.

34.3.7.2.3.2 Fire-resistive Separation. Service corridors shall be separated from exit access corridors as required by 34.3.7.2.1.3.

34.3.7.2.3.3 Exiting.

(A) Service corridors shall not be used as a required exit access corridor.

(B) Service corridors shall be provided with two or more exits, and not more than one-half of the required number of exits shall lead to the fabrication area.

(C) The travel distance within a service corridor to an exit or to a door into a fabrication area shall not exceed 75 ft (23 m). Dead ends shall not exceed 4 ft (1220 mm).

(D) Doors from service corridors shall swing in the direction of exit travel and shall be self-closing.

34.3.7.2.4 Storage Areas for Hazardous Production Materials.

34.3.7.2.4.1 General.

(A) Storage of HPM in fabrication areas in quantities not exceeding the limits set forth in Table 34.1.3.1 shall be within approved or listed storage cabinets, within gas cabinets, or within a workstation.

(B) The storage of hazardous production in quantities greater than those specified in Table 34.1.3.1 shall be in liquid storage rooms complying with 34.3.2.4, gas rooms complying with 34.3.6.1, or HPM rooms complying with 34.3.7.2.4.2, as appropriate for the materials stored.

(C) The storage of hazardous materials other than HPM shall be in accordance with other applicable provisions of this *Code* and NFPA 1.

34.3.7.2.4.2 HPM Rooms.

(A) HPM rooms shall be constructed as required for the applicable protection level, based on the classification of hazardous materials stored therein.

(B) HPM rooms shall be separated from other areas by not less than a 2-hour fire barrier wall and horizontal assembly, or both, where the area is 300 ft^2 (27.9 m^2) or more and by not less than 1-hour fire resistance construction where the area is less than 300 ft^2 (27.9 m^2).

(C) When two means of egress are required by 34.3.2.5.3 for an HPM room, liquid storage room, or gas room, one means of egress shall be directly to the outside of the building.

(D) Except for surfacing, floors of HPM rooms shall be of noncombustible liquid-tight construction.

(E) Raised grating over floors shall be of noncombustible materials.

34.3.7.2.4.3 Doors. Door openings to HPM rooms, liquid storage rooms, and gas rooms that penetrate a fire barrier wall, including doors to corridors, shall be self-closing fire door assemblies having a fire protection rating of not less than ¾ hour.

34.3.7.2.4.4 Ventilation. Ventilation for HPM rooms, liquid storage rooms, and gas rooms shall comply with 34.3.2.6.

34.3.7.2.4.5 Emergency Alarm System. Emergency alarms for HPM rooms, liquid storage rooms, and gas rooms shall comply with 34.3.7.3.6.2.

34.3.7.2.4.6 Separation of HPM. Hazardous production materials stored in HPM rooms, liquid storage rooms, and gas rooms shall be separated from incompatible materials in accordance with Table 34.3.7.2.4.6.

34.3.7.2.5 Emergency Control Station.

(A) An emergency control station shall be provided on the premises at an approved location, outside of the fabrication area, and shall be continuously staffed by trained personnel.

(B) The emergency control station shall receive signals from emergency equipment and alarm and detection systems.

(C) The emergency equipment and alarm and detection systems specified in 34.3.7.2.5(B) shall include, but not necessarily be limited to, the following where such equipment or systems are required to be provided in 34.3.7 or elsewhere in this *Code*.

(1) Automatic fire sprinkler system alarm and monitoring systems
(2) Manual fire alarm systems
(3) Emergency alarm systems
(4) Continuous gas detection systems
(5) Smoke detection systems
(6) Emergency power systems

34.3.7.3 Systems and Equipment.

34.3.7.3.1 Piping and Tubing.

34.3.7.3.1.1 General. Hazardous production materials piping and tubing shall comply with 34.3.7.3.1.2 and 34.3.7.3.1.3 and shall be installed in accordance with ASME B31.3, *Process Piping*, and NFPA 1.

34.3.7.3.1.2 Location of HPM Supply Piping and Tubing in Service Corridors. Hazardous production materials supply piping or tubing in service corridors shall be exposed to view.

34.3.7.3.1.3 Installation of HPM Piping and Tubing in Exit Access Corridors and Above Other Occupancies. The installation of HPM piping and tubing within the space defined by the walls of exit access corridors and the floor or roof above, or in concealed spaces above other occupancies, shall be in accordance with the following, except for transverse crossings of the corridors by supply piping that is enclosed within a ferrous pipe or tube for the width of the corridor:

(1) Automatic sprinklers shall be installed within the space, unless the space is less than 6 in. (152 mm) in the least dimension.
(2) Ventilation with not less than six air changes per hour shall be provided, and the space shall not be used to convey air from any other area.
(3) Where the piping or tubing is used to transport HPM liquids, a receptor that meets the following criteria shall be installed below such piping or tubing.
    (a) The receptor shall be designed to collect any discharge or leakage and drain it to an approved location.
    (b) The 1-hour enclosure shall not be used as part of the receptor.
(4) HPM supply piping and tubing and HPM nonmetallic waste lines shall meet the following criteria:
    (a) The lines shall be separated from the exit access corridor and from areas not complying with Protection Level 5 by construction as required for walls or partitions that have a fire resistance rating of not less than 1 hour.
    (b) Where gypsum wallboard is used, joints on the piping side of the enclosure shall not be required to be taped, provided the joints occur over framing members.
    (c) Access openings into the enclosure shall be protected by approved fire-rated assemblies.

Table 34.3.7.2.4.6 Minimum Separation of HPM

Material	Highly Toxic	Toxic	Acid	Base	Flammable	Oxidizer	Water-reactive	Pyrophoric	Unstable (reactive)	Organic Peroxide
Highly Toxic		NR	1 hr	1 hr	1 hr	1 hr	1 hr	1 hr	1 hr	1 hr
Toxic	NR		S	S	S	S	S	S	S	S
Acid	1 hr	S		S	S[1]	S	S	S[1]	S	S
Base	1 hr	S	S		S	S	S	S	S	S
Flammable	1 hr	S	S[1]	S		S	R	S	S	S
Oxidizer	1 hr	S	S	S	S		S	S[1]	S	S
Water-reactive	1 hr	S	S	S	R	S		S	S	S
Pyrophoric	1 hr	S	S[1]	S	S	S[1]	S		S	S
Unstable (reactive)	1 hr	S	S	S	S	S	S	S		S
Organic Peroxide	1 hr	S	S	S	S	S	S	S	S	

NR = Not required.
1 hr = 1-hour fire-resistance–rated construction.
S = Separation by a partial noncombustible partition extending not less than 18 in. (457 mm) above and to the sides of the stored material.
R = Separate rooms, which are not required to have a fire resistance rating.
Note: HPM gases are required to be separated from HPM liquids and solids by 1-hour fire-resistance–rated construction or are required to be kept in approved gas cabinets. HPM gases also are required to be separated from gases in other HPM hazard categories as required by Table 34.3.7.2.4.6, or are required to be kept in approved gas cabinets.
[1] Separation by not less than 20 ft (6 m) is permitted in lieu of a noncombustible partition.

(5) Readily accessible manual or automatic remotely activated, fail-safe emergency shutoff valves shall be installed on piping and tubing other than waste lines at the following locations:
   (a) At branch connections into the fabrication area
   (b) At entries into exit access corridors

34.3.7.3.2 Electrical Equipment in Fabrication Areas.

(A) Electrical equipment and devices within the fabrication area shall comply with Chapter 52.

(B) The requirements for hazardous locations shall not be required to be applied where the average air change is at least four times that set forth in 34.3.7.3.3 and where the number of air changes at any location is not less than three times that required by 34.3.7.3.3.

(C) The use of recirculated air shall be permitted.

(D) Workstations shall not be energized without adequate exhaust ventilation. *(See 34.3.7.3.3 for workstation exhaust ventilation requirements.)*

34.3.7.3.3 Ventilation Systems.

34.3.7.3.3.1 General. Mechanical exhaust ventilation shall be provided throughout the fabrication area at the rate of not less than 1 $ft^3/min/ft^2$ (0.044 $L/s/m^2$) of floor area.

(A) The use of recirculated air shall be permitted to meet the average and minimum number of air changes specified in 34.3.7.3.3.2.

(B) The exhaust air duct system of one fabrication area shall not connect to another duct system outside that fabrication area within the building.

(C) Ventilation shall be provided to capture and exhaust fumes and vapors at workstations.

(D) Two or more operations at a workstation shall not be connected to the same exhaust system where either one or the combination of the substances removed could constitute a fire, an explosion, or a hazardous chemical reaction within the exhaust duct system.

(E) Exhaust ducts penetrating occupancy separations shall be contained in a shaft of equivalent fire resistance-rated construction.

(F) Exhaust ducts shall not penetrate firewalls.

(G) Fire dampers shall not be installed in exhaust ducts.

34.3.7.3.3.2 Ventilation of Service Corridors, HPM Rooms, Liquid Storage Rooms, and Gas Rooms. Service corridors, HPM rooms, liquid storage rooms, and gas rooms shall be mechanically ventilated at 1 $ft^3/min/ft^2$ (0.044 $L/s/m^2$) or six air changes per hour, whichever is greater.

34.3.7.3.4 Gas Detection Systems. A continuous gas detection system shall be provided in the locations described in 34.3.7.3.4.1 through 34.3.7.3.4.4 for HPM gases when the physiological warning properties of the gas are at a higher level than the accepted permissible exposure limit (PEL) for the gas and for flammable gases.

34.3.7.3.4.1 Fabrication Areas. A continuous gas detection system shall be provided at locations in fabrication areas where gas is used.

34.3.7.3.4.2 HPM Rooms. A continuous gas detection system shall be provided in HPM rooms that do not comply with the requirements for gas rooms where gas is used in the room.

34.3.7.3.4.3 Gas Cabinets, Exhausted Enclosures, and Gas Rooms. A continuous gas detection system shall be provided in gas cabinets and exhausted enclosures. A continuous gas detection system shall be provided in gas rooms where gases are not located in gas cabinets or exhausted enclosures.

34.3.7.3.4.4 Exit Access Corridors. Where gases are transported in piping placed within the space defined by the walls of an exit access corridor and the floor or roof above the exit access corridor, a continuous gas detection system shall be provided where piping is located and in the exit access corridor.

Exception: The continuous gas detection system shall not be required for occasional transverse crossings of the corridors by supply piping that is enclosed in a ferrous pipe or tube for the width of the corridor.

34.3.7.3.4.5 Gas Detection System Operation. The continuous gas detection system shall be capable of monitoring the room, area, or equipment in which the gas is located at or below the permissible exposure limit (PEL) or ceiling limit (CL) of the gas for which detection is provided.

(A) For flammable gases, the monitoring detection threshold level shall be vapor concentrations in excess of 20 percent of the lower explosive limit (LFL).

(B) Monitoring for highly toxic and toxic gases shall also comply with the requirements in NFPA 1 for highly toxic and toxic material.

34.3.7.3.4.6 Alarms. The gas detection system shall be provided with an emergency alarm complying with 34.3.7.3.6.3.

34.3.7.3.4.7 Shutoff of Gas Supply.

(A) The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected.

Exception: When the gas detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

(B) Automatic closure of shutoff valves shall comply with the following.

(1) Where the gas detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
(2) Where the detection sampling point initiating the gas detection system alarm is within a room, and compressed gas containers are not in gas cabinets or an exhausted enclosure, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
(3) Where the gas detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the compressed gas container of specific gas detected supplying the manifold shall automatically close.

34.3.7.3.5 Manual Fire Alarm System.

(A) An approved manual fire alarm system shall be provided throughout buildings required to comply with Protection Level 5.

(B) Activation of the alarm system shall initiate a local alarm and transmit a signal to the emergency control station.

(C) The fire alarm system shall be designed and installed in accordance with *NFPA 72, National Fire Alarm Code*.

34.3.7.3.6 Emergency Alarm System.

34.3.7.3.6.1 Exit Access Corridors and Service Corridors.

(A) An approved emergency alarm system shall be provided for exit access corridors and service corridors.

(B) Emergency alarm-initiating devices shall be installed in exit access corridors and service corridors at not more than 150-ft (45.7-m) intervals and at each exit and exit access doorway.

34.3.7.3.6.2 HPM Rooms, Liquid Storage Rooms, and Gas Rooms.

(A) An approved emergency alarm system shall be provided for HPM rooms, liquid storage rooms, and gas rooms.

(B) Emergency alarm-initiating devices shall be installed outside of each interior exit access door for HPM rooms, liquid storage rooms, and gas rooms.

34.3.7.3.6.3 Gas Detection Systems.

(A) Gas detection systems shall initiate an alarm when a short-term hazard condition is detected.

(B) The local alarm shall be both visual and audible and shall provide warning both inside and outside the area where the gas is detected.

(C) The audible alarm shall be distinct from all other alarms.

34.3.7.3.6.4 Alarm-Initiating Devices. An approved emergency telephone system, a local alarm manual pull stations, or other approved alarm-initiating devices shall be permitted to be used as emergency alarm-initiating devices.

34.3.7.3.6.5 Alarm Notification. Activation of the emergency alarm system shall sound a local alarm and notify the emergency control station.

34.3.7.3.7 Emergency Power System. An emergency power system shall be provided for buildings, or portions thereof, required to comply with Protection Level 5 where required in 34.3.7.3.7.1. The emergency power system shall be designed to automatically supply power to required electrical systems when the normal electrical supply system is interrupted.

34.3.7.3.7.1 Where Required. Emergency power shall be provided for electrically operated equipment and connected control circuits for the following systems:

(1) HPM exhaust ventilation systems
(2) HPM gas cabinet ventilation systems
(3) HPM exhausted enclosure ventilation systems

(4) HPM gas room ventilation systems
(5) HPM gas detection systems
(6) Emergency alarm systems
(7) Manual fire alarm systems
(8) Automatic fire sprinkler system monitoring and alarm systems
(9) Electrically operated systems required elsewhere in this *Code* applicable to the use, storage, or handling of HPM

34.3.7.3.7.2 Emergency Power for Exhaust Ventilation Systems. Exhaust ventilation systems shall be permitted to be designed to operate at not less than one-half the normal fan speed on the emergency power system where it is demonstrated that the level of exhaust will maintain a safe atmosphere.

34.3.7.3.8 Fire Sprinkler System Protection in Exhaust Ducts for HPM.

34.3.7.3.8.1 General. Automatic fire sprinkler system protection shall be provided in exhaust ducts conveying vapors, fumes, mists, or dusts generated from HPM in accordance with 34.3.7.3.8.2 through 34.3.7.3.8.4 and the *Uniform Mechanical Code*, as referenced in Chapter 50.

34.3.7.3.8.2 Metallic Exhaust Ducts and Noncombustible, Nonmetallic Exhaust Ducts. Automatic fire sprinkler system protection shall be provided in metallic exhaust ducts and noncombustible, nonmetallic exhaust ducts where all of the following conditions apply:

(1) Where the largest cross-sectional diameter is equal to or greater than 10 in. (254 mm)
(2) Where the ducts are within the building
(3) Where the ducts are conveying flammable vapors or fumes

34.3.7.3.8.3 Combustible, Nonmetallic Exhaust Ducts. Automatic fire sprinkler system protection shall be provided in combustible, nonmetallic exhaust ducts where the largest cross-sectional diameter of the duct is equal to or greater than 10 in. (254 mm).

Exception No. 1: Ducts are listed or approved for applications without automatic fire sprinkler system protection.

Exception No. 2: Ducts are not more than 12 ft (3657 mm) in length and installed below ceiling level.

34.3.7.3.8.4 Automatic Sprinkler Locations.

(A) Sprinklers system shall be installed at 12-ft (3657-mm) intervals in horizontal ducts and at changes in direction.

(B) In vertical ducts, sprinklers shall be installed at the top and at alternate floor levels.

Chapter 35 Structural Design

35.1 General.

35.1.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures, and portions thereof regulated by this *Code*.

35.1.2* Structural Design. Buildings, structures, and portions thereof shall be designed and constructed to support, within the limitations specified in this *Code*, all loads set forth in this chapter and elsewhere in this *Code* and combined in accordance with Section 35.15.

35.1.2.1 Design Methods. Design shall be in accordance with strength design, load and resistance factor design, or allowable stress design methods, as permitted by the applicable material chapters.

35.1.2.2 Basic Requirements. The basic requirements of strength, serviceability, self-straining forces, and analysis shall be in accordance with Section 1.3 of ASCE 7, *Minimum Design Loads for Buildings and Other Structures*.

35.1.2.3 One- and Two-Family Dwellings. One- and two-family dwellings shall be permitted to be designed and constructed in accordance with the following reference documents, subject to the limitations therein:

(1) PCA EB118, *Prescriptive Method for Insulating Concrete Forms in Residential Construction*
(2) ACI 530/ASCE 5/TMS 402, *Building Code Requirements for Masonry Structures*, Chapter 5
(3) AISI-Prescriptive, *Standard for Cold-Formed Steel Framing — Prescriptive Method for One and Two Family Dwellings*
(4) ANSI/AF&PA WFCM, *Wood Frame Construction Manual for One- and Two- Family Dwellings*
(5) SSTD-10, *Standard for Hurricane Resistant Construction*
(6) IRC, *International Residential Code*

35.1.2.4 General Structural Integrity. The requirements for general structural integrity shall be in accordance with Section 1.4 of ASCE 7.

35.1.2.5 Load Path. Any method of construction to be used shall result in a system that provides an identified, continuous load path capable of transferring all loads from their point of origin through the load-resisting elements to the ultimate point of support.

35.1.2.6 In-situ Load Tests.

35.1.2.6.1 The authority having jurisdiction shall be responsible for authorizing an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy.

35.1.2.6.2 Engineering analysis and load tests shall be conducted in accordance with the responsible registered design professional's (RDP's) quality assurance program as required in Chapter 40.

35.1.2.7 Preconstruction Load Tests. Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable material design standard, or alternative test procedures in accordance with the responsible registered design professional's (RDP's) quality assurance program as required in Chapter 40, shall be load tested in accordance with the responsible registered design professional's (RDP's) quality assurance program as required in Chapter 40.

35.1.2.8 Deflections.

35.1.2.8.1 General.

35.1.2.8.1.1 The deflection limits of structural members shall not exceed the more restrictive of the limits specified in Table 35.1.2.8.1.1 or in 35.1.2.8.2 through 35.1.2.8.8.

35.1.2.8.1.2 Drift limits applicable to earthquake loading shall be in accordance with Section 9 of ASCE 7.

35.1.2.8.2 Reinforced Concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318, *Building Code Requirements for Structural Concrete*.

Table 35.1.2.8.1.1 Deflection Limits

Load Case	Deflection Limit[1]		
	L	***S* or *W*[2]**	***D* + *L***
Roof members			
Supporting plaster ceiling	*l*/360	*l*/360	*l*/240
Supporting nonplaster ceiling	*l*/240	*l*/240	*l*/180
Not supporting ceiling	*l*/180	*l*/180	*l*/120
Floor members	*l*/360	—	*l*/240
Exterior walls			
With brittle finishes		*l*/240	—
With flexible finishes		*l*/120	—
Interior walls and partitions[3]			
With brittle finishes	*l*/240	—	—
With flexible finishes	*l*/120	—	—
Farm buildings	—	—	*l*/180
Greenhouses	—	—	*l*/120

For SI units, 1 in. = 25.4 mm.

Note: *L* = live load, *S* = snow load, *W* = wind load, *D* = dead load, *l* = span length in inches.

[1] For structural roofing and siding made of formed metal sheets, the total load deflection is not to exceed *l*/60. For secondary structural members to which formed metal roofing or siding is attached, the live load deflection is not to exceed *l*/150 for roofs and *l*/90 for walls. For roofs, this exception applies only when the metal sheets have no roof covering.

[2] The wind load is permitted to be taken as 0.7 times of the components and cladding load for the purpose of the deflection limits herein.

[3] Horizontal loads to be applied to interior partitions are determined in accordance with 35.6.9.

35.1.2.8.3 Steel. The deflection of steel structural members shall not exceed that permitted by the following, as applicable:

(1) AISC ASD, *Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design*
(2) AISC LRFD, *Load and Resistance Factor Design for Structural Steel Buildings*
(3) AISI-CFSD, *Standard for Cold-Formed Steel Framing—General Provisions*
(4) ASCE 3, *Standard for the Structural Design of Composite Slabs*
(5) ASCE 8, *Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members*
(6) *Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders*

35.1.2.8.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by ACI 530/ASCE 5/TMS 402.

35.1.2.8.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA SAS 30, *Aluminum Construction Manual Series, Section 1, Specifications for Aluminum Structures.*

35.1.2.8.6 Glazing. Glazing supports shall comply with Section 46.9.

35.1.2.8.7 Wood. The deflection of wood structural members shall not exceed that permitted by the AF&PA ASD, *Allowable Stress Design (ASD) Manual for Engineered Wood Construction*, or AF&PA LRFD, *Load and Resistance Factor Design Manual for Engineered Wood Construction.*

35.1.2.8.8* Roof Deflection. All roofs shall be designed with a slope or camber to allow drainage after the dead load deflection due to initial set and long-time deformation has taken place, except that roof construction shall be permitted to be level if the dead load deflection pockets due to initial set and long-time deformation meet the following criteria:

(1) They are not over ½ in. (13 mm) deep below the drainage invert.
(2) They deflect not more than ½ in. (13 mm), at any point, for a 5-psf (0.24-kN/m^2) live load on all or alternate spans.
(3) Cantilever members drained at the unsupported end are not required to meet the deflection requirements.
(4) Roofs with a slope of less than ¼ in./ft (6 mm/300 mm) shall be designed to prevent instability from ponding loads.

35.2 Definitions. The following definitions are extracted from ASCE 7 and are reprinted with permission of ASCE. *(See flood-related definitions in Section 39.2.)*

35.2.1 Addition. An increase in building area, aggregate floor area, height, or number of stories of a structure. **[ASCE 7:**9.2.1]

35.2.2 Allowable Stress Design. A method of proportioning structural members such that elastically computed stresses produced in the members by nominal loads do not exceed specified allowable stresses (also called working stress design). **[ASCE 7:**1.2]

35.2.3 Basic Wind Speed (*V*). Three-second gust speed at 33 ft (10 m) above the ground in Exposure C (see ASCE 7, Section 6.5.6.3) as determined in accordance with ASCE 7, Section 6.5.4. **[ASCE 7:**6.2]

35.2.4 Buildings. Structures, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy. **[ASCE 7:**1.2]

35.2.5 Component. A part or element of an architectural, electrical, mechanical, or structural system. **[ASCE 7:**9.2.1]

35.2.6 Components and Cladding. Elements of the building envelope that do not qualify as part of the main wind-force resisting system. **[ASCE 7:**6.2]

35.2.7 Concrete.

35.2.7.1 Plain Concrete. Concrete that is either unreinforced or contains less reinforcement than the minimum amount specified in ACI 318 for reinforced concrete. **[ASCE 7:**9.2.1]

35.2.7.2 Reinforced Concrete. Concrete reinforced with no less than the minimum amount required by ACI 318, prestressed or nonprestressed, and designed on the assumption that the two materials act together in resisting forces. **[ASCE 7:**9.2.1]

35.2.8 Construction Documents (Structural Design). The written, graphic, electronic, and pictorial documents describing the design, locations, and physical characteristics of the project required to verify compliance with ASCE 7 and this *Code.* **[ASCE 7:**9.2.1]

35.2.9 Design Earthquake. The earthquake effects that are two-thirds of the corresponding maximum considered earthquake. **[ASCE 7:**9.2.1]

35.2.10 Design Pressure (*p*). Equivalent static pressure to be used in the determination of wind loads for buildings. **[ASCE 7:**6.2]

35.2.11 Design Strength. The product of the nominal strength and a resistance factor, Φ. **[ASCE 7:**1.2]

35.2.12 Facilities.

35.2.12.1 Essential Facilities. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from wind, snow, or earthquakes. **[ASCE 7:**1.2]

35.2.12.2 Temporary Facilities. Buildings or other structures that are to be in service for a limited time and have a limited exposure period for environmental loadings. **[ASCE 7:**1.2]

35.2.13 Factored Load. The product of the nominal load and a load factor. **[ASCE 7:**1.2]

35.2.14 Glazing. Glass or transparent or translucent plastic sheet used in windows, doors, skylights, or curtain walls. **[ASCE 7:**6.2]

35.2.15 Importance Factor (*I*). A factor that accounts for the degree of hazard to human life and damage to property. **[ASCE 7:**6.2]

35.2.16 Limit State. A condition beyond which a structure or member becomes unfit for service and is judged either to be no longer useful for its intended function (serviceability limited state) or to be unsafe (strength limit state). **[ASCE 7:**1.2]

35.2.17 Loads. Forces or other actions that result from the weight of all building materials, occupants and their possessions, environmental effects, differential movement, and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude. All other loads are variable loads. *(See also Nominal Loads.)* **[ASCE 7:**1.2]

35.2.17.1 Dead Loads. Dead loads consist of the weight of all materials of construction incorporated into the building including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items, and fixed service equipment including the weight of cranes. **[ASCE 7:**3.1]

35.2.17.2 Live Loads. Live loads are those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load, or dead load. Live loads on a roof are those produced (1) during maintenance by workers, equipment, and materials; and (2) during the life of the structure by movable objects such as planters and by people. **[ASCE 7:**4.1]

35.2.17.3 Nominal Loads. The magnitudes of the loads specified in ASCE 7, Sections 3 through 9 (dead, live, soil, wind, snow, rain, flood and earthquake). **[ASCE 7:**1.2]

35.2.18 Load Effects. Forces and deformations produced in structural members by the applied loads. **[ASCE 7:**1.2]

35.2.19 Load Factor. A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the load into a load effect, and for the probability that more than one extreme load will occur simultaneously. **[ASCE 7:**1.2]

35.2.20 Maximum Considered Earthquake Ground Motion. The most severe earthquake effects considered by these Standards as defined in ASCE 7, Section 9.4.1. **[ASCE 7:**9.2.1]

35.2.21 Occupancy. The purpose for which a building or other structure, or part thereof, is used or intended to be used. **[ASCE 7:**1.2]

35.2.22 Occupancy Importance Factor (*I*). A factor assigned to each structure according to its Seismic Use Group as prescribed in ASCE 7, Section 9.1.4. **[ASCE 7:**9.2.1]

35.2.23 Openings. Apertures or holes in the building envelope which allow air to flow through the building envelope and which are designed as "open" during design winds as defined by ASCE 7. **[ASCE 7:**6.2]

35.2.24 Partition. A nonstructural interior wall that spans horizontally or vertically from support to support. The supports may be the basic building frame, subsidiary structural members, or other portions of the partition system. **[ASCE 7:**9.2.1]

35.2.25 Resistance Factor. A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure *(also called strength reduction factor).* **[ASCE 7:**1.2]

35.2.26 Seismic Design Category. A classification assigned to a structure based on its Seismic Use Group and the severity of the design earthquake ground motion at the site as defined in ASCE 7, Sections 9.4.1 and 9.4.2. **[ASCE 7:**9.2.1]

35.2.27 Seismic Forces. The assumed forces prescribed herein, related to the response of the structure to earthquake motions, to be used in the design of the structure and its components. **[ASCE 7:**9.2.1]

35.2.28 Seismic Use Group. A classification assigned to a structure based on its use as defined in ASCE 7, Section 9.1.3. **[ASCE 7:**9.2.1]

35.2.29 Site Class. A classification assigned to a site based on the types of soils present and their engineering properties as defined in ASCE 7, Section 9.4.1.2. **[ASCE 7:**9.2.1]

35.2.30 Strength.

35.2.30.1 Nominal Strength. (1) In general, the capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths and dimensions and formulas derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions. (2) For the purposes of earthquake loading, strength of a member or cross section calculated in accordance with the requirements and assumptions of the strength design methods of ASCE 7(or the referenced standards) before application of any strength reduction factors. **[ASCE 7:**1.2 & 9.2.1]

35.2.30.2 Required Strength. Strength of a member, cross section, or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by ASCE 7. **[ASCE 7:**9.2.1]

35.2.31 Strength Design. A method of proportioning structural members such that the computed forces produced in the members by the factored loads do not exceed the member design strength (also called *load and resistance factor design*). **[ASCE 7:**1.2]

35.2.32 Structure. That which is built or constructed and limited to buildings and nonbuilding structures as defined herein. **[ASCE 7:**9.2.1]

35.2.32.1 Other Structures. Structures, other than buildings, for which loads are specified in ASCE 7. **[ASCE 7:**1.2]

35.2.33 Wall. A component that has a slope of 60 degrees or greater with the horizontal plane used to enclose or divide space. **[ASCE 7:**9.2.1]

35.2.33.1 Bearing Wall. Any wall meeting either of the following classifications: (1) Any metal or wood stud wall that supports more than 100 lb/linear ft (1400 N/linear m) of vertical load in addition to its own weight. (2) Any concrete or masonry wall that supports more than 200 lb/linear ft (2900 N/linear m) of vertical load in addition to its own weight. **[ASCE 7:**9.2.1]

35.2.33.2 Bearing Wall System. A structural system with bearing walls providing support for all or major portions of the vertical loads. Shear walls or braced frames provide seismic force resistance. **[ASCE 7:**9.2.1]

35.2.33.3 Cripple Wall. Short stud wall, less than 8 ft (2.4 m) in height, between the foundation and the lowest framed floors with studs not less than 14 in. (35 mm) long—also known as a knee wall. Cripple walls can occur in both engineered structures and conventional construction. **[ASCE 7:**9.2.1]

35.2.33.4 Light Framed Wall. A wall with wood or steel studs. **[ASCE 7:**9.2.1]

35.2.33.5 Light-Framed Wood Shear Wall. A wall constructed with wood studs and sheathed with material rated for shear resistance. **[ASCE 7:**9.2.1]

35.2.33.6 Nonbearing Wall. Any wall that is not a bearing wall. **[ASCE 7:**9.2.1]

35.2.33.7 Nonstructural Wall. All walls other than bearing walls or shear walls. **[ASCE 7:**9.2.1]

35.2.33.8 Shear Wall. A wall, bearing or nonbearing, designed to resist lateral seismic forces acting in the plane of the wall (sometimes referred to as a vertical diaphram). **[ASCE 7:**9.2.1]

35.3 Occupancy Category. For the purposes of determining the loads for use in the structural design thereof, all buildings and other structures shall be assigned an occupancy category in accordance with Table 35.3.

35.4 Construction Documents.

35.4.1 General. Construction documents shall show the size, section, and relative locations of all structural members with floor levels, column centers, and all offsets fully dimensioned.

35.4.2 Structural Design Information Required. The design loads and other information related to the structural design required by 35.4.2.1 through 35.4.2.6 shall be indicated on the construction documents for all parts of the building or structure.

35.4.2.1 Floor Live Load.

35.4.2.1.1 The uniformly distributed, concentrated, and impact floor live load utilized in the design shall be indicated for all floor areas. *(See Section 35.6.)*

35.4.2.1.2 Live load reduction of the uniformly distributed floor live loads *(see 35.6.7)*, if utilized in the design, shall be indicated.

35.4.2.2 Roof Live Load. The roof live load utilized in the design shall be indicated for all roof areas. *(See Section 35.7.)*

35.4.2.3 Snow Load.

35.4.2.3.1 The ground snow load (p_g) shall be indicated. *(See Section 35.8.)*

35.4.2.3.2 In areas where the ground snow load (p_g) exceeds 10 psf (0.48 kN/m^2), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

(1) Flat-roof snow load (p_f)
(2) Snow exposure factor (C_e)
(3) Snow load importance factor (I) and occupancy category
(4) Thermal factor (C_t)

35.4.2.4 Wind Load. The following information related to wind loads shall be shown *(see Section 35.9)*, regardless of whether wind loads govern the lateral design of the building:

(1) Basic wind speed (mph)
(2) Wind importance factor (I) and occupancy category
(3) Wind exposure—with wind exposure and applicable wind direction indicated if more than one wind exposure is utilized
(4) Building classification as enclosed, partially enclosed, or open, and protection of openings when required
(5) Topographic factor (K_{zt})
(6) Wind design pressure (p) to be used for the design of exterior components and cladding not specifically designed by the responsible registered design professional—with p for each exposure indicated if more than one exposure is utilized

35.4.2.5 Earthquake Design Data. The following information related to seismic design shall be shown *(see Section 35.10)*, regardless of whether seismic loads govern the lateral design of the building:

(1) Mapped maximum considered earthquake spectral response acceleration at short periods (S_s) and at a period of 1 second (S_1)
(2) Site class
(3) Design earthquake spectral response acceleration at short periods (S_{DS}) and at a period of 1 second (S_{D1})
(4) Seismic use group and occupancy category
(5) Seismic importance factor (I)
(6) Seismic design category
(7) Basic seismic force–resisting system
(8) Analysis procedure

35.4.2.6 Other Loads.

35.4.2.6.1 Special Loads. Special loads that are applicable to the design of the building, structure, or portions thereof shall be indicated.

35.4.2.6.2 Flood Loads. For buildings and structures located wholly or partly within the flood hazard area established in 39.4.2, the following information related to flood loads shall be shown, regardless of whether flood loads govern the design of the foundation or building:

(1) Flood hazard zone(s) and boundaries, as shown on the flood hazard map
(2) Design flood elevation (DFE)
(3) For buildings or structures located wholly or partly within areas subject to high-velocity wave action (V zones), the elevation of the bottom of the lowest horizontal structural member of the lowest floor, excluding piles and columns

Table 35.3 Occupancy Category of Buildings and Other Structures for Wind, Snow, and Earthquake

Nature of Occupancy	Occupancy Category
A. Buildings and other structures that represent a low hazard to human life in the event of failure including, but not limited to, the following: (1) Agricultural facilities (2) Certain temporary facilities (3) Minor storage facilities	I
B. All buildings and other structures except those listed in Categories I, III, and IV	II
C. Buildings and other structures that represent a substantial hazard to human life in the event of failure including, but not limited to, the following: (1) Buildings and other structures where more than 300 people congregate in one area (2) Buildings and other structures with day-care facilities with a capacity greater than 150 (3) Buildings and other structures with elementary school or secondary school with a capacity greater than 250 (4) Buildings and other structures with a capacity greater than 500 for colleges or adult education facilities (5) Health care facilities with a capacity of 50 or more resident patients but that do not have surgery or emergency treatment facilities (6) Jails and detention facilities (7) Power-generating stations and other public utility facilities not included in Category IV D. Buildings containing toxic gases that are required to comply with Protection Level 4 or Protection Level 5 in accordance with Chapter 34. E. Buildings and other structures containing hazardous materials (toxic, explosive, or other hazardous substances) are eligible for classification as Category II structures if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in Section 1.5.2 of ASCE 7 that a release of the hazardous material does not pose a threat to the public.	III
F. Buildings and other structures designated as essential facilities including, but not limited to, the following: (1) Hospitals and other health care facilities having surgery or emergency treatment facilities (2) Fire, rescue, and police stations and emergency vehicle garages (3) Designated earthquake, hurricane, or other emergency shelters (4) Designated emergency preparedness, communications, and operations centers and other facilities required for emergency response (5) Power-generating stations and other public utility facilities required in an emergency (6) Ancillary structures (including, but not limited to, communications towers, fuel storage tanks, cooling towers, electrical substation structures, fire water storage tanks, or other structures housing or supporting water or other fire suppression material or equipment) required for operation of Category IV structures during an emergency (7) Aviation control towers, air traffic control centers, and emergency aircraft hangars (8) Water storage facilities and pump structures required to maintain water pressure for fire suppression (9) Buildings and other structures having critical national defense functions G. Buildings containing highly toxic gases that are required to comply with Protection Level 4 or Protection Level 5 in accordance with Chapter 34, and buildings containing materials that are capable of detonation or deflagration that are required to comply with Protection Level 1 or Protection Level 5 in accordance with Chapter 34. H. Buildings and other structures containing extremely hazardous materials (toxic, explosive, or other hazardous substances) are eligible for classification as Category II structures if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in Section 1.5.2. of ASCE 7 that a release of the extremely hazardous material does not pose a threat to the public. This reduced classification shall not be permitted if the building or other structures also function as essential facilities.	IV

Source: Extracted from ASCE 7.

(4) For buildings or structures located entirely within flood hazard areas not subject to high-velocity wave action, the elevation of the top of the lowest floor
(5) Predevelopment and proposed post-construction ground elevations adjacent to the building or structure
(6) Dimensions and locations of flood openings, as permitted by 39.12.3.1.1
(7) For floodproofed areas below the DFE, as permitted by 39.12.3.1.2, the following information:
   (a) Elevation to which the building or structure is floodproofed
   (b) Description of floodproofing techniques
   (c) Lateral and buoyant flood loads during the design flood
(8) For breakaway walls, as permitted by 39.12.3.2.2, the following information:
   (a) Description of breakaway wall construction and the attachment to the foundation
   (b) Flood loads against the breakaway wall during the base flood
   (c) Load to which the breakaway wall and its attachment, or both, are designed to fail

35.5 Dead Loads.

35.5.1 Weights of Materials and Construction. In determining dead loads for the purposes of design, the actual weights of materials and constructions shall be used, provided that, in the absence of definite information, values approved by the authority having jurisdiction shall be used.

35.5.2 Weights of Fixed Service Equipment. In determining dead loads for the purpose of design, the weight of fixed service equipment, such as plumbing stacks and risers; electrical feeders; and heating, ventilating, and air-conditioning systems, shall be included.

35.5.3 Permanent Partition Loads. The actual weight of all permanent partitions shall be included in the dead load for the purposes of structural design. *(See also 35.6.2.3.1.)*

35.6 Live Loads.

35.6.1 General.

35.6.1.1 The live loads assumed for the purposes of design shall be the greatest loads produced by the intended uses and occupancies but shall not be less than the loads required by Section 35.6.

35.6.1.2* Floors and other structural elements of buildings in the locations specified in Table 4-1 of ASCE 7 shall be designed to support the uniformly distributed live loads prescribed in 35.6.2 or the minimum concentrated loads prescribed in 35.6.3, whichever produces the greater stresses.

35.6.1.2.1 For this chapter, the definitions in 35.6.1.2.1.1 and 35.6.1.2.1.2 shall apply.

35.6.1.2.1.1 Balcony (Exterior). An exterior floor projecting from, and supported by, a structure without additional independent supports.

35.6.1.2.1.2 Deck. An exterior floor supported on at least two opposing sides by an adjacent structure and/or posts, piers, or other independent supports.

35.6.1.3 The authority having jurisdiction shall approve the required live load for any occupancy not specifically provided for in Section 35.6.

35.6.1.4 Where structural members are arranged so as to create continuity, members shall be designed using the loading conditions that would cause maximum shear and bending moments.

35.6.1.4.1 Where uniform floor loads are involved, loading distribution shall be permitted to be limited to full dead load on all spans in combination with full live load (or reduced live load, if permitted by 35.6.7) on adjacent spans and alternate spans.

35.6.1.4.2 For roof loads, the requirement of 35.6.1.4 shall be satisfied in accordance with 35.7.1.2.

35.6.2 Uniform Live Loads.

35.6.2.1 The minimum, uniformly distributed live load in pounds per square foot shall be as set forth in Table 4-1 of ASCE 7.

35.6.2.2 The live loads in Table 4-1 of ASCE 7 shall be the minimum loads to be used for the occupancies listed.

35.6.2.3 Where the building will be subjected to greater live loads than those specified in Table 4-1 of ASCE 7, such loads shall be utilized for design, including, but not limited to, the requirements in 35.6.2.3.1 through 35.6.2.3.3.

35.6.2.3.1 Partitions shall meet the requirements of 35.6.2.3.1.1 and 35.6.2.3.1.2.

35.6.2.3.1.1 In office buildings or other buildings where partitions will be erected or rearranged, provision for partition weight shall be made, regardless of whether partitions are shown on the plans

35.6.2.3.1.2 The requirement of 35.6.2.3.1.1 shall not apply where the specified live load exceeds 80 psf (3.83 kN/m^2).

35.6.2.3.2 Footboards in reviewing stands, grandstands, and bleachers shall be designed to resist 120 lb/linear ft (180 kg/linear m).

35.6.2.3.3 Reviewing stands, grandstands, bleachers, and supporting structures shall meet the requirements of 35.6.2.3.3.1 and 35.6.2.3.3.2.

35.6.2.3.3.1 Reviewing stands, grandstands, bleachers, and supporting structures shall be designed to resist a horizontal swaying force applied to the seats as follows:

(1) In a direction parallel to the length of the seats, 24 lb/linear ft (36 kg/linear m) of seats
(2) In a direction perpendicular to the length of the seats, 10 lb/linear ft (15 kg/linear m) of seats

35.6.2.3.3.2 Sway loads shall not be required to be applied in both directions simultaneously.

35.6.3 Concentrated Loads.

35.6.3.1 Provision shall be made in designing floors and other structural elements of buildings for a concentrated load as set forth in Table 4-1 of ASCE 7.

35.6.3.2 Unless otherwise specified in 35.6.3.3, the indicated concentrated load shall be assumed to occupy an area of 2.5 ft^2 (0.23 m^2) and shall be so located as to produce the maximum stress conditions in the structural members.

35.6.3.3 Stage floors shall meet the following requirements:

(1) Stage floors shall be designed to support not less than a 2000 lb (8.9 kN) concentrated load on a 1-ft^2 (0.09-m^2) area at any point.

(2) The concentrated load specified in 37.6.3.3(1) shall not be required to be applied simultaneously with the required uniform load.

35.6.4 Truck and Bus Garages.

35.6.4.1 Minimum live loads for garages having trucks or buses shall be as specified in Table 35.6.4.1 but shall not be less than 50 psf (2.4 kN/m^2).

Table 35.6.4.1 Uniform and Concentrated Loads

Loading Class[1]	Uniform Load [lb/linear ft of lane (kN/linear m of lane)]	Concentrated Load[2] [lb (kN)]	
		For Moment Design	For Shear Design
H20-44 and HS20-44	640 (9.3)	18,000 (80)	26,000 (115)
H15-44 and HS15-44	480 (7.0)	13,500 (60)	19,500 (87)

[1]An H loading class designates a two-axle truck with a semitrailer. An HS loading class designates a tractor truck with a semitrailer. The numbers following the letter classification indicate the gross weight, in tons, of the standard truck and the year the loadings were instituted.

[2]See 35.6.4.2 for the loading of multiple spans.

35.6.4.2 The concentrated load and uniform load shall be uniformly distributed over a 10-ft (3.0-m) width on a line normal to the centerline of the lane placed within a lane 12 ft (3.7 m) in width.

35.6.4.2.1 The loads shall be placed within their individual lanes so as to produce the maximum stress in each structural member.

35.6.4.2.2 Single spans shall be designed for the uniform load in Table 35.6.4.1, and one simultaneous concentrated load shall be positioned to produce the maximum effect.

35.6.4.2.3 Multiple spans shall be designed for the uniform load in Table 35.6.4.1 on the spans, and two simultaneous concentrated loads in two spans shall be positioned to produce the maximum negative moment effect.

35.6.4.2.4 Multiple span design loads, for other effects, shall be the same as for single spans.

35.6.5 Handrails, Guards, Grab Bars, and Vehicle Barriers.

35.6.5.1 All required handrails, guards, grab bars, and vehicle barriers shall be designed and constructed to the structural loading conditions in Section 4.4 of ASCE 7.

35.6.5.2 For guards in industrial and storage occupancy classifications, in areas that are not accessible to the general public and that have an occupant load not greater than 50, guards shall be permitted to be designed for the same loads as for one- and two-family dwellings.

35.6.6* Impact Loads. Provisions for the live loads specified in 35.6.2 shall be made in the structural design for occupancies and loads that involve vibration and impact forces, as required in Section 4.7 of ASCE 7.

35.6.7 Reduction in Live Loads. Reductions in the minimum required design live load shall be permitted in accordance with Section 4.8 of ASCE 7.

35.6.8 Crane Loads. All craneways and supporting construction shall be designed and constructed to comply with Section 4.10 in ASCE 7.

35.6.9 Interior Walls and Partitions.

35.6.9.1 Interior walls and partitions, including their finish materials, shall have the strength to resist a horizontal load of not less than 5 psf (0.24 kN/m^2).

35.6.9.2 The provisions of 35.6.9.1 shall not apply to flexible, folding, and portable partitions under 6 ft (1.8 m) in height.

35.7 Roof Loads.

35.7.1 General. The structural supports of roofs and marquees shall be designed to resist wind loads and, where applicable, snow loads, and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in Section 35.7.

35.7.1.1 The roof live loads shall be assumed to act vertically on the area projected on a horizontal plane.

35.7.1.2 Distributions of roof live loads shall be in accordance with 35.7.1.2.1 and 35.7.1.2.2.

35.7.1.2.1 Where uniform roof live loads are involved in the design of structural members arranged so as to create continuity, the loading distribution shall be permitted to be limited to full dead loads on all spans in combination with full roof live loads on adjacent spans and on alternate spans.

35.7.1.2.2 Distribution of snow loads on continuous span members shall be in accordance with 35.8.5.

35.7.2 Minimum Roof Live Loads. Ordinary roofs, either flat, pitched, or curved, shall be designed for the live loads as specified in Section 4.9 of ASCE 7.

35.7.3 Rain Loads. Rain loads, where utilized in the combination of loads specified in Section 35.15, shall be calculated in accordance with Section 8 of ASCE 7.

35.7.3.1 For roofs with a slope less than one-fourth unit vertical in 12 units horizontal (¼:12), the design calculations shall include verification of the prevention of ponding instability in accordance with Section 8.4 of ASCE 7.

35.7.3.2 Roofs with provisions for controlled drainage shall be designed in accordance with Section 8.5 of ASCE 7.

35.7.3.3 Rain loading shall also comply with Section 38.11.

35.7.4 Special-Purpose Roofs. Where occupied for incidental promenade purposes, roofs shall be designed for a minimum live load of 60 psf (2.87 kN/m^2) and 100 psf (4.79 kN/m^2) where designed for roof gardens or assembly or educational occupancies.

35.7.4.1 Landscaped roofs shall meet the requirements of 35.7.4.1.1 and 35.7.4.1.2.

35.7.4.1.1 Where roofs are to be landscaped, the uniform design live load in the landscaped area shall be 20 psf (0.96 kN/m^2).

35.7.4.1.2 The weight of the landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

35.7.4.2 Where awnings and canopies are covered with a fabric material, such awnings and canopies shall be designed for a uniform live load of 5 psf (0.24 kN/m^2), as well as for snow loads and wind loads as specified in Section 35.8 and Section 35.9.

35.7.4.3 Roofs to be utilized for other special purposes shall be designed for all loads as necessary for the intended use, or as otherwise approved.

35.8 Snow Loads.

35.8.1 General.

35.8.1.1 All buildings and other structures shall be designed to resist the design snow loads.

35.8.1.2 Design snow loads shall be determined in accordance with Section 7 of ASCE 7, but the design roof load shall be not less than that determined by Section 35.7.

35.8.2* Ground Snow Loads. The ground snow loads used in calculating the design snow loads for roofs shall be determined in accordance with Section 7.2 of ASCE 7.

35.8.3 Flat-Roof and Low-Slope Snow Loads.

35.8.3.1 The snow load, p_f, on a roof with a slope equal to or less than 5 degrees (1 in./ft (83 mm/m) = 4.76 degrees) shall be calculated in accordance with Section 7.3 of ASCE 7.

35.8.3.2* The snow exposure factor shall be determined from Table 7-2 of ASCE 7.

35.8.4 Occupancy Category and Snow Load Importance Factor.

35.8.4.1 Buildings and other structures shall be assigned an occupancy category in accordance with Table 35.3 to determine the snow load importance factor.

35.8.4.2* The snow load importance factor, *I*, shall be determined from Table 7-4 of ASCE 7.

35.8.5 Distribution of Snow Load. Where balanced snow loads are involved in the design of structural roof members and arranged so as to create continuity, selected spans shall be loaded in accordance with Section 7.5 of ASCE 7.

35.9 Wind Loads.

35.9.1 General.

35.9.1.1 All buildings, structures, and parts thereof shall be designed to withstand the appropriate wind loads prescribed herein.

35.9.1.2 Decreases in wind loads shall not be permitted to be made to account for the effect of shielding by other structures.

35.9.1.3 Determination of wind loads shall be in accordance with 35.9.1.3.1 and 35.9.1.3.2.

35.9.1.3.1 Wind loads on every building or structure shall be determined by the provisions of Section 6 of ASCE 7.

35.9.1.3.2 As an alternative to the requirement of 35.9.1.3.1, the following standards shall be permitted, subject to the limitations therein:

(1) ANSI/NAAMM FP 1001, *Guide Specifications for Design of Metal Flagpoles Manual*
(2) Wind tunnel tests conducted in accordance with Section 6.6 of ASCE 7
(3) ANSI/TIA/EIA-222-F, *Structural Standards for Steel Antenna Towers and Antenna Structures*
(4) Bleachers and grandstands per 35.9.1.6

35.9.1.4* For buildings or other structures sited such that they are subject to the channeling effects or buffeting in the wake of upwind obstructions, or for those buildings and other structures having unusual geometric shapes or response characteristics, wind loads shall be based on wind tunnel tests or nationally recognized data.

35.9.1.5 No part (component, cladding, or fastener) of a building or structure shall be designed for a wind load of less than 10 psf (0.48 kN/m^2).

35.9.1.6 Grandstands and bleachers shall meet the requirements of 35.9.1.6.1 and 35.9.1.6.2.

35.9.1.6.1 Uplift wind pressures equal in magnitude to those determined by 35.9.1.3.1 shall be assumed to be acting vertically on the gross horizontal projection of the closed-deck grandstand, the understructure of which is unenclosed.

35.9.1.6.2 Uplift wind pressures equal to 60 percent of these values in 35.9.1.6.1 shall be assumed to be acting vertically on the gross horizontal projection of the closed-deck grandstand, the understructure of which is enclosed at the perimeter with solid walls.

35.9.2 Basic Wind Speed.

35.9.2.1 The basic wind speed used to calculate the wind loads shall be determined in accordance with Section 6.5.4 of ASCE 7.

35.9.2.2* When referenced documents are based on fastest-mile wind speeds, the 3-second gust wind velocities of ASCE 7, Figure 6.1, shall be converted to fastest-mile wind velocities using Table 35.9.2.2.

Table 35.9.2.2 Wind Speed Conversion Table [mi/hr (m/s)]

3-Second Gust	Fastest Mile
85 (38)	70 (31)
90 (40)	75 (34)
100 (45)	80 (36)
105 (47)	85 (38)
110 (49)	90 (40)
120 (54)	100 (45)
125 (56)	105 (47)
130 (58)	110 (49)
140 (63)	120 (54)
145 (65)	125 (56)
150 (67)	130 (58)
160 (72)	140 (63)
170 (76)	150 (67)

35.9.3* Exposure Category. The appropriate wind exposure category shall be determined for each side of the building or structure consistent with the site terrain in accordance with Section 6.5.6 of ASCE 7.

35.9.4 Occupancy Category and Wind Importance Factor.

35.9.4.1 Buildings and other structures shall be assigned an occupancy category in accordance with Table 35.3 to determine the wind load importance factor.

35.9.4.2* Buildings and other structures shall be assigned a wind load importance factor (*I*) in accordance with Section 6.5.5 of ASCE 7.

35.10 Earthquake Loads.

35.10.1 General. All buildings, and portions thereof, shall be designed and constructed to resist the effects of earthquake motions as prescribed by Section 9 of ASCE 7.

35.10.2* Seismic Use Group. All buildings and other structures shall be assigned to a seismic use group in accordance with Section 9.1.3 of ASCE 7.

35.10.3* Importance Factor. Buildings and other structures shall be assigned a seismic importance factor (I) in accordance with Table 9.1.4 of ASCE 7.

35.10.4 Maximum Considered Earthquake Ground Motions. The maximum considered earthquake ground motions shall be as represented by the mapped spectral response acceleration at short periods (S_s) and at periods of 1 second (S_1) obtained from Figures 9.4.1.1(a) through 9.4.1.1(j) of ASCE 7.

35.10.5 Site Class. A site class shall be determined in accordance with Section 9.4.1.2 of ASCE 7.

35.10.6 Design Earthquake Spectral Response Acceleration. Design earthquake spectral response acceleration at short periods (S_{DS}) and at periods of 1 second (S_{D1}) shall be determined in accordance with Section 9.4.1.2.5 of ASCE 7.

35.10.7 Seismic Design Category. The seismic design category shall be determined in accordance with Section 9.4.2 of ASCE 7.

35.10.8 Seismic Force Resisting System. The seismic force-resisting system used in the building or structure shall comply with Section 9.5.2.2 of ASCE 7.

35.10.9 Analysis Procedure. The analysis procedure used to evaluate the structure shall comply with Section 9.5.2.5 of ASCE 7.

35.11 Lateral Soil Loads. In absence of a geotechnical soil analysis, soil loads in Table 35.11 shall be used as the minimum design lateral soil loads.

35.12* Flood Loads.

35.12.1 General. All buildings and other structures located in areas prone to flooding, as defined on the flood hazard map *(see Chapter 39)*, shall be designed, constructed, connected, and anchored to resist the loads from flooding associated with the design flood.

35.12.2 Design Flood Loads. Design flood loads shall be determined in accordance with Section 5.3 of ASCE 7.

35.12.3 Flood Hazard Areas. Buildings and structures located wholly or partly within flood hazard areas established by 39.4.2, including substantial improvements and restoration of substantial damage, shall be as follows:

(1) Such buildings and structures shall be designed, constructed, connected, and anchored to prevent flotation, collapse, or permanent lateral movement due to the action of loads during the design flood, including hydrostatic loads, buoyancy, hydrodynamic loads, impact loads, and associated wind loads.
(2) Tanks shall be designed and constructed to prevent flotation, collapse, and lateral movement when empty and shall not require anchorage.
(3) Such buildings and structures shall be designed and constructed in accordance with the requirements of Chapter 39.

35.13 Ice Loads — Atmospheric Icing Loads. Ice loads as a result of atmospheric icing shall be determined in accordance with Section 10 of ASCE 7.

35.14 Other Minimum Loads.

35.14.1 General. In addition to the other design loads specified in this chapter, buildings and other structures shall be designed to resist the loads specified in Section 35.14.

35.14.2 Hydrostatic Uplift.

35.14.2.1 All foundation slabs and other footings subjected to water pressure shall be designed to resist a uniformly distributed uplift equal to the full hydrostatic pressure.

35.14.2.2 The loads required by 35.14.2.1 shall be determined in accordance with Section 5.2 of ASCE 7.

35.14.3 Heliport and Helistop Landing Areas. In addition to the other design requirements of this chapter, heliport and helistop landing or touchdown areas shall be designed for the maximum stress induced by any of the following:

(1) Dead load of the heliport and helistop landing or touchdown areas plus actual gross weight of the helicopter plus snow load
(2) Dead load of the heliport and helistop landing or touchdown areas plus two, single, concentrated impact loads meeting all of the following criteria:
    (a) The impact loads shall be spaced a nominal 8 ft (2.4 m) apart, applied anywhere on the touchdown pad so as to represent each of the helicopter's two main landing gear, whether skid type or wheeled type.
    (b) Each impact load shall have a magnitude of 0.75 times the gross weight of the helicopter.
    (c) Both loads acting together shall have a magnitude of 1.5 times the gross weight of the helicopter.
(3) Dead load of the heliport and helistop landing or touchdown areas plus a uniform live load of 60 psf (2.87 kN/m^2)

35.15 Load Combinations.

35.15.1 All buildings and other structures shall be designed using the provisions of Section 2 of ASCE 7.

35.15.2 Either Section 2.3 or Section 2.4 of ASCE 7 shall be used exclusively for proportioning elements of a particular construction material throughout the structure.

35.16 Building Rehabilitation. Building rehabilitation shall be in accordance with Chapter 15.

Chapter 36 Soils, Foundations, and Retaining Walls

36.1 Scope. The requirements in this chapter provide minimum standards for the modification of soils and the design and construction of foundations and retaining walls.

36.1.1 In addition to the requirements of this chapter, structures assigned to Seismic Design Category C, Seismic Design Category D, Seismic Design Category E, and Seismic Design Category F shall comply with the requirements in ASCE 7, *Minimum Design Loads for Buildings and Other Structures*, Section 9 and A9.7.

36.1.2 The requirement of 36.1.1 shall not apply to detached one- and two-family dwellings in Seismic Design Category C.

Table 35.11 Soil Lateral Load

Description of Backfill Material[a]	Unified Soil Classification	Design Lateral Soil Load[b] [psf per ft (kPa/m) of depth]
Well-graded, clean gravels; gravel-sand mixes	GW	30[c] (4.7)
Poorly graded clean gravels; gravel-sand mixes	GP	30[c] (4.7)
Silty gravels; poorly graded gravel-sand mixes	GM	40[c] (6.3)
Clayey gravels; poorly graded gravel-and-clay mixes	GC	45[c] (7.1)
Well-graded, clean sands; gravelly sand mixes	SW	30[c] (4.7)
Poorly graded clean sands; sand-gravel mixes	SP	30[c] (4.7)
Silty sands; poorly graded sand-silt mixes	SM	45[d] (7.1)
Sand-silt clay mix with plastic fines	SM-SC	45[d] (7.1)
Clayey sands; poorly graded sand-clay mixes	SC	60[d] (9.4)
Inorganic silts and clayey silts	ML	45[d] (7.1)
Mixture of inorganic silt and clay	ML-CL	60[d] (9.4)
Inorganic clays of low to medium plasticity	CL	60[d] (9.4)
Organic silts and silt clays, low plasticity	OL	Unsuitable as backfill material
Inorganic clayey silts, elastic silts	MH	Unsuitable as backfill material
Inorganic clays of high plasticity	CH	Unsuitable as backfill material
Organic clays and silty clays	OH	Unsuitable as backfill material

[a] The definition and classification of soil materials are to be in accordance with ASTM D 2487, *Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)*.

[b] Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions govern. Submerged or saturated soil pressures include the weight of the buoyant soil plus the hydrostatic load.

[c] For relatively rigid walls, as when braced by floors, the design lateral soil load is to be increased for sand- and gravel-type soils to 60 psf per ft (9.4 kPa/m) of depth. Basement walls extending not more than 8 ft (2.4 m) below grade and supporting flexible floor systems are not considered as being relatively rigid walls.

[d] For relatively rigid walls, as when braced by floors, the design lateral load is to be increased for silt- and clay-type soils to 100 psf per ft (15.7 kPa/m) of depth.

36.2 Excavations.

36.2.1 Scope. The provisions of Section 36.2 shall apply to excavations for buildings and structures for which permits are issued by the authority having jurisdiction.

36.2.2 Protection of Excavations.

36.2.2.1 Until provisions for permanent supports have been made, excavations shall be guarded to prevent unauthorized personnel from entering and protected to prevent them from damaging property.

36.2.2.2 Excavations, other than minor excavations approved by the authority having jurisdiction, shall not extend within 1 ft (0.30 m) of any plane projecting at an angle of 30 degrees from the horizontal from the bottom of a soil-bearing foundation, unless such footing or foundation is protected against settlement.

36.2.3 Permanent Excavations.

36.2.3.1 No permanent excavations shall be made, and no construction excavations shall be left open, that will endanger adjoining property or buildings or that will be a menace to public health or safety.

36.2.3.2 Permanent excavations and construction excavations shall be well drained, and the drainage shall function as long as the excavation exists.

36.2.3.3 Permanent excavations shall have retaining walls of an approved material with the required strength to retain the embankment plus any surcharge loads, or the embankment shall have safe side slopes, as determined by the authority having jurisdiction.

36.2.4 Fill.

36.2.4.1 Where footings or structural slabs of structures, or both, will be founded on fill, the provisions of 36.2.4 shall apply.

36.2.4.2 No fill shall be used for structural support of buildings and structures located wholly or partly in flood hazard areas subject to high-velocity wave action, as established by 39.4.2.

36.2.4.3 A report shall be prepared and submitted by a registered design professional for approval.

36.2.4.3.1 The report shall cover the following items:

(1) Preparation of the site to receive fill
(2) Specifications for fill material
(3) Test procedures to be used to determine optimum moisture content and maximum dry density of fill material
(4) Test procedures to be used to determine the in-situ dry density of the compacted fill
(5) Minimum acceptable dry density expressed as a percentage of the maximum dry density
(6) Maximum thickness of each lift of fill
(7) Minimum number and frequency of tests required to show compliance with the in-situ minimum dry density

36.2.4.3.2 Subject to the approval of the authority having jurisdiction, the report required in 36.2.4.3 shall not be required for fills of a minor nature, provided that the material is compacted to a minimum of 90 percent of maximum dry density, as determined by an approved test method.

36.2.4.4 Special inspection of placement of fill shall be provided in accordance with 40.3.5.

36.2.5 Site Preparation. Prior to construction, the area to be occupied by the structure shall be cleared of debris, vegetation, and top soil, to the depth necessary, to remove all organic material.

36.3 Investigation and Bearing Capacity of Soil.

36.3.1 Classification.

36.3.1.1 When required by the authority having jurisdiction, classification of the soil under all parts of the proposed structure shall be made in accordance with ASTM D 2487, *Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)*, based on examination of test borings or excavations made at the site.

36.3.1.2 The location of the test borings or excavations and the nature of the subsurface materials shall be indicated on the plans.

36.3.2 Soil Investigation. Where the bearing capacity of the soil is not known or is in question, or where the load to be imposed on the soil is unusual, the authority having jurisdiction shall be permitted to require examination and evaluation of subsoil conditions by a registered professional engineer or a load test.

36.3.2.1 To determine the safe bearing capacity by load tests, an area not less than 2 ft × 2 ft (0.6 m × 0.6 m) shall be loaded to not less than twice the maximum bearing capacity desired for use in the design.

36.3.2.2 The load specified in 36.3.2.1 shall be sustained by the soil until no additional settlement takes place for a period of not less than 48 hours.

36.3.3 Expansive Soils.

36.3.3.1 Where the nature of the soil is not known in sufficient detail, the authority having jurisdiction shall be permitted to require testing to determine the expansive characteristics of the soil.

36.3.3.2 Each potentially expansive stratum of soil above the level where a constant moisture content exists shall be tested in accordance with ASTM D 4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*, to determine its plasticity index (PI).

36.3.3.2.1 If the PI of all stratums is less than 15, the soil shall not be considered expansive.

36.3.3.2.2 If the PI of any stratum is 15 or greater, the soil shall be considered potentially expansive and shall be subjected to additional approved tests and evaluation to determine if the soil will adversely affect the structural integrity and serviceability of the structure.

36.3.4 Presumptive Capacities. Where no unusual soil or moisture conditions are present, the permitted bearing capacities on supporting soils shall not exceed those set forth in Table 36.3.4(a) and Table 36.3.4(b), unless the design bearing capacity is substantiated by recognized tests, analysis, and procedures and then approved.

36.4 Soil-Bearing Footings.

36.4.1 General Provisions.

36.4.1.1 Footings shall be designed to minimize differential settlement.

36.4.1.2 Excavations for continuous footings shall meet the requirements of 36.4.1.2.1 and 36.4.1.2.2.

36.4.1.2.1 Excavations for continuous footings shall be cut true to line and grade, and the sides of footings shall be formed, except where soil conditions are such that the sides of the excavation stand firm and square.

36.4.1.2.2 Excavations shall be made to firm, clean bearing soil, to the frost line at the site, or 12 in. (300 mm) below the finish ground level, whichever is the greatest depth.

36.4.1.3 Footings shall be level or shall be stepped so that both the top and the bottom of the footings are level.

36.4.1.3.1 At steps, the footing shall have a vertical tie of the same cross section and design as the horizontal footings or the smaller of the footings so jointed.

36.4.1.3.2 The maximum riser shall be 18 in. (460 mm), and the minimum run between risers shall be 36 in. (915 mm).

36.4.1.4 Slab-on-ground, raft, or mat footings on expansive soils shall be designed and constructed in accordance with WRI/CRSI's *Design of Slab-on-Ground Foundations* or PTI's *Design and Construction of Post-Tensioned Slabs-on-Ground*.

36.4.2 Design Using Lateral Bearing.

36.4.2.1 Construction using posts or poles as cantilever columns embedded in concrete footings in the earth shall be permitted to be used to resist both axial and lateral loads.

36.4.2.2 The required depth to resist lateral loads shall be determined by use of the design criteria in 36.4.3 or 36.4.4, or by other approved methods.

36.4.3 Design Formula—No Constraint. The following formula shall be permitted to be used in determining the depth of embedment (d) required to resist lateral loads where no constraint is provided at the ground surface, such as rigid floor or ground surface pavement:

$$d = \frac{A}{2}\left[1+\sqrt{1+\frac{4.36h}{A}}\right] \qquad \textbf{(36.1)}$$

where:

d = depth of embedment in earth, but not over 12 ft (3.7 m), for purposes of computing resistance provided by lateral soil pressure [ft(m)]
A = $(2.34P)/(S_1 b)$
h = distance in from ground surface to point of application of P [ft (m)]
P = applied lateral force [lb (kN)]
S_1 = permitted lateral soil bearing pressure as set forth in Table 36.3.4(b), based on a depth ⅓ the depth of embedment [psf (kN/m^2)]
b = diameter of round concrete footing or diagonal dimension of square concrete footing [ft (m)]

Table 36.3.4(a) Maximum Allowable Soil Pressures

Class of Material	Minimum Depth of Footing Below Adjacent Ground		Pressure Permitted if Footing is at Minimum Depth[a]		Increase in Pressure for Each Foot of Depth for Which Footing is Below Minimum[a]		Maximum Pressure[a]	
	ft	m	psf	kN/m²	psf	kN/m²	psf	kN/m²
Compact fine sand	1	0.3	1000[b]	47.9	200[b]	9.6	5000	240
Loose sand	2	0.6	500[b]	24.0	100[b]	4.8	3000	144
Medium stiff clay	1	0.3	2000	95.8	200	9.6	6000	287
Soft, sandy clay or clay	2	0.6	1000	47.9	50	2.4	2000	96
Compact inorganic sand and silt mixtures	1	0.3	1000	47.9	200	9.6	4000	192
Loose inorganic sand and silt mixtures	2	0.6	500	23.9	100	4.8	1000	48
Loose organic sand and silt mixtures and peat	—	—	0	0	0	0	0	0

[a]These pressures are considered sufficient to prevent failure of the supporting ground, but not to prevent excessive foundation movement or settlement where unusual soil or moisture conditions are encountered.
[b]Values are for footings 1 ft (0.30 m) wide and are permitted to be increased in direct proportion to the width of the footing to a maximum of 2½ times the designed value.

Table 36.3.4(b) Maximum Allowable Lateral Soil Pressures

Class of Material	Permitted Pressure per Foot of Depth Below Natural Grade[a, b]		Maximum Permitted Pressure[a]	
	psf	kN/m²	psf	kN/m²
Compact fine sand Medium clay Compact sandy loam Loose, coarse sand and gravel	200	9.6	2500	120
Soft clay Clay loam Poorly compacted sand Clays containing large amounts of silt	100	4.8	1500	72

[a]These pressures are considered sufficient to prevent failure of the supporting ground, but not to prevent excessive foundation movement or settlement where unusual soil or moisture conditions are encountered.
[b]Isolated poles, such as flagpoles or signs, are permitted to be designed using lateral bearing values equal to two times tabulated values.

36.4.4 Design Formula—Constrained. The following formula shall be permitted to be used to determine the depth of embedment (d) required to resist lateral loads where constraint is provided at the ground surface, such as a rigid floor or pavement:

$$d = \sqrt{4.25\frac{Ph}{S_3 b}} \qquad \textbf{(36.2)}$$

where:
d = depth of embedment in earth, but not over 12 ft (3.7 m), for purposes of computing resistance provided by lateral soil pressure [ft (m)]
P = applied lateral force [lb (kN)]
h = distance from ground surface to point of application of P [ft (m)]
S_3 = permitted lateral soil-bearing pressure as set forth in Table 36.3.4(b), based on a depth equal to the depth of embedment [psf (kN/m²)]
b = diameter of round concrete footing or diagonal dimension of square concrete footing [ft (m)]

36.4.5 Flood Hazard Areas.

36.4.5.1 Soil-bearing foundations shall be prohibited for buildings and structures located wholly or partly in flood hazard areas subject to high-velocity wave action, as established by 39.4.2.

36.4.5.2 Soil-bearing foundations for buildings and structures located wholly in flood hazard areas not subject to high-velocity wave action shall meet the requirements of Chapter 39 of this *Code* and Chapters 2 and 5 of SEI/ASCE 24, *Flood Resistant Design and Construction.*

36.5 Pile Foundations.

36.5.1 Conditions of Use.

36.5.1.1 The use of types of piles not specifically mentioned in Section 36.5 and the use of piles under conditions not specifically covered herein shall be permitted, subject to approval, upon submission of acceptable test data, calculations,

or other information relating to the properties and load-carrying capacity of such piles.

36.5.1.2 Portions of piles standing unbraced in air, water, or soil, or other material not capable of providing lateral support, shall meet the requirements of 36.5.1.2.1 and 36.5.1.2.2.

36.5.1.2.1 Portions of piles standing unbraced in air, water, or soil, or other material not capable of providing lateral support, shall conform with the applicable column formula as specified in the material chapters in this *Code*.

36.5.1.2.2 Piles placed in firm ground shall be permitted to be considered restrained against flexural rotation and laterally supported at 5 ft (1.5 m) below the ground surface and, when placed in soft material, at 10 ft (3 m) below the ground surface, unless otherwise required by the authority having jurisdiction after a foundation investigation by an approved agency.

36.5.1.3 Where cast-in-place piles are used, reinforcement shall extend 10 ft (3 m) below the plane where the soil provides lateral support.

36.5.1.3.1 Pile caps and grade beams shall be connected to piles in a manner to transfer forces from the pile cap or grade beam to the pile.

36.5.1.3.2 Shells conforming to the requirements of 36.5.8.1(6) shall be permitted to be considered as reinforcement.

36.5.1.4 Where piles are placed in groups and where soil conditions make load reductions advisable or necessary, the load permitted for a single pile shall be reduced by an approved method.

36.5.1.5 Reinforced concrete pile caps shall be provided for all pile groups.

36.5.1.5.1 Reinforced concrete pile caps shall extend laterally not less than 6 in. (150 mm) beyond the extreme pile surface and vertically not less than 4 in. (100 mm) below the pile butt.

36.5.1.5.2 Pile caps shall not be required where the piles are used to support grade beams, provided that the parts of the grade beams acting in place of the pile cap carry the loads as computed by a recognized method of analysis.

36.5.1.6 Individual pile caps or caissons shall be interconnected by ties, each of which can carry a horizontal force equal to 5 percent of the larger pile loading in tension and compression, unless it can be demonstrated that equivalent restraint can be provided by other approved methods.

36.5.1.7 For buildings and structures located wholly or partly in flood hazard areas, as established by 39.4.2, pile foundations shall meet the requirements of Chapter 39 of this *Code* and SEI/ASCE 24.

36.5.2 Axial and Lateral Loads for Piles. Axial and lateral loads on piles shall be determined by an approved formula, by load tests, or by a foundation investigation by an approved agency, if required by the authority having jurisdiction.

36.5.2.1 Dynamic Load Test. The axial load on a pile shall not exceed the value given by the formulas shown in 36.5.2.1(A), unless such load is determined as specified in 36.5.1.1 or 36.5.2.

(A) For all piles, the following shall apply:

$$\text{allowable axial load} = R/4 \tag{36.3}$$

where R = ultimate driving resistance as determined in 36.5.2.1(B) or 36.5.2.1(C) [tons (metric tons)].

(B) For steel piles, the following shall apply:

$$R = \frac{12Wh\left[(W+0.25P)/(W+P)\right]}{S+(24{,}000RL/AE)} \tag{36.4}$$

(C) For other piles, the following shall apply:

$$R = \frac{12Wh\left[(W+0.1P)/(W+P)\right]}{S+(24{,}000RL/AE)} \tag{36.5}$$

where:

Wh = striking energy (foot-tons)
W = weight of striking parts (tons)
h = height of striking parts (ft)
P = weight of pile (tons)
S = permanent settlement of pile under the average of the last 10 blows (in.)
R = ultimate driving resistance (tons)
L = length of pile (ft)
A = average right cross-sectional area of pile material, (in.^{2})
E = modulus of elasticity of pile (psi)

36.5.2.2 Static Load Test.

36.5.2.2.1 Single piles, where tested, shall be loaded to at least twice the design load, and, where pile groups are tested, the test load shall be not less than 1½ times the total design load for the group.

36.5.2.2.2 All load tests on piles shall be conducted in compliance with procedures set forth in ASTM D 1143, *Standard Test Method for Piles Under Static Axial Compressive Load*, unless modified with the concurrence of the authority having jurisdiction.

36.5.3 Driven Piles.

36.5.3.1 Piles shall be driven to a resistance and penetration in accordance with the plans and specifications.

36.5.3.2 Piles subjected to jetting shall meet the requirements of 36.5.3.2.1 and 36.5.3.2.2.

36.5.3.2.1 Piles shall be permitted to be jetted only when approved and when under the supervision of a registered design professional.

36.5.3.2.2 No jetting shall be permitted where it is considered detrimental to existing structures or piles previously installed.

36.5.4 Wood Piles.

36.5.4.1 Stresses permitted in compression parallel to the grain of wood piles shall comply with the requirements of Chapter 45.

36.5.4.2 Wood piles shall comply with the requirements in 36.5.4.2.1 through 36.5.4.2.8.

36.5.4.2.1 Wood piles shall be of one piece and shall conform to ASTM D 25, *Standard Specification for Round Timber Piles*.

36.5.4.2.2 Untreated piles shall be used only when it has been established that the cutoff will be below the lowest groundwater level assumed to exist during the life of the structure.

36.5.4.2.3 Pressure-preservative treatment shall meet the requirements of 36.5.4.2.3.1 and 36.5.4.2.3.2.

36.5.4.2.3.1 Pressure-preservative treatment for piles as set forth herein shall be in conformance with the requirements of AWPA C1, *Standard for Preservative Treatment of All Timber Products by Pressure Processes*, and AWPA C2, *Standard for the Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Processes,* for the treatment of wood piles.

36.5.4.2.3.2 Preservative treatment required herein shall not be required for rot-and-borer-resistive piles when evidence of these characteristics is presented to the authority having jurisdiction.

36.5.4.2.4 The butt of wood piles supporting structures over the ground shall be permitted to be cut off at any elevation below the ground surface, provided that both of the following criteria are met:

(1) The piles shall be treated with the equivalent of Grade 1 creosote oil under pressure so as to retain not less than 12 lb/ft^3 (190 kg/m^3) of creosote oil
(2) The pile butt shall be coated with two applications of hot creosote oil.

36.5.4.2.5 The butt of wood piles supporting a structure over water shall be permitted to project above the water to the height necessary, when the piles have been treated with the equivalent of Grade 1 creosote oil or 70-30 creosote-coal tar solution under pressure so as to retain not less than 20 lb/ft^3 (320 kg/m^3) of creosote oil or creosote-coal tar solution.

36.5.4.2.6 Wood piles shall be driven with a protective driving cap or ring when necessary to prevent brooming or splitting of the butt.

36.5.4.2.7 When brooming or splitting occurs, wood piles shall be cut back to solid wood before the final resistance to penetration is measured.

36.5.4.2.8 If required, when driving through or to hard material or to rock, wood piles shall be fitted with an approved, metal protective shoe.

36.5.5 Precast Concrete Piles.

36.5.5.1 The allowable compressive stress in precast concrete piles shall not exceed 0.33 f_c'.

36.5.5.2 Precast concrete piles shall conform to the requirements of 36.5.5.3 through 36.5.5.8.

36.5.5.3 The piles shall be cast of concrete having a specified compressive strength, f_c', of not less than 4000 psi (27.6 MPa) and shall be reinforced with a minimum of 4 longitudinal steel bars having total area of not less than 1 percent, or more than 4 percent, of the gross concrete area.

36.5.5.4 All longitudinal bars shall be of uniform size and shall be tied by not less than No. 2 hoops spaced 8 in. (200 mm) apart in the body of the pile and not over 3 in. (75 mm) apart for the first 18 in. (460 mm) from both the butt and the tip.

36.5.5.5 All reinforcement shall be protected by not less than 2 in. (50 mm) of concrete, except for piles exposed to seawater, which shall be protected by not less than 3 in. (75 mm) of concrete cover.

36.5.5.6 For point-bearing piles, the concrete area of the tip shall be not less than 75 percent of the area of the butt.

36.5.5.7 All precast concrete piles shall have their date of manufacture and the lifting points marked on the pile.

36.5.5.8 Precast concrete piles shall be prohibited from being driven until they have attained a compressive strength of not less than 75 percent of the specified compressive strength, but in no case shall a precast pile be permitted to be driven until it can withstand handling and driving stresses.

36.5.6 Prestressed Precast Concrete Piles.

36.5.6.1 Prestressed precast concrete piles shall conform to 36.5.5, and 36.5.6.2 through 36.5.6.6.

36.5.6.2 Prestressed concrete piles shall be cast of concrete having a specified compressive strength, f_c', of not less than 5000 psi (34.5 MPa).

36.5.6.3 The effective prestress in the prestressed concrete pile shall be not less than 700 psi (4.8 MPa).

36.5.6.4 The allowable compressive stress in the concrete of precast prestressed concrete piles shall not exceed the following:

$$f_c = 0.33 f_c' - 0.27 f_{pc} \qquad \textbf{(36.6)}$$

where:

f_c = allowable compressive stress in precast prestressed concrete piles [psi (MPa)]
f_c' = specified compressive strength of concrete [psi (MPa)]
f_{pc} = effective stress due to prestressing on the gross pile section [psi (MPa)]

36.5.6.5 Longitudinal reinforcing shall be tied by No. 2 hoops or No. 5 AS&W gauge spirals spaced at the following intervals:

(1) 8 in. (200 mm) in the body of piling 14 in. (355 mm) or smaller
(2) 9 in. (230 mm) in the body of piling larger than 14 in. (355 mm)
(3) Not over 3 in. (75 mm) for the first 18 in. (460 mm) from both the butt and the tip

36.5.6.6 All reinforcement shall be protected by not less than 2 in. (50 mm) of concrete, except for piles exposed to seawater, which shall be protected by not less than 2½ in. (65 mm) of concrete cover.

36.5.7 Structural Steel Shapes. The materials used for structural steel piles shall conform to the requirements of 36.5.7.1 through 36.5.7.3.

36.5.7.1 Materials used for structural steel piles shall conform to the requirements of Chapter 44.

36.5.7.2 The sections used shall be rolled sections or comparable fully welded built-up sections from plate.

36.5.7.3 Every section shall have an average thickness of metal of not less than ⅜ in. (10 mm). The allowable stress shall not exceed 50 percent of the minimum specified yield strength of the material.

36.5.8 Cast-in-Place Concrete Piles.

36.5.8.1 Metal-cased concrete piles shall consist of a steel shell, driven in intimate contact with the surrounding soil and filled with concrete, and shall conform to the requirements of Chapter 41 and the following provisions:

(1) Steel shells shall be permitted to be uniformly tapered, step tapered, cylindrical, or a combination of such shapes, and shall be laterally corrugated, spirally corrugated, longitudinally fluted, or plain.
(2) Pile shells and end closures shall meet the following requirements:
   (a) They shall have the strength and rigidity to be driven, and to prevent harmful distortion caused by soil pressures or by driving of adjacent piles, until filled with concrete.
   (b) A reduction of cross-sectional area in excess of 15 percent shall be cause for rejection.
   (c) Shells shall be watertight to exclude water during the placing of concrete.
   (d) All rejected piles shall be removed or filled with gravel or concrete.
(3) The minimum diameter of a pile shell shall be 8 in. (200 mm).
(4) Concrete for cast-in-place piles shall meet the following requirements:
   (a) The concrete for cast-in-place piles shall have a specified compressive strength, f'_c, of not less than 3000 psi (20.7 MPa).
   (b) The concrete shall be deposited in a continuous operation to ensure a full-sized pile without voids or separation.
   (c) Concrete shall be placed in the dry by tremie or other approved method.
(5) Splices of shell sections shall be designed to ensure the alignment of the shells and to develop the full strength of the shell section.
(6) The load on the shell shall meet the following requirements:
   (a) The load on the shell shall not exceed 12,000 psi (82.7 MPa) multiplied by the area of the shell.
   (b) Shells having a minimum wall thickness of 0.16 in. (4 mm) shall be permitted to carry part of the load.
   (c) The steel for the shells shall conform to the requirements of Chapter 44.
(7) For friction piles driven in material providing lateral support, the following requirements shall apply:
   (a) The allowable load shall be computed at the cross section located at a point equal to two-thirds of the embedded length of the pile, measured upward from the tip.
   (b) The load on the concrete shall not exceed 25 percent of the specified compressive strength of concrete, f'_c, multiplied by the concrete area.
(8) For end-bearing piles, the following requirements shall apply:
   (a) The concrete area at the critical section shall be such that the unit stress on the concrete does not exceed $0.25\ f'_c$ under the pile load.
   (b) The area of the shell and the critical section of the concrete shall be measured at the elevation where the pile enters the stratum that furnishes end bearing.

36.5.8.2 Uncased concrete piles shall consist of concrete cast-in-place against earth in drilled holes meeting the following requirements:

(1) The construction procedure shall be such as to ensure the exclusion of any foreign matter while securing a full-sized shaft.
(2) The concrete shall have a specified compressive strength, f'_c, of not less than 3000 psi (20.7 MPa).
(3) The compressive stress in the concrete shall not exceed $0.25\ f'_c$.

36.6 Foundation Walls.

36.6.1 General Requirements. Foundation walls shall be designed and constructed in accordance with the structural load requirements of Chapter 35 for the specific materials and the requirements of 36.6.1.1 through 36.6.1.3.

36.6.1.1 Isolated Piers Permitted. The authority having jurisdiction shall be permitted to approve isolated piers under the exterior walls of buildings in locations where extreme dampness exists.

36.6.1.2 Isolated Piers Substituted for Interior Foundation Walls. Isolated piers shall be permitted to be substituted for interior foundation walls for buildings of light-frame construction not over one story, provided that all of the following criteria are met:

(1) The piers are not over 24 in. (610 mm) high.
(2) The piers are a minimum of 12 in. × 12 in. (300 mm × 300 mm) in cross-sectional dimension.
(3) The piers are located not more than 8 ft (2.4 m) apart and at points of concentrated loads.

36.6.1.3 Flood Hazard Areas. Foundation wall construction shall be prohibited for buildings and structures located wholly or partly in flood hazard areas subject to high-velocity wave action, as established by 39.4.2.

36.6.1.3.1 For buildings and structures located within flood hazard areas not subject to high-velocity wave action, foundation walls enclosing an area below the design flood elevation shall have flood openings as required by Chapter 2 of SEI/ASCE 24, or shall be dry floodproofed in accordance with 39.11.1.2.

36.6.1.3.2 In areas below the design flood elevation, and enclosed by foundation walls not dry floodproofed in accordance with 39.11.1.2, the finish grade elevation of an underfloor space (such as a crawl space) shall be not lower than the finish grade elevation adjacent to the outside of the foundation wall.

36.6.2 Foundation Wall Thickness.

36.6.2.1 Minimum Thickness for Concrete and Masonry Walls. The minimum thickness of concrete and masonry foundation walls that are laterally supported at the top and bottom shall comply with 36.6.2.3, 36.6.2.4, 36.6.2.6, and 36.6.2.7 or shall be designed in accordance with ACI 318, *Building Code Requirements for Structural Concrete*, or ACI 530/ASCE 5/TMS 402, *Building Code Requirements for Masonry Structures*.

36.6.2.2 Foundation Walls not Meeting Parameters of Tables 36.6.2.2 (a) through (d). Foundation walls that are not laterally supported at the top and bottom, and foundation walls that are not within the parameters of Table 36.6.2.2(a), Table 36.6.2.2(b), Table 36.6.2.2(c), or Table 36.6.2.2(d) shall be designed in accordance with ACI 530/ASCE 5/TMS 402 or ACI 318.

36.6.2.3 Thickness Based on Walls Supported. The thickness of foundation walls shall be not less than the thickness of the wall supported, unless otherwise permitted by 36.6.2.3.1.

Table 36.6.2.2(a) Plain Masonry and Plain Concrete Foundation Walls

		Minimum Nominal Wall Thickness (in.)		
		Soil Classes and Lateral Soil Load (psf/ft below natural grade)[a]		
Wall Height (ft)	Height of Unbalanced Backfill (ft)	GW, GP, SW, and SP Soils 30	GM, GC, SM, SM-SC, and ML Soils 45	SC, MH, ML-CL, and Inorganic CL Soils 60
Plain Masonry				
≤7	≤4	8	8	8
	5	8	10	10
	6	10	12	10 (solid)[b]
	7	12	10 (solid)[b]	10 (solid)[b]
8	≤ 4	8	8	8
	5	8	10	12
	6	10	12	12 (solid)[b]
	7	12	12 (solid)[b]	See footnote c
	8	10 (solid)[b]	12 (solid)[b]	See footnote c
9	≤4	8	8	8
	5	8	10	12
	6	12	12	12 (solid)[b]
	7	12 (solid)[b]	12 (solid)[b]	See footnote c
	8	12 (solid)[b]	See footnote c	See footnote c
	9	See footnote c	See footnote c	See footnote c
Plain Concrete				
≤7	≤5	7½	7½	7½
	6	7½	7½	8
	7	7½	8	10
8	≤5	7½	7½	7½
	6	7½	7½	10
	7	7½	10	10
	8	10	10	12
9	≤5	7½	7½	7½
	6	7½	7½	10
	7	7½	10	10
	8	10	10	12
	9	10	12	See footnote d

For SI units, 1 in. = 25.4 mm; 1 ft = 0.3048 m; 1 psf/ft = 0.157 kPa/m.

[a] For design lateral soil loads, see Section 35.11. Soil classes are in accordance with the Unified Soil Classification System, and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

[b] These entries represent solid, grouted hollow units or solid masonry units.

[c] A design in compliance with Chapter 43 or reinforcement in accordance with Table 36.6.2.2(b), Table 36.6.2.2(c), or Table 36.6.2.2(d) is required.

[d] A design in compliance with Chapter 41 is required, or reinforcement in accordance with Table 36.6.2.2(b), Table 36.6.2.2(c), or Table 36.6.2.2(d) is required.

36.6.2.3.1 Foundation walls of at least 8 in. (200 mm) nominal thickness shall be permitted to support brick-veneered frame walls, or cavity walls of 10 in. (250 mm) in thickness where the total height of the wall supported complies with the requirements of Chapter 6 of ACI 530/ASCE 5/TMS 402.

36.6.2.3.2 Corbeling of masonry shall be in accordance with Section 5.9.4 of ACI 530/ASCE 5/TMS 402.

36.6.2.4 Thickness Based on Soil Loads, Unbalanced Backfill Height, and Wall Height. Subject to the limitations of ASCE 7, Chapter 9, the thickness of foundation walls shall comply with the requirements of Table 36.6.2.2(a) for plain masonry and plain concrete walls or Table 36.6.2.2(b), Table 36.6.2.2(c), and Table 36.6.2.2(d) for reinforced concrete or masonry walls.

36.6.2.5 Rubble Stone. Subject to the limitations of ASCE 7, Chapter 9, foundation walls of rough or random rubble stone shall be not less than 16 in. (400 mm) thick.

36.6.2.6 Foundation Walls. Subject to the limitations of ASCE 7, Chapter 9, foundation walls constructed in accordance with Table 36.6.2.2(a), Table 36.6.2.2(b), Table 36.6.2.2(c), or Table 36.6.2.2(d) shall comply with all of the following:

(1) Hollow and solid masonry units shall comply with ASTM C 90, *Standard Specifications for Loadbearing Concrete Masonry Units.*
(2) Masonry shall be laid in running bond, and the mortar shall be Type M or Type S.

Table 36.6.2.2(b) 8-in. Reinforced Concrete and Masonry Foundation Walls Where *d* is Greater than or Equal to 5 in.—Reinforced Masonry

		Vertical Reinforcement[a]		
		Soil Classes and Lateral Soil Load (psf/ft below natural grade)[b]		
Wall Height (ft)	Height of Unbalanced Backfill (ft)	GW, GP, SW, and SP Soils 30	GM, GC, SM, SM-SC, and ML Soils 45	SC, MH, ML-CL, and Inorganic CL Soils 60
≤7	≤4	#4 at 48 in. oc	#4 at 48 in. oc	#4 at 48 in. oc
	5	#4 at 48 in. oc	#4 at 48 in. oc	#4 at 40 in. oc
	6	#4 at 48 in. oc	#5 at 48 in. oc	#5 at 40 in. oc
	7	#4 at 40 in. oc	#5 at 40 in. oc	#6 at 48 in. oc
8	≤4	#4 at 48 in. oc	#4 at 48 in. oc	#4 at 48 in. oc
	5	#4 at 48 in. oc	#4 at 48 in. oc	#4 at 40 in. oc
	6	#4 at 48 in. oc	#5 at 48 in. oc	#5 at 40 in. oc
	7	#5 at 48 in. oc	#6 at 48 in. oc	#6 at 40 in. oc
	8	#5 at 40 in. oc	#6 at 40 in. oc	#7 at 40 in. oc
9	≤4	#4 at 48 in. oc	#4 at 48 in. oc	#4 at 48 in. oc
	5	#4 at 48 in. oc	#4 at 48 in. oc	#5 at 48 in. oc
	6	#4 at 48 in. oc	#5 at 48 in. oc	#6 at 48 in. oc
	7	#5 at 48 in. oc	#6 at 48 in. oc	#7 at 48 in. oc
	8	#5 at 40 in. oc	#7 at 48 in. oc	#8 at 48 in. oc
	9	#6 at 40 in. oc	#8 at 48 in. oc	#8 at 32 in. oc

For SI units, 1 in. = 25.4 mm; 1 ft = 0.3048 m; 1 psf/ft = 0.157 kPa/m.

[a] For alternative reinforcement, see 36.6.2.7.

[b] For design lateral soil loads, see Section 35.11. Soil classes are in accordance with the Unified Soil Classification System, and design lateral soil loads are for moist soil, conditions without hydrostatic pressure.

Table 36.6.2.2(c) 10-in. Reinforced Concrete and Masonry Foundation Walls Where *d* is Greater than or Equal to 6.75 in.—Reinforced Masonry

		Vertical Reinforcement[a]		
		Soil Classes and Lateral Soil Load (psf/ft below natural grade)[b]		
Wall Height (ft)	Height of Unbalanced Backfill (ft)	GW, GP, SW, and SP Soils 30	GM, GC, SM, SM-SC, and ML Soils 45	SC, MH, ML-CL, and Inorganic CL Soils 60
≤7	≤5	#4 at 56 in. oc	#4 at 56 in. oc	#4 at 56 in. oc
	6	#4 at 56 in. oc	#4 at 48 in. oc	#4 at 40 in. oc
	7	#4 at 56 in. oc	#5 at 56 in. oc	#5 at 40 in. oc
8	≤4	#4 at 56 in. oc	#4 at 56 in. oc	#4 at 56 in. oc
	5	#4 at 56 in. oc	#4 at 56 in. oc	#4 at 48 in. oc
	6	#4 at 56 in. oc	#4 at 48 in. oc	#4 at 56 in. oc
	7	#4 at 48 in. oc	#4 at 32 in. oc	#6 at 56 in. oc
	8	#5 at 56 in. oc	#5 at 40 in. oc	#7 at 56 in. oc
9	≤4	#4 at 56 in. oc	#4 at 56 in. oc	#4 at 56 in. oc
	5	#4 at 56 in. oc	#4 at 56 in. oc	#4 at 48 in. oc
	6	#4 at 56 in. oc	#4 at 40 in. oc	#4 at 32 in. oc
	7	#4 at 40 in. oc	#5 at 48 in. oc	#6 at 48 in. oc
	8	#4 at 32 in. oc	#5 at 48 in. oc	#4 at 16 in. oc
	9	#5 at 40 in. oc	#6 at 40 in. oc	#7 at 40 in. oc

For SI units, 1 in. = 25.4 mm; 1 ft = 0.3048 m; 1 psf/ft = 0.157 kPa/m.

[a] For alternative reinforcement, see 36.6.2.7.

[b] For design lateral soil loads, see Section 35.11. Soil classes are in accordance with the Unified Soil Classification System, and design lateral soil loads are for moist soil, conditions without hydrostatic pressure.

Table 36.6.2.2(d) 12-in. Reinforced Concrete and Masonry Foundation Walls Where *d* is Greater than or Equal to 8.75 in.—Reinforced Masonry

		Vertical Reinforcement[a]		
		Soil Classes and Lateral Soil Load (psf/ft below natural grade)[b]		
Wall Height (ft)	Height of Unbalanced Backfill (ft)	GW, GP, SW, and SP Soils 30	GM, GC, SM, SM-SC, and ML Soils 45	SC, MH, ML-CL, and Inorganic CL Soils 60
≤7	≤5	#4 at 72 in. oc	#4 at 72 in. oc	#4 at 72 in. oc
	6	#4 at 72 in. oc	#4 at 64 in. oc	#4 at 48 in. oc
	7	#4 at 72 in. oc	#4 at 48 in. oc	#5 at 56 in. oc
8	≤ 5	#4 at 72 in. oc	#4 at 72 in. oc	#4 at 72 in. oc
	6	#4 at 72 in. oc	#4 at 56 in. oc	#5 at 72 in. oc
	7	#4 at 64 in. oc	#5 at 64 in. oc	#4 at 32 in. oc
	8	#5 at 48 in. oc	#4 at 32 in. oc	#5 at 40 in. oc
9	≤ 4	#4 at 72 in. oc	#4 at 72 in. oc	#4 at 72 in. oc
	5	#4 at 72 in. oc	#4 at 72 in. oc	#4 at 64 in. oc
	6	#4 at 72 in. oc	#4 at 56 in. oc	#5 at 64 in. oc
	7	#4 at 56 in. oc	#4 at 40 in. oc	#6 at 64 in. oc
	8	#5 at 64 in. oc	#6 at 64 in. oc	#6 at 48 in. oc
	9	#5 at 56 in. oc	#7 at 72 in. oc	#6 at 40 in. oc

For SI units, 1 in. = 25.4 mm; 1 ft = 0.3048 m; 1 psf/ft = 0.157 kPa/m.

[a] For alternative reinforcement, see 36.6.2.7.

[b] For design lateral soil loads, see Section 35.11. Soil classes are in accordance with the Unified Soil Classification System, and design lateral soil loads are for moist soil, conditions without hydrostatic pressure.

(3) Vertical reinforcement shall have minimum yield strength of 60,000 psi (414 MPa).
(4) The specified location of the reinforcement shall equal or exceed the effective depth distance, *d*, noted in Table 36.6.2.2(b), Table 36.6.2.2(c), or Table 36.6.2.2(d), and the following shall apply:
  (a) The distance shall be measured from the face of the soil side of the wall to the center of vertical reinforcement.
  (b) The reinforcement shall be placed within the tolerances specified in ACI 530.1/ASCE 6/TMS 602, *Specifications for Masonry Structures*, Article 3.4B7 of the specified location.
(5) Grout shall have a specified compressive strength of not less than 2000 psi (13.8 MPa) at 28 days or shall comply with ASTM C 476, *Specifications for Grout for Masonry*.
(6) Concrete shall have a specified compressive strength of not less than 2500 psi (17.2 MPa) at 28 days.

36.6.2.7 Alternative Concrete or Masonry Foundation Wall Reinforcement. In lieu of the reinforcement provisions in Table 36.6.2.2(b), Table 36.6.2.2(c), or Table 36.6.2.2(d), alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per linear foot (linear meter) of concrete or masonry foundation wall shall be permitted to be used, provided that the spacing of reinforcement does not exceed 72 in. (1830 mm), and reinforcing bar size does not exceed No. 11.

36.6.3 Foundation Plate or Sill Bolting. Wood foundation plates or sills shall be bolted to the foundation or foundation walls as provided in Chapter 45.

36.6.4 Masonry Pier and Curtain Wall Foundations.

36.6.4.1 Masonry pier and curtain wall foundations shall be permitted to support detached one- and two-family dwellings of light-frame construction not more than two stories in height that are assigned to Seismic Design Category A, Seismic Design Category B, Seismic Design Category C, or Seismic Design Category D, provided that the following requirements are met:

(1) The wall shall be supported on a continuous concrete footing placed integrally with the exterior pier footings.
(2) The minimum actual thickness of the wall shall be not less than 3⅝ in. (92 mm) and integrally bonded into the piers.
(3) Piers shall be constructed in accordance with Section 43.3. Pier spacing shall be governed by the beam or girder design in accordance with Chapter 44 and Chapter 45, with a maximum spacing of 8 ft (2.44 m) on center.
(4) The maximum height of a 4-in. (100-mm) wall shall not exceed 4 ft (1.2 m).
(5) Piers and anchorage shall be designed to resist the loads and forces determined in accordance with Chapter 35.
(6) The unbalanced fill for 4-in. (100-mm) walls shall not exceed 24 in. (610 mm) for solid masonry or 12 in. (300 mm) for hollow masonry.
(7) In Seismic Design Category D, minimum reinforcement shall be provided in the horizontal and vertical directions. Minimum horizontal joint reinforcement shall be two No. 9 gauge wires spaced at not more than 6 in. (150 mm), or one ¼-in. (6.4-mm) diameter wire spaced at not more than 10 in. (250 mm). Vertical reinforcement shall be minimum #4 bars spaced at not more than 48 in. (1220 mm).

36.6.4.2 Where conditions do not meet the requirements of 36.6.4.1, the foundation shall comply with the requirements of Chapter 43.

36.7 Wood Foundation Systems. Wood foundation systems shall be designed and installed in accordance with AF&PA Technical Report No. 7, *Permanent Wood Foundation System.*

36.8 Waterproofing and Dampproofing. Walls and floors below ground level and enclosing usable space shall be waterproofed or dampproofed in accordance with this section.

36.8.1 Waterproofing Required. Floors and portions of walls, including joints and annular spaces around penetrating items, below the groundwater table shall be waterproofed using approved materials and methods.

36.8.2 Dampproofing Required. Floors and portions of walls located below ground level and above the groundwater table shall be dampproofed using approved materials and methods.

36.8.3 Foundation Drain.

36.8.3.1 Spaces below ground level required to be dampproofed shall be provided with an approved subsoil drain surrounding the foundation and located vertically so that it drains the gravel or stone base required under the floor slab by 36.8.4.

36.8.3.2 Discharge from the drain shall be by gravity or mechanical means in accordance with the UPC, *Uniform Plumbing Code*, to an approved location.

36.8.3.3 A subsoil drainage system shall not be required where the soil is classified as GW, GP, SW, or SP in accordance with ASTM D 2487.

36.8.4 Floor Base. Floors below ground level, other than those required to be waterproofed, shall be placed over a layer of gravel or crushed stone not less than 4 in. (100 mm) thick, and the following also shall apply:

(1) At least 90 percent of the material shall be retained on a No. 4 sieve.
(2) Approved means shall be provided to drain the base to the subsoil drain required by 36.8.3.
(3) The gravel or crushed stone base required by 36.8.4 shall not be required where the soil is classified as GW, GP, SW, or SP in accordance with ASTM D 2487.
(4) A vapor retarder complying with 41.6.3 shall be provided between the layer of gravel or crushed stone, or natural subgrade, and the bottom of the slab.

36.8.5 Site Grading.

36.8.5.1 The site within 10 ft (3.0 m), measured perpendicular to the foundation, shall be graded to slope away from the foundation at not less than 1 unit vertical in 12 units horizontal.

36.8.5.2 Where approved based on soil or climatic conditions, the slope away from the foundation required by 36.8.5.1 shall be permitted to be reduced to not less than 1 unit vertical in 24 units horizontal.

36.8.5.3 Where less than 10 ft (3.0 m) exist between the foundation and property line or another structure, an approved alternate method of diverting water away from the building shall be permitted to be used.

36.9 Retaining Walls. Walls built to retain or support the lateral pressure of earth or water, or other superimposed loads, shall be designed and constructed of masonry, concrete, steel, wood, or other approved materials.

36.9.1 Design. Retaining walls shall be designed to resist the design loads in Chapter 35 and to ensure stability against overturning, sliding, excessive foundation pressure, and water uplift.

36.9.2 Hydrostatic Pressure. Unless drainage is provided, the hydrostatic head of the water pressure shall be assumed to be equal to the height of the wall.

36.9.3 Concrete Retaining Walls. Concrete retaining walls shall be designed and constructed in accordance with ACI 318.

36.9.4 Reinforced Masonry Retaining Walls.

36.9.4.1 Masonry retaining walls shall be designed and constructed in accordance with ACI 530/ASCE 5/TMS 402.

36.9.4.2 Footings for reinforced masonry retaining walls shall be designed in accordance with ACI 318.

36.9.5 Segmental Retaining Walls. Segmental retaining walls shall be designed in accordance with NCMA's *Design Manual for Segmented Retaining Walls.*

Chapter 37 Exterior Wall Construction

37.1 General.

37.1.1 Scope. All exterior walls shall be in compliance with this chapter and shall meet all other applicable requirements of the *Code.*

37.1.1.1 Light-transmitting Plastics. Light-transmitting plastics used in exterior walls shall be in accordance with Section 48.7.

37.1.1.2 Flood Resistance. For buildings and structures located wholly or partly within the flood hazard area established in 39.4.2, exterior walls below the design flood elevation shall comply with the requirements of Chapter 39.

37.1.2 Lintels. Fire protection to the bottom flange of lintels, shelf angles, or plates shall not be required, provided that one of the following conditions is met:

(1) The span is 6 ft (1.8 m) or less.
(2) The lintels, shelf angles, or plates support only masonry veneer.

37.1.3 Parapets. Parapet walls shall be provided on the exterior of all buildings where exterior walls are required to have a fire resistance rating by Table 7.3.2.1, unless otherwise permitted by 37.1.3.1.

37.1.3.1 Parapets not Required. Parapets shall not be required where any of the following conditions exist:

(1) Where unprotected openings are permitted
(2) Where the roof slopes up more than 4 in. in 12 in. (100 mm in 300 mm) from the back of the exterior wall of the building, and the roof covering has a Class A rating
(3) Where the exterior wall of the building is located 20 ft (6.1 m) from the property line or on an alley or public way 20 ft (6.1 m) or more wide
(4) Where the entire building is protected by an automatic sprinkler system in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*
(5) Where the roof is constructed of noncombustible or limited-combustible materials and the joint between the wall, and the roof is sealed using an approved fire penetration seal or fireblock
(6) In Type III (211), Type IV, and Type V (111) construction where all of the following conditions are met:
    (a) The joint between the wall and the roof is sealed using an approved penetration seal or fireblock.

(b) The roof deck meets one of the following criteria:
   i. For a distance of at least 4 ft (1.2 m) from the wall, the roof deck has no openings and is of noncombustible or limited-combustible materials or fire retardant–treated wood,
   ii. For a distance of at least 4 ft (1.2 m) from the wall, the roof deck has no openings and ⅝-in. (15.9-mm) Type X gypsum board is directly beneath the underside of the roof deck, or is supported by a minimum 2-in. (51-mm) ledger at the roof deck, and is attached to the roof framing members.

(c) The entire roof covering has a minimum rating of Class B.

(d) Roof framing elements that are within 5 ft (1.5 m) of the exterior wall are parallel to the exterior wall and are protected to the same fire resistance rating required for the exterior wall.

(e) Roof framing elements that are perpendicular to the wall and all supporting elements of the roof are protected to the same fire resistance rating required for the exterior wall for their full span (roof frame) or height (supporting elements).

(7) Where the building has an area of not more than 1000 ft^2 (93 m^2) on any floor

37.1.3.2 Fire Resistance of Parapets. Parapets shall have the same degree of fire resistance as is required for the wall on which they are erected.

37.1.3.3 Parapet Height. Parapets shall extend not less than 30 in. (760 mm) above any part of the roof that is within 10 ft (3.0 m) of the parapet wall.

37.1.3.4 Coping of Parapets. All parapet walls shall have coping of approved materials.

37.1.4 Vertical Separation of Exterior Openings.

37.1.4.1 Where buildings are over three stories in height, and are not protected throughout with a fire sprinkler system in accordance with NFPA 13, or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and including Four Stories in Height*, openings in exterior walls that expose openings in the next story above shall be separated or protected in accordance with 37.1.4.2 where the openings in the next story above are located within a 5-ft (1.5-m) radius.

37.1.4.2 Protection of openings shall comply with at least one of the following:

(1) Either opening is protected in accordance with Section 7.3.
(2) Protection is provided to separate the openings with a spandrel panel not less than 3 ft (0.9 m) high or a wall with a 1-hour fire resistance rating.
(3) Protection is provided between the openings with a 30-in. (760-mm) horizontally projecting barrier with a 1-hour fire resistance rating.

37.2 Projections.

37.2.1 Cornices. Cornices, architectural appendages, eave overhangs, and other protections extending beyond the exterior wall shall be supported by the building and shall be permitted to be constructed of exterior fire retardant–treated wood or materials required by the type of construction in accordance with Chapter 7.

37.2.2 Bays, Oriels, Porches, Decks, and Balconies. Bay windows, oriel windows, porches, decks, balconies, and similar projections shall conform to the fire resistance rating requirements for exterior walls and floors in Chapter 7 for the type of construction of the building, except as permitted by 37.2.2.1 through 37.2.2.3.

37.2.2.1 Bay and Oriel Windows. Bay windows and oriel windows in buildings 40 ft (12.2 m) in height or less shall be permitted to be constructed of fire retardant–treated wood.

37.2.2.2 Porches, Decks, and Balconies. Porches, balconies, decks, and similar projections from buildings shall be permitted to be constructed of fire retardant–treated wood where attached to buildings less than 40 ft (12.2 m) in height.

37.2.2.3 Combustible Construction. Balconies and similar projections on buildings of Type III, Type IV, and Type V construction shall be permitted to be of combustible construction and shall not be required to have a fire resistance rating where the building is protected by automatic sprinklers in accordance with 55.3.1.1 and where automatic sprinkler protection is extended to such balconies and projections.

37.3* Weather Resistance.

37.3.1 Weather-Resistive Barriers. All walls exposed to the weather shall have a weather-resistive barrier to protect the structure.

37.3.1.1 The exposed wall envelope shall be designed and constructed to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer. Protection against condensation in the exterior wall assembly shall be provided in accordance with Chapter 51.

37.3.1.2 Barriers shall be a minimum of one layer of building paper meeting Federal Specification UUB-790a, *Specification for Building Paper, Vegetable Fiber: Kraft, Waterproofed, Water Repellent, and Fiber Resistant,* for Kraft waterproof building paper, or No.15 asphalt saturated felt complying with Type 1 felt in accordance with ASTM D 226, *Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing*.

37.3.1.3 The weather-resistive barrier shall be free from holes and tears other than those created by attachments and wall penetrations.

37.3.1.4 The barrier shall be applied horizontally and lapped upper layer over lower layer in weatherboard fashion for lengths of not less than 3 in. (76 mm) horizontally and 6 in. (152 mm) vertically.

37.3.1.5 The weather-resistive barrier shall be lapped with all penetration flashings.

37.3.1.6 Weather-resistive barriers shall not be required where permitted by the following:

(1) Where the structure is not intended for human occupancy
(2) Where the exterior cladding is of an approved material or system
(3) Where the exterior wall is back-plastered
(4) Where the exterior wall is sheathed with a water-repellent panel
(5) Where concrete or masonry is constructed in accordance with Chapter 41 or Chapter 43
(6) Where breakaway walls are constructed in accordance with Section 39.6

37.3.2 Flashing. Flashing made of a waterproof, corrosion-resistant material shall be installed on the exposed wall at the following locations in such a manner as to make the exterior wall waterproof:

(1) At exterior wall penetrations
(2) At exterior window and door openings
(3) At chimneys
(4) Under and at the ends of masonry, wood, or metal copings and sills
(5) Continuously above projecting wood trim
(6) At the intersection of exterior walls and porches and decks
(7) At wall and roof intersections
(8) At built-in gutters

37.3.3 Exterior Wall Pockets. In exterior walls of buildings or structures, wall pockets or crevices in which moisture can accumulate shall be avoided or protected with caps or drips, or other approved means shall be provided to prevent water damage.

37.3.4 Masonry. Flashing and weepholes shall be located in the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles, and lintels, where anchored veneers are designed in accordance with Chapter 43.

37.3.5 Parapets. All parapets and exterior horizontal surfaces shall be flashed with a waterproof, corrosion-resistant material.

37.3.6 Window Wells. All window wells shall be extended below the window sill and flashed with a waterproof, corrosion-resistant material.

37.3.7 Decks and Balconies. Decks and balconies shall be waterproof and sloped a minimum of ¼ in. in 12 in. (6 mm in 300 mm) (2 percent) to a drain or outer edge.

37.4 Aluminum Composite Materials.

37.4.1 The requirements of Section 37.4 shall apply to aluminum composite materials (ACM) having a minimum exterior skin thickness of 0.019 in. (0.5 mm), a minimum interior skin thickness of 0.010 in (0.25 mm), and a maximum panel thickness of ¼ in. (6 mm) where installed on exterior walls.

37.4.2 ACM shall be permitted to be installed on the exterior of buildings classified as Type I, Type II, Type III, or Type IV construction, as specified in 37.4.4, without changing the construction classification of the building.

37.4.3 ACM shall not reduce the required fire resistance rating of the exterior wall to which the ACM are attached.

37.4.4 ACM installed on the exterior of buildings classified as Type I, Type II, Type III, or Type IV construction shall comply with each of the following conditions:

(1) ACM that are part of the exterior wall assembly shall be tested in accordance with NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus*, using the maximum panel thickness intended for use and shall meet the conditions of acceptance specified therein.
(2) ACM shall have a Class A rating as specified in Chapter 10, based on the maximum thickness intended for use.
(3) ACM shall be completely separated from the building interior by a thermal barrier meeting the requirements in 48.3.3.

37.4.4.1 The thermal barrier specified in 37.4.4(3) shall not be required where ACM meet either of the following conditions:

(1) ACM are installed as part of a balcony or similar architectural appendage or as exterior trim.
(2) ACM are approved for the specific installation, based on tests conducted using the maximum thickness intended for use in accordance with one of the following:
   (a) NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*
   (b) UL 1040, *Standard for Fire Test of Insulated Wall Construction*
   (c) FM 4880, *Approval Standard for Class 1 Insulated Wall or Wall & Roof/Ceiling Panels; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems*
   (d) UL 1715, *Standard for Safety for Fire Test of Interior Finish Material*

37.4.4.2 ACM tested in accordance with 37.4.4.1(2) shall be tested as an assembly in the manner intended for use that shall include joints, seams, fasteners, and other construction details typical of the intended installation.

37.4.5 ACM shall not be required to comply with 37.4.4, provided that one of the following conditions is met:

(1) ACM shall be permitted to be installed to a maximum height of 40 ft (12.2 m) above grade where either 37.4.5(1)(a) or 37.4.5(1)(b) and 37.4.5(1)(c) are met as follows:
   (a) Where the exterior wall is located not more than 5 ft (1.5 m) from a property line, the ACM shall not cover more than 10 percent of the exterior wall.
   (b) Where the exterior wall is located more than 5 ft (1.5 m) from a property line, the area of the exterior wall covered by the ACM shall not be limited.
   (c) ACM shall have a Class B rating, as specified in Chapter 10, based on the maximum thickness intended for use.
(2) ACM shall be permitted to be installed to a maximum height of 50 ft (15.2 m) above grade, provided that all of the following conditions are met:
   (a) ACM shall be installed on the exterior wall so that the aggregate area of contiguous panels bounded by vertical joints and a vertical separation of not less than 4 ft (1.2 m), as measured to adjacent ACM, does not exceed 300 ft^2 (27.9 m^2).
   (b) ACM shall have a self-ignition temperature of not less than 650°F (343°C) when tested in accordance with ASTM D 1929, *Standard Test Method for Determining Ignition Temperature of Plastics*.
   (c) ACM shall have a Class B rating, as specified in Chapter 10, based on the maximum thickness intended for use.

37.4.6 ACM installed on the exterior walls of buildings classified as Type V construction shall have a Class B rating, as specified in Chapter 10, based on the maximum thickness intended for use.

37.4.7 ACM shall be labeled.

37.5 Exterior Insulation and Finish Systems (EIFS).

37.5.1 General. The provisions of Section 37.5 shall govern the materials, construction, and quality of exterior insulation and finish systems (EIFS) for use as non-load-bearing barrier walls and exterior cladding systems.

37.5.2 Reference Standard. EIFS shall be specified and installed in accordance with EIMA 99A, *Exterior Insulation and Finish Systems (EIFS).*

37.5.3 Expansion Joints. Expansion joints shall be provided in EIFS in the following locations:

(1) Where EIFS adjoin dissimilar construction
(2) Where building expansion joints occur
(3) Where prefabricated panels abut one another
(4) Where the substrate changes
(5) Where significant structural movement occurs due to changes in roofline, building shape, or structural system
(6) In the floor lines in multilevel wood frame construction

37.5.4 Quality Assurance.

37.5.4.1 Manufacturer. The manufacturer shall furnish a report certifying that the materials are in conformance with EIMA 99A, this *Code*, and the contract documents.

37.5.4.2 Contractor. The installing contractor shall have a certificate of instruction from the respective EIFS manufacturer's applicator training program.

Chapter 38 Roof Assemblies and Roof Structures

38.1 Scope. All roof assemblies and rooftop structures shall comply with the requirements of this chapter.

38.1.1 Special Definitions.

38.1.1.1 Roof Assembly. The component(s) above the roof structural framing, including the roof deck, vapor barrier, insulation, roof cover, coatings or toppings, or any combination thereof.

38.1.1.2 Roof Covering. The membrane, which may also be the roof assembly, that resists fire and provides weather protection to the building against water infiltration, wind, and impact.

38.1.1.3 Sloped Glazing. Any installation of glass or other transparent, translucent, or opaque glazing material installed at a slope of 15 degrees or more from the vertical plane, including glazing materials in skylights, roofs, and sloped walls.

38.1.2 Performance Requirements. Roof assemblies and rooftop structures shall provide weather protection and be resistant to exterior fire exposure, interior fire exposure, wind, and hail, as required by this chapter.

38.1.3 Materials and Installations.

38.1.3.1 All materials used within a roof assembly shall be as specified within this chapter or as tested according to standards referenced by Table 38.1.3.1.

38.1.3.2 All roof assemblies shall be designed and installed according to this *Code* and the manufacturer's printed installation instructions and to ensure weather protection for the building.

Table 38.1.3.1 Roofing Materials Standards

Material	Description	Standard
Acrylic coatings used in roofing	BUR standard	ASTM D 6083
Aggregate surfacing	BUR standard	ASTM D 1863
Aluminum	Material standard thickness requirement	t >0.024 in. (0.61 mm)
Asphalt	BUR standard	ASTM D 312
Asphalt adhesive used in roofing	BUR standard	ASTM D 3747
Asphalt cements used in roofing	BUR standard	ASTM D 2823
Asphalt cements used in roofing	BUR standard	ASTM D 3019
Asphalt cements used in roofing	BUR standard	ASTM D 4586
Asphalt coatings	BUR standard	ASTM D 1227
Asphalt coatings	BUR standard	ASTM D 2823
Asphalt coatings	BUR standard	ASTM D 4479
Asphalt glass felt	BUR standard	ASTM D 2178
Asphalt primer	BUR standard	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base sheet	BUR standard	ASTM D 2626
Asphalt-saturated organic felt (perforated)	BUR standard	ASTM D 226
Asphalt-coated glass fiber base sheet	BUR standard	ASTM D 4601
Asphalt-coated organic fiber underlayment sheet	Material standard	ASTM D 4869
Coal tar cements	BUR standard	ASTM D 4022
Coal tar cements	BUR standard	ASTM D 5643
Coal tar pitch	BUR standard	ASTM D 450, Type I or Type II
Coal tar primer	BUR standard	ASTM D 43
Coal tar–saturated organic felt	BUR standard	ASTM D 227
Clay tiles	General product requirements for clay tiles	ASTM C 1167
Concrete roof tiles	Material standard	ASTM C 1492
Copper, lead-coated	Material standard	ASTM B 101
Copper, metal sheet system	Material standard	16 oz/ft^2 (4.9 kg/m^2)
Copper, preformed metal shingles	Material standard	12 oz/ft^2 (3.7 kg/m^2)

Table 38.1.3.1 *Continued*

Material	Description	Standard
Fasteners for asphalt shingles	Fastener standard	ASTM F 1667
Fiberglass reinforced asphalt shingles	General product requirements for asphalt shingles	ASTM D 3462
Glass mat, coal tar	BUR standard	ASTM D 4990
Glass mat, venting type	BUR standard	ASTM D 4897
Insulation, cellular glass	Material standard	ASTM C 552
Insulation, fiberboard	Material standard	ASTM C 208
Insulation, mineral fiber	Material standard	ASTM C 726
Insulation, perlite	Material standard	ASTM C 728
Insulation, polyisocyanurate, faced	Material standard	ASTM C 1289
Insulation, polyisocyanurate, unfaced	Material standard	ASTM C 591
Insulation, spray polyurethane	Material standard	ASTM C 1029
Insulation, polystyrene	Material standard	ASTM C 578
Lead, hard	Material standard	2 lb/ft^2 (9.8 kg/m^2)
Lead, soft	Material standard	3 lb/ft^2 (14.6 kg/m^2)
Liquid-applied coating	Material standard option	ASTM C 836
Liquid-applied coating	Material standard option	ASTM C 957
Liquid-applied coating	Material standard option	ASTM D 1227
Liquid-applied coating	Material standard option	ASTM D 3468
Liquid-applied coating	Material standard option	ASTM D 6694
Low slope roof coverings	Impact resistance tests for low slope roof coverings	ASTM D 3746
Low slope roof coverings	Impact resistance tests for low slope roof coverings	CGSB 37-GP-52M
Mineral-surfaced inorganic cap sheet	BUR standard	ASTM D 3909
Mineral-surfaced roll roofing	Material standards option for mineral-surfaced rolled roofing	ASTM D 3909
Mineral-surfaced roll roofing	Material standards of mineral-surfaced roll roofing	ASTM D 6380

Table 38.1.3.1 *Continued*

Material	Description	Standard
Modified bitumen sheets, self-adhering	Material standard	ASTM D 1970
Modified bitumen sheets, SBS modified, with polyester and glass fiber reinforcements	Material standard	ASTM D 6162
Modified bitumen sheets, SBS modified, with glass fiber reinforcements	Material standard	ASTM D 6163
Modified bitumen sheets, SBS modified, with polyester reinforcements	Material standard	ASTM D 6164
Modified bitumen sheets, atactic polypropylene modified, with polyester reinforcements	Material standard	ASTM D 6222
Modified bitumen sheets, atactic polypropylene modified, with polyester and glass fiber reinforcements	Material standard	ASTM D 6223
Modified bitumen sheets, SBS modified, with factory-applied metal sheet	Material standard	ASTM D 6298
Modified bitumen sheets	Material standard	CGSB 37-GP-56M
Organically reinforced asphalt shingles	General product requirements for asphalt shingles	ASTM D 225
Polymer-modified bitumen sheet, APP	Material standard	ASTM D 6222
Polymer-modified bitumen sheet, APP	Material standard	ASTM D 6223
Polymer-modified bitumen sheet, SBS	Material standard	ASTM D 6162
Polymer-modified bitumen sheet, SBS	Material standard	ASTM D 6163
Polymer-modified bitumen sheet, SBS	Material standard	ASTM D 6164
Polymer-modified bitumen sheet, SBS	Material standard	ASTM D 6298
Preservative-treated, taper-sawn shakes of SYP, treated in accordance with AWPA C2	Material standard	CSSB Grade 1 or 2
Slate shingles	Material standard for slate shingles	ASTM C 406

(continues)

Table 38.1.3.1 *Continued*

Material	Description	Standard
Spray-applied polyurethane foam insulation	Material standard	ASTM C 1029
Steel	Material standard	ASTM A 755
Steel, aluminum-zinc alloy coated	Material standard	ASTM A 792
Steel, galvanized	Material standard	ASTM A 653
Terne (tin) and terne-coated stainless	Material standard thickness requirement	Terne coating of 40 lb (18.2 kg) per double base box
Thermoplastic fabrics	BUR standard	ASTM D 5665
Thermoplastic fabrics	BUR standard	ASTM D 5726
Thermoplastic roof coverings	Material standard option	ASTM D 4434
Thermoplastic roof coverings	Material standard option	CAN/CGSB-37.54
Thermoset single-ply roof coverings	Material standard option	ASTM D 4637
Thermoset single-ply roof coverings	Material standard option	CGSB 37-GP-52M
Wood shakes of naturally durable wood	Material standard	CSSB Grade 1
Wood shakes of naturally durable wood, FRT	Material standard	CSSB Grade 1
Wood shakes of naturally durable wood, preservative treated	Material standard	CSSB Grade 1
Wood shakes of naturally durable wood, taper sawn	Material standard	CSSB Grade 1 or Grade 2
Wood shingles	Material standard	CSSB Grade 1, Grade 2, or Grade 3

38.2 Exterior Fire Exposure.

38.2.1* Required Tests.

38.2.1.1 Where roof coverings are required by 38.2.3 to be fire resistance rated as either Class A, Class B, or Class C for exterior fire exposure, they shall be tested according to either NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*, or other approved test methods.

38.2.1.2 The fire resistance rating shall be applicable to the type of deck to be used and the maximum slope to be provided.

38.2.2 Allowable Class A, Class B, or Class C Roof Coverings. The following roof coverings shall be permitted to be used where Class A, Class B, or Class C roof coverings are required:

(1) Brick or masonry
(2) Clay or concrete roof tile
(3) Exposed concrete roof deck or concrete paver blocks
(4) Copper or ferrous sheets or shingles
(5) Slate
(6) Minimum of 4 lb/ft^2 (19.5 kg/m^2) of gravel or slag embedded in a flood coat of asphalt or coal tar over built-up roofing (BUR) installed at maximum slope of ½ in./ft (13 mm/300 mm)
(7) Ballasted sheet membrane roofing system installed in accordance with 38.4.3.2

38.2.3* Minimum Roof Covering Classification. Roof coverings shall comply with Table 38.2.3, unless otherwise permitted by the following:

(1) Single-family dwellings and townhouses with a leading roof edge separated a minimum of 5 ft (1.5 m) from property lines shall be permitted to use nonclassified roof coverings.
(2) One- or two-story buildings of Type II (000), Type III (200), and Type V (000) with a horizontally projected roof area less than 2000 ft^2 (186 m^2), and with a minimum 10-ft (3.0-m) separation from the leading edge of the roof to the property line on all sides of the building, shall be permitted to use nonclassified roof coverings.
(3) Agricultural buildings shall be permitted to use nonclassified roof coverings.

Table 38.2.3 Minimum Roof Covering Classification

Type of Construction	Minimum Roof Covering Classification
Type I (442)	B
Type I (332)	B
Type II (222)	B
Type II (111)	B
Type II (000)	C
Type III (211)	B
Type III (200)	C
Type IV (2HH)	B
Type V (111)	B
Type V (000)	C

38.3 Interior Fire Exposure.

38.3.1 Fire Resistance—Rated Construction. Where the roof assembly or rooftop structure is required by Chapter 7 to have a fire resistance rating, the assembly shall comply with Chapter 8.

38.3.2 Above-Deck Combustible Components within a Roof Assembly. In Type I and Type II construction, where above-deck combustible materials are used as components of the roof assembly, other than for structural and lightweight structural concrete roof decks or fire retardant—treated wood decks with minimum $^{23}/_{32}$-in. (18-mm) thick tongue-and-groove longitudinal edges, Exposure 1 wood structural panels, or 1-in. (25-mm) nominal tongue-and-groove boards, the roof assembly shall be tested in accordance with one of the following:

(1) FM 4450, *Test Standard for Class 1 Insulated Steel Deck Roofs*
(2) FM 4470, *Approval Standard for Class 1 Roof Covers*
(3) UL 1256, *Standard for Safety for Fire Test of Roof Deck Construction*

38.3.3 Foam Plastic Insulation. Foam plastic insulation shall meet the requirements of Section 48.3.

38.4 Wind Resistance.

38.4.1 Roof Assemblies and Flashings.

38.4.1.1 All roof assemblies and flashings shall be designed to withstand wind pressures as required by Section 35.9.

38.4.1.2 Wind resistance of roof assemblies and flashings shall be determined by calculation in accordance with the material design standards or tested as required by 38.4.2.

38.4.2 Roof Assembly Testing.

38.4.2.1 Roof assemblies, other than those installed to meet prescriptive requirements in 38.4.3, shall be tested for wind resistance in accordance with one of the applicable tests in Table 38.4.2.1.

Table 38.4.2.1 Wind Resistance Test Standards by Roof Assembly Type

Roof Assembly Type	Wind Resistance Test Standard
Built-up roofing	FM 4470, UL 580, or UL 1897
Modified bitumen	FM 4470, UL 580, or UL 1897
Adhered sheet membranes	FM 4470, UL 580, or UL 1897
Through-fastened metal panel	ASTM E 1592, FM 4471, UL 580, or UL 1897
Metal shingle	ASTM E 1592, UL 580, or UL 1897
Standing seam metal	FM 4471, ASTM E 1592, UL 580, or UL 1897
Mechanically attached sheet membrane	FM 4470, UL 580, or UL 1897

38.4.2.2* The flashing assembly shall be tested and listed according to FM 4435, *Test Standard for Roof Perimeter Flashing*, or shall be designed and installed according to ANSI/SPRI ES-1, *Wind Design Guide for Edge Systems Used with Low Slope Roofing Systems.*

38.4.3 Prescriptive Wind Uplift Requirements.

38.4.3.1 Concrete and Clay Roof Tile. Concrete and clay roof tile shall be installed according to FRSA/NTRMA 07320/1, *Concrete and Clay Roof Tile Installation Manual.*

38.4.3.2* Loose-laid Ballasted Roofs. Loose-laid ballasted roofs shall be designed and installed according to ANSI /SPRI RP-4, *Wind Design Standard for Ballasted Singly-Ply Roofing Systems*, for roof slopes not exceeding 2 in./ft (50 mm/300 mm).

38.4.3.3 Asphalt Shingles. Installation of asphalt shingles shall be in accordance with the manufacturer's recommendations and the attachments used throughout the certification testing required by 38.4.3.3.1 through 38.4.3.3.3.

38.4.3.3.1 Fiberglass reinforced shingles shall be tested in accordance with ASTM D 3462, *Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.*

38.4.3.3.2 Organically reinforced asphalt shingles shall be tested in accordance with ASTM D 225, *Standard Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules.*

38.4.3.3.3 For roofs located where the basic wind speed required in Section 35.9 is 110 mph (49 m/s) or greater, asphalt composition shingles shall be tested in accordance with ASTM D 3161-99a, *Standard Test Method for Wind Resistance of Asphalt Shingles,* using the fan-induced method modified to 110 mph (49 m/s).

38.4.4 Gravel and Stone. Gravel or stone shall not be used on buildings greater than 60 ft (18 m) in height, or on any building located in a hurricane-prone region as defined in ASCE 7, *Minimum Design Loads for Buildings and Other Structures.*

38.5 Hail Resistance.

38.5.1 Hail Exposure Maps. The hail exposure map shown in Figure 38.5.1 shall be used to determine the hail exposure specified in 38.5.1.1 and 38.5.1.2.

38.5.1.1 Moderate Hail Areas. Areas subject to a minimum of one hail day with 1.5-in. (38-mm) hail or greater in a 20-year period shall be considered to have moderate hail exposure.

38.5.1.2 Severe Hail Areas. Areas subject to a minimum of one hail day with 2-in. (50-mm) hail or greater in a 20-year period shall be considered to have severe hail exposure.

38.5.2 Impact Resistance Testing for Hail. Roof assemblies shall be tested and classified for hail impact resistance as specified in 38.5.2.1 through 38.5.2.3.

38.5.2.1 Tests for Moderate Hail. All roof assemblies installed in locations classified as moderate hail exposure shall be tested and classified in accordance with one of the following:

(1) They shall be tested and classified as moderate hail (MH) or severe hail (SH) in accordance with FM 4470.
(2) They shall be tested and classified as Class 2, Class 3, or Class 4 in accordance with UL 2218, *Standard for Impact Resistance of Prepared Roof Covering Materials.*
(3) They shall be tested and listed as Class 2, Class 3, or Class 4 in accordance with FM 4473, *Test Standard for Specification Test Protocol for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls.*

38.5.2.2 Tests for Severe Hail. All roof assemblies installed in locations classified as severe hail exposure in accordance with one of the following:

(1) They shall be tested and classified as severe hail (SH) in accordance with FM 4470.
(2) They shall be tested and classified as Class 3 or Class 4 in accordance with UL 2218.
(3) They shall be tested and listed as Class 3 or Class 4 in accordance with FM 4473.

38.5.2.3 Ballasted Roof Coverings. Roof coverings that are ballasted with concrete roof pavers complying with ASTM C 1491, *Standard Specification for Concrete Roof Pavers*, for large stone ballast, or roof coverings that are covered with a minimum of 4 lb/ft^2 (19.5 kg/m^2) of gravel or slag embedded in a flood coat of hot asphalt or coal tar, shall be considered acceptable for moderate or severe hail exposure.

38.6 Sloped Roof Covering Underlayment Requirements. Roof coverings designed to be applied to roofs with a minimum slope of 3 in./ft (75 mm/300 mm) shall have underlayment installed according to 38.6.1 through 38.6.4.

38.6.1 Asphalt Shingles. Underlayment used beneath asphalt shingles shall meet the requirements of Type I of ASTM D 226, *Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing*, or ASTM D 4869, *Standard Specification for Asphalt Saturated Organic Felt Shingle Underlayment Used in Steep Slope Roofing.*

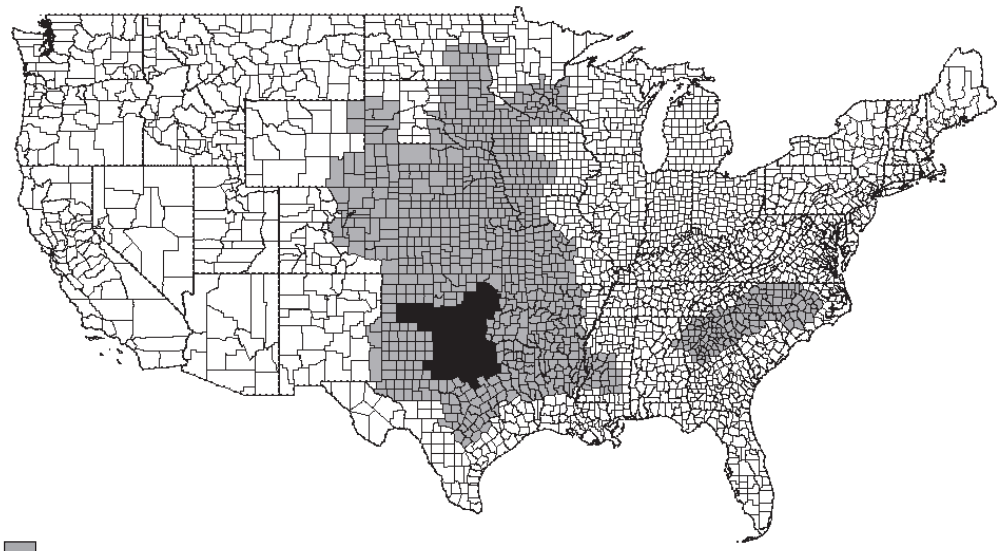


FIGURE 38.5.1 Hail Exposure Map.

38.6.2 Concrete Tiles. Underlayment used beneath concrete tiles shall meet the requirements of Type I or Type II of ASTM D 226.

38.6.3 Other Materials. Underlayments used beneath metal roofing applied to a supporting substrate, mineral-surfaced roll roofing, wood shakes, wood shingles, or slate shingles shall meet the requirements of Type I of ASTM D 226.

38.6.4* Ice Dam Protection. In regions where the average daily temperature in January is 30°F (−1°C) or less, a self-adhering, polymer modified bitumen sheet meeting the requirements of ASTM D 1970, *Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection*, shall be used as underlayment from the eave edge to a point at least 24 in. (610 mm) inward from the interior plane of the exterior wall.

38.7 Attic Ventilation. Attic ventilation shall comply with the following:

(1) Ventilation to the underside of the roof deck shall be provided at both a low point (soffit) and high point (ridge or gable end) of the roof.
(2) The total net area of ventilation shall be at least 1/150 of the roof area, projected on a horizontal plane, or shall be in accordance with the roof assembly manufacturer's installation instructions, whichever is greater.

38.8 Roof Flashing Requirements. Flashing and counterflashing shall be provided at all junctures of roofs and vertical surfaces, at valleys, and around all roof penetrations.

38.9 Roof Deck Requirements. Roof decks shall be solidly sheathed, except where the roof assembly is specifically designed for a different system.

38.10 Reroofing. Reroofing shall comply with 15.4.2.4.

38.11 Roof Drainage. The roof slope and drainage capacity shall be as required by this section.

38.11.1* Required Roof Slope. All roofs shall slope at least ¼ in./ft (6 mm/300 mm) toward drains or roof eaves, except for coal tar built-up roof coverings, which shall have a minimum slope of ⅛ in./ft (3 mm/300 mm).

38.11.2* Primary Roof Drainage Systems. The requirements of 38.11.2.1 through 38.11.2.4 shall apply to primary roof drainage systems.

38.11.2.1 A primary roof drainage system shall be provided.

38.11.2.2 The system shall be capable of removing rainwater from the roof at a rate at least equal to the rainfall rates (inches per hour) of a 100-year mean recurrence interval (MRI), 60-minute duration storm.

38.11.2.3 The design rainfall rate (inches per hour) shall be determined from the UPC, *Uniform Plumbing Code*, Appendix D.

38.11.2.4 Where controlled-flow drainage systems are acceptable to the authority having jurisdiction, a primary roof drainage system installed according to Section 1108 of the UPC shall be permitted with the requirements of 38.11.3 still applicable.

38.11.3* Secondary Roof Drainage Systems. The requirements of 38.11.3.1 through 38.11.3.5 shall apply to secondary roof drainage systems.

38.11.3.1 A secondary roof drainage system shall be provided.

38.11.3.2 The system shall be capable of removing rainwater from the roof at a rate that is at least equal to the rainfall rate (inches per hour) of a 100-year MRI, 15-minute duration storm, assuming blockage of the primary system.

38.11.3.3 The secondary drainage system shall be completely independent of the primary roof drainage system.

38.11.3.4 The roof design load shall include the weight of rainwater up to the height above the drainage inlet that is

required to achieve the secondary drainage design capacity, taking into consideration potential ponding resulting from roof deflection.

38.11.3.5 Where wall scuppers or interior drains are used for secondary drainage, the base of the secondary drainage inlets shall be a minimum of 2 in. (50 mm), and a maximum of 6 in. (150 mm), above the base of the primary drainage inlets.

38.11.4 Piping Systems, Gutters, and Wall Scuppers. All vertical and horizontal piping systems, gutters, and wall scuppers used for roof drainage shall be designed and constructed in accordance with Chapter 11 of the UPC, taking into consideration the sizes of all components and slope for horizontal piping and gutters.

38.12 Rooftop Structures.

38.12.1 General. The use of rooftop structures shall comply with 38.12.1.1 and 38.12.1.2.

38.12.1.1 Rooftop structures shall be limited to sheltering of mechanical equipment or openings in the roof.

38.12.1.2 Rooftop structures used for purposes other than as permitted by 38.12.1.1 shall conform to the requirements of this *Code* for an additional story.

38.12.2 Type I and Type II Buildings. Rooftop structures on buildings of Type I or Type II construction shall be not more than 28 ft (8.5 m) in height above the roof and, in all other cases, shall extend not more than 12 ft (3.7 m) above the roof.

38.12.3 Aggregate Area. The aggregate area of rooftop structures shall be not more than 33⅓ percent of the area of the supporting roof.

38.12.4 Construction. Rooftop structures shall be constructed as follows:

(1) The walls, floors, and roof shall be as required for the main part of the building.
(2) Fire protection shall be as required in Chapter 7.
(3) Where all walls of rooftop structures are set back more than 5 ft (1.5 m) from the building exterior walls, fire resistance ratings required by Section 7.2 and Section 7.3 for the building walls shall not be required for the roof structure.

38.12.5 Rooftop Signs. Rooftop signs shall be designed to withstand the combination of loads as required by Section 35.15 and constructed in accordance with the manufacturer's instructions.

38.13 Towers and Spires.

38.13.1 General. The requirements of 38.13.1.1 through 38.13.1.3 shall apply to towers and spires.

38.13.1.1 Towers and spires, where enclosed, shall have exterior walls as required for the building on which they are constructed.

38.13.1.2 The framework of unenclosed towers extending more than 75 ft (23 m) above grade shall be constructed of iron, steel, or reinforced concrete.

38.13.1.3 The roof covering of towers and spires shall be as required for the roof of the building.

38.13.2 Radio and Television Masts. Skeleton towers used as radio and television masts, and located on the roof of a building or structure, shall be constructed of noncombustible materials where over 25 ft (7.6 m) high and shall be supported on a noncombustible framework direct to the ground.

38.14 Light-transmitting Plastic Roof Panels, Sloped Glazing, and Skylights.

38.14.1 General. Light-transmitting plastic roof panels, sloped glazing, and skylights shall be permitted in roof construction, provided that all of the following requirements apply:

(1) Openings through the roof are not required to be protected.
(2) The panels are located a minimum of 25 ft (7.6 m) from fire walls.
(3) The panels are located a minimum of 6 ft (1.8 m) from exterior walls that are required to be fire barrier walls.

38.14.2 Structural Loads. Light-transmitting plastic roof panels, sloped glazing, and skylights shall resist dead, snow, and wind loads as required by Chapter 35 or 46.10.2 (glass only).

38.14.3 Light-Transmitting Plastics.

38.14.3.1 Light-transmitting plastics used as roof panels shall meet the requirements of Chapter 48.

38.14.3.2 Light-transmitting plastics used as glazing in skylights or as sloped glazing shall meet the requirements of Chapter 48.

38.14.4 Glass. Glass used in skylights or as sloped glazing shall meet the following:

(1) Requirements of Section 46.5 and Section 46.8
(2) In moderate and severe hail areas as defined in Section 38.5, impact test requirements of Section 38.5

38.15 Rooftop Heliports. Rooftop heliports shall be designed according to NFPA 418, *Standard for Heliports*, and the design loads of heliports shall be in accordance with 35.14.3.

Chapter 39 Flood-Resistant Design and Construction

39.1* General. Buildings and structures shall be designed and constructed to resist the effects of flood hazards and flood loads.

39.1.1 Applicability. The requirements of this chapter shall apply to the following:

(1) New construction of buildings and structures located wholly or partly within the flood hazard area established in 39.4.2
(2) Substantial improvements and restoration of substantial damage of existing buildings and structures located wholly or partly within the flood hazard area established in 39.4.2

39.1.2 Conflicts with Fire Safety Provisions. For areas below the design flood elevation, where conflicts arise between the flood-resistance provisions of this chapter and the fire safety provisions of Chapter 7, Chapter 8, and Chapter 55, the fire safety provisions shall govern.

39.2 Special Definitions.

39.2.1 Area.

39.2.1.1 Flood Hazard Area. The greater of either (1) the special flood hazard area shown on the flood insurance rate map,

or (2) the area subject to flooding during the design flood and shown on a jurisdiction's flood hazard map, or otherwise legally designated.

39.2.1.2 Special Flood Hazard Area. The land area subject to flooding by the base flood, and depicted on the flood insurance rate map or other flood hazard map as Zone A, Zone AE, Zone A1-30, Zone A99, Zone AO, Zone AR, Zone AH, Zone V, Zone VE, Zone V1-30, or Zone VO.

39.2.2 Basement (Flood Resistance). For all matters related to flood-resistant design and construction, the portion of a building having its floor below ground level on all sides.

39.2.3 Building.

39.2.3.1 Existing Building (Flood Resistance). For all matters related to flood-resistant design and construction, a building for which the *start of construction* commenced before the effective date of the jurisdiction's first floodplain management ordinance, code, or standard.

39.2.3.2 Historic Building (Flood Resistance). A building or structure which is (1) listed or preliminarily determined to be eligible for listing in the National Register of Historic Places, or (2) determined by the secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district, or (3) designated as historic under a state or local historic preservation program approved by the U.S. Department of Interior.

39.2.4 Development (Flood Resistance). Any man-made changes to improved or unimproved real estate, including but not limited to, buildings or other structures, temporary or permanent storage of materials, mining, dredging, filling, grading, paving, excavation, drilling, or other land-disturbing activities.

39.2.5 Dry Floodproofing. A combination of design modifications that result in a building or structure, including the attendant utility and sanitary facilities, being watertight, with walls substantially impermeable to the passage of water, and with structural components having the capacity to resist loads and load combinations associated with the design flood.

39.2.6 Flood. A general and temporary condition of partial or complete inundation of normally dry land by either (1) the overflow of inland or tidal waters, or (2) the rapid accumulation of surface waters from any source.

39.2.6.1 Base Flood. The flood having a 1 percent chance of being equaled or exceeded in any given year.

39.2.6.2 Design Flood. The greater of either (1) the base flood or (2) the flood so designated by the jurisdiction as its regulatory flood, with a 1 percent chance, or less, of being equaled or exceeded in any given year.

39.2.7 Flood Damage–Resistant Material. Any construction material capable of direct and prolonged contact with floodwaters, without sustaining any damage that requires more than cosmetic repairs.

39.2.8 Flood Elevation.

39.2.8.1 Base Flood Elevation (BFE). The elevation of the base flood, including wave height, relative to the datum specified on a jurisdiction's flood hazard map.

39.2.8.2 Design Flood Elevation (DFE). The elevation of the design flood, including wave height, relative to the datum specified on a jurisdiction's flood hazard map.

39.2.9 Flood Insurance Study. An official report provided to a jurisdiction by the Federal Emergency Management Agency, which accompanies the flood insurance rate map and flood boundary and floodway map, and provides the water surface elevation of the base flood, along with supporting technical data.

39.2.10 Flood Load. (See ASCE 7, *Minimum Design Loads for Buildings and Other Structures,* Section 5.0.)

39.2.11 Floodway. *(Also known as Regulatory Floodway).* The channel of a river, creek or other watercourse, and the adjacent land area, that must be reserved in order to pass the base flood discharge without cumulatively raising the water surface elevation more than a designated height.

39.2.12 Functionally Dependent Facility (Flood Resistance). For all matters related to flood-resistant design and construction, any facility that cannot be used for its intended purpose unless it is located or carried out in close proximity to water. *Functionally Dependent Facility* shall include docking or port facilities necessary for the loading or unloading of cargo or passengers, shipbuilding, or ship repair, but shall not include long-term storage, manufacture, sales, or service facilities.

39.2.13* Grade (Ground Level, Flood Resistance). For all matters related to flood-resistant design and construction, the elevation of the natural or graded ground surface, or fill, adjacent to the walls of a building or structure.

39.2.14 High Velocity Wave Action (Flood Resistance). Condition present during the base flood where wave heights are greater than or equal to 3 ft (0.9 m) or where wave run-up elevations exceed 3 ft (0.9 m) above grade. Areas subject to high velocity wave action are designated on the flood insurance rate map or flood hazard map as Zone V, Zone VE, Zone VO, or Zone V1-30.

39.2.15 Lowest Floor (Flood Resistance). For all matters related to flood-resistant design and construction, the floor of the lowest enclosed area of a building or structure. An unfinished or flood-resistant enclosure, used solely for vehicle parking, building access, or limited storage shall not be considered the lowest floor, provided the enclosed area is not constructed so as to render the building or structure in violation of the flood-related provisions of this chapter.

39.2.16 Manufactured Home (Flood Resistance). For all matters related to installation or erection in flood hazard areas: (1) a structure, transportable in one or more sections, built on a chassis and designed to be used as a dwelling with or without a permanent foundation, when connected to the required utilities, and constructed to the Federal Manufactured Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development; (2) a mobile home, park trailer, travel trailer, and similar transportable structure that is placed on a site for 180 consecutive days or longer.

39.2.17 Manufactured Home Park or Subdivision (Flood Resistance). A parcel, or contiguous parcels, of land divided into two or more manufactured home lots.

39.2.18 Map.

39.2.18.1 Flood Boundary and Floodway Map (FBFM). An official map of a jurisdiction, on which the Federal Emergency

Management Agency has delineated flood hazard zones and floodway boundaries for the jurisdiction.

39.2.18.2 Flood Hazard Boundary Map (FHBM). An official map of a jurisdiction, on which FEMA has delineated special flood hazard areas for the jurisdiction.

39.2.18.3 Flood Hazard Map. A map delineating the flood hazard area and adopted by a jurisdiction.

39.2.18.4 Flood Insurance Rate Map (FIRM). An official map of a jurisdiction, on which FEMA has delineated special flood hazard areas and risk premium zones applicable to the jurisdiction. The term *flood insurance rate map* shall include the flood boundary and floodway map, and the flood hazard boundary map.

39.2.19 Regulatory Floodway. See 39.2.11, Floodway.

39.2.20 Start of Construction (Flood Resistance). For all matters related to flood-resistant design and construction, the date of permit issuance for new construction or substantial improvements to an existing structure, provided the actual start of construction, repair, reconstruction, rehabilitation, addition placement, or other improvement is within 180 days after the date of issuance.

39.2.20.1* Actual Start of Construction (Flood Resistance). For all matters related to flood-resistant design and construction, the first placement of permanent construction of a building (including a manufactured home) on a site, such as the pouring of a slab or footings, installation of pilings, or construction of columns. Permanent construction does not include land preparation (such as clearing, excavation, grading or filling); or the installation of streets and walkways; or the excavation for a basement, footings, piers or foundations; or the erection of temporary forms; or the installation of accessory buildings such as garages or sheds not occupied as dwelling units and not part of the main building. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor or other structural part of the building, whether or not that alteration affects the exterior dimensions of the building.

39.2.21 Structure (Flood Resistance). For all matters related to flood-resistant design and construction, a walled and roofed building, a gas or liquid storage tank that is principally above ground, as well as a manufactured home.

39.2.22 Substantial Damage (Flood Resistance). For buildings and structures located wholly or partly within the flood hazard area, damage of any origin whereby the cost of restoring the building or structure to its pre-damage condition would equal or exceed 50 percent of the market value of the building or structure.

39.2.23 Substantial Improvement (Flood Resistance). For buildings and structures located wholly or partly within the flood hazard area: (1) any repair, addition, reconstruction, rehabilitation, or improvement of the building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the alteration is started; or (2) if a building or structure has sustained substantial damage, any repairs or reconstruction regardless of the actual work performed. *Substantial improvement* shall not include the following: (1) any project or improvement of a building or structure required to correct existing health, sanitary or safety code violations identified by the authority having jurisdiction, and that are the minimum necessary to assure safe living conditions; (2) any alteration of a historic building or structure, provided that the alteration will not preclude the continued designation as a historic building or structure.

39.2.24 Variance (Flood Resistance). A grant of relief from a provision or provisions of this *Code*, which permits construction in a manner that would otherwise be prohibited.

39.3 Design Flood.

39.3.1 Flood Frequency.

39.3.1.1 The design flood shall have a 1 percent chance or less of being equaled or exceeded in any given year.

39.3.1.2 The design flood shall be equivalent to, or more severe than, the base flood.

39.3.2* Design Flood Elevation (DFE).

39.3.2.1 The DFE shall be equivalent to the elevation of the design flood, including wave height, relative to the datum specified on a jurisdiction's flood hazard map or otherwise legally designated.

39.3.2.2 The DFE shall be equivalent to or higher than the base flood elevation (BFE).

39.3.2.3 Where BFE data have not been provided in accordance with 39.4.2, the authority having jurisdiction shall obtain and reasonably utilize available flood elevation and floodway data from federal, state, and other sources.

39.4 Flood Hazard Area.

39.4.1 Description.

39.4.1.1 The flood hazard area shall be the greater of either of the following:

(1) Special flood hazard area designated by FEMA on the jurisdiction's most recent flood insurance rate map (FIRM)
(2) Area subject to flooding during the design flood and shown on a jurisdiction's flood hazard map, or otherwise legally designated area

39.4.1.2 The flood hazard area shall be equivalent to, or larger than, the special flood hazard area.

39.4.2 Establishment of Flood Hazard Area. The flood hazard area shall be established by the jurisdiction through the adoption of a flood hazard map and supporting studies, including one of the following:

(1) Most recent flood insurance rate map (FIRM) and flood insurance study
(2) Most recent maps and studies adopted by the jurisdiction for a flood with less than a 1 percent chance of being equaled or exceeded in any given year

39.5 Performance During the Design Flood.

39.5.1 Goals and Objectives. Building performance during the design flood shall be in accordance with the goals and objectives stated in Section 4.1.

39.5.2 Design Loads. Buildings shall be designed to withstand the loads specified in Section 35.12 and the load combinations specified in Section 35.15.

39.5.3 Construction Methods and Practices. Construction methods and practices shall minimize flood damages during the design flood.

39.5.4 Structural Response. Buildings and structures shall resist flotation, collapse, and permanent lateral movement during the design flood.

39.5.5* Flood Damage–Resistant Materials. Buildings and structures within a flood hazard area shall be constructed with materials resistant to flood damage below the design flood elevation.

39.5.6 Systems Effectiveness. Building systems and equipment shall be designed or located, or both designed and located, so as to prevent flood waters from entering or accumulating within the components during design flood conditions.

39.6 Design and Construction Requirements.

39.6.1 General Requirements. Buildings and structures shall be designed and constructed in accordance with SEI/ASCE 24, *Flood Resistant Design and Construction*.

39.6.2 Multiple Flood Hazard Zones. For buildings that lie in more than one flood hazard zone as established by 39.4.2, the entire building shall be designed and constructed to meet the elevation, foundation, and other flood requirements associated with the most hazardous zone.

39.6.3 Design Professional Required. A registered design professional shall develop or review, or both develop and review, the structural design, specifications, and plans for the construction of new buildings and structures, and the substantial improvement of existing buildings and structures, under the following conditions:

(1) Where the building or structure is located, in whole or in part, in a flood hazard area subject to high velocity wave action
(2) Where a nonresidential or multiple occupancy building or structure is located, in whole or in part, in a flood hazard area not subject to high velocity wave action and is proposed to be dry-floodproofed

39.7 Lowest Floor Elevation. The lowest floor elevation shall be determined in accordance with one of the following:

(1) Buildings and structures shall have the lowest floor, including the basement, elevated to or above the design flood elevation, as required by 2.4 of SEI/ASCE 24.
(2) Nonresidential and multiple occupancy buildings and structures, as defined by 39.11.1.2(A) and 39.11.1.2(C), shall be permitted to have the lowest floor below the design flood elevation if the building is dry-floodproofed in accordance with 39.11.1.2(A).

39.7.1 Flood Hazard Areas Not Subject to High Velocity Wave Action. The elevation of the lowest floor shall be measured at the top of the floor.

39.7.2 Flood Hazard Areas Subject to High Velocity Wave Action. The elevation of the lowest floor shall be measured at the bottom of the lowest horizontal structural member supporting the lowest floor.

39.8 Foundations. Foundations shall be designed and constructed as required by 2.5 of SEI/ASCE 24.

39.8.1 Flood Hazard Areas Not Subject to High Velocity Wave Action. The use of structural fill, slabs-on-ground, foundation walls, piers, posts, columns and piles shall be permitted.

39.8.2 Flood Hazard Areas Subject to High Velocity Wave Action. The use of piers, posts, columns, and piles shall be permitted. The use of structural fill, slabs-on-ground, and foundation walls shall be prohibited.

39.9* Materials. Materials below the design flood elevation shall be flood damage resistant and shall comply with the requirements of Section 6 of SEI/ASCE 24.

39.10* Systems. Fire protection, electrical, mechanical, and plumbing systems and equipment, and related ductwork, shall be designed or located, or both, so as to prevent flood waters from entering or accumulating within the components during design flood conditions, as required by Section 8 of SEI/ASCE 24.

39.11 Enclosures Below the Design Flood Elevation.

39.11.1 Areas Not Subject to High Velocity Wave Action.

39.11.1.1* Flood Openings. Walls forming enclosed areas below the lowest floor shall be equipped with flood openings that allow the automatic entry and exit of floodwaters. The following types of flood openings shall be permitted:

(1) Flood openings complying with the requirements of 2.6.1.1 of SEI/ASCE 24, for which the certification of 39.12.3.1.1 shall not be required
(2) Flood openings complying with the requirements of 2.6.1.2 of SEI/ASCE 24, for which the certification of 39.12.3.1.1 shall be required

39.11.1.2* Floodproofing. Buildings and structures shall be permitted to be floodproofed in accordance with Section 7 of SEI/ASCE 24.

(A) For all matters related to flood-resistant design and construction, the following occupancies shall be considered nonresidential-type occupancies, and dry floodproofing of the occupancies meeting the certification requirements of 39.12.3.1.2 of this *Code* and 7.2 of SEI/ASCE 24 shall be permitted:

(1) Assembly
(2) Educational
(3) Day care
(4) Ambulatory health care
(5) Mercantile
(6) Business
(7) Industrial
(8) Storage

(B) For all matters related to flood resistant design and construction, the following occupancies shall be considered residential-type occupancies, and dry floodproofing of the occupancies shall be prohibited:

(1) Health care
(2) Detention and correctional
(3) One- and two-family dwellings
(4) Lodging or rooming houses
(5) Hotels and dormitories
(6) Apartments
(7) Residential board and care

(C) Multiple occupancy buildings or structures shall be permitted to be dry-floodproofed, provided that the following criteria are met:

(1) The occupancies in 39.11.1.2(B) are located above the design flood elevation.
(2) The requirements of 7.2 of SEI/ASCE 24 are met.
(3) The certification requirements of 39.12.3.1.2 are met.

39.11.2* Areas Subject to High Velocity Wave Action. The space below the lowest floor shall be free of obstructions. Areas below the lowest floor shall be permitted to be enclosed with nonsupporting breakaway walls; open wood lattice; or insect screening intended to collapse under wind and flood loads without causing collapse, displacement, or structural damage to the elevated portion of the building or supporting foundation system.

39.11.2.1* Breakaway Wall Design. Where walls and partitions located below the DFE in areas subject to high velocity wave action are required to break away, such walls and their connections to the structure shall be designed for the greatest of the following loads, acting perpendicular to the plane of the wall:

(1) Wind load specified in Section 35.9
(2) Seismic load specified in Section 35.10
(3) 10 psf (0.5 kN/m^2)

39.11.2.2 Breakable Walls Designed to Fail at 20 psf (1 kN/m^2). Breakaway walls that are designed to fail at loads greater than 20 psf (1 kN/m^2) shall not be used unless the design meets the conditions of certification specified in 39.12.3.2.2.

39.11.2.3 Utility Lines and Equipment. Utility lines and equipment shall not be attached to, pass through, or be included in breakaway construction.

39.12 Documentation.

39.12.1 Site Plan Requirements. Prior to the commencement of any development on a parcel containing flood hazard areas as established by 39.4.2, and in addition to the requirements of 1.7.6.3, the applicant shall submit the following for approval:

(1) For other than one- and two-family dwellings, if the proposed building or structure is located wholly or partly within the flood hazard area established by 39.4.2, the locations and quantities associated with any filling, excavation, and grading shall be shown.
(2) The flood hazard zones and boundaries, floodway boundaries, and design flood elevations shown on the flood hazard map adopted by the jurisdiction, or otherwise legally adopted by the jurisdiction, shall be submitted.
(3) If the proposed building or structure is located wholly or partly within the flood hazard area, the lowest floor elevation shall be shown, along with the natural and final ground elevations adjacent to the footprint of the building or structure.

39.12.2 Construction Documents. Construction documents for buildings and structures shall comply with 35.4.2.6.2.

39.12.3 Flood Hazard Certifications.

39.12.3.1 Flood Hazard Areas Not Subject to High Velocity Wave Action. The certifications specified in 39.12.3.1.1 through 39.12.3.1.3 shall be submitted to the authority having jurisdiction for new construction, substantial improvements, and restoration of substantial damage, and the authority having jurisdiction shall keep these as part of its permanent records.

39.12.3.1.1 Flood Opening Certification. For fully enclosed areas below the DFE not meeting the flood opening requirements of 2.6.1.1 of SEI/ASCE 24, a registered architect or licensed engineer shall prepare a certification that the flood openings will allow for the automatic entry and exit of floodwaters, will allow the equalization of hydrostatic forces, and will meet the requirements of 2.6.1.2 of SEI/ASCE 24.

39.12.3.1.2 Floodproofing Certification. For nonresidential or multiple occupancy structures dry-floodproofed below the DFE, a registered design professional shall, using the certificate specified by the authority having jurisdiction, certify that the design and methods of construction are in accordance with accepted standards of practice for meeting the dry-floodproofing provisions of 7.2 of SEI/ASCE 24. The elevation to which the structure is floodproofed shall be included on the certification. Elevations in the certification shall be referenced to the datum shown on the flood hazard map specified in 39.4.2.

39.12.3.1.3 Elevation Certification. An elevation certificate specified by the authority having jurisdiction shall be completed by a licensed or registered professional authorized by law to certify elevation information. The certificate shall include the lowest floor elevation, the lowest elevation of machinery and equipment servicing the building, adjacent grade elevations, and flood opening information. The certificate shall be submitted as required by 1.7.6.6.3.4(C) and 1.7.6.6.3.4(N)(5). Elevations shown on the certificate shall be referenced to the datum shown on the flood hazard map specified in 39.4.2.

39.12.3.2 Flood Hazard Areas Subject to High Velocity Wave Action. The certifications described in 39.12.3.2.1, 39.12.3.2.2, and 39.12.3.2.3 shall be submitted to the authority having jurisdiction for new construction, substantial improvements, and restoration of substantial damage.

39.12.3.2.1 Design Certification. A registered design professional shall certify the following:

(1) The design and methods of construction to be used are in accordance with accepted standards of practice.
(2) The bottom of the lowest horizontal structural member of the lowest floor (excluding the pilings or columns) is elevated to or above the DFE.
(3) The pile or column foundation and structure attached thereto are anchored to resist flotation, collapse, and permanent lateral movement due to the effects of the load combinations specified in Section 35.15.

39.12.3.2.2 Breakaway Wall Certification. For areas subject to high velocity wave action, breakaway walls below the DFE that are designed to fail at loads greater than 20 psf (1 kN/m^2), acting perpendicular to the wall, shall be certified to meet the following criteria by a registered design professional:

(1) The breakaway wall is designed to collapse from a flood load less than that which will occur during the base flood.
(2) The elevated portion of the structure and the supporting foundation system shall resist collapse, displacement, or other structural damage due to the effects of the load combinations specified in Section 35.15.

39.12.3.2.3 Elevation Certification. An elevation certificate specified by the authority having jurisdiction shall be completed by a licensed or registered professional authorized by law to certify elevation information. The certificate shall contain the lowest floor elevation, the lowest elevation of machinery and equipment servicing the building, adjacent grade elevations, and flood opening information. The certificate shall be submitted as required by 1.7.6.6.3.4(C) and 1.7.6.6.3.4(N)(5). Elevations shown on the certificate shall be referenced to the datum shown on the flood hazard map specified in 39.4.2.

39.13 Existing Structures.

39.13.1 For buildings and structures located wholly or partly within the flood hazard area established by 39.4.2, and undergoing substantial improvement or restoration of substantial damage, all aspects of the buildings and structures shall be brought into compliance with the requirements of this chapter for new construction and Chapter 15.

39.13.2 Historic Structures. Historic structures shall comply with 15.9.1.3.

39.14 Manufactured Housing.

39.14.1 Foundation. All new and replacement, manufactured homes located wholly or partly within the flood hazard area established by 39.4.2, including substantial improvements and restoration of substantial damage, shall be installed on a foundation that is designed and constructed in accordance with Section 39.8.

39.14.2 Elevation. All new, replacement, and substantially improved manufactured homes, located wholly or partly within the flood hazard area established by 39.4.2, shall be elevated such that the lowest floor of the manufactured home is at or above the design flood elevation.

39.14.3 Installation and Anchoring. All new, replacement, and substantially improved manufactured homes, located wholly or partly within the flood hazard area established by 39.4.2, shall be installed using methods that minimize flood damage and shall be securely anchored to a foundation satisfying the provisions of 39.14.1. These requirements shall be in addition to the manufacturer's specifications and applicable state and local anchoring requirements for resistance to wind loads.

39.15 Temporary Structures. Where temporary structures are proposed for flood hazard areas, the authority having jurisdiction shall consider the following issues before granting or conditioning the special permit required by 1.7.6.4.3:

(1) Flood warning time necessary to allow removal or relocation of the structure in the event of a flood
(2) Location of the proposed structure relative to any floodways, alluvial fan areas, or areas subject to high velocity wave action

Chapter 40 Quality Assurance During Construction

40.1 General.

40.1.1 Scope. The requirements in this chapter shall provide minimum standards for quality assurance of materials, fabrication, and construction of select components, assemblies, and systems for applicable structures that are designed by one or more registered design professionals.

40.1.2 Purpose. The purpose of the quality assurance requirements in this chapter shall be to provide greater confidence to the responsible registered design professionals (RDPs), the owner, and the authority having jurisdiction that materials, fabrication, and construction regulated by this chapter comply with the design, as delineated in the approved construction documents.

40.1.3 Extent of Quality Assurance.

40.1.3.1 For the purposes of this chapter, quality assurance shall be as defined in 40.2.4.

40.1.3.2 The responsible RDP shall determine the frequency and extent of the applicable tests, inspections, and observations required in this chapter.

40.1.4 Structures Requiring Quality Assurance. A quality assurance program shall be required for structures, components, assemblies, or systems that are required to be designed by a RDP. Unless otherwise required by the authority having jurisdiction, the following are not required to comply with the provisions of this chapter:

(1) Detached one- and two-family dwellings
(2) Buildings in Occupancy Category I of Table 35.3

40.1.4.1 Quality Assurance Programs in Seismic Design Categories C, D, E, and F. In addition to the requirements in this chapter, the quality assurance program for structures and components assigned to Seismic Design Category C, Seismic Design Category D, Seismic Design Category E, or Seismic Design Category F shall comply as a minimum with the provisions of ASCE 7, *Minimum Design Loads for Buildings and Other Structures*, Section A.9.3.

40.1.4.2 Quality Assurance Programs in High Wind Zones.

40.1.4.2.1 In addition to the requirements in this chapter, structures assigned to the following wind exposure categories shall comply with the quality assurance requirements of 40.1.4.2.2:

(1) Wind exposure category B, where the basic wind speed is 120 mph (54 m/s) or greater
(2) Wind exposure categories C and D, where the basic wind speed is 110 mph (49 m/s) or greater

40.1.4.2.2 The quality assurance plan shall, as a minimum, identify and address the following:

(1) Main wind force–resisting systems that are subject to quality assurance
(2) Type and frequency of testing and inspections that are required for each of the wind force–resisting systems
(3) Frequency and distribution of test and inspection reports
(4) Structural observations to be performed and frequency and distribution of structural observations reports

40.1.4.3 Structures, Components, Assemblies, and Systems not Requiring a Quality Assurance Program. A quality assurance program shall not be required for the following structures, components, assemblies, or systems:

(1) Individual spread concrete footings that are supported on earth or rock in buildings three stories or less in height
(2) Continuous concrete footings supporting walls that are supported on earth or rock in buildings three stories or less in height and meeting the requirements of both of the following:
    (a) The footings support walls of light frame construction.
    (b) The structural design is based on a f'_c not greater than 2500 psi (17.2 MN/m^2).
(3) Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.05 MN/m^2)
(4) Concrete or masonry foundation walls constructed in accordance with 36.6.2
(5) Concrete patios, driveways, and sidewalks on grade

40.1.5 Involvement of the Owner and Registered Design Professional. The owner shall directly or indirectly retain the responsible RDPs to prepare, initiate, and monitor a quality assurance program that reflects the requirements of this chapter.

40.1.5.1 As specified hereinafter, and as applicable, each RDP responsible for the design of components, assemblies, or systems governed by this chapter shall prepare, initiate, and monitor a quality assurance program for those parts for which the RDP has design responsibility, or for which the RDP develops criteria for design to be performed by others.

40.1.5.2 The responsible RDP shall recommend to the authority having jurisdiction agents to assist with the implementation of the quality assurance program. The owner or responsible RDP shall be permitted to designate an RDP to implement and monitor the quality assurance program prepared by the responsible RDP.

40.1.6 Responsibilities of the Contractor.

40.1.6.1 The contractor shall provide a quality control program for the construction regulated under this chapter.

40.1.6.2 Quality assurance and its implementation shall not relieve contractors of their responsibilities for quality control of the construction, for compliance with the project construction documents, or for any design for which the contractor is responsible.

40.1.6.3 Whenever owners reserve a quality control procedure in the construction documents for themselves, such a quality control procedure shall be made part of the required quality assurance program and shall be monitored by the responsible RDP.

40.1.7 Building Permit. The quality assurance programs, including the required tests, inspections, and observations, shall be submitted by the permit applicant as a condition for issuance of a building permit.

40.1.8 Reports. As fabrication and construction progress, inspection reports and records of tests and inspections shall be forwarded to the responsible RDP for review and approval.

40.1.8.1 The RDP shall maintain all test and inspection records and make them available to the authority having jurisdiction in the manner requested by the authority having jurisdiction. The RDP shall not be required to maintain any test or inspection records for more than one year after either the issuance of the applicable certificate of occupancy or the termination of the RDP's services, whichever occurs first.

40.1.8.2 The RDP shall note any unresolved construction deficiencies in writing to the authority having jurisdiction and the owner.

40.1.9 Remedial Action.

40.1.9.1 When deviations from design requirements that require remedial action are determined during tests, inspections, or observations, the deviations shall be promptly reported to the contractor and the responsible RDP.

40.1.9.2 If the contractor fails to have required corrective action performed, this lack of action shall be reported to the authority having jurisdiction and the owner.

40.1.10 Final Report. Prior to issuance of a certificate of occupancy, each responsible RDP shall submit to the authority having jurisdiction and to the owner a final report stating that the quality assurance program has been completed and identifying any deficiencies reported to the authority having jurisdiction that, to the best knowledge of the RDP, have not been rectified.

40.1.11 Performance Specifications.

40.1.11.1 The responsible RDP shall identify, in the quality assurance program submitted with the application for building permit, components, assemblies or systems that the RDP has specified to be designed by a responsible RDP under the control of the contractor, from a performance specification provided by the responsible RDP.

40.1.11.2 The responsible RDP shall review the design of the components, assemblies, or systems for conformance to the performance specification and shall include them in the quality assurance program.

40.2 Special Definitions.

40.2.1 Agent. A qualified company or individual assigned to execute the specific tests, inspections, or observations required by the quality assurance program.

40.2.2 Construction Documents (Quality Assurance). The plans, specifications, approved shop drawings, and all other documents that describe the design of a construction project for which a building permit has been issued by the authority having jurisdiction.

40.2.3 Fabricator. The entity performing off-site manufacture or assembly, or both, of construction components or systems.

40.2.4 Quality Assurance. The tests, inspections, and observations of construction to the extent that they provide evidence and documentation to the responsible registered design professional (RDP) and authority having jurisdiction that the work is being constructed in accordance with the registered design professional's design.

40.2.5 Quality Assurance Plan. A written procedure of the tests, inspections, and observations to be performed.

40.2.6 Quality Assurance Program. A predefined set of periodic observations, tests, and other procedures that provide an independent record to the owner, authority having jurisdiction, and RDP that the construction is in general conformance with the approved design documents.

40.2.7 Quality Control. The operational procedures provided by contractors to ensure compliance with construction documents.

40.2.8 Registered Design Professional (RDP). An individual who is registered or licensed to practice his/her respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

40.2.9 Sprayed Fire-Resistive Material. A cementitious or fibrous material that is spray-applied to structural elements, walls, floors, and roofs to provide fire-resistive protection.

40.3 Quality Assurance for Structural Components and Assemblies.

40.3.1 Scope.

40.3.1.1 The responsible RDP shall prepare a quality assurance plan for materials, fabrication, and construction that includes the structural tests, inspections, and observations required by Section 40.3.

40.3.1.2 The tests, inspections, and observations specified in 40.3.1.1 shall be performed in addition to those indicated in 1.7.6.6.

40.3.2 Structural Observations. The responsible RDP or an RDP designated by the responsible RDP shall conduct site visits at the necessary construction stages, as identified in the quality assurance plan, to verify that required structural tests and inspections are being performed and to make observations for general conformance with the RDP's design as delineated in the construction documents.

40.3.3 Structural Tests and Inspections. The quality assurance plan shall include a list of structural tests, inspections, and observations that are to be conducted during fabrication and installation in accordance with the provisions in this chapter.

40.3.3.1 The quality assurance plan shall include the following:

(1) Complete list of materials and work requiring structural tests and inspections
(2) Tests and inspections to be performed
(3) List of agents for the project
(4) Frequency and extent of tests and inspections

40.3.3.2 Tests and inspections shall include those indicated in Section 40.3, as well as Table 40.3.5.1 through Table 40.3.11, as applicable.

40.3.4 Inspection of Fabricators. Where fabrication of structural components or assemblies is being performed in an offsite facility, fabricators shall be inspected as specified in 40.3.4.1 and 40.3.4.2.

40.3.4.1 Prefabrication Inspection. The agent shall verify that fabricators designated for the project maintain quality control procedures that assure the fabricator's ability to conform to approved construction documents.

40.3.4.1.1 Prefabrication inspection shall be permitted to be waived by the responsible RDP if the designated fabricator maintains an agreement with an approved independent inspection or quality control agency that conducts periodic in-plant inspections at the fabricator's plant on a schedule that ensures the fabricator's ability to conform to approved construction documents.

40.3.4.1.2 The waiver permitted by 40.3.4.1.1 shall not eliminate the requirement for structural inspection during fabrication in accordance with 40.3.4.2.

40.3.4.2 Inspection During Fabrication.

40.3.4.2.1 During fabrication, the agent shall confirm that the fabricator is executing the quality control procedures and producing a product that conforms to approved construction documents.

40.3.4.2.2 Structural tests and inspections during fabrication shall be permitted to be reduced, at the option of the responsible RDP, if the fabricator meets the requirements of 40.3.4.1.1.

40.3.4.2.3 Prefabrication inspection shall be permitted to be waived by the authority having jurisdiction if the authority having jurisdiction has in place a program in which fabricators are registered with the jurisdiction and demonstrate compliance with quality control procedures.

40.3.5 In-situ Soils and Controlled Structural Fill.

40.3.5.1 Structural tests and inspection for bearing capacity of in-situ soils shall be as required in Table 40.3.5.1.

Table 40.3.5.1 In-situ Bearing Strata for Footings

Item	Scope (frequency determined by responsible RDP)
Bearing strata quality control review	Review contractor's field quality control procedures.
General excavation	Inspect strata for conformance to the structural drawings, specifications, geotechnical report, or combination thereof. Verify that excavation is to proper depth or material. Verify that excavation is controlled and contains no unsuitable materials.
Bearing surfaces of footings	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, geotechnical report, or combination thereof.

40.3.5.2 Structural tests and inspections for controlled structural fill designed to support the structure shall be as required in Table 40.3.5.2.

Table 40.3.5.2 Controlled Structural Fill (prepared fill)

Item	Scope (frequency determined by responsible RDP)
Controlled structural fill quality control review	Review contractor's field quality control procedures.
Fill material	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
Installation of controlled structural fill	Provide full-time inspection of the installation in accordance with the specifications.
Density of fill	Perform field density tests of the in-place fill in accordance with the specifications.

40.3.6 Foundations. Structural tests and inspection for foundation systems shall be as required in Table 40.3.6(a) and Table 40.3.6(b).

Table 40.3.6(a) Pile Foundations

Item	Scope (frequency determined by responsible RDP)
Pile foundations quality control review	Review contractor's quality control procedures.
Pile materials	Inspect documents identifying pile material and certifying grade of material for conformance to the construction documents and maintenance of that identification from the point of manufacture to the point of delivery to the site.
Pile installation	Perform full-time inspection of installation. Maintain accurate records for each pile. Review final location of each pile.
Precast concrete piles	Perform structural tests and inspections as specified in 40.3.8.
Cast-in-place concrete and reinforcing steel components of piles	Perform structural tests and inspections as specified in 40.3.7.
Specialty piles	Provide inspections and testing criteria for each type of specialty pile (to be provided by responsible RDP).

Table 40.3.6(b) Pier Foundations

Item	Scope (frequency determined by responsible RDP)
Pier foundation quality control review	Review contractor's quality control procedures. Review scope and frequency of testing and inspections.
Pier installation	Perform full-time inspection of installation. Maintain accurate records for each pier. Verify bearing strata for geotechnical requirements.
Cast-in-place concrete and reinforcing steel components of piers	Perform structural tests and inspections as specified in 40.3.7.

40.3.7 Cast-in-Place Concrete Construction. Structural tests and inspection for cast-in-place concrete construction, including post-tensioned concrete, shall be as required in Table 40.3.7 and ACI 318, *Building Code Requirements for Structural Concrete.*

Table 40.3.7 Cast-in-Place Concrete Construction

Item	Scope (frequency determined by responsible RDP)
Cast-in-place concrete construction quality control review	Review contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
Mix design	Review mix designs prior to placement. Verify use of required mix design.
Materials	Review material certifications for conformance to specifications.
Batching plant	Review plant quality control procedures and batching and mixing methods.
Reinforcement installation	Inspect reinforcing for ASTM type, grade, size, quantity, condition, and placement. Verify adequate cover per specifications.
Anchor rods	Inspect anchor rods prior to and during placement of concrete.
Post-tensioning operations	Inspect tensioning and anchorage of tendons. Inspect grouting of bonded tendons. Verify concrete strength prior to stressing of tendons and removal of shores and forms from beams and structural slabs.
Formwork	Inspect form sizes for proper sizes of concrete members. Verify concrete strength prior to removal of forms and shores from beams and structural slabs.
Concrete placement and sampling fresh concrete	Observe concrete placement operations. Verify conformance to specifications, including cold-weather and hot-weather placement procedures. When concrete is sampled to make strength test specimens, perform slump and air content tests and determine the temperature of the concrete.

(continues)

Table 40.3.7 *Continued*

Item	Scope (frequency determined by responsible RDP)
Evaluation of concrete strength	Test and evaluate in accordance with the specifications.
Curing and protection	Observe procedures for conformance to the specifications.
Welding reinforcing steel	Verify weldability of reinforcing steel other than ASTM A 706, *Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.*
Mechanical splices	Verify proper embedment, joint fit-up, and tightness of mechanical parts.
Shotcrete	Inspect shotcrete placement for proper application techniques.

40.3.8 Precast Concrete. Structural tests and inspection for precast concrete shall be as required in Table 40.3.8 and ACI 318.

Table 40.3.8 Precast Concrete Construction

Item	Scope (frequency determined by responsible RDP)
Precast concrete construction quality control review	Review contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
Plant certification/quality control procedures	Review plant quality control procedures. Inspect plant storage and handling procedures. Confirm that approved submittals are in the plant and are being used for fabrication. Review welder's certifications.
Materials	Review material certifications for conformance to specifications.
Formwork	Inspect form sizes.
Reinforcement installation	Inspect reinforcing and prestressing strands for size, quantity, condition, and placement for conformance with construction documents and responsible RDP-approved submittals. Inspect welding.

Table 40.3.8 *Continued*

Item	Scope (frequency determined by responsible RDP)
Mix design	Review mix designs prior to placement. Verify use of required mix design.
Concrete placement	Inspect concrete placement procedures.
Curing and protection	Inspect for maintenance of specified curing temperatures and techniques.
Evaluation of concrete strength	Test for conformance to specifications in accordance with approved submittal.
Prestress operation	Inspect application of prestressing forces. Inspect grouting of bonded, post-tensioned prestressing tendons.
Site erected precast elements	Inspect for compliance with responsible RDP-approved submittals and construction documents. Review site storage and handling procedures for consistency with design of precast elements. Verify that responsible RDP-approved erection drawings are on-site and are being used for erection. Verify that responsible RDP-specified erection procedures are being followed. Observe tensioning and grouting for all bonded post-tensioned tendons. Review welder's certifications. Monitor finished products for structural defects.
Connections/embedded items	Inspect interface connections, including end and edge doweling. Inspect embedments for proper location. Inspect shimming, bearing, bolting, and welding of connections.
Field correction of fabricated items	Review documentation of responsible RDP-approved repair, and verify completion of repairs.

40.3.9 Masonry Construction. Structural tests and inspection of masonry materials and construction shall be as required in ACI 530/ASCE 5/TMS 402, *Building Code Requirements for Masonry Structures.*

40.3.10 Steel Construction. Structural tests and inspection for steel materials, fabrication, and erection shall be as required by the following:

(1) Structural steel shall comply with Table 40.3.10(a).
(2) Cold-formed steel shall comply with Table 40.3.10(b).

Table 40.3.10(a) Steel Construction

Item	Scope(frequency determined by responsible RDP)
Steel construction quality control review	Review contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
Fabricator certification/quality control procedures	Review each fabricator's quality control procedures.
Fabricator inspection	Inspect in-plant fabrication, or review fabricator's approved independent inspection agency's reports.
Materials	Review materials certifications for conformance to the specifications.
Anchor rods	Review contractor's as-built survey. Verify that all anchor rods have been properly tightened and have adequate fit-up.
Bolting	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade.
Welding	Check welder qualifications. Visually inspect fillet welds and test full-penetration field welds in accordance with specifications.
Shear connectors	Inspect for size and placement. Test for proper weld attachment.
Structural framing, bracing, details, and assemblies	Inspect for size, grade of steel, camber, installation, and connection details. Check against approved construction documents and shop drawings.
Open web steel joists	Inspect for size, placement, bridging, bearing, and connection to structure. Visually inspect all welds of a minimum of 5 percent of the joists, randomly selected.
Expansion and adhesive anchors	Review installation procedures for both mechanical anchors and adhesive anchors. Verify that materials are suitable for job conditions.
Metal decking	Verify gauge width and type. Inspect placement, laps, welds, sidelap attachment, and screws or other mechanical fasteners. Check welder's qualifications.
Field correction of fabricated items	Review documentation of responsible RDP-approved repair, and verify completion of repairs.

Table 40.3.10(b) Light-Framed Cold-Formed Steel

Item	Scope (frequency determined by responsible RDP)
Light-framed cold-formed steel quality control review	Review contractor's field quality control procedures. Review scope of testing and inspections.
Fabricator's quality control procedures	Review fabricator's quality control procedures.
Material certification	Review for conformance to construction documents.
Fabrication inspection	Inspect in-plant fabrication or review fabricator's approved independent inspection agency's reports.
Shear walls, diaphragms, and holddowns	Inspect thickness and grade of wood structural panel, blocking, hold-down anchors, and the edge and field attachment of the structural wood panel to the framing for conformance to the responsible RDP-approved submittals and construction documents. Review panelized construction for proper wood structural panel overlaps.

(continues)

Table 40.3.10(b) *Continued*

Item	Scope (frequency determined by responsible RDP)
Installation	Verify that type, size, quantity, location, details, and connections of framing and bracing members conform to responsible RDP-approved submittals and the construction documents.
Welding	Check welders' qualifications. Verify that welding conforms to AWS specifications, responsible RDP-approved submittals, and the construction documents. Visually inspect welds.
Other fasteners	Verify fastener type and installation procedures. Verify that fasteners conform to responsible RDP-approved submittals and the construction documents. Verify that fasteners are installed tight.
Field correction of fabricated items	Review documentation of responsible RDP-approved repair, and verify completion of repairs.

40.3.11 Wood Construction. Structural tests and inspection for wood framing and engineered wood components or assemblies, including fastening and other connection methods, shall be as required in Table 40.3.11.

Table 40.3.11 Wood Construction

Item	Scope (frequency determined by responsible RDP)
Wood construction quality control review	Review contractor's quality control procedures. Review scope and frequency of testing and inspections.
Fabricator certification/quality control procedures for prefabricated wood components	Review fabricator's quality control procedures.
Material grading	Inspect lumber for conformance to the construction documents. Check moisture content, as applicable.
Framing, details, and connections	Inspect members for size, placement, and connection details. Inspect blocking between floors and at posts. Verify proper connection hardware and its installation. Inspect bearing, nailing, and completed connections for conformance to the responsible RDP-approved submittals and construction documents.
Shear walls, diaphragms, and holddowns	Inspect thickness and grade of wood structural panel, blocking, hold-down anchors, and the edge and field nailing of the wood structural panel to the framing for conformance to the responsible RDP-approved submittals and construction documents. Review panelized construction for proper wood structural panel overlaps.
Wood trusses	Inspect size and location of nail plates, split rings, bolts, or other connection devices for conformance to responsible RDP-approved submittals and the construction documents. Verify that nails, bolts, hold-down anchors or clips, or other devices are tight and otherwise properly installed. Verify that permanent web bracing, including X-bracing, has been installed.
Laminated lumber	Inspect grade, nailing, end bearing, and end attachment for conformance to responsible RDP-approved submittals and the construction documents.
Anchor bolts	Verify that anchor bolts have been placed as indicated on the plans.

40.3.12 Special Cases. A quality assurance program shall be prepared by the responsible RDP for permitted work that is, in the opinion of the RDP, unusual in nature, such as the following:

(1) Application of structural materials, components, assemblies, or systems that are alternatives to those recognized by this *Code* or its applicable reference standards
(2) Construction or installation of structural materials, components, assemblies, or systems required to be installed in accordance with manufacturers' instructions that prescribe requirements not recognized by this *Code* or its applicable reference standards

40.4 Quality Assurance for Wall Finish Systems.

40.4.1 Scope.

40.4.1.1 A quality assurance program for wall finish systems shall be prepared by the responsible RDP.

40.4.1.2 Tests and inspection for curtain walls, wall panels, and veneers shall be as required in Table 40.4.1.2.

Table 40.4.1.2 Exterior Wall Panels and Veneers

Item	Scope (frequency determined by responsible RDP)
Curtain wall quality control review	Review contractor's quality control procedures. Review scope and frequency of testing and inspections.
Precast concrete panels	Perform applicable structural tests and inspections as specified in 40.3.8.
Light-framed cold-formed steel framing for panels	Perform applicable structural tests and inspections as specified in 40.3.10(2).
Proprietary lightweight curtain wall systems	Review manufacturer's fabrication methods and quality control procedures. Review material certification and inspect fabrication of structural framing, details, connections, and fasteners for conformance to responsible RDP-approved submittals and the construction documents.
Masonry veneers	Perform applicable structural tests and inspections as specified in 40.3.9. Verify that shelf angles, ties to the backup structure, and other structural supports are installed in conformance with the construction documents and responsible RDP-approved submittals.
Field correction of fabricated items	Review documentation of responsible RDP-approved repair, and verify completion of repairs.

40.4.2 Exterior Insulation and Finish Systems (EIFS). Inspection of the installation of EIFS systems shall be performed in accordance with EIMA 99A, *Exterior Insulation and Finish Systems (EIFS).*

40.5 Quality Assurance for Sprayed Fire-Resistive Materials.

40.5.1 Scope.

40.5.1.1 A quality assurance program for sprayed fire-resistive materials shall be prepared by the responsible RDP.

40.5.1.2 Tests and inspections shall be as required in Table 40.5.1.2 and ASTM E 605, *Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members,* and ASTM E 736, *Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.*

Table 40.5.1.2 Sprayed Fire-Resistive Materials

Item	Scope (frequency determined by responsible RDP)
Sprayed fire-resistive materials quality control review	Review contractor's quality control procedures. Review scope and frequency of testing and inspections.
Materials	Review material certifications for conformance to specifications.
Installation	Review surfaces to receive sprayed fire-resistive materials, temperature at application, equipment, and application procedures. Verify installation procedure with manufacturer's written instructions.

40.5.2 Density.

40.5.2.1 The density of the sprayed fire-resistive materials shall not be less than the density specified in the approved fire resistance–rated designs.

40.5.2.2 Density of the sprayed fire-resistive materials shall be determined in accordance with ASTM E 605.

40.5.3 Bond Strength.

40.5.3.1 The cohesive/adhesive bond strength of the cured sprayed fire-resistive materials applied to structural elements shall not be less than 150 psf (7.18 kN/m^2).

40.5.3.2 The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E 736, by testing in-place samples of the sprayed fire-resistive material selected as specified in 40.5.3.2.1 and 40.5.3.2.2.

40.5.3.2.1 The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistive materials shall be selected from each floor, roof, and wall assembly at the rate of not less than one sample for every 10,000 ft^2(930 m^2), or part thereof, of the sprayed area in each story.

40.5.3.2.2 The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistive materials shall be selected from beams, girders, joists, trusses, and columns at the rate of not less than one sample for each type of structural element for each 10,000 ft^2 (930 m^2) of floor area, or part thereof, in each story.

40.6 Quality Assurance for Smoke Control Systems.

40.6.1 Scope. A quality assurance program for the installation and operation of smoke control systems shall be prepared by the responsible RDP.

40.6.1.1 Special tests and inspection of smoke control systems shall include testing during erection and prior to concealment of ductwork for the purposes of identifying leakage and recording the actuating device location.

40.6.1.2 Prior to occupancy and after substantial completion, pressure difference testing, flow measurements, and detection and control verification shall be performed.

40.6.2 Qualifications. Testing and inspection agents for smoke control systems shall have expertise in fire protection engineering and mechanical engineering and shall be certified as air balancers.

40.7 Quality Assurance for Stairs and Railings.

40.7.1 A quality assurance program for the fabrication and installation of stairs, handrails, and guardrails shall be prepared by the responsible RDP.

40.7.2 Anchorage of stair and railing assemblies to structural supports shall be inspected for compliance with construction documents.

40.8 Quality Assurance for Nonstructural Components and Systems. Quality assurance programs shall be prepared by each responsible RDP for seismic load-resisting connections; supports; and anchorages of specific nonstructural components, assemblies, and equipment as required in accordance with ASCE 7, Section A.9.3.

40.9 Quality Assurance for Penetrations and Joints. A quality assurance program for the installation of firestop systems and devices and systems installed to protect joints shall be prepared and monitored by the responsible RDP.

Chapter 41 Concrete

41.1 Scope.

41.1.1 The provisions of Section 41.2 through Section 41.7 shall apply to the design and construction of concrete elements.

41.1.2 The provisions of Section 41.8 shall apply to the design and construction of cast-in-place reinforced gypsum concrete.

41.2 General. The design and construction of cast-in-place or precast structural elements of plain or reinforced concrete, including prestressed concrete, shall comply with ACI 318, *Building Code Requirements for Structural Concrete*, unless modified by other provisions of this chapter and the following:

(1) Basement, foundation, and above-grade walls of one- and two-family dwellings using insulating concrete forms (ICF) shall be permitted to be designed and constructed in accordance with the provisions of PCA EB118, *Prescriptive Method for Insulating Concrete Forms in Residential Construction*, provided that the building meets the limitations of Table 1.1 of that document.

(2) Basement, foundation, and above-grade walls of one- and two-family dwellings using conventional forms with flat surfaces shall be permitted to be designed and constructed in accordance with the provisions of PCA EB118 for flat ICF walls, provided that the building meets the limitations of Table 1.1 of that document.

41.2.1 Slabs-on-Ground.

41.2.1.1 The design and construction of slabs-on-ground that transmit vertical loads or lateral forces from other parts of the structure to the soil shall comply with ACI 318 and Section 41.6.

41.2.1.2 Slabs-on-ground that do not transmit vertical loads or lateral forces from other parts of the structure to the soil shall comply with Section 41.6.

41.2.2 Concrete on Steel Form Decks. The design and construction of concrete slabs cast on stay-in-place steel form decks shall comply with 41.2.2.

41.2.2.1 Noncomposite Steel Form Decks. The design and construction of concrete slabs cast on stay-in-place, noncomposite steel form decks shall comply with ACI 318.

41.2.2.2 Composite Steel Form Decks.

41.2.2.2.1 The design and construction of concrete slabs cast on stay-in-place, composite steel form decks shall comply with ASCE 3, *Standard for the Structural Design of Composite Slabs*.

41.2.2.2.2 Concrete used in the construction of slabs described in 41.2.2.2.1 shall comply with the applicable portions of Chapter 1 through Chapter 7 of ACI 318.

41.2.3 Concrete Piles, Piers, and Caissons.

41.2.3.1 The design and construction of portions of concrete piles, piers, and caissons that are laterally supported by soil shall comply with Chapter 36.

41.2.3.2 Portions of concrete piles, piers, and caissons in soil not capable of providing lateral support, or in air or water, shall comply with ACI 318.

41.2.3.3 Concrete piles, piers, and caissons supporting structures assigned to Seismic Design Category D, Seismic Design Category E, or Seismic Design Category F shall comply with Section 21.10.4 of ACI 318 if not in conflict with the requirements of Chapter 36 of this *Code* and Section A.9.7 of ASCE 7, *Minimum Design Loads for Buildings and Other Structures*.

41.3 Construction Documents. Information designated in Section 1.2.1 of ACI 318 shall be shown on construction documents.

41.4 Quality Assurance. The quality assurance of concrete construction shall be provided in accordance with 40.3.7 and 40.3.8.

41.5 Seismic Requirements. In addition to the requirements of this chapter, the design and construction of concrete elements that resist seismic forces shall comply with the requirements of Section A.9.9 of ASCE 7.

41.6 Slabs-on-Ground. The provisions of this section shall apply to all concrete slabs-on-ground.

41.6.1 Durability. Concrete used in slabs-on-ground shall comply with the durability requirements of Chapter 4 of ACI 318.

41.6.2 Minimum Thickness. The minimum thickness of slabs-on-ground shall be 3½ in. (90 mm).

41.6.3 Vapor Retarder.

41.6.3.1 A vapor retarder having a perm rating not exceeding 0.5 or a 6-mil (0.15-mm) thickness of polyethylene shall be placed between the top of the subgrade or base material and the bottom of the slab.

41.6.3.2 Joints in the vapor retarder shall be lapped a minimum of 6 in. (150 mm).

41.6.3.3 A vapor retarder shall not be required to be provided under the following conditions:

(1) Where local site conditions have been approved
(2) Where the slab is not enclosed within a building and will not be enclosed at a later date
(3) In occupancies where migration of moisture through the slab is not detrimental to the intended use of the building
(4) In unheated, detached buildings accessory to one- and two-family dwellings
(5) In unheated storage rooms of less than 70 ft^2 (6.5 m^2) in one- and two-family dwellings

41.7 Shotcrete.

41.7.1 General. Shotcrete shall be defined as concrete or mortar thrust pneumatically at high velocity onto a surface. Shotcrete shall comply with the provisions of this chapter for reinforced and plain concrete construction, except as specified in Section 41.7.

41.7.2 Specifications. Specifications for shotcrete shall comply with ACI 506.2, *Specification for Materials, Proportioning, and Application of Shotcrete.*

41.8 Reinforced Gypsum Concrete.

41.8.1 Criteria.

41.8.1.1 Materials used in reinforced gypsum concrete shall comply with ASTM C 317, *Standard Specification for Gypsum Concrete.*

41.8.1.2 The design and installation of cast-in-place reinforced gypsum concrete shall be in accordance with ASTM C 956, *Standard Specification for Installation of Cast-in-Place Reinforced Gypsum Concrete.*

41.8.1.3 Precast gypsum concrete shall be used only where approved.

41.8.2 Limitations of Use.

41.8.2.1 Cast-in-place reinforced gypsum concrete shall be constructed with nonabsorptive formboard or surfacing where used for either of the following:

(1) For occupancies producing unusually high humidities
(2) For ceilings of structures not completely enclosed

41.8.2.2 Concentrated loads, such as from water tanks, fan bases, cooling towers, flagpoles, and signs, shall be transmitted directly to the primary roof framing members, walls, or footings.

41.8.3 Testing.

41.8.3.1 Testing of gypsum concrete shall be in accordance with the criteria set forth in ASTM C 472, *Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.*

41.8.3.2 One test of each day's pour of cast-in-place gypsum concrete shall be made, and the results thereof shall be presented to the authority having jurisdiction.

Chapter 42 Aluminum

42.1 General. Aluminum construction shall be designed and constructed in accordance with approved standards.

Chapter 43 Masonry

43.1 Scope. The provisions of this chapter shall apply to the design and construction of masonry elements, whether unreinforced or reinforced, used in buildings and other structures.

43.2 General. The design and construction of structural elements of unreinforced or reinforced masonry shall comply with ACI 530/ASCE 5/TMS 402, *Building Code Requirements for Masonry Structures*, except as modified by other provisions of this chapter.

43.3 Design. Masonry structures and their component members shall be designed in accordance with the provisions of Chapter 1 of ACI 530/ASCE 5/TMS 402 and one of the following chapters from ACI 530/ASCE 5/TMS 402:

(1) Allowable Stress Design—Chapter 2
(2) Strength Design of Masonry—Chapter 3
(3) Prestressed Masonry—Chapter 4
(4) Empirical Design of Masonry—Chapter 5
(5) Veneer—Chapter 6
(6) Glass Unit Masonry—Chapter 7

43.4 Construction Documents. Information designated in Section 1.2 of ACI 530/ASCE 5/TMS 402 shall be shown on construction documents.

43.5 Quality Assurance. The quality assurance of masonry construction shall be provided in accordance with 40.3.9.

43.6 Masonry Construction Materials. Material for masonry construction shall be according to Part 2 of ACI 530.1/ASCE 6/TMS 602, *Specification for Masonry Structures.*

43.6.1 Second-Hand Units.

43.6.1.1 Second-hand masonry units shall not be reused unless the units conform to the requirements for new units.

43.6.1.2 The units shall be free from cracks and other defects that will interfere with laying or use.

43.6.1.3 Old mortar shall be cleaned from the unit before reuse.

43.6.2 Surface-Bonding Mortar.

43.6.2.1 Surface-bonding mortar shall comply with ASTM C 887, *Standard Specification for Packaged, Dry, Combined Materials for Surface Bonding Mortar.*

43.6.2.2 Surface bonding of concrete masonry units shall comply with ASTM C 946, *Standard Practice for Construction of Dry-Stacked, Surface-Bonded Walls.*

43.7 Masonry Construction. Masonry construction shall comply with the requirements of 43.7.1 through 43.7.4 and ACI 530.1/ASCE 6/TMS 602.

43.7.1 Open-end units with beveled ends shall be fully grouted.

43.7.2 Head joints of open-end units with beveled ends shall not be required to be mortared.

43.7.3 The beveled ends of open-end units shall form a grout key that allows grouts within ⅝ in. (15.9 mm) of the face of the unit.

43.7.4 Open-end units shall be placed to prevent leakage of the grout.

43.8 Seismic Requirements.

43.8.1 General. In addition to the requirements of this chapter, the design and construction of masonry elements shall comply with the requirements of Section 1.13 of ACI 530/ASCE 5/TMS 402.

43.8.2 One- and Two-Family Dwellings. In detached one- and two-family dwellings of light-frame construction and of two stories or less, masonry veneer shall comply with the requirements of ACI 530/ASCE 5/TMS 402, except that the isolation requirements of ACI 530/ASCE 5/TMS 402, Section 6.2.2.10.1.2, and the independent support requirements for each story specified in ACI 530/ASCE 5/TMS 402, Section 6.2.2.10.2.2, shall not apply in Seismic Design Category D.

43.9 Masonry and Concrete Fireplaces and Chimneys. Masonry and concrete fireplaces and chimneys shall comply with the requirements of NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.* Chimney and fireplace construction shall be in accordance with 32.11.

Chapter 44 Steel

44.1 General. The provisions of this chapter shall govern the quality, design, fabrication, and erection of steel used structurally in buildings or structures.

44.1.1 Special Definitions.

44.1.1.1 Adjusted Shear Resistance. The unadjusted shear resistance multiplied by the shear resistance adjustment factors.

44.1.1.2 Type I (Segmented) Shear Wall. A wall designed to resist inplane lateral forces that is fully sheathed and that is provided with hold-down anchors at each end of the wall segment.

44.1.1.3* Type II (Perforated) Shear Wall. A wall designed to resist inplane lateral forces that is sheathed with wood structural panel or sheet steel that contains openings, but that has not been specifically designed and detailed for force transfer around wall openings.

44.1.1.4* Type II Shear Wall Segment. A section of shear wall with full-height sheathing and that meets the required aspect ratio limits.

44.1.2 Identification of Steel for Structures.

44.1.2.1 Steel furnished for structural load-carrying purposes shall be identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter.

44.1.2.2 Steel that is not identifiable as to grade shall be tested to determine conformity to the standards or specifications discussed in 44.1.2.1.

44.2 Structural Steel Construction.

44.2.1 General.

44.2.1.1 The design, fabrication, and erection of structural steel for buildings and structures shall be in accordance with either the AISC LRFD, *Load and Resistance Factor Design for Structural Steel Buildings,* or AISC ASD, *Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design.*

44.2.1.2 Web openings in structural steel beams shall be permitted to be designed in accordance with ASCE 23, *Specification for Structural Steel Beams with Web Openings.*

44.2.2 Seismic Design Categories A, B, and C.

44.2.2.1 Structural steel buildings assigned to Seismic Design Category A, Seismic Design Category B, and Seismic Design Category C shall be of any construction permitted in AISC ASD or AISC LRFD.

44.2.2.2 An *R* factor as set forth in ASCE 7, *Minimum Design Loads for Buildings and Other Structures,* Table 9.5.2.2, for the appropriate steel system shall be permitted when the structure is designed and detailed in accordance with the provisions of AISC Seismic, *Seismic Provisions for Structural Steel Buildings,* Part I.

44.2.2.3 Systems not detailed in accordance with 44.2.2.1 and 44.2.2.2 shall use the *R* factor in ASCE 7, Table 9.5.2.2, designated for "structural steel systems not specifically detailed for seismic resistance."

44.2.3 Seismic Design Categories D, E, and F. Structural steel buildings assigned to Seismic Design Category D, Seismic Design Category E, and Seismic Design Category F shall be designed and detailed in accordance with AISC Seismic, Part I.

44.2.4 Seismic Requirements for Composite Construction.

44.2.4.1 The design, construction, and quality of composite steel and concrete components that resist seismic forces shall conform to the requirements of the AISC LRFD or ACI 318, *Building Code Requirements for Structural Concrete.*

44.2.4.2 An *R* factor as set forth in ASCE 7, Table 9.5.2.2, for the appropriate composite steel and concrete system shall be permitted when the structure is designed and detailed in accordance with the provisions of AISC Seismic, Part II.

44.2.4.3 In Seismic Design Category B through Seismic Design Category F, the design of the systems shall conform to the requirements of AISC Seismic, Part II.

44.2.4.4 Composite structures shall be permitted in Seismic Design Category D through Seismic Design Category F, subject to the limitations in ASCE 7, Table 9.5.2.2, when evidence approved by the authority having jurisdiction is provided to demonstrate that the proposed system will perform as intended by AISC Seismic, Part II.

44.2.4.5 Where composite elements or connections are required to sustain inelastic deformations, the evidence approved by the authority having jurisdiction shall be based on cyclic testing.

44.3 Steel Joists.

44.3.1 The design, manufacture, and use of open web steel joists and joist girders shall be in accordance with one of the following Steel Joist Institute (SJI) specifications:

(1) *Standard Specifications for Open Web Steel Joists, K Series*
(2) *Standard Specifications for Longspan Steel Joists, LH Series and Deep Longspan Steel Joists, DLH Series*
(3) *Standard Specifications for Joist Girders*

44.3.2 Where required, the seismic design of steel buildings in which joists are used shall be in accordance with the additional provisions of 44.2.2 or 44.2.3.

44.4 Steel Cable Structures.

44.4.1 General. The design, fabrication, and erection of steel cables for buildings, including related connections and protective coatings, shall be in accordance with ASCE 19, *Structural Applications of Steel Cables for Buildings.*

44.4.2 Seismic Requirements for Steel Cable. The design strength of steel cables shall be determined by the provisions of ASCE 19, except as modified by the following provisions:

(1) A load factor of 1.1 shall be applied to the prestress force included in T_3 and T_4, as defined in Section 3.1.2 of ASCE 19.
(2) In Section 3.2.1 of ASCE 19, item (c) shall be replaced with "1.5 T_3" and item (d) shall be replaced with "1.5 T_4".

44.5 Steel Storage Racks.

44.5.1 The design, testing, and utilization of industrial steel storage racks shall be in accordance with RMI's *Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks,* the scope of which includes industrial pallet racks, movable shelf racks, and stacker racks.

44.5.2 The RMI specification referenced in 44.5.1 shall not apply to other types of racks, such as drive-in and drive-through racks, cantilever racks, portable racks, or rack buildings.

44.5.3 When required, the seismic design of storage racks shall also be in accordance with Section 9 of ASCE 7.

44.6 Cold-Formed Steel.

44.6.1 Design.

44.6.1.1 The design of cold-formed carbon and low alloy steel structural members shall be in accordance with AISI-NASPEC, *North American Specification for the Design of Cold-Formed Steel Structural Members.*

44.6.1.2 The design of cold-formed stainless steel structural members shall be in accordance with ASCE 8, *Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members.*

44.6.2 Composite Slabs on Steel Decks. Composite slabs of concrete on steel decks shall be designed and constructed in accordance with ASCE 3, *Standard for the Structural Design of Composite Slabs,* or other approved standards.

44.7 Cold-Formed Steel Framing.

44.7.1 General. The design, installation, and construction of cold-formed steel for structural and nonstructural framing shall be in accordance with AISI-CFSD, *Standard for Cold-Formed Steel Framing—General Provisions.*

44.7.2 Trusses. The design, quality assurance, installation, and testing of cold-formed steel trusses shall be in accordance with AISI-Truss, *Standard for Cold-Formed Steel Framing—Trusses,* subject to the limitations therein.

44.7.3 Headers. The design and installation of the following shall be permitted to be in accordance with AISI-Header, *Standard for Cold-Formed Steel Framing—Header Design,* subject to the limitations therein:

(1) Cold-formed steel box and back-to-back headers
(2) Double L-headers used in single-span conditions for load-carrying purposes

44.7.4 Prescriptive Framing. One- and two-story single family dwellings and townhouses shall be permitted to be constructed in accordance with AISI-Prescriptive, *Standard for Cold-Formed Steel Framing—Prescriptive Method for One and Two Family Dwellings,* subject to the limitations in Tables A1.1-1 and A1.1-2 therein.

44.8 Cold-Formed Steel Framing Shear Walls. Cold-formed steel framing shear walls shall meet the following criteria:

(1) In addition to the requirements of 44.7.1, the design of shear walls of light-framed cold-formed steel construction, for the purpose of resisting wind and seismic loads, shall be in accordance with the requirements of 44.8.1 for Type I (segmented) shear walls or 44.8.2 for Type II (perforated) shear walls.
(2) In Seismic Design Category D, Seismic Design Category E, and Seismic Design Category F, Type I and Type II shear walls also shall comply with 44.8.3.

44.8.1 Type I (Segmented) Shear Walls. Requirements for Type I (segmented) shear walls shall be as follows:

(1) The nominal shear value for Type I shear walls, as shown in Table 44.8.1(a) for wind loads, Table 44.8.1(b) for wind and seismic loads, or Table 44.8.1(c) for seismic loads, shall be permitted to establish allowable shear values or design shear values.
(2) The allowable shear value (ASD) or design shear value (LRFD) shall be determined using the factor of safety (Ω) or the resistance factor (Φ) set forth in 44.8.1.1.
(3) Boundary members, chords, collectors, and connections thereto shall be proportioned to transmit the induced forces.
(4) As an alternative to the values in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c), shear values shall be permitted to be calculated by the principles of mechanics by using approved fastener values and shear values appropriate for the sheathing material attached.
(5) Type I shear walls sheathed with wood structural or sheet steel panels shall be permitted to have window openings between hold-down anchors at each end of a wall segment, where details are provided to account for force transfer around openings.
(6) The aspect ratio limitations of 44.8.1.2(5) shall apply to the entire Type I segment and to each wall pier at the side of each opening.

(7) The height of the wall pier shall be defined as the clear height of the pier at the side of an opening.
(8) The width of a pier shall be defined as the sheathed width of the pier.
(9) The width of wall piers shall be not less than 24 in. (610 mm).
(10) Openings shall be permitted in Type I walls where detailing is provided for force transfer around the openings.

44.8.1.1 Design Shear Value Determination.

44.8.1.1.1 Where allowable stress design is used, the allowable shear value shall be determined by dividing the nominal shear value, shown in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c), by a factor of safety (Ω) of 2.5.

44.8.1.1.2 Where load and resistance factor design is used, the design shear value shall be determined by multiplying the nominal shear value, shown in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c), by a resistance factor (Φ) of 0.55.

44.8.1.2 Limitations for Systems in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c). The lateral-resistant systems listed in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c) shall conform to the following requirements:

(1) Studs shall be a minimum of 1⅝ in. × 3½ in. (41 mm × 89 mm) with a ⅜-in. (9.5-mm) return lip, and, as a minimum, studs shall be doubled (back to back) at shear wall ends.

Table 44.8.1(a) Nominal Shear Values for Wind Forces for Shear Walls Framed with Cold-Formed Steel Studs (lb/ft)[a,b]

Assembly Description	Maximum Aspect Ratio (*h/w*)	Fastener Spacing at Panel Edges (in.)[c]				Maximum Framing Spacing (in. oc)
		6	4	3	2	
15⁄32-in. structural 1 sheathing (4-ply), one side	2:1	1065[d]	—	—	—	24
7⁄16-in. rated sheathing (OSB), one side	2:1	910[d]	1410	1735	1910	24
7⁄16-in. rated sheathing (OSB), one side oriented perpendicular to framing	2:1	1020	—	—	—	24
7⁄16-in. rated sheathing (OSB), one side	4:1	—	1025	1425	1825	24
0.018-in. steel sheet, one side	2:1	485	—	—	—	24
0.027-in. steel sheet, one side	4:1	—	1000	1085	1170	24

For SI units, 1 in. = 25.4 mm, 1 lb/ft = 14.5939 N/m.
[a] Nominal shear values need to be multiplied by the resistance factor (Φ) to determine design strength or divided by the factor of safety (Ω) to determine allowable shear values as set forth in 44.8.1.1.
[b] See 44.8.1.2(8)(b) for requirements for sheathing applied to both sides of the wall,
[c] Screws in the field of the panel need to be installed 12 in. (305 mm) oc, unless otherwise shown.
[d] Where fully blocked gypsum board is applied to the opposite side of this assembly, per Table 44.8.1(b), with screw spacing at 7 in. (178 mm) oc edge and 7 in. (178 mm) oc field, these nominal values are permitted to be increased by 30 percent.

Table 44.8.1(b) Nominal Shear Values for Wind and Seismic Forces for Shear Walls Framed with Cold-Formed Steel Studs and Faced with Gypsum Board (lb/ft)[a,b]

Wall Construction	Maximum Aspect Ratio (*h/w*)	Orientation	Screw Spacing (in. oc)		Nominal Shear Value (lb/ft)
			Edge	Field	
½-in. gypsum board on one side of wall; studs maximum 24 in. oc	2:1	Gypsum board applied perpendicular to framing, with strap blocking behind the horizontal joint and with solid blocking between the first two end studs	7	7	290
		Gypsum board applied vertically, with all edges attached to framing members	4	4	425

For SI units, 1 in. = 25.4 mm, 1 lb/ft = 14.5939 N/m.
[a] Nominal shear values need to be multiplied by the resistance factor (Φ) to determine design strength or divided by the factor of safety (Ω) to determine allowable shear values as set forth in 44.8.1.1.
[b] See 44.8.1.2(8)(b) for requirements for sheathing applied to both sides of the wall.

Table 44.8.1(c) Nominal Shear Values for Seismic Forces for Shear Walls Framed with Cold-Formed Steel Studs (lb/ft)[a,b]

Assembly Description	Maximum Aspect Ratio (h/w)	Fastener Spacing at Panel Edges (in.)[c]				Maximum Framing Spacing (in. oc)
		6	4	3	2	
15⁄32-in. structural 1 sheathing (4-ply) plywood, one side	2:1[d]	780	990	1465	1625	24
15⁄32-in. structural 1 sheathing (4-ply) plywood, one side; end studs 0.043 in. minimum thickness	2:1	—	—	1775	2190	24
15⁄32-in. structural 1 sheathing (4-ply) plywood, one side; all studs 0.043 in. minimum thickness	2:1	890	915	1775	2190	24
7⁄16-in. OSB, one side	2:1	700	915	1275	1625	24
7⁄16-in. OSB, one side; end studs 0.043 in. minimum thickness	2:1[d]	—	—	1520	2060	24
0.018-in. steel sheet, one side	2:1	390	—	—	—	24
0.027-in. steel sheet, one side	2:1[d]	—	1000	1085	1170	24

For SI units, 1 in. = 25.4 mm, 1 lb/ft = 14.5939 N/m.

[a] Nominal shear values need to be multiplied by the resistance factor (Φ) to determine design strength or divided by the factor of safety (Ω) to determine allowable shear values as set forth in 44.8.1.1.

[b] See 44.8.1.2(8)(b), for requirements for sheathing applied to both sides of the wall.

[c] Screws in the field of the panel need to be installed 12 in. (305 mm) oc, unless otherwise shown.

[d] Shear wall aspect ratios greater than 2:1, but not exceeding 4:1, are permitted, provided that the nominal shear values are multiplied by 2 w/h.

(2) Track shall be a minimum of 1¼ in. × 3½ in. (31 mm × 89 mm).

(3) Both studs and track shall have a minimum uncoated base metal thickness of 33 mil (0.84 mm) and shall be of one of the following grades of structural quality steel:
   (a) SS Grade 33, in accordance with ASTM A 653, *Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*
   (b) SS Grade 33, in accordance with ASTM A 792, *Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process*
   (c) SS Grade 33, in accordance with ASTM A 875, *Standard Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process*

(4) Fasteners along the edges in shear panels shall be placed not less than ⅜ in. (9.5 mm) in from panel edges.

(5) The shear wall aspect ratio, h/w, shall not exceed the values in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c).

(6) Panel thicknesses shown in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c) shall be minimum thicknesses, and the following requirements also shall apply:
   (a) Panels less than 12 in. (305 mm) wide shall not be used.
   (b) All panel edges shall be fully blocked.

(7) Where horizontal-strap blocking is used to provide blocking for panel edges, it shall be a minimum 1½ in. (38 mm) wide and of the same material and thickness of the track and studs.

(8) Requirements for design shear values shall be as follows:
   (a) The design shear values for shear panels with different nominal shear values applied to the same side of a wall shall not be cumulative, except as permitted in Table 44.8.1(a), Table 44.8.1(b), and Table 44.8.1(c).
   (b) For walls with material applied to both faces of the same wall, the design shear value of material of the same capacity shall be cumulative.
   (c) Where the material nominal shear values are not equal, the design shear value shall be either two times the design shear value of the material with the smaller value or the design shear value shall be the value of the stronger side, whichever is greater.
   (d) Summing shear values of dissimilar material applied to opposite faces or to the same wall line shall be prohibited, unless permitted by Table 44.8.1(a).

44.8.1.2.1 Sheet Steel Sheathing. Requirements for sheet steel sheathing shall be as follows:

(1) Steel sheets attached to cold-formed steel framing shall be permitted to resist horizontal forces produced by wind or seismic loads.

(2) Steel sheets shall have a minimum base metal thickness as shown in Table 44.8.1(a) or Table 44.8.1(c) and shall be of the following grades of structural quality steel:
   (a) SS Grade 33, in accordance with ASTM A 653
   (b) SS Grade 33, in accordance with ASTM A 792
   (c) SS Grade 33, in accordance with ASTM A 875

(3) Nominal shear values used to establish the allowable shear value or design shear value shall comply with Table 44.8.1(a) for wind loads and Table 44.8.1(c) for seismic loads.
(4) Steel sheets shall be permitted to be applied either parallel to or perpendicular to framing.
(5) All edges of steel sheets shall be attached to framing members or strap blocking or shall be overlapped and attached to each other with screw spacing as required for edges.
(6) Screws used to attach steel sheets shall be minimum No. 8 modified truss head screws.

44.8.1.2.2 Wood Structural Panel Sheathing. Requirements for wood structural panel sheathing shall be as follows:

(1) Cold-formed steel frame wall systems sheathed with wood structural panels shall be permitted to resist horizontal forces produced by wind or seismic loads.
(2) Nominal shear values used to establish the allowable shear value or design shear value shall comply with Table 44.8.1(a) for wind loads and Table 44.8.1(c) for seismic loads.
(3) Wood structural panels shall comply with USDOC PS 1, *U.S. Product Standard for Construction and Industrial Plywood*, or USDOC PS 2, *Performance Standard for Wood-Based Structural-Use Panels*, and shall be manufactured using exterior glue.
(4) Wood structural panels shall be attached to steel framing with flat-head self-drilling tapping screws with a minimum head diameter of 0.292 in. (8 mm) in accordance with SAE J78, *Standard for Steel Self-Drilling Tapping Screws*.
(5) Where 7/16-in. (11-mm) OSB is specified, 15/32-in. (12-mm) structural 1 sheathing (plywood) shall be permitted.
(6) Structural panels shall be permitted to be applied either parallel to or perpendicular to framing.
(7) Increases of the nominal loads shown in Table 44.8.1(a) and Table 44.8.1(c) shall not be permitted.

44.8.1.2.3 Gypsum Board Panel Sheathing. The requirements for gypsum board panel sheathing shall be as follows:

(1) Cold-formed steel frame wall systems sheathed with gypsum board shall be permitted to resist horizontal forces produced by wind or seismic loads.
(2) Nominal shear values used to establish the allowable shear value or design shear value shall comply with Table 44.8.1(b).
(3) The shear values in Table 44.8.1(b) shall not be cumulative with the shear values of other materials applied to the same wall, unless otherwise permitted herein.
(4) Where gypsum board is applied perpendicular to studs, end joints of adjacent courses of gypsum board sheets shall not occur over the same stud.
(5) Screws used to attach gypsum board shall be minimum No. 6 screws in accordance with ASTM C 954, *Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness*.

44.8.2 Type II (Perforated) Shear Walls. Type II (perforated) shear walls sheathed with wood structural panels or sheet steel shall be permitted to resist wind and seismic loads when designed in accordance with 44.8.2.

44.8.2.1 Limitations. The following limitations shall apply to the use of the requirements of 44.8.2:

(1) A Type II shear wall segment shall be located at each end of a Type II shear wall.
(2) Openings shall be permitted to occur beyond the ends of the Type II shear wall, but the width of such openings shall not be included in the width of the perforated shear wall.
(3) In Seismic Design Category D, Seismic Design Category E, and Seismic Design Category F, nominal shear values shall be based on edge screw spacing not less than 4 in. (100 mm) oc.
(4) A Type II shear wall shall not have out-of-plane (horizontal) offsets.
(5) Where out-of-plane offsets occur, portions of the wall on each side of the offset shall be considered as separate perforated shear walls.
(6) Collectors for shear transfer shall be provided through the full length of the Type II shear wall.
(7) A Type II shear wall shall have uniform top-of-wall and bottom-of-wall elevations.
(8) Type II shear walls not having uniform elevations shall be designed by other methods.
(9) Type II shear wall height, h, shall not exceed 20 ft (6 m).

44.8.2.2 Type II Shear Wall Resistance. The Type II shear wall resistance shall be equal to the adjusted shear resistance times the sum of the widths of the perforated shear wall segments and shall be calculated in accordance with 44.8.2.2.1 through 44.8.2.2.4.

44.8.2.2.1 Percent of Full-Height Sheathing. The percent of full-height sheathing shall be calculated as the sum of widths of Type II shear wall segments divided by the total width of the Type II shear wall, including openings.

44.8.2.2.2 Maximum Opening Height Ratio. The maximum opening height ratio shall be calculated by dividing the maximum opening clear height by the shear wall height, h.

44.8.2.2.3 Unadjusted Shear Resistance.

44.8.2.2.3.1 The unadjusted shear resistance shall be as set forth in Table 44.8.1(a) and Table 44.8.1(c) when the aspect ratio of any Type II shear wall segment used in the calculation of Type II shear wall resistance does not exceed 2:1.

44.8.2.2.3.2 When the aspect ratio of any Type II shear wall segment used in the calculation of Type II shear wall resistance is greater than 2:1, but does not exceed 4:1, the unadjusted factored shear resistance shall be the factored shear resistance set forth in Table 44.8.1(a) and Table 44.8.1(c) multiplied by $2w/h$.

44.8.2.2.4 Adjusted Shear Resistance.

44.8.2.2.4.1 The adjusted shear resistance shall be calculated by multiplying the unadjusted factored shear resistance in Table 44.8.1(a) and Table 44.8.1(c) by the shear resistance adjustment factors of Table 44.8.2.2.4.1.

44.8.2.2.4.2 For intermediate percentages of full-height sheathing, the shear resistance adjustment factor shall be permitted to be interpolated.

44.8.2.3 Anchorage and Load Path. The design of perforated shear wall anchorage and load path shall conform to the requirements of 44.8.2.3, or shall be calculated using principles of mechanics.

44.8.2.3.1 Uplift Anchorage at Type II Shear Wall Ends.

44.8.2.3.1.1 Anchorage for uplift forces due to overturning shall be provided at each end of the Type II shear wall.

Table 44.8.2.2.4.1 Shear Resistance Adjustment Factor (C_a)

Wall Height, h (ft)	Maximum Opening Height Ratio and Height[1]				
	$h/3$ (ft)	$h/2$ (ft)	$2h/3$ (ft)	$5h/6$ (ft)	h (ft)
8.0	2⅔	4.0	5⅓	6⅔	8.0
10.0	3½	5.0	6⅔	8⅓	10.0
Percent of Full-Height Sheathing(%)[2]	**Shear Resistance Adjustment Factor**				
10	1.00	0.69	0.53	0.43	0.36
20	1.00	0.71	0.56	0.45	0.38
30	1.00	0.74	0.59	0.49	0.42
40	1.00	0.77	0.63	0.53	0.45
50	1.00	0.80	0.67	0.57	0.50
60	1.00	0.83	0.71	0.63	0.56
70	1.00	0.87	0.77	0.69	0.63
80	1.00	0.91	0.83	0.77	0.71
90	1.00	0.95	0.91	0.87	0.83
100	1.00	1.00	1.00	1.00	1.00

For SI units, 1 in. = 25.4 mm; 1 ft = 0.3048 m.
[1] See 44.8.2.2.2.
[2] See 44.8.2.2.1.

44.8.2.3.1.2 In Seismic Design Category D through Seismic Design Category F, the uplift anchorage shall conform to the requirements of 44.8.3.3, except that, for each story, the tension chord uplift force, T, shall be calculated in accordance with the following:

$$T = \frac{Vh}{C_a \sum L_i} \quad \textbf{(44.1)}$$

where:
T = tension chord uplift force [lb (kN)]
V = shear force in Type II shear wall [lb (kN)]
h = shear wall height [ft/1000 (mm/1000)]
C_a = shear resistance adjustment factor from Table 44.8.2.2.4.1
L_i = sum of widths of Type II shear wall segments [ft/1000 (mm/1000)]

44.8.2.3.2 Anchorage for In-Plane Shear. The unit shear force, v, transmitted into the top and out of the base of the Type II shear wall full-height sheathing segments, and into collectors (drag struts) connecting shear wall segments, shall be calculated in accordance with the following:

$$v = \frac{V}{C_a \sum L_i} \quad \textbf{(44.2)}$$

where:
v = unit shear force [lb/ft (kN/m)]
V = shear force in Type II shear wall [lb (kN)]
C_a = shear resistance adjustment factor from Table 44.8.2.2.4.1
L_i = sum of widths of Type II shear wall segments [ft/1000 (mm/1000)]

44.8.2.3.3 Uplift Anchorage Between Perforated Shear Wall Ends. In addition to the requirements of 44.8.2.3.1, perforated shear wall bottom plates at full-height sheathing shall be anchored for a uniform uplift force, t, equal to the unit shear force, v, determined in 44.8.2.3.2.

44.8.2.3.4 Compression Chords. Vertical elements at each end of each perforated shear wall segment shall be designed for a compression force, C, equal to the tension chord uplift force, T, calculated in 44.8.2.3.1.2.

44.8.2.3.5 Load Path.

44.8.2.3.5.1 A load path to the foundation shall be provided for each tension chord uplift force, T and t, for each unit shear force, v, and for each compression force, C.

44.8.2.3.5.2 Elements resisting shear wall forces contributed by multiple stories shall be designed for the sum of forces contributed by each story.

44.8.3 Seismic Design Categories D, E, and F.

44.8.3.1 General.

44.8.3.1.1 In addition to the requirements of 44.8.1 and 44.8.2, light-framed cold-formed steel wall systems that resist seismic loads, in buildings assigned to Seismic Design Category D, Seismic Design Category E, and Seismic Design Category F, shall comply with the requirements of 44.8.3.

44.8.3.1.2 Calculation of shear values in accordance with 44.8.1 shall not be permitted.

44.8.3.2 Connections. Requirements for connections shall be as follows:

(1) Connections for diagonal bracing members, top chord splices, boundary members, and collectors shall be designed to develop the nominal tensile strength of the member or the design seismic force, whichever is less, multiplied by the seismic overstrength factor, Ω_o, from Section 9 of ASCE 7.
(2) The pull-out resistance of screws shall not be used to resist design seismic forces.

44.8.3.3 Anchorage of Braced Wall Segments. Requirements for anchorage of braced wall segments shall be as follows:

(1) Studs or other vertical boundary members at the ends of wall segments that resist seismic loads, braced with either sheathing or diagonal braces, shall be anchored such that the bottom track is not forced to resist uplift by bending of the track web.
(2) Both flanges of the studs shall be braced to prevent lateral torsional buckling.
(3) Studs or other vertical boundary members, and anchorage thereto, shall have the nominal strength to resist design seismic force multiplied by the seismic overstrength factor, Ω_o, from Section 9 of ASCE 7.

44.8.3.4 Sheet Steel Sheathing. In addition to the other requirements of this *Code*, where steel sheathing provides lateral resistance, the design and construction of such walls shall be in accordance with the all of the following:

(1) Perimeter members at openings shall be provided and shall be detailed to distribute the shearing stresses.
(2) Wall studs and track shall have a minimum, uncoated, base metal thickness of 33 mil (0.84 mm).
(3) The nominal shear value for light-framed wall systems for buildings in Seismic Performance Category D, Seismic Performance Category E, and Seismic Performance Category F shall be based on values from Table 44.8.1(c).

44.8.3.5 Wood Structural Panel Sheathing. In addition to the other requirements of this *Code*, where wood structural panels provide lateral resistance, the design and construction of such walls shall be in accordance with the following:

(1) Perimeter members at openings shall be provided and shall be detailed to distribute the shearing stresses.
(2) Wood sheathing shall not be used to splice perimeter members at openings.
(3) Wall studs and track shall have a minimum uncoated base metal thickness of 33 mil (0.84 mm) and shall not have an uncoated base metal thickness greater than 48 mil (1.2 mm).
(4) The nominal shear value for light-framed wall systems for buildings in Seismic Performance Category D, Seismic Performance Category E, and Seismic Performance Category F shall be based on values from Table 44.8.1(c).

44.8.3.6 Diagonal Bracing. Requirements for diagonal bracing shall be as follows:

(1) Where diagonal bracing is provided for lateral resistance, provisions shall be made for pretensioning, or other methods of installing tension-only bracing shall be used to guard against loose diagonal straps.
(2) The l/r of the brace shall be permitted to exceed 200.

44.8.3.7 Gypsum Board Panel Sheathing. Gypsum board panel sheathing shall be permitted to resist seismic loads, subject to the limitations in ASCE 7, Table 9.5.2.2.

Chapter 45 Wood

45.1 Scope. The provisions of Section 45.2 through Section 45.6 apply to the design and construction of wood elements.

45.2 Special Definitions.

45.2.1 Accreditation Body. An approved, third-party organization that is independent of the grading and inspection agencies, and the lumber mills, and that initially accredits and subsequently monitors, on a continuing basis, the competency and performance of a grading or inspection agency related to carrying out specific tasks.

45.2.2* Fiberboard. A fibrous, homogeneous panel made from lignocellulosic fibers and having a density of less than 31 lb/ft^3 (497 kg/m^3) but more than 10 lb/ft^3 (160 kg/m^3).

45.2.3 Hardboard. A fibrous-felted, homogeneous panel made from lignocellulosic fibers consolidated under heat and pressure in a hot press to a density not less than 31 lb/ft^3 (497 kg/m^3).

45.2.4 Lumber (Grade). The classification of lumber in regard to strength and utility in accordance with USDOC PS 20, *American Softwood Lumber Standard*, and the grading rules of an approved lumber rules-writing agency.

45.2.5 Nominal Size (Lumber). The commercial size designation of width and depth, in standard sawn lumber and glued laminated lumber grades, meeting the requirements of USDOC PS 20 for sawn lumber and AF&PA NDS, *National Design Specification for Wood Construction,* for glued laminated lumber.

45.2.6 Panel, Wood Structural. A panel manufactured from veneers; or wood strands or wafers; or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems, including composite panels, oriented strand board, and plywood.

45.2.6.1 Composite Wood Structural Panel. A structural panel that is made of layers of veneer and wood-based material.

45.2.6.2 Oriented Strand Board (OSB) Wood Structural Panel. A mat-formed wood structural panel product composed of thin, rectangular wood strands or wafers arranged in oriented layers and bonded with waterproof adhesive.

45.2.6.3 Plywood Wood Structural Panel. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers.

45.2.7* Particleboard. A generic term for a panel primarily composed of cellulosic materials, generally in the form of discrete pieces or particles, as distinguished from fibers, that are combined with synthetic resin or other suitable bonding system by a process in which the interparticle bond is created by the bonding system under heat and pressure.

45.2.8 Structural Glued Laminated Timber. Any member comprising an assembly of laminations of lumber in which the grain of all laminations is approximately parallel longitudinally, and in which the laminations are bonded with adhesives.

45.2.9 Wood.

45.2.9.1 Fire Retardant–Treated Wood. A wood product impregnated with chemical by a pressure process or other means during manufacture, which is tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials,* has a listed flame spread of 25 or less, and shows no evidence of significant progressive combustion when the test is continued for an additional 20-minute period; nor does the flame front progress more than 10.5 ft (3.2 m) beyond the centerline of the burners at any time during the test.

45.2.9.2 Preservative-treated Wood. Wood impregnated under pressure with compounds that reduce their susceptibility to deterioration caused by fungi, insects, or marine borers.

45.3 General. All wood members and their fasteners shall be designed and constructed in accordance with this chapter and all other applicable requirements of this *Code*.

45.4 Design Requirements. The design of structural elements or systems constructed partially or wholly of wood or wood-based products shall be based on one of the methods in 45.4.1 or 45.4.2.

45.4.1 Allowable Stress Design.

45.4.1.1 Structural analysis and construction of wood elements and structures using allowable stress design methods shall be in accordance with AF&PA ASD, *Allowable Stress Design (ASD) Manual for Engineered Wood Construction*.

45.4.1.2 Design using allowable stress design methods shall resist the applicable load combinations of Section 35.15 in accordance with the provisions of this chapter.

45.4.1.3 The design and construction of one- and two-family dwellings of light-frame wood construction shall be permitted to be in accordance with the provisions of the AF&PA WFCM, *Wood Frame Construction Manual for One- and Two-Family Dwellings*, subject to the limitations of Section 1.1.3 therein.

45.4.2 Load and Resistance Factor Design.

45.4.2.1 The structural analysis and construction of wood elements and structures using load and resistance factor design methods shall be in accordance with AF&PA LRFD, *Load and Resistance Factor Design Manual for Engineered Wood Construction*.

45.4.2.2 Design using load and resistance factor design methods shall resist the applicable load combinations of Section 35.15 in accordance with the provisions of this chapter.

45.5 Criteria.

45.5.1 General. Wood members and their fastenings shall conform to the requirements of this chapter and the standards herein.

45.5.2 Lumber Identification. Lumber used for load-supporting purposes, including end-jointed or edge-glued lumber, machine stress–rated lumber, and machine-evaluated lumber, as well as solid-sawn lumber, shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with USDOC PS 20, or equivalent, and the following also shall apply:

(1) Grading practices and identification shall comply with rules published by an agency approved in accordance with USDOC PS 20 or equivalent procedures.
(2) In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of 45.5.2 shall be permitted for precut, remanufactured, or rough-sawn lumber, and for sizes larger than 3 in. (75 mm) nominal thickness.

45.5.3 Determination of Sizes.

45.5.3.1 For the purposes of this chapter, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions, unless specifically designated as actual dimensions.

45.5.3.2 Minimum dressed sizes corresponding to nominal sizes shall conform with the provisions of USDOC PS 20.

45.5.4 End-jointed Lumber. Approved end-jointed lumber shall be permitted to be used interchangeably with solid-sawn members of the same species and grade.

45.5.5 Prefabricated Wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D 5055, *Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists*.

45.5.6 Structural Glued Laminated Timber. Glued laminated timbers shall be manufactured and identified as required in ANSI/AITC A190.1, *American National Standard, Structural Glued Laminated Timber*, and ASTM D 3737, *Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)*.

45.5.7 Wood Structural Panels.

45.5.7.1 A wood structural panel, where used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms and built-up members), shall conform to the requirements for its type in USDOC PS 1, *U.S. Product Standard for Construction and Industrial Plywood*, or USDOC PS 2, *Performance Standard for Wood-based Structural-Use Panels*.

45.5.7.2 Each panel or member shall be identified for grade and glue type by the trademarks of an approved testing and grading agency.

45.5.7.3 Wood structural panel components shall be designed and fabricated in accordance with the standards in 45.5.7.1 and identified by the trademarks of an approved testing and inspection agency indicating conformance with the applicable standard.

45.5.7.4 Wood structural panels that are permanently exposed in outdoor applications shall be of exterior type, except that wood structural panel roof sheathing exposed to the outdoors on the underside shall be permitted to be of interior type bonded with exterior glue, Exposure 1.

45.5.8 Fiberboard.

45.5.8.1 Where used, fiberboard shall conform to ASTM C 208, *Standard Specification for Cellulosic Fiber Insulating Board*.

45.5.8.2 Fiberboard sheathing, where used structurally, shall be so identified by an approved agency as conforming to ASTM C 208.

45.5.9 Hardboard Products.

45.5.9.1 Hardboard siding, where used structurally, shall be identified by an approved agency conforming to ANSI/AHA A135.6, *Hardboard Siding*.

45.5.9.2 Hardboard underlayment shall meet the strength requirements of 7/32-in. (5.6-mm) or 1/4-in. (6.4-mm) service class hardboard, planed or sanded on one side to a uniform thickness of not less than 0.200 in. (5.1 mm).

45.5.9.3 Prefinished hardboard paneling shall meet the requirements of ANSI/AHA A135.5, *Prefinished Hardboard Paneling*.

45.5.9.4 Other basic hardboard products, aside from those discussed in 45.5.9.1 through 45.5.9.3, shall meet the requirements of ANSI/AHA A135.4, *Basic Hardboard*.

45.5.9.5 Hardboard products shall be installed in accordance with manufacturer's recommendations.

45.5.10 Particleboard.

45.5.10.1 Particleboard shall conform to ANSI A208.1, *Standard for Particleboard.*

45.5.10.2 Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency.

45.5.10.3 Particleboard shall not be utilized for applications other than those indicated in 45.5.10, unless the particleboard complies with the provisions of documents referenced in Section 45.4 for particleboard shear walls.

45.5.10.4 Particleboard floor underlayment shall conform to Type PBU of ANSI A208.1.

45.5.10.5 Type PBU particleboard underlayment shall be not less than ¼-in. (6.4-mm) thick and shall be installed in accordance with the installation instructions of the Composite Panel Association.

45.5.11 Preservative-treated Wood.

45.5.11.1 Preservative-treated wood shall comply with the following:

(1) All lumber, timber, plywood, piles, and poles supporting permanent structures and required by 45.6.9 to be preservative-treated shall conform to the requirements of the applicable AWPA Standard C1, C2, C3, C4, C9, C14, C15, C16, C22, C23, C24, C28, C31, C33, or M4, for the species, product, preservative, and end use.
(2) Preservatives shall conform to AWPA P1/P13, P2, P5, P8, and P9.

45.5.11.2 All wood required by this chapter to be preservative-treated shall bear the quality mark of an inspection agency that maintains continuing supervision, testing, and inspection over the quality of the preservative-treated wood.

45.5.11.3 Inspection agencies for preservative-treated wood shall be listed by an accreditation body that complies with the requirements of the American Lumber Standards Treated Wood Program or equivalent.

45.5.11.4 The quality mark discussed in 45.5.11.2 shall be on a stamp or label affixed to the preservative-treated wood.

45.5.11.5 The quality mark discussed in 45.5.11.2 shall include the following information:

(1) Identification of treating manufacturer
(2) Type of preservative used
(3) Minimum preservative retention (pcf)
(4) End use for which the product is treated
(5) AWPA standard to which the product was treated
(6) Identity of the accredited inspection agency

45.5.11.6 Where preservative-treated wood is used in enclosed locations where drying in service cannot readily occur, such wood shall be at a moisture content of 19 percent or less before being covered with insulation, interior wall finish, floor covering, or other materials.

45.5.12 Structural Composite Lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D 5456, *Standard Specification for Evaluation of Structural Composite Lumber Products.*

45.5.13 Hardwood Plywood. Hardwood and decorative plywood shall be manufactured and identified as required in ANSI/HPVA HP-1, *American National Standard for Standard for Hardwood and Decorative Plywood.*

45.5.14 Interior Paneling.

45.5.14.1 All softwood wood structural panels used for interior paneling shall conform with USDOC PS 1 or USDOC PS 2.

45.5.14.2 Prefinished hardboard paneling shall meet the requirements of ANSI/AHA A135.5. All hardwood plywood shall conform to ANSI/HPVA HP-1.

45.5.15 Fire Retardant–Treated Wood.

45.5.15.1 Labeling. Fire retardant–treated lumber and wood structural panels shall be labeled and listed with the following information:

(1) Identification mark of an approved agency that lists materials in accordance with Chapter 3 *(See 3.2.5, Listed.)*
(2) Identification of the treating manufacturer
(3) Name of the fire-retardant treatment
(4) Species of wood treated
(5) End use of the product
(6) Flame spread and smoke developed rating
(7) Method of drying after treatment
(8) Verification of conformance with appropriate standards in accordance with 45.5.15.2 through 45.5.15.5
(9) The words "No increase in the listed classification when subjected to the Standard Rain Test (ASTM D 2898, *Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire-Testing*)," for fire retardant–treated wood exposed to weather, damp, or wet locations

45.5.15.2 Strength Adjustments.

45.5.15.2.1 Design values for untreated lumber and wood structural panels, as specified in Section 45.5, shall be adjusted for fire retardant–treated wood.

45.5.15.2.2 Adjustments to design values shall be based on an approved method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire retardant–treated wood will be subjected, the type of treatment, and the redrying procedures.

45.5.15.2.2.1 Wood Structural Panels. Adjustment to design values for wood structural panels shall be in accordance with the following:

(1) The effect of the treatment, the method of redrying after treatment, and the exposure to high temperatures and high humidities on the flexure properties of fire retardant–treated softwood plywood shall be determined in accordance with ASTM D 5516, *Standard Test Method for Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures.*
(2) The test data developed by ASTM D 5516 shall be used to develop adjustment factors or maximum loads and spans, or both, for untreated plywood design values in accordance with ASTM D 6305, *Standard Practice for Calculating Bending Strength Design Adjustment Factors for Fire-Retardant-Treated Plywood Roof Sheathing.*
(3) Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

45.5.15.2.2.2 Lumber. Adjustment to design values for lumber shall be in accordance with the following:

(1) For each species of wood treated, the effect of the treatment, the method of redrying after treatment, and the exposure to high temperatures and high humidities on the allowable design properties of fire retardant–treated lumber shall be determined in accordance with ASTM D 5664, *Standard Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber.*
(2) The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with an approved method of investigation.
(3) Each manufacturer shall publish the modification factors for service at temperatures of 100°F (37.8°C) and for service as roof framing.
(4) The roof framing modification factors shall take into consideration the climatological location.

45.5.15.3 Exposure to Weather or Damp or Wet Locations. Where fire retardant–treated wood is exposed to weather or damp or wet locations, it shall be identified as "exterior" to indicate that there is no increase in the listed flame spread index when subjected to ASTM D 2898. *(See 3.3.578.1, Fire Retardant–Treated Wood.)*

45.5.15.4 Interior Applications. Interior fire retardant–treated wood shall have a moisture content of not over 28 percent when tested in accordance with the procedures of ASTM D 3201, *Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products*, at 92 percent relative humidity. Interior fire retardant–treated wood shall be tested in accordance with 45.5.15.2.2.1 or 45.5.15.2.2.2.

45.5.15.5 Moisture Content. Fire retardant–treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT), the kiln temperatures shall not exceed the temperatures used in drying the lumber and plywood submitted for the testing described in 45.5.15.2.

45.5.16 Trusses.

45.5.16.1 Metal plate connected wood trusses shall be manufactured in accordance with ANSI/TPI 1, *National Design Standard for Metal Plate Connected Wood Truss Construction*.

45.5.16.2 Each manufacturer of trusses using metal plate connectors shall retain an approved agency to make nonscheduled inspections of truss manufacturing and delivery operations.

45.5.16.3 The inspection discussed in 45.5.16.2 shall cover all phases of truss operations, including lumber storage, handling, cutting fixtures, presses or rollers, manufacturing, bundling, and banding.

45.5.17 Connectors, Nails, and Staples.

45.5.17.1 Joist hangers and connectors shall comply with ASTM D 1761, *Standard Test Methods for Mechanical Fasteners in Wood.*

45.5.17.2 Nails and spikes shall conform to requirements of ASTM F 1667, *Specification for Driven Fasteners: Nails, Spikes, and Staples.*

45.5.17.3 Nails used for framing and sheathing connections shall have minimum average bending yield strengths as follows:

(1) 80 ksi (551 MPa) for shank diameters larger than 0.177 in. (4.50 mm) but not larger than 0.254 in. (6.45 mm)
(2) 90 ksi (620 MPa) for shank diameters larger than 0.142 in. (3.61 mm) but not larger than 0.177 in. (4.50 mm)
(3) 100 ksi (689 MPa) for shank diameters of 0.142 in. (3.61 mm) or less

45.6 General Construction Requirements.

45.6.1 General. The provisions of Section 45.6 shall apply to the design methods specified in Section 45.4.

45.6.2 Continuous Load Path.

45.6.2.1 A continuous load path shall be provided to transfer all gravity, seismic, and wind loads from the roof, wall, and floor systems to the foundation.

45.6.2.2 Where the structural wood frame is more than one story in height or one story over elevated foundation (piles), and studs and posts are not continuous from sill to roof, the members shall be secured together with the following to ensure a continuous load path:

(1) Approved framing anchors
(2) Approved framing clips
(3) Approved framing splices
(4) Other approved connections

45.6.3 Size of Structural Members. Computations to determine the required sizes of structural members shall be based on the actual size of the member and not on nominal sizes.

45.6.4 Wall Framing.

45.6.4.1 Wall framing shall be designed and installed in accordance with the appropriate design methodology in Section 45.4.

45.6.4.2 Studs shall have full bearing on 2-in. (50-mm) nominal dimension lumber [actual 1½ in. (38-mm)] or larger plate or sill having a width at least equal to the width of the studs.

45.6.4.3 Headers, double joists, trusses, or other approved assemblies that are adequate to transfer all loads to the vertical members shall be provided over all window and door openings in load-bearing walls and partitions.

45.6.4.4 All wood columns and posts shall be framed to provide full-end bearing.

45.6.4.5 As an alternative to the requirement of 45.6.4.4, column-and-post end connections shall be designed to resist the full compressive loads, neglecting all end-bearing capacity.

45.6.4.6 Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

45.6.5 Floor and Roof Framing.

45.6.5.1 Wall framing shall be designed and installed in accordance with the appropriate design methodology in Section 45.4.

45.6.5.2 Joist and rafter spans shall be permitted to be in accordance with AF&PA's *Span Tables for Joists and Rafters.*

45.6.5.3 The design of plank and beam flooring shall be permitted to be in accordance with AF&PA Wood Construction Data No. 4, *Plank and Beam Framing for Residential Buildings.*

45.6.5.4 Combustible framing shall be minimum of 2 in. (51 mm) from all flues, chimneys, and fireplaces, but shall not be less than the distance specified in the NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-burning Appliances.*

45.6.5.5 Combustible framing shall be a minimum of 6 in. (152 mm) away from flue openings.

45.6.6 Wall Sheathing.

45.6.6.1 Wall sheathing shall be designed and installed in accordance with the appropriate methodology in Section 45.4.

45.6.6.2 Where wood structural panel sheathing is used as the exposed finish on the exterior of outside walls, it shall have an exterior exposure durability classification.

45.6.6.3 Where wood structural panel sheathing is used on the exterior of outside walls, but not as the exposed finish, it shall be of a type manufactured with exterior glue (Exposure 1 or Exterior).

45.6.6.4 Where wood structural panel sheathing is used elsewhere, it shall be of a type manufactured with intermediate or exterior glue.

45.6.7 Floor and Roof Sheathing.

45.6.7.1 Structural floor sheathing shall be designed and installed in accordance with the appropriate methodology in Section 45.4.

45.6.7.2 Wood structural panel roof sheathing shall be bonded by exterior glue.

45.6.8 Connections and Fasteners.

45.6.8.1 Connections for wood members shall be designed in accordance with the appropriate methodology in Section 45.4.

45.6.8.2 The number and size of nails connecting wood members shall not be less than that set forth in Table 45.6.8.2.

Table 45.6.8.2 General Fastening Schedule

Connection	Nailing[1]	Location
Joist to sill or girder	3-8d common	Toenail
Bridging to joist	2-8d common	Toenail each end
1 in. × 6 in. (25 mm × 152 mm) subfloor or less to each joist	2-8d common	Face nail
Wider than 1 in. × 6 in. (25 mm × 152 mm) subfloor to each joist	3-8d common	Face nail
2-in. (51-mm) subfloor to joist or girder	2-16d common	Blind and face nail
Sole plate to joist or blocking	16d at 16 in. (406 mm) oc 3-16d per 16 in. (406 mm)	Typical face nail Braced wall panels
Top plate to stud	2-16d common	End nail
Stud to sole plate	4-8d common 2-16d common	Toenail End nail
Double studs	16d at 24 in. (610 mm) oc	Face nail
Double top plates	16d at 16 in. (406 mm) oc 8-16d common	Typical face nail Lap splice
Blocking between joists or rafters to top plate	3-8d common	Toenail
Rim joist to top plate	8d at 6 in. (152 mm) oc	Toenail
Top plates, laps, and intersections	2-16d common	Face nail
Continuous header, two pieces	16d common	16 in. (406 mm) oc along edge
Ceiling joists to plate	3-8d common	Toenail
Continuous header to stud	4-8d common	Toenail
Ceiling joists, laps over partitions	3-16d common	Face nail
Ceiling joists to parallel rafters	3-16d common	Face nail
Rafter to plate	3-8d common	Toenail

Table 45.6.8.2 ***Continued***

Connection	Nailing[1]	Location
1-in. (25-mm) brace to each stud and plate	2-8d common	Face nail
1 in. × 8 in. (25 mm × 203 mm) sheathing or less to each bearing wall	2-8d common	Face nail
Wider than 1 in. × 8 in. (25 mm × 203 mm) sheathing to each bearing wall	3-8d common	Face nail
Built-up corner studs	16d common	24 in. (610 mm) oc
Built-up girder and beams	20d common 2-20d common	32 in. (813 mm) oc At top and bottom staggered at ends and at each splice
2-in. (51-mm) planks	16d common	At each bearing
Wood Structural Panels and Particleboard[2]		See footnote 7
Subfloor, roof, and wall sheathing (to framing):		
≤½ in. (≤13 mm)	6d[3,4]	
19/32 in.–¾ in. (15.1 mm–19.1 mm)	8d[5] or 6d[6]	
⅞ in.–1 in. (22.2 mm–25.4 mm)	8d[3]	
1⅛ in.–1¼ in. (28.6 mm–31.8 mm)	10d[5] or 8d[6]	
Single floor (combination subfloor underlayment to framing):		
≤¾ in. (≤19.1 mm)	6d[6]	
⅞ in.–1 in. (22.2 mm–25.4 mm)	8d[6]	
1⅛ in.–1¼ in. (28.6 mm–31.8 mm)	10d[5] or 8d[6]	
Panel siding (to framing):		See footnote 7
≤½ in. (≤13 mm)	6d[8]	
⅝ in. (16 mm)	8d[8]	
Fiberboard sheathing:		See footnote 7
½ (13 mm)	No. 11 ga[9] 6d[5] No. 16 ga[10]	
25/32 in. (20 mm)	No. 11 ga[9] 8d[5] No. 16 ga[10]	
Interior paneling:		See footnote 7
¼ in. (6.4 mm)	4d[11]	
⅜ in. (9.5 mm)	6d[12]	

[1] Common or box nails are permitted to be used except where otherwise stated.

[2] Nails spaced at 6 in. (152 mm) on center at edges, 12 in. (305 mm) at intermediate supports, except 6 in. (152 mm) at all supports, where spans are 48 in. (1219 mm) or more. Nails for wall sheathing are permitted to be common, box, or casing.

[3] Common or deformed shank.

[4] For roof sheathing applications, 8d nails are the minimum required for wood structural panels.

[5] Common.

[6] Deformed shank.

[7] Fasteners spaced 3 in. (76 mm) on center at exterior edges and 6 in. (152 mm) on center at intermediate supports.

[8] Corrosion-resistant siding or casing nail.

[9] Corrosion-resistant roofing nails with 7/16-in. (11-mm) diameter head and 1½ in. (38-mm) length for ½-in. (13-mm) sheathing, and 1¾-in. (44-mm) length for 25/32-in. (20-mm) sheathing.

[10] Corrosion-resistant staples with nominal 7/16-in. (11-mm) crown and 1⅛-in. (29-mm) length for ½-in. (13-mm) sheathing, and 1½-in. (38-mm) length for 25/32-in. (20-mm) sheathing. Panel supports at 16 in. (406 mm) [20 in. (508 mm) if strength axis in the long direction of the panel, unless otherwise marked].

[11] Casing or finish nails spaced 6 in. (152 mm) on panel edges, 12 in. (305 mm) at intermediate supports.

[12] Panel supports at 24 in. (610 mm). Casing or finish nails spaced 6 in. (152 mm) on panel edges, 12 in. (305 mm) at intermediate supports.

45.6.8.3 Sheathing nails or other approved sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

45.6.8.4 Connections depending on joist hangers or framing anchors, ties, and other mechanical fastenings not otherwise covered shall be permitted to be used where approved.

45.6.8.5 Clips, staples, glues, and other approved methods of fastening shall be permitted where approved.

45.6.8.6 Fasteners for preservative-treated and fire retardant–treated wood shall be of hot-dipped, zinc-coated galvanized steel; stainless steel; silicon bronze; or copper.

45.6.8.7 Fastenings for wood foundations shall be in accordance with AF&PA Technical Report No. 7, *Permanent Wood Foundation System,* or the SPC Publication, *Permanent Wood Foundations: Design & Construction Guide.*

45.6.9 Protection Against Decay and Termites.

45.6.9.1 Where required, protection from decay and termites shall be provided by the use of naturally durable or preservative-treated wood.

45.6.9.2 *Naturally durable wood* shall be understood to be the heartwood of the following species, with the exception that an occasional piece of heartwood with corner sapwood shall be permitted to be included if 90 percent or more of the width of each side on which it occurs is heartwood:

(1) Decay resistant: redwood, cedars, black locust
(2) Termite resistant: redwood, eastern red cedar

45.6.9.3 *Preservative-treated wood* shall be understood to be pressure-impregnated wood meeting the retention requirements applicable to the species, products, treatment, and conditions of use in the applicable standards of the American Wood Preservers Association (AWPA).

45.6.9.4 The requirements for protection shall be in accordance with 45.6.9.4.1 and 45.6.9.4.2.

45.6.9.4.1 In geographical areas where experience has demonstrated a specific need, approved naturally durable wood or preservative-treated wood shall be used for wood members that form the structural supports of the following:

(1) Buildings
(2) Balconies
(3) Porches
(4) Other permanent building appurtenances whose members are exposed to the weather without protection from a roof, eave, overhang, or other covering to prevent moisture or water accumulation on the surface or at joints between members

45.6.9.4.2 Depending on local experience, the structural members specified in 45.6.9.4.1 shall be permitted to include horizontal members such as girders, joists, and decking, and vertical members such as posts, poles, and columns.

45.6.9.5 The requirements for termite infestation areas shall be in accordance with 45.6.9.5.1 and 45.6.9.5.2.

45.6.9.5.1 In geographical areas where hazard of termite damage is known to be heavy, the authority having jurisdiction shall be permitted to require floor framing of naturally durable wood or preservative-treated wood, as addressed in 45.6.9.6 through 45.6.9.6.15, and soil treatment or other approved methods of termite protection.

45.6.9.5.2 In geographical areas where hazard of termite damage is known to be heavy, foam plastic insulation including, but not limited to, extruded or expanded polystyrene or polyisocyanurate, clearance between earth and foam plastics applied to the exterior wall shall not be less than 6 in. (152 mm). Foam plastic shall not be installed below grade on foundation walls or below grade on the exterior of slab foundations unless otherwise permitted by the following:

(1) Foam plastic insulation shall be permitted where an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
(2) Foam plastic insulation shall be permitted to be installed on the interior side of basement walls constructed of solid concrete.
(3) Foam plastic insulation shall be permitted to be applied to the exterior of slab foundations, provided that clearance between earth and foam plastics applied to the exterior wall is not less than 6 in. (152 mm).

45.6.9.6 The requirements for wood used above ground shall be in accordance with 45.6.9.6.1 through 45.6.9.6.16.

45.6.9.6.1 Wood installed above ground in the locations specified in this section shall be either naturally durable wood or preservative-treated wood.

45.6.9.6.2 Preservative-treated wood shall be in accordance with AWPA C2, *Standard for the Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Processes*, or AWPA C9, *Plywood—Preservative Treatment by Pressure Processes*, or applicable AWPA standards for aboveground use.

45.6.9.6.3 Where wood joists or the bottom of a wood structural floor without joists is closer than 18 in. (457 mm), or wood girders are closer than 12 in. (305 mm), to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation, the floor assembly (including posts, girders, joists, and subfloor) shall be of either naturally durable wood or preservative-treated wood.

45.6.9.6.4 All wood framing members, including wood sheathing, that rest on exterior foundation walls and are less than 8 in. (203 mm) from exposed earth shall be of either naturally durable wood or preservative-treated wood. Wood framing members and furring strips attached directly to the interior of exterior masonry or concrete walls below grade shall be of either approved naturally durable wood or preservative-treated wood.

45.6.9.6.5 Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of either naturally durable wood or preservative-treated wood.

45.6.9.6.6 The ends of wood girders entering exterior masonry or concrete walls shall be provided with a ½-in. (13-mm) air space on top, sides, and end, unless either naturally durable wood or preservative-treated wood is used.

45.6.9.6.7 Clearance between wood siding and earth on the exterior of a building shall not be less than 6 in. (152 mm), except where siding, sheathing, and wall framing are of either naturally durable wood or preservative-treated wood.

45.6.9.6.8 Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of either naturally durable wood or preservative-treated wood, unless otherwise permitted by the following:

(1) The requirement of 45.6.9.6.8 shall not apply to posts or columns that are either exposed to the weather or located in basements or cellars where both of the following criteria are met:
   (a) They are supported by concrete piers or metal pedestals projected at least 1 in. (25 mm) above the slab or deck and 6 in. (152 mm) above exposed earth.
   (b) They are separated from exposed earth by an impervious moisture barrier.
(2) The requirement of 45.6.9.6.8 shall not apply to posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building where both of the following criteria are met:
   (a) They are supported by a concrete pier or metal pedestal at a height greater than 8 in. (203 mm) from exposed earth.
   (b) They are separated from exposed earth by an impervious moisture barrier.

45.6.9.6.9 The portions of glued laminated timbers that form the structural supports of a building or other structure, and are exposed to weather and not protected by a roof, an eave, or a similar covering, shall be pressure treated with preservative or manufactured from naturally durable or preservative-treated wood.

45.6.9.6.10 Wood in contact with the ground or fresh water shall comply with the following:

(1) Wood in contact with the ground (exposed earth) that supports permanent structures shall be of naturally durable wood (of a species for both decay and termite resistance) or preservative-treated wood.
(2) Preservative-treated wood shall be treated in accordance with AWPA C2, AWPA C9, or other applicable AWPA standard for soil or fresh water contact where used in the locations specified in 45.6.9.6.10.
(3) Untreated wood shall be permitted where such wood is continuously and entirely below the groundwater level or is submerged in fresh water.

45.6.9.6.11 The following posts and columns supporting permanent structures shall be of preservative-treated wood:

(1) Posts embedded in concrete in direct contact with the earth
(2) Posts embedded in concrete exposed to the weather
(3) Posts in direct contact with the earth

45.6.9.6.12 Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood, unless separated from such floors or roofs by an impervious moisture barrier.

45.6.9.6.13 Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches, or similar permanent building appurtenances where such members are exposed to the weather without protection from a roof, an eave, an overhang, or other covering to prevent moisture or water accumulation on the surface or at joints between members.

45.6.9.6.14 The requirement of 45.6.9.6.13 shall not apply to buildings located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use durable materials where the structure is exposed to weather.

45.6.9.6.15 Wood installed in retaining or crib walls shall be of preservative-treated wood that has been treated in accordance with AWPA C2 or AWPA C9 for protection from soil and fresh water contact, unless otherwise permitted by the following:

(1) Where the wall is not more than 2 ft (610 mm) in height and is separated from the lot line or a permanent building by a minimum distance equal to the height of the wall, the wall shall be permitted to be of untreated wood.
(2) Where a retaining wall or a crib wall is not more than 2 ft (610 mm) in height and is located on the lot line, the wall shall be permitted to be of naturally durable wood.
(3) Where a retaining wall or a crib wall is not more than 4 ft (1219 mm) in height and is separated from the lot line or a permanent building by a minimum distance equal to the height of the wall, the wall shall be permitted to be of naturally durable wood.

45.6.9.6.16 Lumber and plywood used in wood foundation systems shall conform to Chapter 36 and the provisions of AF&PA Technical Report No. 7 or the SPC Publication, *Permanent Wood Foundations: Design & Construction Guide*.

45.6.10 Wood Supporting Masonry or Concrete. Wood members shall not be used to permanently support the dead load of any masonry or concrete, unless otherwise permitted by the following:

(1) Masonry or concrete nonstructural floor or roof surfacing not more than 4 in. (102 mm) thick shall be permitted to be supported by wood members.
(2) Any structure shall be permitted to rest on wood piles constructed in accordance with the requirements of Chapter 36.
(3) Veneer of brick, concrete, or stone applied in an approved manner shall be permitted to be supported by an approved, treated wood foundation where the maximum height of veneer is not more than 30 ft (9.1 m) above the foundation.
(4) Where the veneer specified in 45.6.10(3) is used as an interior wall finish as permitted by ACI 530/ASCE 5/TMS 402, *Building Code Requirements for Masonry Structures*, to support masonry veneer or wood, it shall be permitted to be supported on wood floors that are designed to support the additional load and to limit the deflection and shrinkage to 1/600 of the span of the supporting members.
(5) Glass block masonry having an installed weight of 20 lb/ft^2 (97.6 kg/m^2) or less, and installed in an approved manner, shall be permitted to be supported by wood members, provided that supporting wood floors are designed to limit deflection and shrinkage to 1/600 of the span of the supporting members.

45.6.11 Fiberboard.

45.6.11.1 To ensure tight-fitting assemblies, fiberboard edges shall be manufactured with square, shiplapped, beveled, tongue-and-groove or U-shaped joints.

45.6.11.2 Where used as roof insulation in all types of construction, fiberboard shall be protected with an approved roof covering.

45.6.11.3 Where installed and fireblocked to comply with Chapter 8, fiberboard shall be permitted to be used as wall insulation in all types of construction.

45.6.11.4 In fire wall and fire separation wall constructions, unless treated to comply with a flame spread of 25 or less and a smoke developed index of 450 or less, as determined in accordance with NFPA 255, the boards shall be cemented directly to the concrete, masonry, or other noncombustible or limited-combustible base and shall be protected with an approved noncombustible or limited-combustible veneer anchored to the base without intervening air spaces.

45.6.11.5 Fiberboard wall insulation applied on the exterior of foundation walls shall be protected below ground level with a bituminous coating.

45.6.11.6 Where used as roof decking in open beam construction, fiberboard insulation roof decking shall have a nominal thickness of not less than 1 in. (25.4 mm).

Chapter 46 Glass and Glazing

46.1 General.

46.1.1 All glass and glazing construction shall be designed and constructed in accordance with this chapter, all other applicable requirements of this *Code*, and the referenced standards in Chapter 2.

46.1.2 Where the requirements of the referenced standards differ from the requirements of this chapter, the requirements of this chapter shall apply.

46.2 Special Definitions.

46.2.1 Dalle Glass. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

46.2.2 Decorative Glass. A carved, leaded, or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture, or other design qualities or components cannot be removed without destroying the glazing material; and whose surface, or assembly into which it is incorporated, is divided into segments.

46.3 Labeling.

46.3.1 Each light shall bear the manufacturer's label designating the type and thickness of glass or glazing.

46.3.1.1 Safety glazing shall be identified in accordance with 46.5.1.1.

46.3.1.2 When approved by the authority having jurisdiction, labels shall not be required on glass, other than tempered glass, provided that an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with the approved plans and specifications.

46.3.2 Each unit of tempered glass shall be permanently identified by the manufacturer, as specified in 46.3.2.1 and 46.3.2.2.

46.3.2.1 The permanent identification shall be etched or ceramic-fired on the glass and shall be visible when the unit is glazed.

46.3.2.2 Tempered spandrel glass shall be exempted from permanent labeling as described in 46.3.2 and shall be identified with a removable paper label by the manufacturer.

46.4 Louvered Windows or Jalousies.

46.4.1 Float, wired, and patterned glass in jalousies and louvered windows shall be no thinner than nominal 3⁄16 in. (5 mm) and no longer than 48 in. (1220 mm).

46.4.1.1 Where glass types other than those described in 46.4.1 are used, the design shall be submitted to the authority having jurisdiction for approval.

46.4.1.2 Exposed glass edges shall be smooth.

46.4.2 Wired glass with wire exposed on longitudinal edges shall not be used in jalousies or louvered windows.

46.5 Human Impact Loads.

46.5.1 Testing and Classification of Glazing. Glazing shall be tested and classified as follows:

(1) Individual glazed areas, including glass mirrors, in hazardous locations such as those indicated in 46.5.2 shall pass the test requirements of CPSC 16 CFR 1201.
(2) Glazing shall comply with the CPSC 16 CFR 1201 criteria for Category I or Category II as indicated in Table 46.5.1, unless otherwise required in 46.5.1(3) through 46.5.1(6).
(3) In other than educational occupancies, wired glass installed in fire door assemblies, fire window assemblies, and view panels in fire resistance–rated walls shall comply with ANSI Z-97.1, *Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.*
(4) Light-transmitting materials used as glazing in hazardous locations shall comply with the weathering requirements of ANSI Z-97.1.
(5) The requirements of 46.5.1 shall not apply to glass-block walls
(6) Louvered windows and jalousies shall comply with Section 46.4.

46.5.1.1 Identification of Safety Glazing.

46.5.1.1.1 Except as indicated in 46.5.1.3, each pane of safety glazing installed in hazardous locations shall be identified by a label specifying whether the manufacturer or installer is the labeler and the safety glazing standard with which it complies, as well as the information specified in Section 46.3.

46.5.1.1.2 The label required by 46.5.1.1.1 shall be one of the following types:

(1) Acid etched
(2) Sand blasted
(3) Ceramic fired
(4) Embossed mark
(5) Type that, once applied, cannot be removed without being destroyed

46.5.1.2 Alternative Identification of Safety Glazing. The requirements of 46.5.1.1 shall not apply where the following criteria are met:

(1) For other than tempered glass, labels shall not be required, provided that the authority having jurisdiction approves the submission of a certificate, affidavit, or other evidence confirming compliance with this *Code*.
(2) Tempered spandrel glass shall be permitted to be identified by the manufacturer with a removable paper label.

46.5.1.3 Multilight Assemblies.

46.5.1.3.1 Multilight glazed assemblies having individual lights not exceeding 1 ft^2 (0.09 m^2) in exposed area shall have at least one light in the assembly marked as indicated in 46.5.1.1.

Table 46.5.1 Minimum Category Classification of Glazing

Exposed Surface Area of One Side of One Light	Glazing in Storm or Combination Doors	Glazing in Doors	Glazed Panels Regulated by 46.5.2.1(8)	Glazed Panels Regulated by 46.5.2.1(7)	Doors and Enclosures Regulated by 46.5.2.1(5) and 46.5.2.1(6)	Sliding Glass Doors Patio Type
≤9 ft^2	I	I	No requirements	I	II	II
>9 ft^2	II	II	II	II	II	II

For SI units, 1 ft^2 = 0.093 m^2.

46.5.1.3.2 Lights in the assembly, other than those described in 46.5.1.3.1, shall be marked "CPSC 16 CFR 1201" or "ANSI Z97.1," as appropriate.

46.5.2 Hazardous Locations.

46.5.2.1 The following specific hazardous locations shall require safety glazing materials:

(1) Glazing in swinging doors, except jalousies
(2) Glazing in fixed panels and sliding panels of sliding-type door assemblies and panels in sliding and bifold closet door assemblies
(3) Glazing in storm doors
(4) Glazing in all unframed swinging doors
(5) Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs, and showers
(6) Glazing in any portions of a building wall enclosing hot tubs, whirlpools, saunas, steam rooms, bathtubs, and showers where the bottom exposed edge of the glazing is less than 60 in. (1524 mm) above a standing surface
(7) Glazing in an individual fixed or operable panel adjacent to a door where both of the following conditions exist:
    (a) The nearest exposed edge of the glazing is within a 24-in. (610-mm) arc of either vertical edge of the door in a closed position.
    (b) The bottom exposed edge of the glazing is less than 60 in. (1524 mm) above the floor or walking surface.
(8) Glazing in an individual fixed or operable panel, other than in those locations described in 46.5.2.1(5), 46.5.2.1(6), and 46.5.2.1(7), where all of the following conditions exist:
    (a) The exposed area of an individual pane is greater than 9 ft^2 (0.84 m^2).
    (b) The exposed bottom edge is less than 18 in. (457 mm) above the floor.
    (c) The exposed top edge is greater than 36 in. (914 mm) above the floor.
    (d) One or more walking surface(s) is within 36 in. (914 mm) horizontally of the plane of the glazing.
(9) Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface
(10) Glazing in walls and fences enclosing indoor and outdoor swimming pools, hot tubs, and spas where all of the following conditions are present:
    (a) The bottom edge of the glazing on the pool or spa side is less than 60 in. (1524 mm) above a walking surface on the pool or spa side of the glazing.
    (b) The glazing is within 60 in. (1524 mm) horizontally of the water's edge of a swimming pool or spa.
(11) Glazing adjacent to stairways, landings, and ramps within 36 in. (914 mm) horizontally of a walking surface where the exposed surface of the glass is less than 60 in. (1524 mm) above the plane of the adjacent walking surface
(12) Glazing adjacent to stairways within 60 in. (1524 mm) horizontally of the bottom tread of a stairway in any direction where the exposed surface of the glass is less than 60 in. (1524 mm) above the nose of the tread

46.5.2.2 The requirements of 46.5.2.1 shall not apply where otherwise permitted by the following:

(1) Glazing in panels where there is an intervening wall or other permanent barrier between the door and glazing shall not be required to comply with 46.5.2.1(7).
(2) Glazing specified in 46.5.2.1(7) shall comply with 46.5.2.1(8) where located as follows:
    (a) In walls perpendicular to the plane of the door in a closed position in one- and two-family dwellings
    (b) In walls perpendicular to the plane of the door in a closed position within dwelling units of apartment occupancies
    (c) In walls perpendicular to the plane of the door in a closed position in residential board and care occupancies, small facilities
    (d) Where access is through the door to a closet or storage area 3 ft (0.9 m) or less in depth
(3) Safety glazing as specified in 46.5.2.1(8) shall not be required in the following installations:
    (a) A protective bar 1½ in. (38 mm) or more in height, capable of withstanding a horizontal load of 50 lb/ft (730 N/m) without contacting the glass, installed on the accessible sides of the glazing 34 in. to 38 in. (864 mm to 965 mm) above the floor
    (b) The outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 ft (7.6 m) or more above any grade, roof, walking surface, or other horizontal or sloped [within 45 degrees (0.78 rad) of horizontal] surface adjacent to the glass exterior
(4) Safety glazing as specified in 46.5.2.1(11) and 46.5.2.1(12) shall not be required for the following installations:
    (a) Where the side of a stairway, landing, or ramp has a guard or handrail, including balusters or in-fill panels, complying with the provisions of 11.2.2.4.5 and 35.6.5
    (b) Where the plane of the glass is greater than 18 in. (457 mm) from the railing

46.5.2.3 The following products, materials, and uses shall not be considered as creating hazardous locations:

(1) Openings in doors through which a 3-in. (75-mm) sphere is unable to pass
(2) Decorative glass as specified in 46.5.2.1(1), 46.5.2.1(7), and 46.5.2.1(8)
(3) Glazing materials used as curved glass panels in revolving doors
(4) Commercial refrigerated cabinet glazed doors
(5) Glass block panels
(6) Louvered windows and jalousies complying with the requirements of Section 46.4
(7) Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support

46.5.3 Fire Department Access Panels.

46.5.3.1 Fire department glass access panels shall be of tempered glass.

46.5.3.2 For insulating glass units, all panes shall be tempered glass.

46.6 Glass in Handrails and Guards. Glass used as structural balustrade panels in railings shall be constructed of one of the following:

(1) Single fully tempered glass
(2) Laminated fully tempered glass
(3) Laminated heat-strengthened glass

46.6.1 Glazing in railing in-fill panels shall meet the following requirements:

(1) Glazing in railing in-fill panels shall be of an approved safety glazing material that conforms to the provisions of Section 46.6.
(2) For all glazing types, the minimum nominal thickness shall be ¼ in. (6.4 mm).
(3) Fully tempered glass and laminated glass shall comply with Category II of CPSC 16 CFR 1201.

46.6.2 Structural balustrade panels shall meet the following requirements:

(1) The panels and their support system shall be designed to withstand the loads specified in 35.6.5.
(2) A safety factor of 4 shall be used.

46.6.3 Handrails and guard sections shall meet the following requirements:

(1) Each handrail or guard section shall be supported by a minimum of three glass balusters or shall be otherwise supported to remain in place if one baluster panel fails.
(2) Glass balusters shall not be installed without an attached handrail or guard.

46.6.4 Glazing materials shall not be installed in railings in parking garages, except for pedestrian areas not exposed to impact from vehicles.

46.7 Glazing in Athletic Facilities.

46.7.1 General. Glazing in athletic facilities and for similar uses subject to impact loads that forms whole or partial wall sections, or that is used as a door or part of a door, shall comply with 46.7.2 and 46.7.3.

46.7.2 Racquetball and Squash Courts.

46.7.2.1 Test methods and loads for individual glazed areas of racquetball and squash courts subject to impact loads shall conform to those of CPSC 16 CFR 1201, with impacts being applied at a height of 59 in. (1499 mm) above the playing surface to an actual or simulated glass wall installation with fixtures, fittings, and methods of assembly identical to those used in practice.

46.7.2.2 Glass walls shall meet the following criteria:

(1) A glass wall used in a racquetball or squash court, or for similar use subject to impact loads, shall remain intact following a test impact.
(2) The deflection of such walls shall be not greater than 1½ in. (38 mm) at the point of impact for a drop height of 48 in. (1219 mm).

46.7.2.3 Glass doors shall meet the following criteria:

(1) Glass doors shall remain intact following a test impact at the prescribed height in the center of the door.
(2) The relative deflection between the edge of a glass door and the adjacent wall shall not exceed the thickness of the wall plus ½ in. (12.7 mm) for a drop height of 48 in. (1219 mm).

46.7.3 Gymnasiums and Basketball Courts. Glazing in gymnasiums, multipurpose gymnasiums, basketball courts, exercise rooms, and similar athletic facilities subject to human impact loads shall comply with Category II of CPSC 16 CFR 1201.

46.8 Sloped Glazing and Skylights.

46.8.1 Section 46.8 shall apply to the installation of glass and other transparent, translucent, or opaque glazing material installed at a slope more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs, and sloped walls.

46.8.2 The requirements for allowable glazing materials and limitations shall be as follows:

(1) Sloped glazing shall be permitted to be of any of the following materials, subject to the limitations specified:
    (a) For monolithic glazing systems, the glazing material of the single light or layer shall be permitted to be any of the following:
        i. Laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer
        ii. Wired glass
        iii. Light-transmitting plastic materials meeting the requirements of Chapter 48
        iv. Heat-strengthened glass
        v. Fully tempered glass
    (b) For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in 46.8.2(1)(a).
(2) Annealed glass shall be permitted to be used as specified within 46.8.3.6(2) and 46.8.3.6(3).

46.8.3 Screens shall meet the requirements of 46.8.3.1 through 46.8.3.6.

46.8.3.1 Where used in monolithic glazing systems, heat-strengthened glass and fully tempered glass shall have screens installed below the glazing material.

46.8.3.2 The screens and their fastenings shall meet the following requirements:

(1) They shall be capable of supporting twice the weight of the glazing.
(2) They shall be installed within 4 in. (102 mm) of the glass.

46.8.3.3 The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gauge (0.0808 in.) with mesh not larger than 1 in. × 1 in. (25 mm × 25 mm).

46.8.3.4 In a corrosive atmosphere, structurally equivalent, noncorrosive screen materials shall be used.

46.8.3.5 Heat-strengthened glass, fully tempered glass, and wired glass, where used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.

46.8.3.6 In monolithic and multiple-layer sloped glazing systems, the following modifications to the requirements of 46.8.3.1 through 46.8.3.5 shall apply:

(1) Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass 10 ft (3 m) or less above the walking surface.
(2) Screens shall not be required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
(3) Any glazing material, including annealed glass, shall be permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 ft (9 m) above grade.
(4) Screens shall not be required within individual dwelling units in one- and two-family dwellings; within dwelling units of apartment occupancies; or within residential board and care occupancies, small facilities, where fully tempered glass is used as single glazing, or as both panes in an insulating glass unit, and where the following conditions are met:
    (a) Each pane of the glass is 16 ft^2 (1.5 m^2) or less.
    (b) The highest point of the glass is 12 ft (3.7 m) or less above any walking surface or other accessible area.
    (c) The glass thickness is 3⁄16 in. (4.8 mm) or less.
(5) Screens shall not be required for laminated glass with a 15-mil (0.38-mm) polyvinyl butyral (or equivalent) interlayer used within individual dwelling units in one- and two-family dwellings; within dwelling units of apartment occupancies; or within residential board and care occupancies, small facilities, where the following conditions are met:
    (a) Each pane of glass is 16 ft^2 (1.5 m^2) or less.
    (b) The highest point of the glass is 12 ft (3.7 m) or less above a walking surface or other accessible area.

46.8.4 Requirements for sloped glazing and skylight frames shall be as follows:

(1) In Type I and Type II construction, sloped glazing and skylight frames shall be constructed of noncombustible materials.
(2) In structures where acid fumes deleterious to metal are incidental to the use of the buildings, approved pressure-treated wood or other approved noncorrosive materials shall be permitted to be used for sash and frames.
(3) Sloped glazing and skylights shall be designed for tributary roof loads in Section 35.7.
(4) Skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal plane shall be mounted at least 4 in. (102 mm) above the plane of the roof on a curb construction as required for the frame.
(5) Skylights shall not be installed in the plane of the roof where the roof pitch is less than 45 degrees (0.79 rad) from the horizontal.
(6) Curbs for skylights shall not be required on roofs with a minimum slope of 14 degrees (3 units vertical in 12 units horizontal) in one- and two-family dwellings. All unit skylights installed in a roof with a pitch flatter than 14 degrees (0.25 rad) shall be mounted at least 4 in. (102 mm) above the plane of the roof on a curb construction as required for the frame, unless otherwise specified in the manufacturer's installation instructions.

46.9 Glass Supports.

46.9.1 To be considered firmly supported, the framing members for each individual pane of glass shall be designed so the deflection of the edge of the glass perpendicular to the glass pane does not exceed 1⁄175 of the glass edge length or ¾ in. (19.1 mm), whichever is less, when subjected to the larger of the positive or negative load where loads are combined as specified in Section 35.15.

46.9.2 Where the firm support specified in 46.9.1 is not provided on all sides (for example, three sides, two sides, cantilever, or highly flexible), the following criteria shall be met:

(1) Detailed shop drawings and specifications and rational analysis or test data, or both, assuring safe performance for the specific installation shall be prepared by engineers experienced in such work
(2) The drawings and specifications and analysis or test data, or both, shall be submitted to, and formally approved by, the authority having jurisdiction.

46.10 Wind, Snow, and Dead Loads on Glass and Glazing.

46.10.1 Glass Sloped 15 Degrees (0.26 rad) or Less from Vertical.

46.10.1.1 Glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors, and other exterior applications shall be designed to resist the wind loads in Section 35.9 for components and cladding.

46.10.1.2 Glazing firmly supported on all four edges shall be permitted to be designed as vertical glazing based on the following equation:

$$F_{gw} \le F_{ga} \qquad \textbf{(46.1)}$$

where:
F_{gw} = wind load on the glass computed per Section 35.9 [psf (kN/m^2)]
F_{ga} = maximum allowable load on glass [psf (kN/m^2)] *(See 46.10.1.3.)*

46.10.1.3 The maximum allowable load on the glass shall be computed by the following formula:

$$F_{ga} = c_1 F_{ge} \quad \textbf{(46.2)}$$

where:
c_1 = factor determined from Table 46.10.1.3 based on glass type
F_{ge} = maximum allowable equivalent load determined from Figure 46.10.1.3(a) through Figure 46.10.1.3(l) for the applicable glass dimensions and thickness [psf (kN/m^2)]

Table 46.10.1.3 c_1 Factors for Vertical and Sloped Glass [for use with Figure 46.10.1.3(a) through Figure 46.10.1.3(l)][a]

Glass Type	Factor
Single glass	
Regular (annealed)	1.0
Heat strengthened	2.0
Fully tempered	4.0
Wired	0.5
Patterned[b]	1.0
Sandblasted[c]	0.5
Laminated—regular plies[d]	0.7/0.9[e]
Laminated—heat-strengthened plies[d]	1.5/1.8[e]
Laminated—fully tempered plies[d]	3.0/3.6[e]
Insulating glass[f]	
Regular (annealed)	1.8
Heat strengthened	3.6
Fully tempered	7.2
Laminated—regular plies[d]	1.4/1.6[e]
Laminated—heat-strengthened plies[d]	2.7/3.2[e]
Laminated—fully tempered plies[d]	5.4/6.5[e]

[a] Either Table 46.10.1.3 or Table 46.10.2.4 is appropriate for sloped glass, depending on whether the snow or wind load is dominant (*see 45.10.2.*) For glass types (vertical or sloped) not included in the tables, refer to ASTM E 1300, *Standard Practice for Determining Load Resistance of Glass in Buildings*, for guidance.
[b] The value for patterned glass is based on the thinnest part of the pattern; interpolation between graphs is permitted.
[c] The value for sandblasted glass is for moderate levels of sandblasting.
[d] Values for laminated glass are based on the total thickness of the glass and apply for glass with two equal glass ply thicknesses.
[e] The lower value applies where, for any laminated glass pane, either the ratio of the long to short dimension is greater than 2.0, or the lesser dimension divided by the thickness of the pane is 150 or less. The higher value applies in all other cases.
[f] Values apply for insulating glass with identical panes.

46.10.1.4 Where the glass is not firmly supported on all four edges, analysis or test data ensuring safe performance for the specific installation shall be prepared by a registered design professional.

46.10.2 Glass Sloped More Than 15 Degrees (0.26 rad) from Vertical.

46.10.2.1 Glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs, and other exterior applications shall be designed to resist the most critical of the following combinations of loads:

(1)
$$F_g = W_o - D \quad \textbf{(46.3)}$$

(2)
$$F_g = W_i + D + 0.5\ S \quad \textbf{(46.4)}$$

(3)
$$F_g = 0.5\ W_i + D + S \quad \textbf{(46.5)}$$

where:
F_g = total load on glass [psf (kN/m^2)]
W_o = outward wind force, as calculated in Section 35.9 [psf (kN/m^2)]
D = glass dead load [psf (kN/m^2)] *[see 46.10.2.2]*
W_i = inward wind force as calculated in Section 35.9 [psf (kN/m^2)]
S = snow load as determined in Section 35.8 [psf (kN/m^2)]

46.10.2.2 The glass dead load shall be defined as follows:

(1) For glass sloped 30 degrees (0.52 rad) or less from horizontal,

$$D = 13\ t_g \quad \text{(for SI, } D = 0.0245\ t_g\text{)} \quad \textbf{(46.6)}$$

(2) For glass sloped more than 30 degrees (0.52 rad) from horizontal,

$$D = 13\ t_g \cos\theta \quad \text{(for SI, } D = 0.0245\ t_g \cos\theta\text{)} \quad \textbf{(46.7)}$$

where:
t_g = total glass thickness of glass panes and plies [in. (mm)]
θ = angle of slope from horizontal

46.10.2.3 The design of sloped glazing shall be based on the following equation:

$$F_g \le F_{ga} \quad \textbf{(46.8)}$$

where:
F_g = maximum load on the glass determined from the load combinations of Equation 46.3, Equation 46.4, and Equation 46.5. [psf (kN/m^2)]
F_{ga} = maximum allowable load on the glass [psf (kN/m^2)] *[see 46.10.2.4]*

46.10.2.4 The maximum allowable load on the glass shall be determined as follows:

(1) If F_g is determined by load combinations shown in Equation 46.3 and Equation 46.4, F_{ga} shall be computed as for vertical glazing in 46.10.1.3.
(2) If F_g is determined by the load combination shown in Equation 46.5, F_{ga} shall be computed by the following equation:

$$F_{ga} = c_2 F_{ge} \quad \textbf{(46.9)}$$

where:
c_2 = factor determined from Table 46.10.2.4, based on glass type
F_{ge} = maximum allowable equivalent load determined from Figure 46.10.1.3(a) through Figure 46.10.1.3(l) for the applicable glass dimensions and thickness [psf (kN/m^2)]

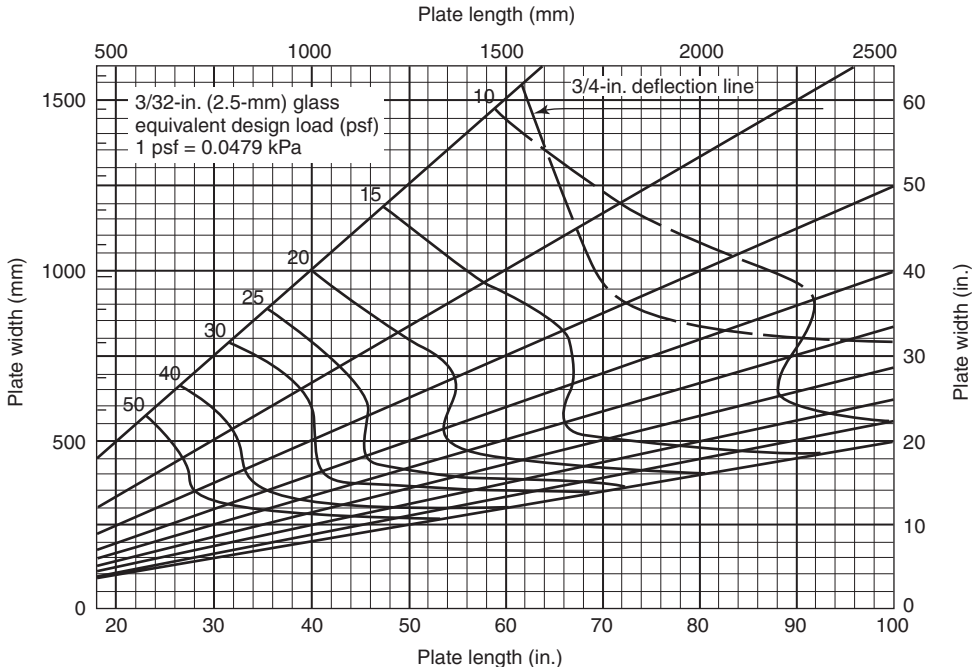


FIGURE 46.10.1.3(a) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [3⁄32-in. (2.5-mm) glass].

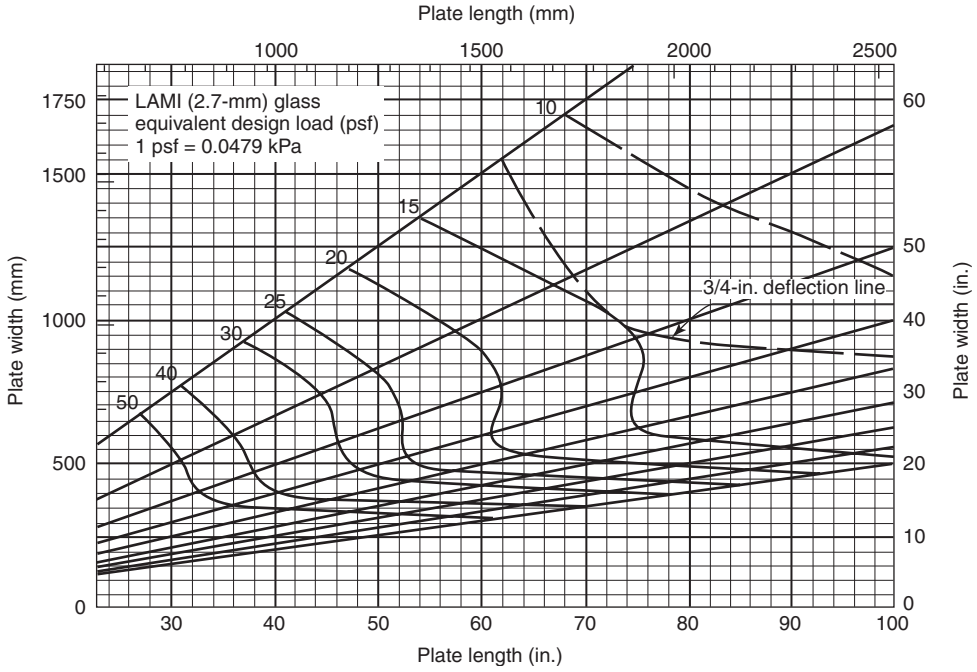


FIGURE 46.10.1.3(b) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [LAMI Glass (7⁄64 in. (2.7 mm))].

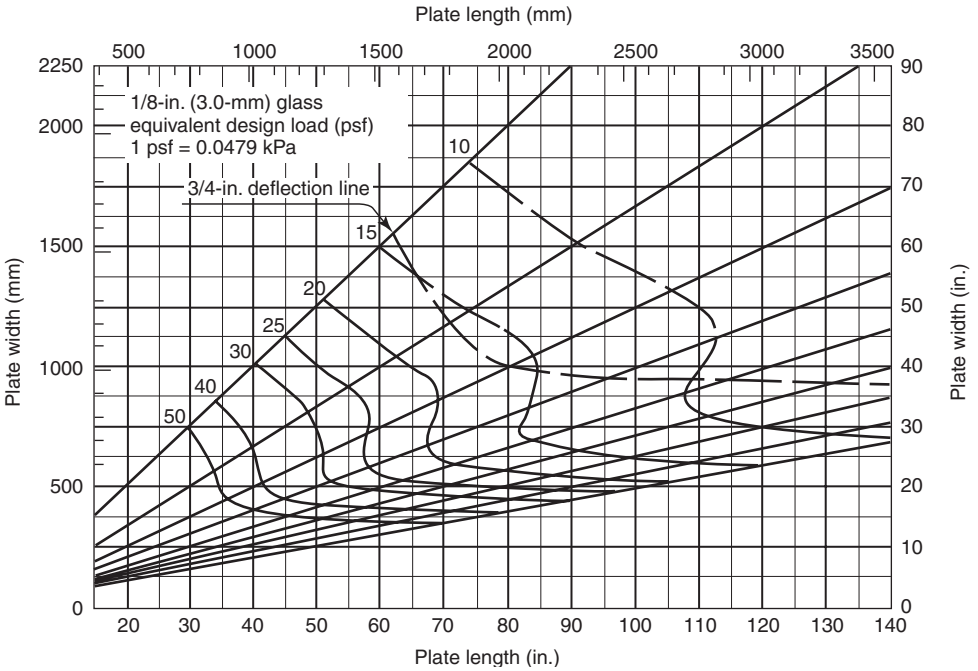


FIGURE 46.10.1.3(c) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [⅛-in. (3.0-mm) glass].

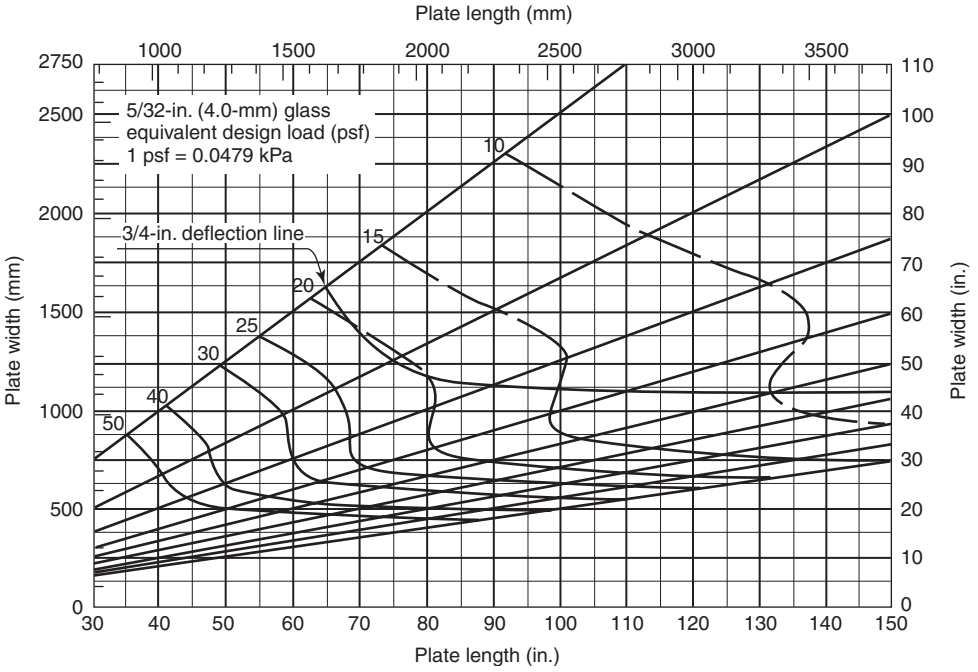


FIGURE 46.10.1.3(d) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [5⁄32-in. (4.0-mm) glass].

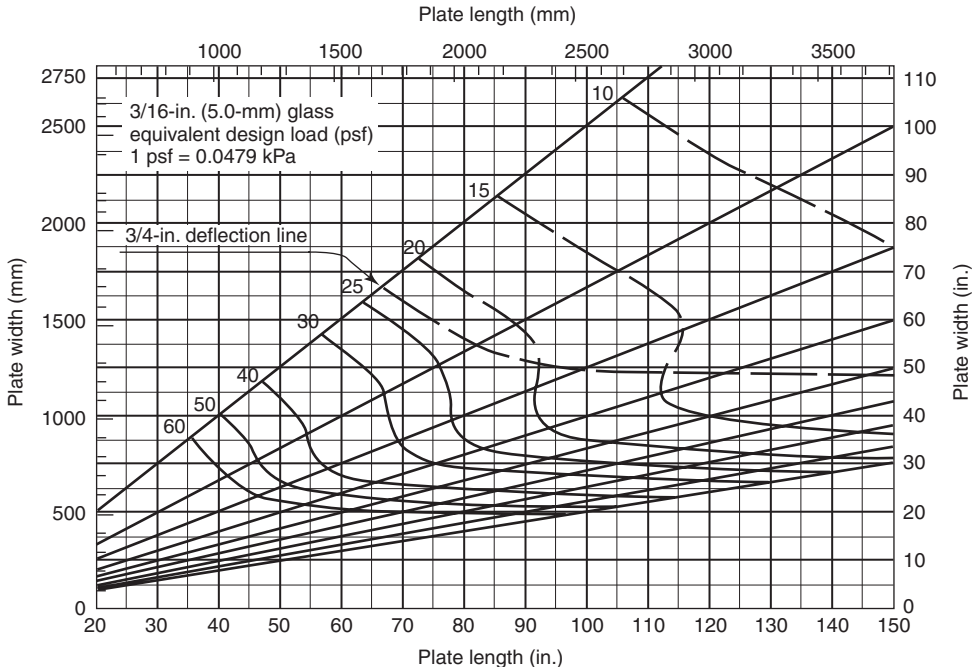


FIGURE 46.10.1.3(e) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [3⁄16-in. (5.0-mm) glass].

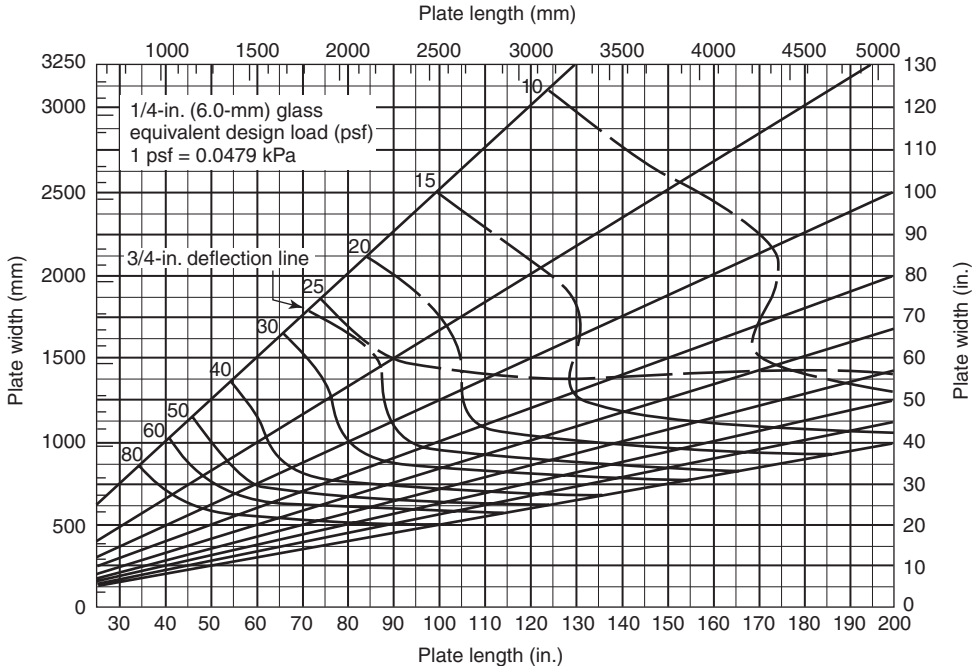


FIGURE 46.10.1.3(f) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [1⁄4-in. (6.0-mm) glass].

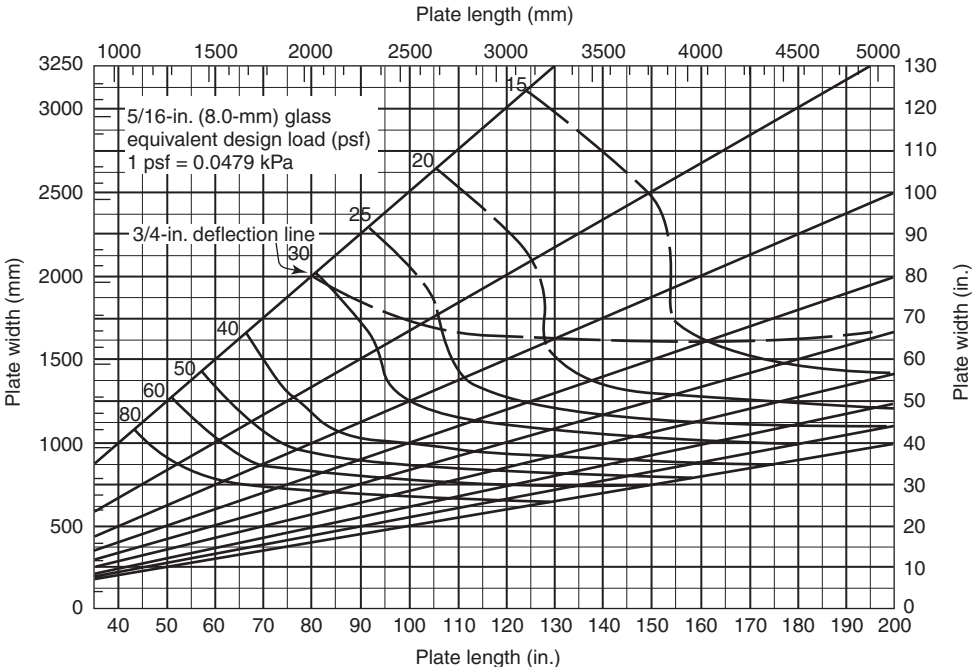


FIGURE 46.10.1.3(g) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [5/16-in. (8.0-mm) glass].

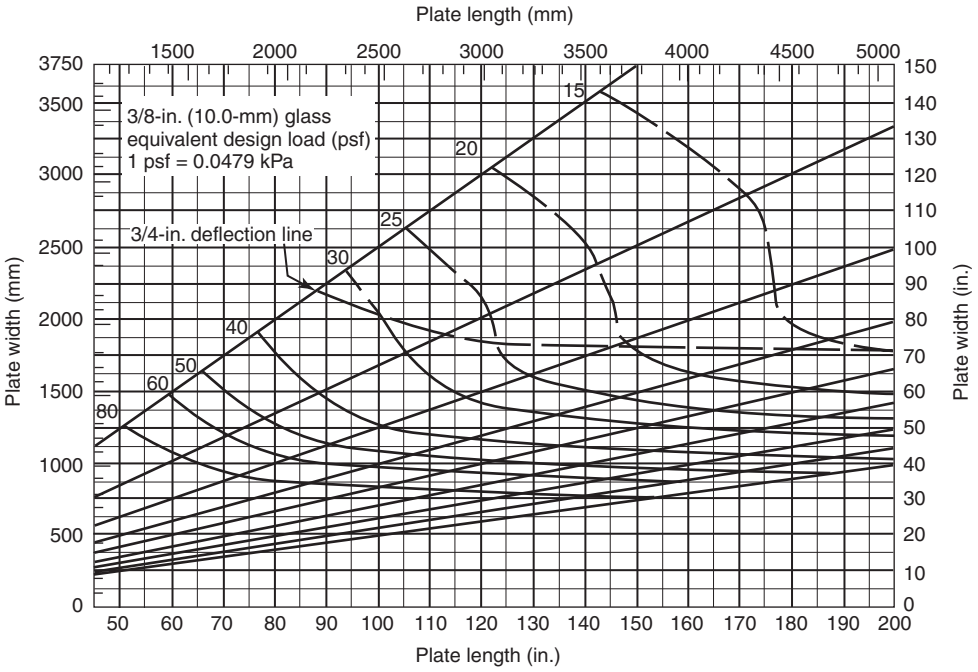


FIGURE 46.10.1.3(h) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [3/8-in. (10.0-mm) glass].

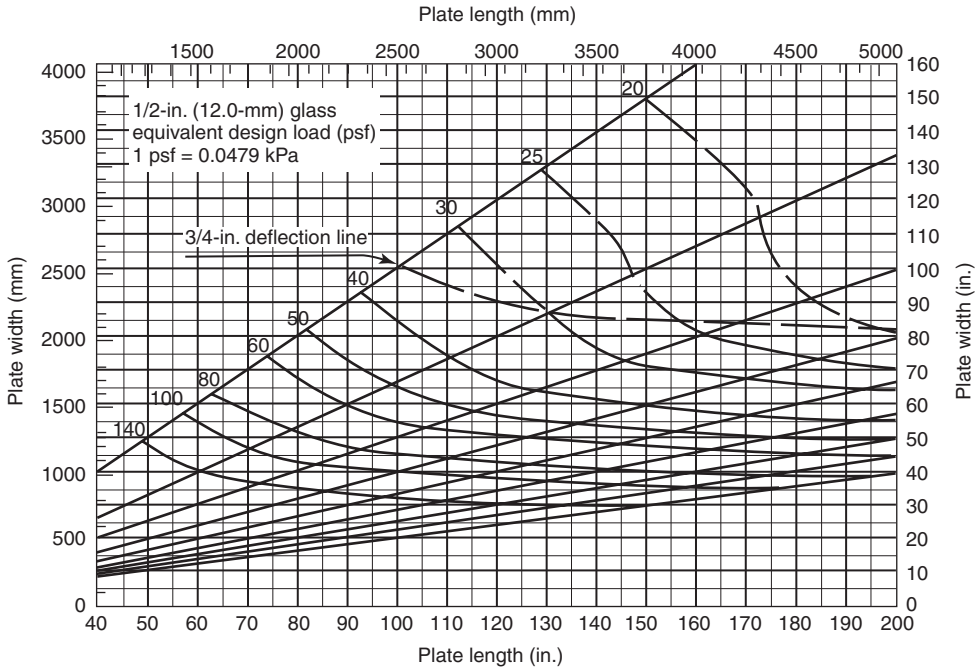


FIGURE 46.10.1.3(i) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [½-in. (12.0-mm) glass].

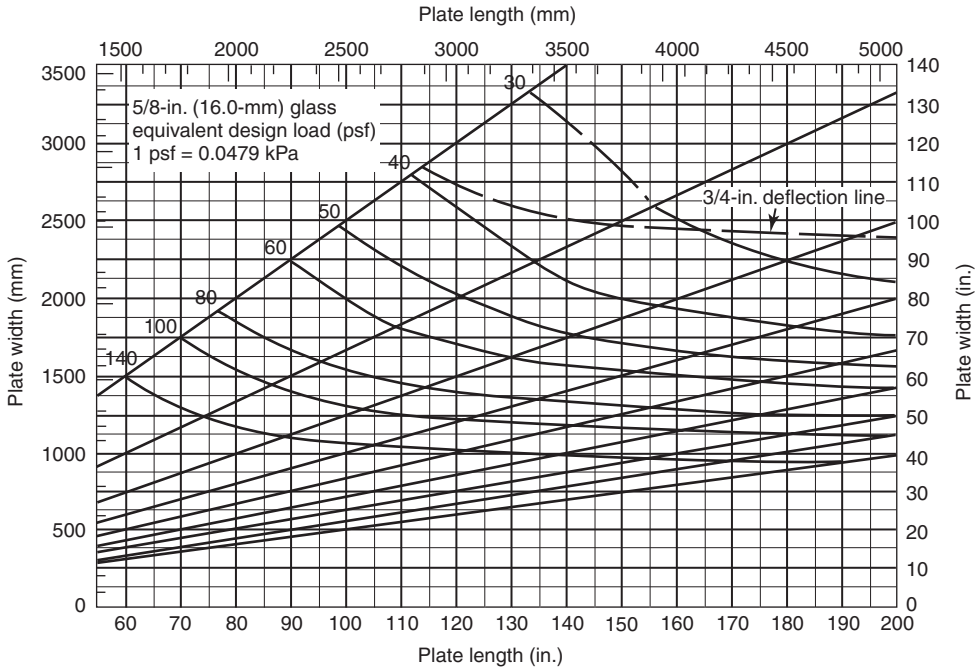


FIGURE 46.10.1.3(j) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [⅝-in. (16.0-mm) glass].

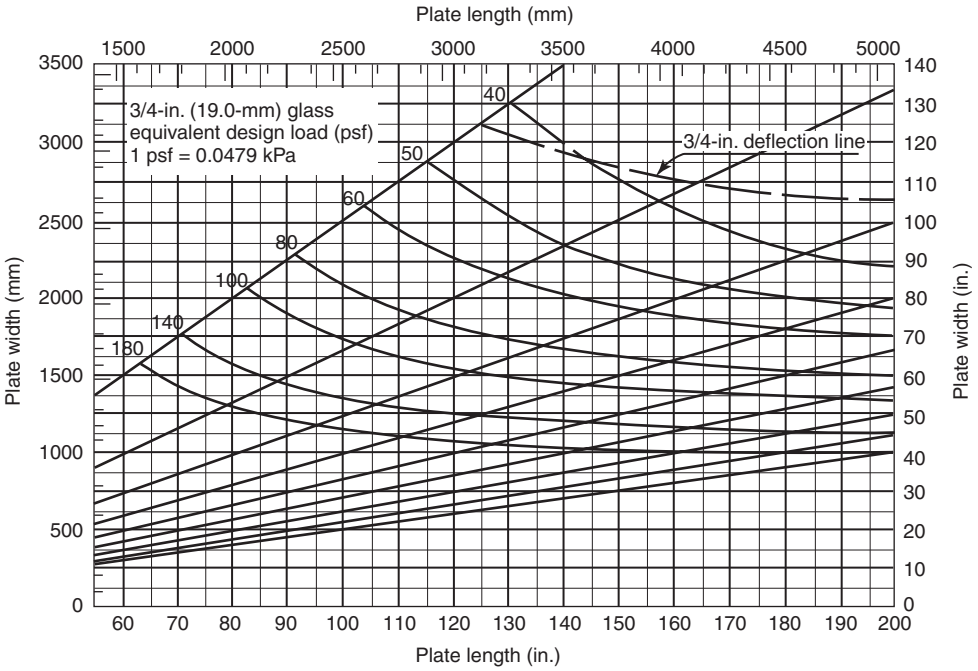


FIGURE 46.10.1.3(k) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [¾-in. (19.0-mm) glass).

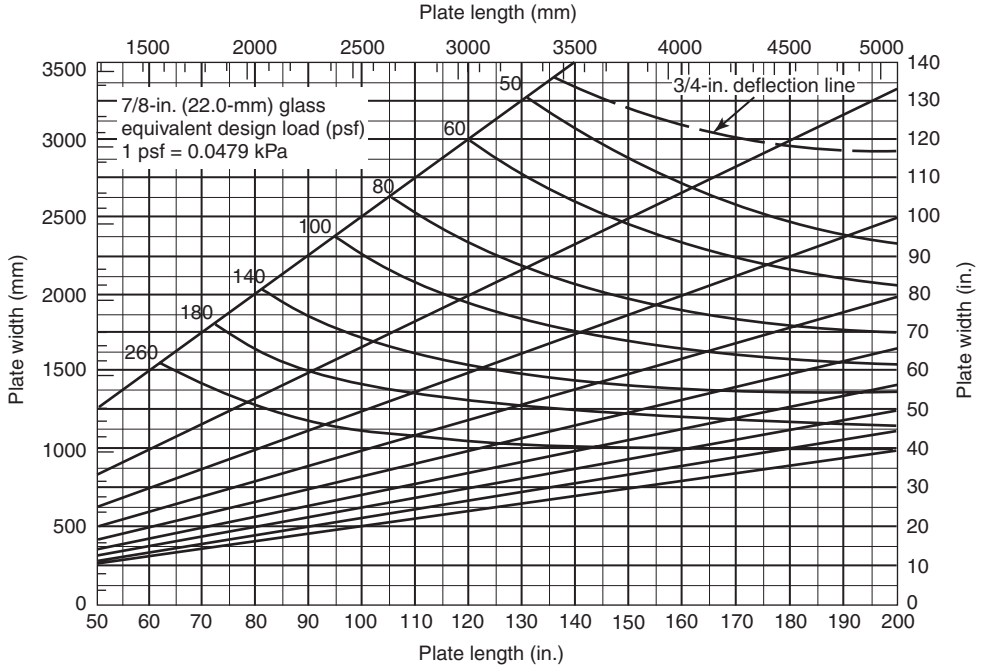


FIGURE 46.10.1.3(l) Maximum Allowable Load for Vertical and Sloped Rectangular Glass Supported on All Edges [⅞-in. (22.0-mm) glass].

Table 46.10.2.4 c_2 Factors for Sloped Glass [for use with Figure 46.10.1.3(a) through Figure 46.10.1.3(l)][a]

Glass Type	Factor
Single glass	
Regular (annealed)	0.6
Heat strengthened	1.6
Fully tempered	3.6
Wired	0.3
Patterned[b]	0.6
Laminated—regular plies[c]	0.3/0.5[d]
Laminated—heat-strengthened plies[c]	0.8/1.2[d]
Laminated—fully tempered plies[c]	1.8/2.7[d]
Insulating glass[e]	
Regular (annealed)	1.1
Heat strengthened	2.9
Fully tempered	6.5
Laminated — regular plies[c]	0.5/0.8[d]
Laminated — heat-strengthened plies[c]	1.4/2.2[d]
Laminated — fully tempered plies[c]	3.3/4.9[d]

[a] Either Table 46.10.1.3 or Table 46.10.2.4 is appropriate for sloped glass, depending on whether the snow or wind load is dominant (*see 46.10.2*). For glass types (vertical or sloped) not included in the tables, refer to ASTM E 1300 for guidance.

[b] The value for patterned glass is based on the thinnest part of the pattern; interpolation between graphs is permitted.

[c] Values for laminated glass are based on the total thickness of the glass and apply for glass with two equal glass ply thicknesses.

[d] The lower value applies where, for any laminated glass pane, either the ratio of the long to short dimension is greater than 2.0, or the lesser dimension divided by the thickness of the pane is 150 or less. The higher value applies in all other cases.

[e] Values apply for insulating glass with identical panes.

46.11 Glass in Floors and Sidewalks.

46.11.1 Glass installed in the walking surface of floors, landings, stairwells, and similar locations shall comply with 46.11.2 through 46.11.4.

46.11.2 The design for glass used in floors, landings, stair treads, and similar locations shall be determined as indicated in 46.11.4, based on the load that produces the greater stresses from one of the following:

(1) The uniformly distributed unit load (F_u) from Section 35.6.2
(2) The concentrated load (F_c) from Section 35.6.3
(3) The actual load (F_a) produced by the intended use

46.11.2.1 The dead load (D) for glass in psf (kN/m^2) shall be taken as the total thickness of the glass plies in. × 13 (mm × 0.0245).

46.11.2.2 Load reductions allowed by 35.6.7 shall not be permitted.

46.11.3 Requirements for glass used in floors and sidewalks shall be as follows:

(1) Laminated glass having a minimum of two plies shall be used.
(2) The glass shall be capable of supporting the total design load, as indicated in 46.11.4, with any one ply broken.

46.11.4 The design of the glass shall be determined in accordance with the following:

(1)

$$\left[2\ F_u + D\right] \le 0.67 c_2 F_{ge} \qquad \textbf{(46.10)}$$

(2)

$$\left[(8\ F_c/A) + D\right] \le 0.67 c_2 F_{ge} \qquad \textbf{(46.11)}$$

(3)

$$\left[F_a + D\right] \le 0.67 c_2 F_{ge} \qquad \textbf{(46.12)}$$

where:
F_u = uniformly distributed load [psf (kN/m^2)]
D = glass dead load [psf (kN/m^2)]
= 13 t_g (for SI, D = 0.0245 t_g) where t_g = total glass thickness [in. (mm)]
c_2 = factor determined from Table 46.10.2.4 based on glass type
F_{ge} = maximum allowable load on glass, determined from Figure 46.10.1.3(a) through Figure 46.10.1.3(l) for the applicable glass dimensions and thickness [psf (kN/m^2)]
F_c = concentrated load [lb (kN)]
A = area of rectangular glass [ft^2(m^2)]
F_a = actual intended use load [psf (kN/m^2)]

46.11.4.1 The factor, c_2, for laminated glass in Table 46.10.2.4 shall apply to two-ply laminates only.

46.11.4.2 The value of F_a shall be doubled for dynamic applications.

46.12 Glazing Replacement. The installation or replacement of glass shall be as required for new installations.

46.13 Fire Protection Glazing. Fire protection glazing shall comply with the requirements in Chapter 8.

Chapter 47 Gypsum Board, Lath, and Plaster

47.1 General Requirements.

47.1.1 Application.

47.1.1.1 The requirements of this chapter shall apply to the use of gypsum board, gypsum veneer plaster, gypsum plaster, and portland cement plaster.

47.1.1.2 Gypsum board, gypsum veneer plaster, gypsum plaster, and portland cement plaster systems and materials shall be constructed in accordance with this chapter and all other applicable requirements of this *Code*.

47.1.2 Identification and Storage of Materials. All materials shall be delivered, stored, and identified in accordance with the provisions of the material standard referenced by this *Code*.

47.1.3 Fire Rating Required. Where required to provide a fire resistance rating, lath, plaster, and gypsum board systems or assemblies shall meet the requirements of Chapter 8 of this *Code*.

47.1.4 Inspection. Lath and gypsum wallboard shall be inspected in accordance with 1.7.6.6.3.4(F) of this *Code*.

47.1.5 Special Definitions.

47.1.5.1 Dash-bond Coat (of plaster). A thick, wet mixture of aggregate and portland cement mixed in proportions of two parts aggregate to one part portland or plastic cement, dashed onto a monolithic surface to improve the mechanical key for subsequent plaster coats.

47.1.5.2 Gypsum Base for Veneer Plaster. A gypsum board used as the base for application of a gypsum veneer plaster.

47.1.5.3 Gypsum Board. The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing.

47.1.5.4 Gypsum Lath. A gypsum board used as the base for application of gypsum plaster.

47.1.5.5 Gypsum Panel Products. The general name for a family of sheet products consisting essentially of gypsum.

47.1.5.6 Gypsum Wallboard. A gypsum board used primarily as an interior surfacing for building structures.

47.1.5.7 Moist Curing. A method for the retention of moisture for hydration of portland cement plaster.

47.1.5.8 Plaster.

47.1.5.8.1 Gypsum Plaster. The generic name for a family of powdered cementitious products consisting primarily of calcined gypsum with additives to modify physical characteristics, and having the ability, when mixed with water, to produce a plastic mortar or slurry that can be formed to the desired shape by various methods and that subsequently sets to a hard, rigid mass.

47.1.5.8.2 Gypsum Veneer Plaster. A calcined gypsum plaster specially manufactured to provide high strength, hardness, and abrasion resistance when applied in thin coats over a gypsum base for veneer plasters.

47.1.5.8.3 Portland Cement Plaster. A plaster mix in which portland cement or combinations of portland and masonry cements or portland cement and lime are the principal cementitious materials mixed with aggregate.

47.1.5.9 Surface.

47.1.5.9.1 Interior Surface. A surface other than a weather-exposed surface.

47.1.5.9.2* Weather-Exposed Surface. The surface of walls, ceilings, roofs, soffits, and similar surfaces exposed to the weather.

47.2 Gypsum Board and Gypsum Veneer Plaster.

47.2.1 General.

47.2.1.1 Exposure to Weather and Water.

47.2.1.1.1 Gypsum wallboard shall not be installed where it will be directly exposed to the weather or to water and shall not be applied until weather protection for the application is provided.

47.2.1.1.2 Gypsum sheathing shall be installed and protected from exposure in compliance with ASTM C 1280, *Standard Specification for Application of Gypsum Sheathing*.

47.2.1.2 Treatment of Joints in Fire Resistance–Rated Systems.

47.2.1.2.1 The face layers of all fire resistance–rated gypsum board systems, except those tested with a material equivalent to joint treatment or those tested without joint treatment, shall have joints and fastener heads treated as required by the fire resistance listing.

47.2.1.2.2 Taping and finishing of joints and fasteners shall not be required in systems where square edge or tongue-and-groove edge gypsum sheathing is installed.

47.2.1.3 Fire Resistance Rating Required.

47.2.1.3.1 Where gypsum board systems are required to be fire rated, details of construction shall be in accordance with the applicable fire resistance listing.

47.2.1.3.2 Fire-rated gypsum board systems shall be constructed in accordance with the Gypsum Association's GA-600, *Fire Resistance Design Manual*, or other recognized resource.

47.2.1.4 Shear Values.

47.2.1.4.1 Walls. Shear values for walls sheathed with gypsum board shall be in accordance with Section 44.8 or Section 45.4.

47.2.1.4.2 Ceilings.

47.2.1.4.2.1 Values for shear diaphragms of gypsum board wood-framed ceiling assemblies shall not exceed those in Table 47.2.1.4.2.1.

47.2.1.4.2.2 Gypsum board horizontal diaphragms shall not be used to resist loads imposed by masonry or concrete construction.

47.2.1.4.2.3 The maximum allowable diaphragm proportions shall be 1½ to 1 spanning between shear-resisting elements.

47.2.1.4.2.4 Resistance by rotation or cantilevered conditions shall not be permitted.

47.2.1.4.2.5 The requirements of 47.2.1.4.2.5(A) and 47.2.1.4.2.5(B) shall apply to gypsum board used in a diaphragm ceiling.

(A) The gypsum board shall be installed perpendicular to ceiling framing members.

(B) The end joints of adjacent courses of gypsum board shall not occur on the same joist.

47.2.1.5 Framing Support Materials.

47.2.1.5.1 Steel Support. Steel framing support materials shall comply with ASTM C 645, *Standard Specification for Nonstructural Steel Framing Members*, or ASTM C 955, *Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases*, as specified by Section 44.7 of this *Code*.

47.2.1.5.2 Wood Support.

47.2.1.5.2.1 Wood support materials shall be not less than 2 in. nominal (38 mm) in their least dimension.

47.2.1.5.2.2 Wood furring strips installed over solid backing shall be not less than 1 in. × 2 in. nominal (19 mm × 38 mm) in dimension.

47.2.2 Gypsum Board Materials.

47.2.2.1 Gypsum board materials shall comply with the following:

(1) ASTM C 36, *Standard Specification for Gypsum Wallboard*
(2) ASTM C 79, *Standard Specification for Treated Core and Nontreated Core Gypsum Sheathing Board*

Table 47.2.1.4.2.1 Shear Values for Shear Diaphragms of Gypsum Board Wood-Framed Ceiling Assemblies[1,2]

Gypsum Board Material	Material Thickness (Minimum) (in.)	Spacing of Framing Members (in.)	Maximum Fastener Spacing (in.)	Shear Value (lb/ft of wall)	Minimum Fastener Size[3,4]
Gypsum wallboard, gypsum base for veneer plaster	½	16 oc	7	90	5d cooler or wallboard nails
Gypsum wallboard, gypsum base for veneer plaster	½	24 oc	7	70	5d cooler or wallboard nails

For SI units, 1 in. = 25.4 mm. 1 lb/ft = 14.5939 N/m.

[1]Diaphragms are not to be used to resist loads imposed by masonry or concrete construction. Values are not cumulative with other horizontal diaphragm values. Values shown are for short-term loading due to wind or due to seismic loading. Values are to be reduced 25 percent for normal loading.

[2]All perimeter edges blocked at the top plate of wall using wood framing members not less than 2 in. × 6 in. nominal (38 mm × 145 mm) in dimension, installed flat over the top plate to provide a nailing attachment surface for the gypsum board not less than 2 in. (51 mm) in width.

[3]Alternate nails can be substituted, provided that their dimensions are equal to or greater than those of the item described.

[4]Type S or Type W drywall screws, a minimum of 1¼ in. (32 mm) in length, can be substituted for the prescribed nails.

(3) ASTM C 442, *Standard Specification for Gypsum Backing Board, Gypsum Coreboard and Gypsum Shaftliner Board*
(4) ASTM C 630, *Standard Specification for Water-Resistant Gypsum Backing Board*
(5) ASTM C 931, *Standard Specification for Exterior Gypsum Soffit Board*
(6) ASTM C 960, *Standard Specification for Predecorated Gypsum Board*
(7) ASTM C 1177, *Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing*
(8) ASTM C 1178, *Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel*
(9) ASTM C 1278, *Standard Specification for Fiber-Reinforced Gypsum Panel*
(10) ASTM C 1395, *Specification for Gypsum Ceiling Board*
(11) ASTM C 1396, *Standard Specification for Gypsum Board*

47.2.2.2 Accessories used in the application of gypsum board shall comply with ASTM C 1047, *Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.*

47.2.2.3 Joint treatment materials used in the application of gypsum board shall comply with ASTM C 475, *Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.*

47.2.2.4 Fasteners used in the application of gypsum board shall comply with one of the following:

(1) ASTM C 514, *Standard Specification for Nails for the Application of Gypsum Board*
(2) ASTM F 547, *Standard Terminology of Nails for Use with Wood and Wood-Base Materials*
(3) ASTM C 954, *Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness*
(4) ASTM C 1002, *Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs*

47.2.2.5 Adhesives used for fastening gypsum board to wood framing shall comply with ASTM C 557, *Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.*

47.2.3 Gypsum Board Installation.

47.2.3.1 Application and finishing of gypsum board shall comply with ASTM C 840, *Standard Specification for Application and Finishing of Gypsum Board*, or Gypsum Association's GA-216, *Application and Finishing of Gypsum Board.*

47.2.3.2 Installation of gypsum sheathing shall comply with ASTM C 1280.

47.2.4 Gypsum Veneer Plaster Materials.

47.2.4.1 Gypsum base for veneer plaster shall comply with ASTM C 588, *Standard Specification for Gypsum Base for Veneer Plasters.*

47.2.4.2 Gypsum veneer plaster shall comply with ASTM C 587, *Standard Specification for Gypsum Veneer Plaster.*

47.2.4.3 Accessories used in the application of gypsum base for veneer plaster shall comply with ASTM C 1047.

47.2.4.4 Fasteners used in the application of gypsum base for veneer plaster shall comply with the following standards:

(1) ASTM C 514, *Standard Specification for Nails for the Application of Gypsum Board*
(2) ASTM F 547, *Standard Terminology for Nails for Use with Wood and Wood-Based Materials*
(3) ASTM C 954, *Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness*
(4) ASTM C 1002, *Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs*

47.2.4.5 Adhesives used for fastening gypsum base for veneer plaster to wood framing shall comply with ASTM C 557.

47.2.5 Gypsum Veneer Plaster Installation.

47.2.5.1 Application of gypsum base that is to receive gypsum veneer plaster shall comply with ASTM C 844, *Standard Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster.*

47.2.5.2 Application of gypsum veneer plaster shall comply with ASTM C 843, *Standard Specification for Application of Gypsum Veneer Plaster*.

47.3 Gypsum Lath and Gypsum Plaster.

47.3.1 General. Gypsum plaster shall not be installed on building exterior or weather-exposed surfaces.

47.3.2 Materials.

47.3.2.1 Gypsum lath and gypsum plaster materials shall comply with the following:

(1) ASTM C 28, *Standard Specification for Gypsum Plasters,* ASTM C 59, *Standard Specification for Gypsum Casting Plaster and Gypsum Molding Plaster,* or ASTM C 61, *Standard Specification for Gypsum Keene's Cement*
(2) ASTM C 37, *Standard Specification for Gypsum Lath*
(3) ASTM C 206, *Standard Specification for Finishing Hydrated Lime*
(4) ASTM C 847, *Standard Specification for Metal Lath,* ASTM C 933, *Standard Specification for Welded-Wire Lath,* or ASTM C 1032, *Standard Specification for Woven-Wire Plaster Base*

47.3.2.2 Inorganic aggregates, where used with gypsum plaster, shall comply with ASTM C 35, *Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster*.

47.3.2.3 Bonding compounds, where used with gypsum plaster, shall comply with ASTM C 631, *Standard Specification for Bonding Compounds for Interior Gypsum Plastering*.

47.3.3 Installation.

47.3.3.1 Lathing and Furring.

47.3.3.1.1 The installation of interior lathing and furring used to support gypsum plaster shall comply with ASTM C 841, *Standard Specification for Installation of Interior Lathing and Furring*.

47.3.3.1.2 Grounds, where installed, shall provide for a thickness of plaster not less than that required by ASTM C 842, *Standard Specification for Application of Interior Gypsum Plaster*.

47.3.3.2 Plaster.

47.3.3.2.1 The installation of gypsum plaster shall comply with ASTM C 842.

47.3.3.2.2 Ceiling surfaces that require a thickness of plaster greater than that shown in ASTM C 842 shall have metal lath or wire fabric lath installed before plastering.

47.4 Portland Cement Plaster.

47.4.1 General.

47.4.1.1 Shear Values. Shear values for walls sheathed with lath and plaster shall be in accordance with Section 45.4.

47.4.1.2 Temperature Requirements.

47.4.1.2.1 Plaster coats shall be protected from freezing for a period of not less than 24 hours after set has occurred.

47.4.1.2.2 Plaster shall be applied when the ambient temperature is higher than 40°F (4°C), unless provisions are made to keep the temperature in the work area above 40°F (4°C) for not less than 48 hours prior to, during, and subsequent to application of plaster.

47.4.1.3 Weather-Resistive Barriers.

47.4.1.3.1 Weather-resistive barriers shall be installed as required in Section 37.3.

47.4.1.3.2 Weather-resistive barriers applied over wood-based sheathing shall consist of two layers of Federal Specification UU-B 790a, *Specification for Building Paper, Vegetable Fiber: Kraft, Waterproofed, Water Repellent, and Fiber Resistant,* Grade D paper.

47.4.1.4 Masonry and Concrete Surfaces.

47.4.1.4.1 Masonry and concrete surfaces shall comply with 47.4.1.4.1.1 and 47.4.1.4.1.2.

47.4.1.4.1.1 Surfaces shall be clean, free from efflorescence, from form-oil, or from other elements that would interfere with bonding.

47.4.1.4.1.2 Surfaces shall have the roughness, suction, and dampness to provide the bond for the plaster.

47.4.1.4.2 If the surface is not sufficiently rough, as specified in 47.4.1.4.1.2, it shall be prepared by one or more of the following methods:

(1) Sandblasting
(2) Wire brushing
(3) Acid etching
(4) Chipping
(5) Application of a dash-bond coat left untrowled, undisturbed, and moist cured for not less than 24 hours
(6) Application of an approved bonding compound

47.4.2 Materials.

47.4.2.1 Plaster. Portland cement plaster materials shall conform with the following:

(1) ASTM C 91, *Standard Specification for Masonry Cement*
(2) ASTM C 150, *Standard Specification for Portland Cement*
(3) ASTM C 206, *Standard Specification for Finishing Hydrated Lime*
(4) ASTM C 595, *Standard Specification for Blended Hydraulic Cements*
(5) ASTM C 1328, *Standard Specification for Plastic (Stucco) Cement*

47.4.2.2 Lath and Accessories.

47.4.2.2.1 Lath used for the support of portland cement plaster shall comply with ASTM C 847, ASTM C 933, or ASTM C 1032.

47.4.2.2.2 Lath, lath fasteners, and lath attachment devices shall be corrosion resistant.

47.4.2.3 Inorganic Aggregates. Inorganic aggregates used with portland cement plaster shall comply with ASTM C 35.

47.4.2.4 Sand. Sand used with portland cement plaster shall comply with ASTM C 897, *Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters*.

47.4.2.5 Bonding Compounds. Bonding compounds used with portland cement plaster shall comply with ASTM C 932, *Standard Specification for Surface-Applied Bonding Agents for Exterior Plastering*.

47.4.3 Installation.

47.4.3.1 Lath, Furring, and Accessories.

47.4.3.1.1 The installation of lath and furring used for the support of portland cement plaster shall comply with ASTM C 1063, *Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster*.

47.4.3.1.2 Grounds, where installed, shall provide for a thickness of plaster not less than that required by ASTM C 926, *Standard Specification for Application of Portland Cement-Based Plaster.*

47.4.3.1.3 The requirements for foundation weep screed shall be as follows:

(1) Foundation weep screed shall be installed at the bottom of all steel-framed or wood-framed exterior walls to receive lath and plaster.
(2) The bottom edge of the foundation weep screed shall be placed not less than 1 in. (25 mm) below the joint formed by the foundation and framing.
(3) The nose of the screed shall be placed not less than 4 in. (100 mm) above the earth or 2 in. (50 mm) above paved surfaces.
(4) The weather-resistive barrier and lath shall entirely cover the vertical attachment flange of the screed and shall terminate at the top edge of the nose or ground flange.

47.4.3.1.4 Solid backing shall be installed to provide support for lath where lath installed on a vertical plane extends between rafters or other similar projecting members.

47.4.3.1.5 Gypsum board, where used as a backing for lath, shall meet the requirements of 47.4.3.1.5.1 and 47.4.3.1.5.2.

47.4.3.1.5.1 Gypsum sheathing shall be permitted to be used as a backing for metal or wire fabric lath where covered by a weather-resistive barrier.

47.4.3.1.5.2 Gypsum lath or gypsum wallboard shall be permitted to be used as a backing for self-furred metal or wire fabric lath on ceilings, soffits, or interior walls where covered by a weather-resistive barrier.

47.4.3.2 Portland Cement Plaster.

47.4.3.2.1 Installation of portland cement plaster shall comply with ASTM C 926 and the requirements of 47.4.3.2.2 through 47.4.3.2.10.

47.4.3.2.2 Plaster thickness shall be as defined in 47.4.3.2.2.1 and 47.4.3.2.2.2 and shall be measured from the face of the base or lath.

47.4.3.2.2.1 Metal plaster base and wire lath shall be covered by not less than three coats of plaster as defined in ASTM C 926.

47.4.3.2.2.2 Solid plaster bases or plaster surfaces completely covered by veneer or other facing material shall be covered by not less than two coats of plaster as specified in ASTM C 926.

47.4.3.2.3 Interior wood-frame walls covered with cement plaster and subject to water splash shall have framing members protected with an approved moisture barrier.

47.4.3.2.4 Plaster installed to stud construction where the stud construction rests on an on-grade concrete floor slab system shall be applied so as to cover, but not to extend below, the lath and weather barrier.

47.4.3.2.5 The second coat of plaster shall be applied to a true, even plane, floated and left rough to provide bond for the third or finish coat, and shall have no variation greater than ¼ in. (6 mm) in any direction for 10 ft (3.0 m).

47.4.3.2.6 Ceiling surfaces that require a thickness of plaster greater than that specified in ASTM C 926 shall have metal lath or wire fabric lath installed before plastering.

47.4.3.2.7 Curing time between plaster coats shall be as required in 47.4.3.2.7.1 or 47.4.3.2.7.2.

47.4.3.2.7.1 The curing time for exterior plaster application shall be as follows:

(1) A 48-hour interval between application of the first and second coat of plaster and a 7-day interval between application of the second and third or finish coat of plaster shall be allowed for plaster curing.
(2) The third or finish coat of plaster shall be allowed to cure for a period of not less than 7 days.

47.4.3.2.7.2 The curing time for interior plaster application shall be as follows:

(1) A 24-hour interval between application of the first and second coat of plaster and a 48-hour interval between application of the second and third or finish coat of plaster shall be allowed.
(2) The third or finish coat of plaster shall be allowed to cure for a period of not less than 7 days.

47.4.3.2.8 Moist curing of plaster shall meet the requirements of 47.4.3.2.8.1 through 47.4.3.2.8.3.

47.4.3.2.8.1 Plaster shall be moist cured for not less than 48 hours between applications of successive coats of plaster.

47.4.3.2.8.2 Moist curing shall not be required where job and weather conditions are favorable to the retention of moisture in the plaster for the required time period.

47.4.3.2.8.3 Plaster applied directly to unit masonry or over gypsum backing shall be permitted to have its second coat applied as soon as the first coat has attained sufficient hardness.

47.4.3.2.9 An alternate method of plaster curing shall be permitted if the requirements of 47.4.3.2.9.1 and 47.4.3.2.9.2 are met.

47.4.3.2.9.1 To accelerate the application process, the second coat of plaster shall be permitted to be applied as soon as the first coat is rigid enough to resist cracking and the pressures of the second coat application.

47.4.3.2.9.2 Where the alternate method of application specified in 47.4.3.2.9.1 is used, curing of the first coat of plaster shall not be required, and the second coat shall be cured as described in 47.4.3.2.8.

47.4.3.2.10 Plasticity agents shall meet the requirements of 47.4.3.2.10.1 through 47.4.3.2.10.3.

47.4.3.2.10.1 Only approved plasticity agents, and approved amounts thereof, shall be added to portland cement.

47.4.3.2.10.2 Where plastic cement or masonry cement is used, no additional lime or plasticizer shall be added.

47.4.3.2.10.3 Hydrated lime used as a plasticizer shall be added to plaster as specified in ASTM C 926.

Chapter 48 Plastics

48.1 Scope. All plastic materials used in or on buildings or structures shall meet the requirements in this chapter.

48.2 Special Definitions.

48.2.1 Foam Plastic Insulation. A cellular plastic used for thermal insulating or acoustical applications, having a density of 20 lb/ft^3 (320 kg/m^3) or less, containing open or closed cells, formed by a foaming agent.

48.2.2* Light-Diffusing System. Panels, grids, baffles, or lenses made with light-transmitting plastics, positioned below independently mounted electrical light sources, skylights, or light-transmitting roof panels.

48.2.3 Material.

48.2.3.1 Thermoplastic Material. Plastic material capable of being repeatedly softened by heating and hardened by cooling, and that, in the softened state, can be repeatedly shaped by molding or forming.

48.2.3.2 Thermoset Material. Plastic material that, after having been cured by heat or other means, is substantially infusible and cannot be softened and formed.

48.2.4 Panel.

48.2.4.1* Light-Transmitting Plastic Roof Panel. A structural plastic panel in the plane of the roof, fastened to roof members, that transmits light into the structure.

48.2.4.2* Light-Transmitting Plastic Wall Panel. A plastic panel fastened to structural wall members that transmits light into the structure.

48.2.5 Plastic.

48.2.5.1 Glass Fiber Reinforced Plastic. Plastic material containing not less than 20 percent by weight glass fiber that imparts some mechanical properties superior to those of the base resin.

48.2.5.2 Light-Transmitting Plastic. Plastic material that is used to transmit light into structures.

48.2.6 Plastic Glazing. Plastic panels or lenses that are glazed or set in a frame or sash and are not mechanically fastened to a structural member of the structure.

48.3 General Criteria—Foam Plastic Insulation. Section 48.3 shall govern the requirements and application of foam plastic insulation in construction.

48.3.1 Product Identification.

48.3.1.1 A label of an approved agency shall appear on foam plastic insulation products, packages, or containers and components delivered to a job site.

48.3.1.2 The label described in 48.3.1.1 shall indicate the manufacturer, product identification, product listing, and information to establish that the end use will conform to this *Code*.

48.3.2 Surface-burning Characteristics.

48.3.2.1* Unless otherwise permitted by 48.3.2.3, foam plastic insulation or foam plastic cores of manufactured assemblies and components shall be tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, at the maximum thickness intended for use and shall have a flame spread index of 75 or less and a smoke developed index of 450 or less.

48.3.2.2 Foam plastic loose-fill insulation shall be tested as sheets or boardstock.

48.3.2.3 The requirements of 48.3.2.1 and 48.3.2.2 shall not apply where otherwise permitted by the following:

(1) As provided in Section 48.5, the smoke developed index for interior trim shall not be required.
(2) Foam plastic insulation in cold storage buildings, ice plants, food plants, food processing rooms, and similar areas where tested in a thickness of 4 in. (100 mm) shall be permitted in a thickness of up to 10 in. (254 mm) where that portion of the building and the room are equipped with an automatic fire sprinkler system in accordance with 55.3.1.1.
(3) Foam plastic insulation that is part of a Class A, Class B, or Class C roof covering system shall not be required to meet the surface-burning requirements, provided that the system with the foam plastic insulation passes FM 4450, *Test Standard for Class I Insulated Steel Deck Roofs*, or UL 1256, *Standard for Safety for Fire Test of Roof Deck Constructions*. For roof applications, the smoke developed index shall not be required.
(4) Foam plastic insulation at the thickness and density intended for use shall not be required where approved and where both of the following criteria are met:
   (a) The end-use configuration is tested in accordance with 48.4.4 or 48.4.1.5.
   (b) The requirements of 48.3.2.1 and 48.3.2.2 are met when tested at a minimum thickness of 4 in. (100 mm) and at the density intended for use.

48.3.3 Thermal Barrier.

48.3.3.1 Foam plastic insulation and components shall be separated from the interior of a building and from plenums by an approved thermal barrier of 0.5-in. (12.7-mm) gypsum wallboard or equivalent material that will limit the average temperature rise of the unexposed surface to not more than 250°F (139°C) after 15 minutes of fire exposure complying with the standard time-temperature curve of NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*.

48.3.3.2 The thermal barrier shall remain in place for 15 minutes, based on one of the following tests:

(1) UL 1715, *Standard for Safety for Fire Test of Interior Finish Material*
(2) FM 4880, *Approval Standard for Class 1 Insulated Wall or Wall and Roof/Ceiling Panels; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems*
(3) UL 1040, *Standard for Fire Test of Insulated Wall Construction*
(4) NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*

48.3.3.3 Combustible concealed spaces shall comply with Section 8.14.

48.3.3.4 The requirements of 48.3.3.1 through 48.3.3.3 shall not apply where otherwise permitted by the following:

(1) The thermal barrier shall not be required in masonry or concrete wall, floor, or roof construction where the foam plastic insulation is covered on each face by concrete or masonry with a minimum 1-in. (25.4-mm) thickness.
(2) The thermal barrier shall not be required in cooler and freezer walls, provided that all of the following conditions are met:
   (a) The foam plastic used in cooler and freezer walls is a maximum thickness of 10 in. (254 mm) and, when tested, is a minimum thickness of 4 in. (100 mm) and has a flame spread index of 25 or less and a smoke developed index of 450 or less.

(b) The flash and self-ignition temperatures of the foam plastic are not less than 600°F (316°C) and 800°F (427°C), respectively, when tested in accordance with ASTM D 1929, *Standard Test Method for Determining Ignition Temperature of Plastics*.

(c) The foam plastic is covered by aluminum not less than 0.032 in. (0.8 mm) thick or corrosion-resistant steel having a base metal thickness not less than 0.0160 in. (0.4 mm) at any point.

(d) The cooler or freezer walls are protected by an automatic sprinkler system in accordance with 55.3.1.1.

(e) The cooler or freezer is within a building, and the cooler or freezer and the part of the building in which it is located are protected by an automatic sprinkler system in accordance with 55.3.1.1.

(3) The thermal barrier shall not be required in walk-in coolers in unsprinklered buildings, provided that all of the following conditions are met:

(a) The foam plastic insulation is used in thicknesses of 4 in. (100 mm) or less.

(b) The foam plastic insulation has a flame spread of 75 or less.

(c) The aggregate floor area of the walk-in coolers is 400 ft^2 (37 m^2) or less.

(d) The foam plastic insulation is covered either by aluminum not less than 0.032 in. (0.8 mm) thick or corrosion-resistant steel having a minimum base metal thickness of 0.016 in. (0.4 mm).

(4) The thermal barrier shall not be required on or in exterior walls of one-story buildings where all of the following criteria are met:

(a) The foam plastic insulation meets all of the following requirements:

i. It is 4 in. (100 mm) or less in thickness.

ii. It has a flame spread index of 25 or less.

iii. It has a smoke developed index of 450 or less.

iv. It is covered either by aluminum with a thickness equal to or greater than 0.032 in. (0.8 mm) or corrosion-resistant steel having a base metal thickness greater than 0.0160 in. (0.4 mm).

(b) The building is equipped throughout with an automatic sprinkler system in accordance with 55.3.1.1.

(5) The thermal barrier shall not be required in roof assemblies where the following criteria are met:

(a) The foam plastic insulation installed in a roof assembly in accordance with this *Code* and the manufacturer's installation instructions is separated from the interior of the building by wood structural sheathing not less than 0.47 in. (12 mm) in thickness bonded with exterior glue, with edges supported by one of the following:

i. Blocking

ii. Tongue-and-groove joints

iii. Other approved type of edge support

iv. Other equivalent material

(b) The foam plastic insulation is a part of a Class A, Class B, or Class C roof-covering assembly, provided that the assembly with the foam plastic insulation satisfactorily passes either of the following:

i. FM 4450, *Test Standard for Class I Insulated Steel Deck Roofs*

ii. UL 1256, *Standard for Safety for Fire Test of Roof Deck Constructions*

(6) The thermal barrier shall not be required in attics and crawl spaces if the foam plastics are installed within an attic or crawl space where entry is made only for service of utilities, and the foam plastic is protected against ignition by one of the following:

(a) Mineral fiber insulation of 1.5-in. (38-mm) thickness

(b) Wood structural panel, particle board, or hardboard of 0.25-in. (6.4-mm) thickness

(c) Gypsum wallboard of 0.375-in. (9.5-mm) thickness

(d) Corrosion-resistant steel having a base metal thickness of 0.016 in. (0.4 mm)

(e) Other approved material, consistent with the requirements of the application and installed so that the foam plastic insulation is not exposed

(7) The thermal barrier shall not be required in doors where the following criteria are met:

(a) The foam plastic insulation meeting the requirements of 48.3.2 is used as a core of pivoted or side-hinged doors that comply with the following:

i. The doors do not require a fire protection rating.

ii. The door skin is steel having a thickness of at least 0.016 in. (0.4 mm) or aluminum having a thickness of at least 0.032 in. (0.8 mm) at any point.

(b) The foam-filled exterior entrance doors of residential occupancies that comply with the following:

i. The doors do not require a fire resistance rating.

ii. The doors are faced with wood or other approved materials.

(c) The foam plastic insulation is used as core material for garage doors, and the following criteria are met:

i. No fire resistance rating is required for the assembly.

ii. The door is faced with at least 0.032-in. (0.8-mm) aluminum, 0.010-in. (0.25-mm) steel, or a 0.125-in. (3.2-mm) thickness of wood.

(d) The garage doors have facings other than those specified in 48.3.3.4(7)(c)(ii) and are tested in accordance with, and meet the acceptance criteria of, ANSI/DASMA 107, *Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation*

(e) The foam plastic insulation is used as core material for garage doors in one- and two-family dwellings and the foam plastic insulation complies with 48.3.2

(8) The thermal barrier shall not be required in conjunction with siding backer board where the following criteria are met:

(a) The foam plastic insulation 0.5 in. (12.7 mm) or less in thickness and having a potential heat of not more than 2000 Btu/ft^2 (22.7 MJ/m^2) when tested in accordance with NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, is separated from the interior of the building by a least 2 in. (51 mm) of mineral fiber insulation or equivalent

(b) The siding and foam plastic insulation are applied over existing siding

(9) The thermal barrier shall not be required on interior trim where the foam plastic meets the requirements of Section 48.5.

(10) The thermal barrier shall not be required on interior plastic signs in covered mall buildings where used in accordance with Section 48.8.
(11) In Type V construction, foam plastic insulation shall be permitted to be spray applied to sill plates and headers without requiring a thermal barrier where the foam plastic insulation complies with all of the following:
  (a) The maximum thickness of the foam plastic insulation is 3¼ in. (82.6 mm).
  (b) The density of the foam plastic insulation ranges between 1.5 pcf to 2.0 pcf (24 kg/m^3 to 32 kg/m^3).
  (c) The foam plastic insulation has a flame spread index of 25 or less.
(12) The thermal barrier shall not be required where tested in accordance with 48.4.4.

48.3.3.5 Walk-in coolers with foam plastic insulation of a thickness greater than 4 in. (100 mm) and up to and including 10 in. (254 mm) in unsprinklered buildings shall be permitted where all of the following conditions are met:

(1) The flame spread is equal to or less than 75.
(2) The aggregate floor area of the walk-in coolers is 400 ft^2 (37 m^2) or less.
(3) A thermal barrier is provided.

48.4 Specific Application Requirements—Foam Plastic Insulation.

48.4.1 Exterior Walls.

48.4.1.1 General.

48.4.1.1.1 Exterior walls of buildings shall meet the requirements of Chapter 37.

48.4.1.1.2 Exterior walls of Type I, Type II, Type III, and Type IV buildings of any height containing foam plastics shall conform to the requirements of 48.4.1.2 through 48.4.1.8.

48.4.1.1.3 Exterior walls of cold storage buildings constructed of noncombustible or limited-combustible materials or of more than one story in height, or both, shall conform to requirements of 48.4.1.2 through 48.4.1.8.

48.4.1.1.4 Exterior walls of Type V buildings shall conform to Section 48.3.

48.4.1.2* Fire-rated Walls. Walls requiring a fire resistance rating shall comply with the following:

(1) Testing shall be conducted per NFPA 251.
(2) Data shall be provided to validate that the fire resistance rating is maintained.

48.4.1.3 Thermal Barriers. Foam plastic insulation shall be separated from the building interiors by a thermal barrier(s) conforming to the requirements of 48.3.3, unless otherwise permitted by one of the following:

(1) Approval based on special tests conducted in accordance with 48.4.4
(2) One-story buildings complying with 48.3.3.4(4)

48.4.1.4 Flame Spread and Smoke Developed Index. Foam plastic insulation, exterior facings, and coatings shall be tested separately in the thickness of intended use per NFPA 255.

48.4.1.4.1 Each component shall have a flame spread index of 25 or less and a smoke developed index of 450 or less.

48.4.1.4.2 Factory-manufactured or prefabricated panels having a total thickness equal to or less than 0.25 in. (6.4 mm) and an aluminum facing of a minimum of 0.020 in. (0.5 mm) shall be permitted to be tested as an assembly in cases where the foam plastic core is not exposed during on-site construction.

48.4.1.5 Wall Assembly Flammability.

48.4.1.5.1 The wall assembly shall be tested in accordance with, and the results shall comply with, the acceptance criteria of NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.*

48.4.1.5.2 The requirement of 48.4.1.5.1 shall not apply to one-story buildings complying with 48.3.3.4(4).

48.4.1.6 Potential Heat Content.

48.4.1.6.1 The potential heat of foam plastic insulation in any portion of the wall or panel shall not exceed the value of the potential heat of the foam plastic insulation in the wall assembly (expressed in MJ/m^2) that is tested per 48.4.1.5.

48.4.1.6.2 The potential heat of the foam plastic shall be determined per NFPA 259.

48.4.1.6.3 The requirements of 48.4.1.6.1 and 48.4.1.6.2 shall not apply to one-story buildings complying with 48.3.3.4(4).

48.4.1.7 Labeling.

48.4.1.7.1 Each piece of foam plastic insulation shall be labeled on the edge or face with labels from an approved agency.

48.4.1.7.2 The label on foam plastic insulation shall identify the following:

(1) Approved agency
(2) Manufacturer's product identification information
(3) Other performance characteristics that indicate that the product's use conforms with this *Code*

48.4.1.8 Ignition Characteristics.

48.4.1.8.1 Exterior walls shall not produce sustained flaming when tested per NFPA 268, *Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.*

48.4.1.8.2 Testing of minimum and maximum thickness shall be required where more than one thickness is installed.

48.4.1.8.3 The requirements of 48.4.1.8.1 and 48.4.1.8.2 shall not apply to assemblies protected on the outside with facings of one or more of the following items:

(1) Thermal barrier meeting requirements of 48.3.3
(2) Glass fiber reinforced concrete panels with a minimum thickness of 0.375 in. (9.5 mm)
(3) Portland cement plaster with minimum thickness of 0.875 in. (22 mm) meeting the requirements of Section 47.4
(4) Metal-faced panels with a minimum thickness of 0.019-in. (0.48-mm) aluminum or 0.016-in. (0.4-mm) corrosion-resistant steel
(5) Concrete or masonry with a minimum thickness of 1 in. (25.4 mm)

48.4.2 Roofing. Foam plastic insulation meeting the requirements of 48.3.1, 48.3.2, and 48.3.3 shall be approved as part of

a roof-covering assembly where the assembly is tested as an assembly in accordance with NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*, and has been determined to meet the requirements of Class A, Class B, or Class C.

48.4.3 Plenums. The use of foam plastic insulation as wall or ceiling finish in plenums shall be permitted where the insulation meets one of the following criteria:

(1) The foam plastic insulation complies with 48.3.2.1 and is separated from the plenum by a thermal barrier complying with 48.3.3.
(2) The foam plastic insulation has a flame spread index of 25 or less and a smoke developed index of 50 or less when tested in accordance with NFPA 255 and meets one of the following criteria:
  (a) The foam plastic is separated from the plenum by a thermal barrier complying with 48.3.3.
  (b) The foam plastic is approved based on tests conducted in accordance with 48.4.4.
(3) The foam plastic insulation complies with 48.3.2.1 and is covered by the corrosion-resistant steel having a base metal thickness of not less than 0.0160 in. (0.4 mm) and meets one of the following:
  (a) The foam plastic is separated from the plenum by a thermal barrier complying with 48.3.3.
  (b) The foam plastic is approved based on tests conducted in accordance with 48.4.4.

48.4.4 Alternate Testing and Approval.

48.4.4.1 The requirements of 48.3.3 through 48.4.3 shall be permitted to be replaced by special testing, and the approval of foam plastic shall be based on large-scale tests such as, but not limited to, the following:

(1) UL 1715, *Standard for Safety for Fire Test of Interior Finish Material*
(2) UL 1040, *Standard for Fire Test of Insulated Wall Construction*
(3) FM 4880, *Approval Standard for Class 1 Insulated Wall or Wall and Roof/Ceiling Panels; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems*
(4) NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*

48.4.4.2 The testing shall be performed on the finished foam plastic assembly related to the actual end-use configuration and on the maximum thickness intended for use.

48.4.4.3 Foam plastics used as interior finish shall also conform to the flame spread requirements of Chapter 10.

48.4.4.4 Assemblies, as tested, shall be constructed such that construction details (for example, joints, seams) are reflective of the final assembly.

48.5 Specific Requirements — Interior Finish and Trim.

48.5.1 All plastic materials installed as interior finish or trim shall comply with requirements of Chapter 10.

48.5.2 Foam plastics shall only be installed as interior finish where approved by the alternate requirements of 48.4.4.

48.5.3 Foam plastics used as interior trim shall meet all of the following requirements:

(1) They shall have a minimum density of 20 lb/ft^3 (320 kg/m^3).
(2) They shall have a maximum thickness of 0.5 in. (12.7 mm) and a maximum width of 8 in. (204 mm).
(3) They shall constitute no more than 10 percent of the total wall and ceiling area of any room or space.
(4) They shall have a flame spread index of 75 or less when tested per NFPA 255.

48.6 Specific Requirements — Plastic Veneers.

48.6.1 Plastic veneer used as an interior finish material shall comply with Chapter 10.

48.6.2 Plastic veneer meeting the requirements of 48.7.2 shall be permitted on the exterior of all buildings of any type occupancy, provided that all of the following criteria are met:

(1) The height of the plastic veneer does not exceed 50 ft (15 m) above grade.
(2) The total surface area of any section does not exceed 300 ft^2 (28 m^2).
(3) A minimum 4-ft (1.2-m) vertical separation exists between sections.

48.6.3 Plastic veneer on the exterior of Type V (000) construction that is not required to have fire-rated exterior walls shall be permitted, and the plastic veneer shall not be required to meet 48.6.2(1) through 48.6.2(3). In this application, the plastic veneers shall not be required to meet the smoke developed requirements of 48.7.2(2).

48.7 Specific Requirements — Light-transmitting Plastics.

48.7.1 General.

48.7.1.1 The requirements of Section 48.7 shall govern the use of light-transmitting plastics.

48.7.1.2 Plastics used in buildings or structures for interior finish and trim shall also meet the requirements of Chapter 10.

48.7.1.3 Light-transmitting plastics shall be permitted to be used in walls and roofs where other applicable code requirements are met.

48.7.2 Flammability Specifications. Plastics used for exterior veneer and light-transmitting applications shall meet all of the following criteria:

(1) They shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.
(2) They shall have a smoke developed index not greater than 450 when tested in the manner intended for use in accordance with NFPA 255 or not greater than 75 when tested in the thickness intended for use in accordance with ASTM D 2843, *Standard Test for Density of Smoke from the Burning or Decomposition of Plastics.*
(3) They shall meet the criteria of one of the following classifications:
  (a) CC1 — Plastic materials that have a burn length of 1 in. (25 mm) or less and flame extinguishment when tested at a nominal thickness of 0.060 in. (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635, *Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position*
  (b) CC2 — Plastic materials that have a burning rate of 2.5 in./min (64 mm/min) or less when tested at a nominal thickness of 0.060 in. (1.5 mm), or at a thickness intended for use, in accordance with ASTM D 635

48.7.3 Light-transmitting Plastic Skylight Glazing. Light-transmitting plastics used for skylights shall meet the requirements of 48.7.3.1 to 48.7.3.9.

48.7.3.1 The requirements for light-transmitting plastics used as skylight glazing shall be as follows.

48.7.3.1.1 Light-transmitting plastics used as glazing in skylights shall meet the requirements of 48.7.2.

48.7.3.1.2 The requirement of 48.7.3.1.1 shall not apply when the light-transmitting plastic meets the requirements for roof-covering class in accordance with Chapter 38.

48.7.3.2 Skylights shall be permitted in roof construction, except where openings through the roof are required to be protected.

48.7.3.3 Where exterior wall openings are required to be protected, a skylight shall not be installed within 6 ft (1.8 m) of such exterior wall.

48.7.3.4 Skylights shall be mounted where all of the following conditions are met:

(1) The light-transmitting plastic shall be mounted above the plane of the roof on a curb constructed in accordance with the requirements for the type of construction classification and at least 4 in. (100 mm) above the plane of the roof.
(2) The edges of the light-transmitting plastic skylights shall be protected by metal or other approved noncombustible material.

48.7.3.4.1 The requirement of 48.7.3.4(1) shall not apply where skylights are used on roofs having a minimum slope of 3 units vertical in 12 units horizontal (3:12) in one- or two-family dwellings or where the roof covering is unclassified.

48.7.3.4.2 The requirement of 48.7.3.4(2) shall not apply where unclassified roof coverings are permitted or where the light-transmitting plastic skylight has been shown to resist ignition where exposed at the edge to a flame from a Class B brand, as described in NFPA 256.

48.7.3.5 Unless the skylight meets the Class B burning brand test, as described in NFPA 256, skylights shall have the following slopes:

(1) Flat or corrugated light-transmitting plastic skylights shall slope at least 4 units vertical in 12 units horizontal (4:12).
(2) Dome-shaped skylights shall rise above the mounting flange for a minimum distance equal to 10 percent of the maximum span of the dome, but not less than 3 in. (76.2 mm).

48.7.3.6 Unless the building is equipped throughout with an automatic sprinkler system in accordance with 55.3.1.1, or when the building is equipped with smoke and heat vents, each skylight shall have a maximum area within the curb of 100 ft^2 (9 m^2).

48.7.3.7 The aggregate area of skylights shall meet the requirements of 48.7.3.7.1 and 48.7.3.7.2.

48.7.3.7.1 The aggregate area of skylights shall be as follows:

(1) Where CC1 plastics are used, the aggregate area of skylights shall not exceed 33⅓ percent of the floor area of the room or space sheltered by the roof in which the skylights are installed.
(2) Where CC2 plastics are used, the aggregate area of skylights shall not exceed 25 percent of the floor area of the room or space sheltered by the roof in which the skylights are installed.

48.7.3.7.2 The aggregate area limitation of 48.7.3.7.1 shall be permitted to be increased 100 percent where the building is equipped throughout with an automatic sprinkler system in accordance with 55.3.1.1, or the where the building is equipped with smoke and heat vents.

48.7.3.8 Skylights shall meet the requirements of 48.7.3.8.1 and 48.7.3.8.2.

48.7.3.8.1 Skylights shall be separated from each other by a distance of not less than 4 ft (1.2 m), as measured in a horizontal plane.

48.7.3.8.2 The requirement of 48.7.3.8.1 shall not apply where one of the following conditions is met:

(1) The building shall be equipped throughout with an automatic sprinkler system in accordance with 55.3.1.1.
(2) The skylight shall serve as an approved fire-venting system.
(3) In one- and two-family dwellings, or on buildings with an unclassified roof covering, skylights shall be separated from each other by a distance of not less than 16 in. (406 mm), measured in a horizontal plane, and each skylight shall not exceed a maximum area within the curb of 100 ft^2 (9 m^2).

48.7.3.9 Combinations of light-transmitting plastic roof panels and skylights shall be subject to the area and percentage limitations and separation requirements applicable to plastic light-transmitting roof panel installations.

48.7.4 Plastic Light Diffusers in Ceilings. Light-transmitting plastics used for light diffusers in ceilings shall meet the requirements of 48.7.2 and 48.7.4.

48.7.4.1* Plastic light diffusers shall be permitted in other than exit passageways and exit stairways in nonsprinklered buildings.

48.7.4.2 Where walls and ceilings are required to be fire resistive or of noncombustible or limited-combustible construction and walls are set out or ceilings are dropped more than 1¾ in. (44.4 mm), plastic materials with a flame spread index of 25 or less and a smoke developed index of 450 or less shall be used, unless they meet the following criteria:

(1) The plastic materials shall be protected on both sides by an automatic sprinkler system in accordance with 55.3.1.1.
(2) Plastic ceiling light diffusers shall meet the requirements of 48.7.2 and all of the following:
    (a) Plastic ceiling light diffusers shall be supported directly or indirectly from the ceiling or roof construction by use of noncombustible hangers.
    (b) Hangers shall be at least No. 12 steel-wire gauge [0.106-in. (2.7-mm)] galvanized wire or equivalent.
    (c) Plastic ceiling light diffusers, as installed, shall fall from their mountings at an ambient temperature not higher than 200°F (111°C) below the ignition temperature of the plastic material.
    (d) Plastic light diffusers shall be mounted in the ceiling so that they remain in place at an ambient temperature of 175°F (79°C) for a period of not less than 15 minutes.
    (e) Light-diffusing ceilings installed below sprinkler heads shall be installed so that they do not interfere with the effective operation of the automatic sprinkler system and shall provide access to all valves and sprinkler heads of the system.
    (f) The maximum size of any single plastic light-transmitting panel shall not exceed 10 ft (3 m) or an area of 30 ft^2 (2.8 m^2).

48.7.5 Plastic Light Diffusers in Electrical Fixtures. Light-transmitting plastics used for plastic light diffusers in electrical fixtures shall meet the requirements of 48.7.5.1 through 48.7.5.2.

48.7.5.1* Plastic light diffusers in electrical fixtures shall be permitted to be used in all buildings and shall meet the following requirements:

(1) They shall comply with 48.7.2.
(2) The light diffusers, as installed, shall fall from their mountings at an ambient temperature of at least 200°F (111°C) below the ignition temperature of the plastic material.
(3) The plastic light diffusers shall be mounted so that they remain in place at an ambient temperature of 175°F (79°C) for a period of not less than 15 minutes.

48.7.5.2 Unless an automatic sprinkler system is installed in accordance with 55.3.1.1, the area of light diffusers where used in exitways, exit passages, or corridors shall not exceed 30 percent of the aggregate area of the ceiling in which they are installed.

48.7.6 Light-transmitting Exterior Plastic Wall Panels. Light-transmitting plastics used for light-transmitting exterior plastic wall panels shall meet the requirements of 48.7.6.1 to 48.7.6.7.

48.7.6.1 Except where prohibited, light-transmitting plastics shall be permitted to be used as wall panels in exterior walls, provided that the walls are not required to have a fire resistance rating and the installation conforms to the requirements of 48.7.6.

48.7.6.2 Light-transmitting exterior plastic wall panels shall be erected and anchored on a foundation, waterproofed or otherwise protected from moisture absorption, and sealed with a coat of mastic or other approved waterproof coating.

48.7.6.3 The use of light-transmitting exterior plastic wall panels shall not alter the type of construction classification of the building.

48.7.6.4 Light-transmitting exterior plastic wall panels shall not be installed more than 75 ft (23 m) above grade plane, except as permitted by 48.7.6.6.

48.7.6.5 The maximum area requirements for light-transmitting exterior wall panels shall be as specified in 48.7.6.5.1 through 48.7.6.5.3.

48.7.6.5.1 The maximum area of a single wall panel and the minimum vertical and horizontal separation requirements for light-transmitting exterior wall panels shall be as provided for in Table 48.7.6.5.1.

48.7.6.5.2 The maximum percentage of wall area of any story in light-transmitting exterior plastic wall panels shall not exceed that indicated in Table 48.7.6.5.1 or the percentage of unprotected openings permitted by Section 7.3, whichever is smaller.

48.7.6.5.3 The requirements of 48.7.6.5.1 and 48.7.6.5.2 shall not apply where otherwise permitted by any of the following:

(1) In structures provided with approved flame barriers extending 30 in. (760 mm) beyond the exterior wall in the plane of the floor, a vertical separation shall not be required at the floor, except that provided by the vertical thickness of the flame barrier projection.
(2) The requirements of 48.7.6.5.1 and 48.7.6.5.2 shall not apply to veneers of approved, weather-resistant light-transmitting plastics used as exterior siding in buildings of Type V construction.
(3) The area of light-transmitting plastic wall panels in exterior walls of greenhouses shall be exempt from the area limitations of Table 48.7.6.5.1 but shall be limited as required for unprotected openings in accordance with Section 7.3.
(4) Light-transmitting plastic wall panels that meet the requirements of FM 4411, *Insulated Wall Constructions*, shall not be limited to the area and separation requirements of Table 48.7.6.5.1.

48.7.6.6 Where the building is equipped throughout with an automatic sprinkler system in accordance with 55.3.1.1, the maximum percentage area of an exterior wall in any story in light-transmitting plastic wall panels, and the maximum square footage of a single area given in Table 48.7.6.5.1, shall be permitted to be increased by 100 percent, provided that the area of light-transmitting plastic wall panels does not exceed 50 percent of the wall area in any story, or the area permitted for unprotected openings, whichever is smaller. These limitations shall be exempt from height limitations.

48.7.6.7 Combinations of light-transmitting plastic glazing and light-transmitting plastic wall panels shall be subject to the area, height, and percentage limitations and the separation requirements applicable to the class of light-transmitting plastic, as prescribed for light-transmitting plastic wall panel installations.

48.7.7 Light-transmitting Plastic Glazing. Light-transmitting plastic materials used for light-transmitting plastic glazing shall meet the requirements of 48.7.2, 48.7.7.1, and 48.7.7.2.

48.7.7.1 Light-transmitting plastic glazing shall be permitted in openings in exterior walls of buildings of Type V (000) construction where not required to be protected.

48.7.7.2 Light-transmitting plastic glazing shall be permitted in openings in the exterior walls of buildings of types of construction other than Type V (000), where not required to be protected, in accordance with the following provisions:

(1) The aggregate area of light-transmitting plastic glazing shall not exceed 25 percent of the area of any wall face of the story in which it is installed.
(2) The area of a single pane of glazing installed above the first story shall not exceed 16 ft^2 (1.5 m^2), and the vertical dimension of a single pane shall not exceed 4 ft (1.2 m).
(3) Where an automatic sprinkler is provided throughout in accordance with 55.3.1.1, the aggregate area of glazing permitted by 48.7.7.2(1) shall be permitted to be increased to a maximum of 50 percent of the wall face of the story in which it is installed with no limit on the maximum dimension or area of a single pane of glazing.
(4) Approved flame barriers extending 30 in. (760 mm) beyond the exterior wall in the plane of the floor, or vertical panels not less than 4 ft (1.2 m) in height, shall be installed between glazed units located in adjacent stories.
(5) Light-transmitting plastics shall not be installed more than 75 ft (23 m) above grade level.
(6) The requirements of 48.7.7.2 (4) and 48.7.7.2(5) shall not apply to buildings equipped throughout with an automatic sprinkler in accordance with 55.3.1.1.

Table 48.7.6.5.1 Area Limitation and Separation Requirements for Exterior Light-Transmitting Plastic Wall Panels

Fire Separation Distance (ft)	Class of Plastic	Maximum Percentage Area of Exterior Wall in Plastic Wall Panels	Maximum Single Area of Plastic Wall Panels (ft^2)	Minimum Separation of Plastic Wall Panels (ft)	
				Vertical	Horizontal
<6	—	NP	NP	—	—
≥6 <11	CC1	10	50	8	4
	CC2	NP	NP	—	—
≥11 ≤ 30	CC1	25	90	6	4
	CC2	15	70	8	4
>30	CC1	50	NL	3	0
	CC2	50	100	6	3

For SI units, 1 ft = 0.305 m; 1 ft^2 = 0.093 m^2.
Note: For combinations of plastic glazing and plastic wall panel areas permitted, see 48.7.6.7.
NL = Not limited.
NP = Not permitted.

48.7.8 Light-transmitting Plastic Roof Panels. Light-transmitting plastics used for light-transmitting roof panels shall meet the requirements of 48.7.8.1 to 48.7.8.4.

48.7.8.1 Except where prohibited, light-transmitting plastics shall be permitted to be used as light-transmitting plastic roof panels where any of the following conditions are met:

(1) The building is equipped throughout with an automatic sprinkler in accordance with 55.3.1.1.
(2) The roof construction is not required to have a fire resistance rating.
(3) The light-transmitting plastic roof panels meet the requirements for roof coverings in accordance with Chapter 38.

48.7.8.2 Individual light-transmitting plastic roof panels shall meet the requirements of 48.7.8.2.1 and 48.7.8.2.2.

48.7.8.2.1 Individual light-transmitting plastic roof panels shall be separated from each other by a distance of not less than 4 ft (1.2 m), measured in a horizontal plane.

48.7.8.2.2 The requirement of 48.7.8.2.1 shall not apply where one of the following conditions exists:

(1) The separation between light-transmitting plastic roof panels shall not be required in a building equipped throughout with an automatic sprinkler system in accordance with 55.3.1.1.
(2) The separation between light-transmitting plastic roof panels shall not be required in buildings complying with the conditions of 48.7.8.4.2(2) and 48.7.8.4.2(3).

48.7.8.3 Where exterior wall openings are required to be protected, a light-transmitting plastic roof panel shall not be installed within 6 ft (1.8 m) of such exterior wall.

48.7.8.4 Light-transmitting plastic roof panels shall meet the requirements of 48.7.8.4.1 and 48.7.8.4.2.

48.7.8.4.1 Light-transmitting plastic roof panels shall be limited in area, and the aggregate area of panels shall be limited by a percentage of the floor area of the room or space sheltered in accordance with Table 48.7.8.4.1.

Table 48.7.8.4.1 Area Limitations for Light-transmitting Plastic Roof Panels

Class of Plastic	Maximum Area of Individual Roof Panels		Maximum Aggregate Area of Roof Panels (percent of floor area)
	ft^2	m^2	
CC1	300	27.9	30
CC2	100	9.3	25

48.7.8.4.2 The requirement of 48.7.8.4.1 shall not apply where one of the following conditions exists:

(1) The area limitations of Table 48.7.8.4.1 shall be permitted to be increased by 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with 55.3.1.1.
(2) Low hazard occupancy buildings, such as swimming pool shelters, shall be exempt from the area limitations of Table 48.7.8.4.1, provided that the building does not exceed 5000 ft^2 (465 m^2) and has a minimum fire separation distance of 10 ft (3 m).
(3) Greenhouses that are occupied for growing plants on a production or research basis, without public access, shall be exempt from the area limitations of Table 48.7.8.4.1, provided that they have a minimum fire separation distance of 4 ft (1.2 m).
(4) Roof coverings over terraces and patios in residential occupancies shall be exempt from the area limitations of Table 48.7.8.4.1.

48.7.9 Light-transmitting Plastics Used in Awnings and Canopies. The requirements for light-transmitting plastics used as or in awnings and canopies shall be as follows:

(1) Awnings and canopies and similar structures constructed of light-transmitting plastics shall be constructed in accordance with the provisions specified in Chapter 13 and Section 32.4 for projections and appendages.
(2) Light-transmitting plastics used in canopies for motor vehicle fuel stations shall comply with the appropriate sections of this *Code*.

48.7.10 Light-transmitting Plastic Covers on Solar Collectors. Light-transmitting plastic covers on solar collectors having noncombustible sides and bottoms shall be permitted on buildings not over three stories in height or 9000 ft^2 (836 m^3) in total floor area, provided that one of the following criteria is met:

(1) The light-transmitting plastic cover shall not exceed 33.3 percent of the roof area for CC1 materials.
(2) The light-transmitting plastic cover shall not exceed 25 percent of the roof area for CC2 materials.
(3) Plastic covers having a thickness of 0.010 in. (0.25 mm) or less shall be permitted to be of any plastic material, provided that the area of the collectors does not exceed 33.3 percent of the roof area.

48.7.11 Light-transmitting Plastics Used for Partitions. Light-transmitting plastics used in or as partitions shall comply with the requirements of Chapter 10.

48.7.12 Light-transmitting Plastics Used in Bathroom Accessories. Requirements for glazing in light-transmitting plastics used in bathroom accessories shall be as follows:

(1) Light-transmitting plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures, and similar accessory units.
(2) Safety glazing shall be provided in accordance with ANSI Z 97.1, *Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.*

48.8 Specific Requirements — Plastic Interior Signs.

48.8.1 Signs installed on the faces of interior walls shall comply with Section 48.8.

48.8.2 Light-transmitting plastic interior wall signs shall comply with the following requirements:

(1) The sign shall have an area not greater than 20 percent of the wall area to which it is attached.
(2) The sign shall have an area not greater than 24 ft^2 (2.23 m^2).
(3) The edges and backs of the sign shall be fully encased in metal.

48.8.3 Plastic interior wall signs in mall buildings shall comply with 27.4.4.11.

48.8.4 Foam plastics shall be permitted to be used as signs in covered mall buildings in accordance with 27.4.4.11.

48.9 Specific Requirements—Light-transmitting Plastics Used in Greenhouses. Light-transmitting plastics shall be permitted in lieu of glass in greenhouses.

Chapter 49 Interior Environment

49.1 General.

49.2 Ventilation.

49.2.1 Required Ventilation.

(A) All rooms and occupied spaces in buildings shall be ventilated by natural or mechanical means in accordance with the provisions of this chapter.

(B) Mechanical ventilation systems shall be designed, constructed and installed in accordance with Chapter 50.

(C) Mechanical ventilation systems shall operate to the extent that all occupied rooms are continuously provided with the required ventilation rate while occupied.

49.2.2 Ventilation Rates.

49.2.2.1 Ventilation rates for the following occupancies shall conform to ASHRAE 62, *Ventilation for Acceptable Indoor Air Quality*:

(1) Assembly
(2) Business
(3) Educational
(4) Day care
(5) Detention
(6) Health care
(7) Mercantile

(A) Industrial occupancies shall be provided with general ventilation systems for replacing mildly contaminated air by means of natural air currents and openings, or they shall be provided with mechanical fans, ducts, and outlets.

(B) Contaminated air shall be cleaned and recirculated.

(C) Local exhaust systems shall be provided to collect and remove moisture and odors, fumes, smoke, gas, mist, heat, dust, or other materials that are in sufficient quantities to irritate or injure occupants.

(D) Hazardous emissions, such as toxic, corrosive, acidic, and hot materials, that result from industrial processes shall be captured and exhausted to the outdoors.

(E) Hazardous emissions shall be retained in the area where they originate by methods such as maintaining negative pressure to adjacent spaces and sealing the area of origin from adjacent areas until they are exhausted to the outdoors.

(F) Air containing hazardous emissions shall be cleaned before it is exhausted outdoors.

49.2.2.2 (Reserved)

49.2.2.3 Storage occupancies shall be provided with ventilation to provide not less than two air changes per hour.

49.2.2.4 Open parking structures shall not require mechanical ventilation.

49.2.2.5 An enclosed parking structure shall have a ventilation system designed to limit the concentration of carbon monoxide to not more than 35 parts per million of air when measured between 36 in. and 48 in. (900 mm and 1200 mm) from the floor.

49.2.2.6 Private parking structures shall be permitted to have a mechanically operated exhaust system that provides four changes of air per hour, with the air taken from within 16 in. (400 mm) of the finished floor. The mechanically operated system shall be operated by a single pole switch or a timer switch.

49.2.2.7 Ventilation rates for one- and two-family dwellings and multifamily dwelling units, hotel guest rooms, and residential board and care occupancies shall provide not less than the air change rates indicated in Table 49.2.2.7 where mechanical ventilation systems are installed. Where mechanical ventilation systems are not provided, the exterior openable window area shall be at least 4 percent of the floor area.

Table 49.2.2.7 Ventilation Rates

Occupancy	Intermittent Local Ventilation Airflow Rates	Continuous Local Exhaust Airflow Rates
Habitable rooms (other than kitchens)	0.35 ach each but not less than 15 ft^3/min (7.5 L/s) per person	
Kitchens	100 ft^3/min (50 L/s)	5 ach
Residential bathroom and toilet rooms	50 ft^3/min (25 L/s)	20 ft^3/min (10 L/s)

ach = air changes per hour.

Notes:

1. Intermittent local ventilation is designed to be operated as needed by the occupant.
2. Continuous local ventilation is designed to operate without occupant intervention.

49.2.2.8 Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the unobstructed opening to the adjoining room shall be at least 8 percent of the floor area of the interior room or space but not less than 25 ft^2 (2.33 m^2). The ventilation openings to the outdoors shall be based on the total floor area being ventilated.

49.2.3 Ventilating Systems in Spaces Using Chemicals or Containing Hazardous Agents. Ventilating systems in laboratories or spaces using chemicals or containing hazardous agents shall be in accordance with the applicable provisions of NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*; NFPA 99; *Standard for Health Care Facilities;* and Chapter 34.

49.2.4 Commercial Cooking Equipment. Systems for the ventilation of commercial cooking equipment shall be designed, constructed, and installed in accordance with Chapter 50.

49.2.5 Radon Control Methods.

49.2.5.1 General. The radon control methods discussed in this chapter represent a combination of good construction practices that have been coupled with specific radon removal strategies. The radon control methods presented are based on radon mitigation procedures that have been used successfully for various foundation types *(see Figure 49.2.5.3.3.4, Figure 49.2.5.3.4, Figure 49.2.5.3.5, and Figure 49.2.5.3.5.1)* and include options to accommodate regional construction practices and site conditions. These techniques, in combination with a recommended test by the homeowner after occupancy, provide radon reduction in newly constructed homes.

49.2.5.2 Applicability.

49.2.5.2.1 This chapter contains requirements to control radon levels in new construction of one- and two-family dwellings and other residential buildings three stories or less in height as defined by this *Code*.

49.2.5.2.2 The requirements of this chapter are also applicable when additions are made to the foundations of existing one- and two-family dwellings that result in extension of the building footprint.

49.2.5.2.3* The requirements of this chapter shall be applicable in all Zone 1 counties, as designated by the map of radon zones shown in Figure 49.2.5.2.3, developed by the U.S. Geological Survey and U.S. Environmental Protection Agency. In addition, the requirements of this chapter shall be applicable in all areas designated by local officials as Zone 1, based on locally available data.

49.2.5.3 Requirements.

49.2.5.3.1 Subfloor Preparation. A layer of gas-permeable material shall be placed under all concrete slabs and wood-framed basement floors, and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a sub-slab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:

(1) A uniform layer of clean aggregate that is a minimum of 4 in. (102 mm) thick and that consists of material that will pass through a 2-in. (51-mm) sieve and be retained by a ¼-in. (6.4-mm) sieve
(2) A uniform layer of sand (native or fill), a minimum of 4 in. (102 mm) thick, overlain by a layer or strips of 1-in. (25.4-mm) geotextile drainage matting designed to allow the lateral flow of soil gases
(3) Other materials, systems, or floor designs with demonstrated capability to allow depressurization across the entire subfloor area

49.2.5.3.2 Soil-gas Retarder. A minimum 6-mil (0.15-mm) [or 3-mil (0.075-mm) cross-laminated] polyethylene or equivalent flexible sheeting shall be placed on top of the gas-permeable layer prior to casting the slab or constructing the floor. The sheeting shall cover the entire floor assembly to serve as a soil-gas retarder by bridging any cracks that develop in the slab or floor assembly and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 in. (305 mm). The sheeting shall fit closely around any pipe, wire, or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.

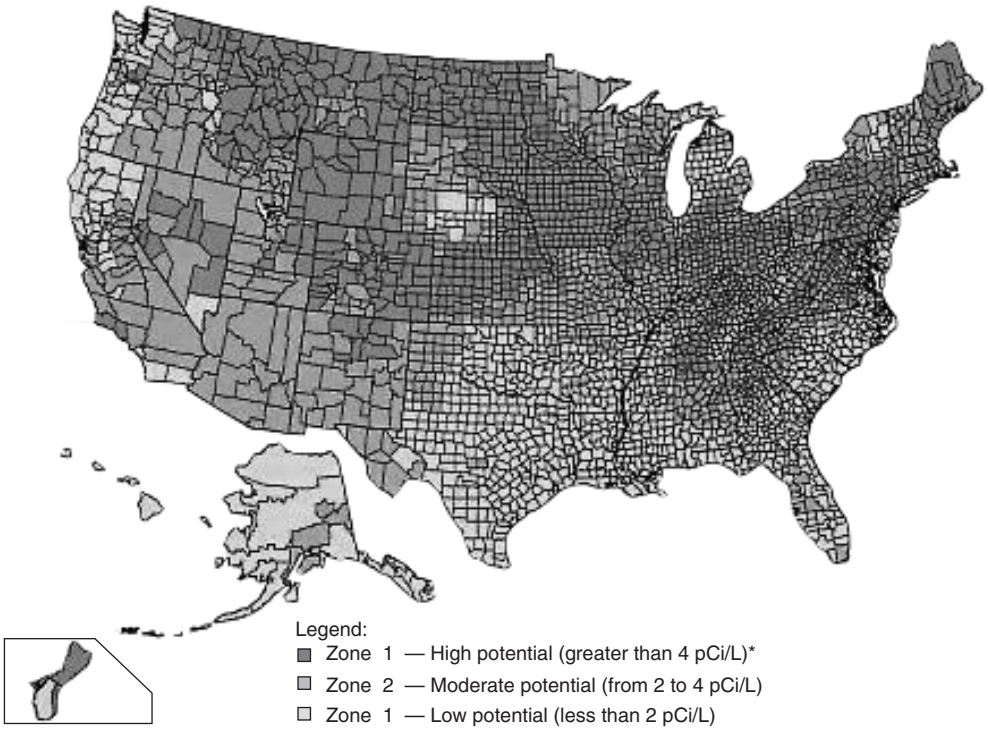
49.2.5.3.3 Entry Routes. Potential soil-gas entry routes shall be closed in accordance with 49.2.5.3.3.1 through 49.2.5.3.3.10.

49.2.5.3.3.1 Floor Openings. Openings around bathtubs, showers, water closets, pipes, wires, or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

49.2.5.3.3.2 Concrete Joints. All control joints, isolation joints, construction joints, and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.

49.2.5.3.3.3 Condensate Drains. Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

49.2.5.3.3.4 Sumps. Sump pits open to soil or serving as the termination point for sub-slab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid in accordance with Figure 49.2.5.3.3.4. Sumps used as the suction point in a sub-slab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.



* A list of high potential (Zone 1) counties can be found in Annex A, Table A.49.2.5.2.3.

FIGURE 49.2.5.2.3 EPA Map of Radon Zones.

49.2.5.3.3.5 Foundation Walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks, or other openings around all penetrations of both exterior and interior surfaces of hollow foundation walls below the ground surface shall be filled with polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

49.2.5.3.3.6 Dampproofing. The exterior surfaces of portions of walls below the ground surface shall be dampproofed as required by Chapter 36 of this *Code*.

49.2.5.3.3.7 Air-Handling Units. Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit, either by the manufacturer or in the field.

49.2.5.3.3.8 Ducts. Ductwork passing through a crawl space or beneath a slab shall be of seamless material, unless the air-handling system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed to prevent air leakage.

49.2.5.3.3.9 Crawl Space Floors. Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

49.2.5.3.3.10 Crawl Space Access. Access doors and other openings or penetrations between basements and adjoining crawl spaces shall be closed, gasketed, or otherwise filled to prevent air leakage.

49.2.5.3.4 Passive Submembrane Depressurization System. In buildings with crawl space foundations, the following components of a passive submembrane depressurization system shall be installed during construction in accordance with Figure 49.2.5.3.4, unless an approved mechanical crawl space ventilation system or other equivalent system is installed.

49.2.5.3.4.1 Ventilation. Crawl spaces shall be provided with vents to the exterior of the building. The minimum net area of ventilation openings shall comply with Chapter 49 of this *Code*.

49.2.5.3.4.2 Soil-Gas Retarder. The soil in crawl spaces shall be covered with a continuous layer of minimum 6-mil (0.15-mm) polyethylene sheeting or equivalent material. The ground cover shall be lapped a minimum of 12 in. (305 mm) at joints, shall be sealed to any piers and around any penetrations, and shall extend to all foundation walls enclosing the crawl space area walls.

49.2.5.3.4.3 Vent Pipe.

(A) A plumbing tee or other approved connection shall be inserted horizontally beneath the sheeting and connected to a minimum 3-in. (76-mm), maximum 4-in. (102-mm), diameter fitting with a vertical vent pipe installed through the sheeting.

(B) The vent pipe shall meet the following criteria:

(1) It shall extend up through the building floors, terminating at least 12 in. (305 mm) above the surface of the roof at a location at least 10 ft (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 ft (610 mm) below the exhaust point.
(2) It shall terminate at least 10 ft (3048 mm) from any window or other opening in adjoining or adjacent buildings.

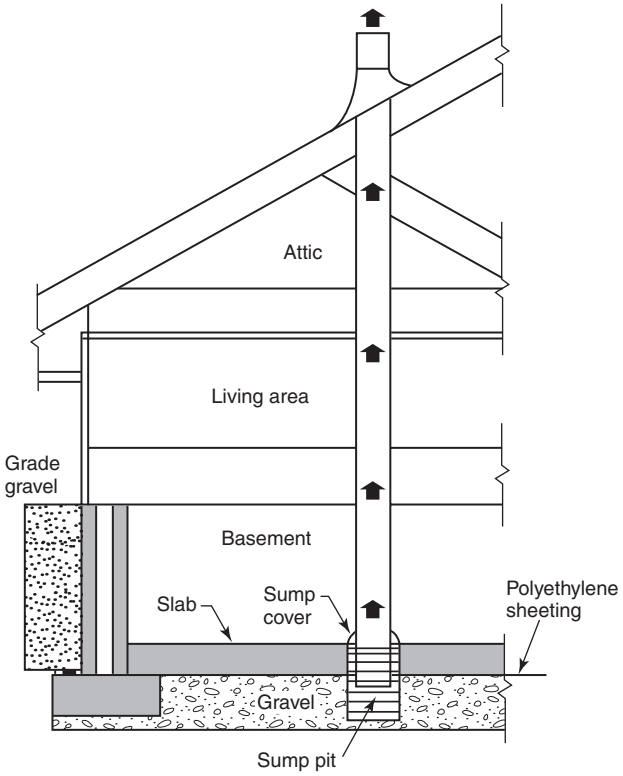


FIGURE 49.2.5.3.3.4 Passive Radon System Vented Through Sump.

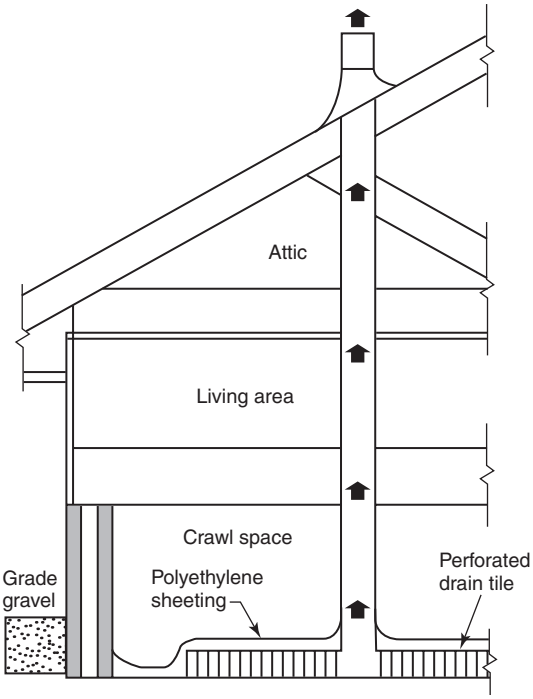


FIGURE 49.2.5.3.4 Submembrane Depressurization System for Crawl Space.

49.2.5.3.5 Passive Sub-slab Depressurization System. In basement or slab-on-grade buildings, the following components of a passive sub-slab depressurization system shall be installed during construction in accordance with Figure 49.2.5.3.5.

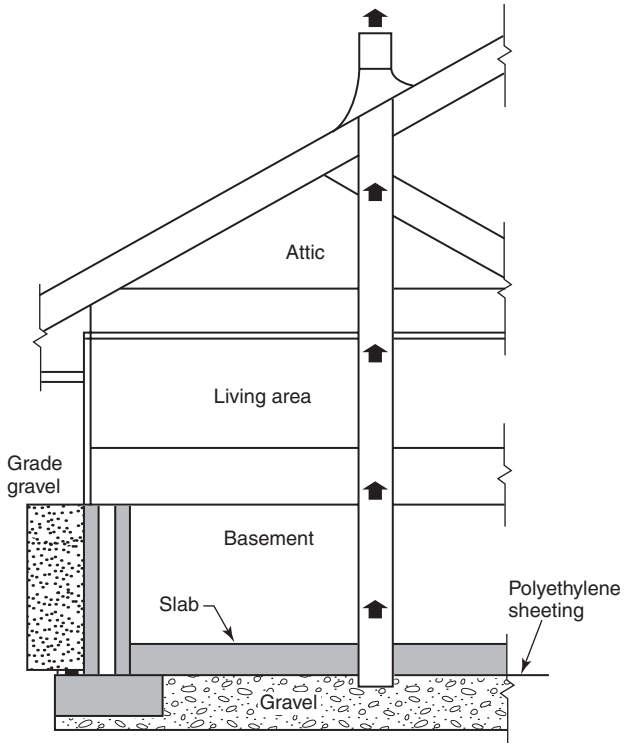


FIGURE 49.2.5.3.5 Typical Sub-slab Depressurization Passive Radon System.

49.2.5.3.5.1 Vent Pipe.

(A) A minimum 3-in. (76-mm) diameter ABS, PVC, or equivalent gas-tight pipe shall be embedded vertically into the sub-slab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the sub-slab permeable material. Alternatively, the pipe shall be inserted directly into an interior perimeter drain tile loop, or through a sealed sump cover where the sump is exposed to the sub-slab aggregate or connected to it through a drainage system in accordance with Figure 49.2.5.3.5.1.

(B) The vent pipe shall meet the following criteria:

(1) It shall extend up through the building floors, terminating at least 12 in. (305 mm) above the surface of the roof, at a location at least 10 ft (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 ft (610 mm) below the exhaust point.
(2) It shall terminate at least 10 ft (3048 mm) from any window or other opening in adjoining or adjacent buildings.

49.2.5.3.5.2 Multiple Vent Pipes. In buildings where interior footings or other barriers separate the sub-slab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent

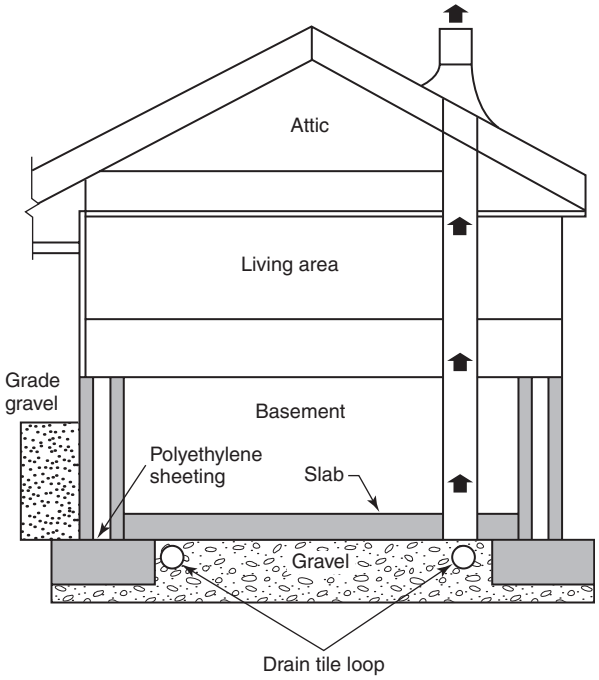


FIGURE 49.2.5.3.5.1 Passive Radon System Using Drain Tile Loop.

that terminates above the roof, or each individual vent pipe shall terminate separately above the roof.

49.2.5.3.5.3 Vent Pipe Drainage. All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas retarder.

49.2.5.3.5.4 Vent Pipe Accessibility.

(A) Radon vent pipes shall be accessible for future fan installation through an attic or other area outside the habitable space.

(B) The radon vent pipe shall not be required to be accessible in an attic space where an approved rooftop electrical supply is provided for future use.

49.2.5.3.5.5 Vent Pipe Identification.

(A) All exposed and visible interior vent pipes shall be identified with at least one label on each floor and in accessible attics. The label shall read as follows:

PASSIVE RADON REDUCTION SYSTEM

(B) In addition to the label specified in 49.2.5.3.5.5(A), a notice to the homeowner shall be placed in a conspicuous area near the vent pipe that states the following:

THERE ARE NO REQUIREMENTS FOR THIS RADON REDUCTION SYSTEM TO BE TESTED BY THE BUILDER. IT IS RECOMMENDED THAT OCCUPANTS TEST FOR RADON AND TAKE REMEDIAL ACTION AS NECESSARY. Call 1-800-SOS-RADON FOR MORE INFORMATION.

49.2.5.3.5.6 Combination Foundations. Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate vent pipes installed in each type of foundation area. Each vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

49.2.5.3.5.7 Building Depressurization. Joints in air ducts and plenums in unconditioned spaces shall meet the requirements of Chapter 50. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 51. Firestopping shall meet the requirements contained in Chapter 8 of this *Code*.

49.2.5.3.5.8 Power Source. To provide for future installation of an active sub-membrane or sub-slab depressurization system, an electrical circuit terminated in an approved box shall be installed in the attic or other anticipated location of vent pipe fan during construction. An electrical supply shall also be accessible in anticipated locations of system failure alarms.

49.2.6* Flood Hazard Areas. For new construction of buildings and structures located wholly or partly within flood hazard areas established by 39.4.2, including substantial improvements and restoration of substantial damage, ventilation openings required by this chapter shall be located above the design flood elevation.

49.3 Lighting.

49.3.1 Natural lighting shall be provided to all rooms used by human beings in accordance with 49.3.2 and 49.3.3, or fixed artificial light shall be provided in accordance with 49.3.4.

49.3.2 Where natural light is provided, it shall have a net glazed area of not less than 8 percent of the total area of the room served.

49.3.3 Fixed artificial lighting shall be permitted to be substituted for natural lighting. Fixed artificial lighting shall be capable of providing an average of 10 foot-candles of illumination, measured at a height of 30 in. (762 mm) above the floor.

49.3.4 Lighting of the means of egress shall be provided in accordance with Section 11.8 and Section 11.9 of this *Code*.

49.4 Sound Transmission.

49.4.1 General. The provisions of Section 49.4 shall apply to dwelling units in two-family dwellings, townhouses, and apartment buildings; guest rooms and guest suites in hotels and dormitories; and sleeping rooms in lodging and rooming houses and residential board and care occupancies, hereinafter referred to as living units.

49.4.2 Airborne Sound Transmission.

(A) All interior walls and floor-ceiling assemblies that separate living units, and that separate living units and spaces not a part of the living unit, shall have a sound transmission class (STC) of not less than 50 for airborne noise when tested in accordance with ASTM E 90, *Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements*.

(B) The requirement of 49.4.2(A) shall not apply to entrance doors to living units, provided that the door is tight-fitting to the frame and sill.

49.4.3 Structure-borne Sound Transmission. All floor-ceiling assemblies between living units, and between living units and spaces not a part of the living unit, shall have an impact insulation class (IIC) of not less than 45 when tested in accordance with ASTM E 492, *Standard Test Method for Laboratory Measurement of Impact Sound Through Floor-Ceiling Assemblies Using the Tapping Machine*.

49.5 Interior Space Dimensions.

49.5.1 Ceiling Heights.

49.5.1.1 In all occupancies, ceilings of rooms used for human occupancy shall have a clear height as specified in 11.1.5.

49.5.1.2 Rotary fan blades in all occupancies shall be protected where the blades of the fan are located within 7 ft (2134 mm) of the finished floor. They shall be protected with guards with openings that will prohibit the passage of a ½-in. (12.7-mm) sphere.

49.5.1.3 Rotary fan blades in dwelling units located not less than 6⅔ ft (2032 mm) above the finished floor shall not be required to be protected with guards.

49.6 Access to Attics.

49.6.1 Where mechanical or electrical equipment or utility piping is installed in attics, access shall be provided.

49.6.2 Attic access openings shall be not less than 22 in. × 30 in. (559 mm × 762 mm).

49.7 Design Conditions.

49.7.1 General. All rooms and occupied spaces in buildings shall have indoor winter design comfort conditions in accordance with the provisions of this chapter.

49.7.2 Outdoor Climatic Data.

49.7.2.1 The outdoor climatic data required for the design of indoor comfort conditioning equipment shall be the climatic data published in the ASHRAE *Handbook of Fundamentals* unless otherwise established by the authority having jurisdiction.

49.7.2.2 The outside winter design temperatures shall be those listed for the heating dry bulb (DB), 99 percent annual cumulative frequency of occurrence, and the outside cooling design temperatures shall be those listed for the cooling dry bulb and wet bulb, 1 percent annual cumulative frequency of occurrence, unless otherwise established by the authority having jurisdiction.

49.7.3 Indoor Design Conditions. Indoor winter design conditions shall be within the winter comfort zone as published in ASHRAE 55, *Thermal Environmental Conditions for Human Occupancy*, and the ASHRAE *Handbook of Fundamentals*, unless otherwise established by the authority having jurisdiction.

49.8 Special Requirements for Occupancies.

49.8.1 Special Occupancies. Where either natural or artificial lighting is provided in educational occupancies, the minimum light level values in Table 49.8.1 shall be maintained at work levels.

Table 49.8.1 General Lighting Levels

Area	Minimum Light Level (ft-candles)
Lecture/demonstration	150
Sewing	150
Drafting	100
Cooking	50
Other	70

Note: There is no general listing of lighting level. The requirements for special occupancies are in Section 11.9.

49.9 Vermin Proofing. (Reserved—See Annex B.)

Chapter 50 Mechanical Systems

50.1 General. All mechanical systems and equipment shall be designed and constructed in accordance with the following:

(1) Fuel gas appliances shall be designed and constructed in accordance with NFPA 54, *National Fuel Gas Code*.

(2) Oil-burning appliances shall be designed and constructed in accordance with NFPA 31, *Standard for the Installation of Oil-Burning Equipment*.

(3) Solid fuel appliances shall be designed and constructed in accordance with NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*.

(4) Exhaust systems for air conveying of materials shall be designed and constructed in accordance with NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*.

(5) Commercial kitchens shall be designed and constructed in accordance with NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*.

(6) Stationary fuel cell power plants shall be constructed, designed, and installed in accordance with NFPA 853, *Standard for the Installation of Stationary Fuel Cell Power Plants*.

(7) Air-conditioning and ventilating systems shall be designed and constructed in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

(8) Warm air heating and air-conditioning systems shall be designed and constructed in accordance with NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*.

(9) All other mechanical systems and equipment shall be designed and constructed in accordance with the 2000 *Uniform Mechanical Code*.

50.2 Flood Resistance. For new construction of buildings and structures that are located wholly or partly within flood hazard areas established by 39.4.2, including substantial improvements and restoration of substantial damage, all mechanical systems and equipment below the design flood elevation, including ductwork, shall meet the requirements of Section 8 of SEI/ASCE 24, *Flood Resistant Design and Construction*.

Chapter 51 Energy Efficiency

51.1 General. The requirements of this chapter shall regulate the energy efficient design of the building envelope; the conditioning of the enclosed environment through heating, venting, and air-conditioning equipment and systems; and other equipment and systems that contribute the building's energy consumption.

51.1.1 Application. Energy efficient design requirements shall govern the following:

(1) New construction
(2) Additions, alterations, modernizations, or renovations to existing buildings or structures

51.1.2 Occupancy Classification. For the purposes of this chapter, each occupancy within the building or structure shall be subject to the applicable requirements for that occupancy. Where an occupancy contains another occupancy whose area is less than 10 percent of the area of the total floor area in which it is located, the primary occupancy shall be considered the occupancy.

51.1.3 Special Definitions (Reserved).

51.2 Commercial.

51.2.1 The following occupancies shall meet the requirements of ASHRAE/IESNA 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*:

(1) Assembly
(2) Educational
(3) Health care
(4) Ambulatory health care
(5) Detention and correctional
(6) Lodging and rooming house
(7) Hotels and dormitory
(8) Apartment
(9) Mercantile
(10) Business

51.2.2 The following occupancies shall be exempt from the provisions of this chapter:

(1) Storage
(2) Industrial

51.3 Residential.

51.3.1 One- and two-family dwellings shall meet the requirements of 51.3.2.2 through 51.3.2.14.3 or shall meet the requirements of ASHRAE 90.2, *Energy Efficient Design of Low-Rise Residential Buildings*.

51.3.1.1 For the purposes of Section 51.3, the following provisions shall be considered as part of ASHRAE 90.2:

(1) Subsection 5.3.9.2 and subsection 5.5.9.2 of ASHRAE 90.2 shall include additional provisions, which shall read "Shading coefficients shall be determined in accordance with NFRC 100 and NFRC 200, by an accredited, independent laboratory, and the fenestration shall be labeled for U-factor and SHGC. To revise SC to SHGC in the standard, use the following equation: SHGC = 0.86 SC."
(2) Section 6.3.3.2 of ASHRAE 90.2 shall read "combustion air shall comply with the applicable state or local mechanical codes, or in the absence thereof, Chapter 50 of this *Code*."

51.3.1.2 Manufactured homes shall not be required to comply with the requirements of 51.3.1 through 51.3.1.1(1).

51.3.2 Simplified Prescriptive Method.

51.3.2.1 General. Paragraph 51.3.2.2 shall provide thermal performance requirements for the building envelope and performance requirements for heating, venting, air-conditioning, and service water heating equipment for one- and two-family dwellings.

51.3.2.2 Building Envelope.

(A) For one- and two-family dwellings with a window area less than or equal to 18 percent of the gross floor area, the sum of the thermal resistance of the cavity insulation and continuous insulation uninterrupted by framing applied to the opaque building envelope components shall be greater than or equal to the minimum *R*-values, and the thermal transmittance of all fenestration assemblies shall be less than or equal to the maximum *U*-values, shown in Table 51.3.2.2(a), Table 51.3.2.2(b), Table 51.3.2.2(c), or Table 51.3.2.2(d). Paragraph 51.3.2.2 through paragraph 51.3.2.4 shall apply to the use of those tables.

Table 51.3.2.2(a) Climate Bin for Heating Degree Days Less than 10,001

Cooling Degree Hours, Base 74°F (23.33°C)												
	≥43,200		2									
	43,199 to 32,400		3									
	32,399 to 21,600	1	4	5	8							
	21,599 to 10,800			6	9	11	13	15				
	10,799 to 0			7	10	12	14	16	17	18	19	20
		0 to 899	900 to 1,799	1,800 to 2,699	2,700 to 3,599	3,600 to 4,499	4,500 to 5,399	5,400 to 6,299	6,300 to 7,199	7,200 to 8,099	8,100 to 8,999	9,000 to 10,000
		Heating Degree Days, Base 65°F (18.33°C)										

Table 51.3.2.2(b) Envelope Criteria for Ducts Inside Conditioned Envelope

Bin			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ceilings	With Attic	*R*	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	38
	Without Attic	*R*	19	30	19	19	19	19	19	30	19	19	30	19	30	30	30	30	30	30	30	30
Walls	Above Grade Frame and Band Joists	*R*	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
	Above Grade Concrete Exterior or Integral Insulation	*R*	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	7.6	7.6	10	10	10	10	10	10
	Above Grade Concrete Interior Insulation	*R*	3.4	3.4	3.4	3.4	3.4	3.4	3.4	10	10	3.4	10	10	10	10	10	10	13	13	13	13
	Frame Adjacent Unconditioned Space	*R*	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	19	19
	Mass Adjacent Unconditioned Space	*R*	0	1.9	1.9	0	1.9	0	0	1.9	1.9	0	1.9	0	3.4	1.9	3.4	3.4	3.4	3.4	3.4	3.4
Basement	Exterior or Integral Insulation	*R*	0	4	4	4	4	4	4	4	4	4	5	5	8	8	15	8	15	15	15	15
		Depth	None	Full	Half	Half	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full
	Interior Insulation	*R*	0	11	11	11	11	11	11	11	11	11	11	11	11	11	13	13	13	13	13	15
Crawl Space		*R*	8	8	8	8	8	8	8	11	11	11	11	11	11	11	19	19	19	19	19	19
Floors	Frame Over Exterior Ambient Condition	*R*	19	19	19	19	19	19	19	30	19	19	30	19	30	30	30	30	30	30	30	30
	Frame Over Unconditioned Space	*R*	11	11	11	11	11	11	11	11	11	11	11	11	11	11	19	19	19	19	19	19
	Slab on Grade	*R*	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	8	8	8
		Ft	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Fenestration		*U*	1.31	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.36	0.49	0.36	0.36	0.36	0.36
		SHGC	0.44	0.44	0.44	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61

For SI units, 1 ft = 305 mm; HDD65/1.8 = HDD18; CDH74/1.8 = CDH23;
R-val*0.1761 = *R*(SI); *U*-val*5.678 = *U*(SI).
SHGC = solar heat coefficient.

Table 51.3.2.2(c) Envelope Criteria for Ducts Outside Conditioned Envelope

Bin			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ceilings	With Attic	*R*	30	30	30	30	30	30	30	30	30	30	30	30	30	30	38	30	30	49	49	49
	Without Attic	*R*	19	30	30	19	30	19	19	30	30	30	30	30	30	30	30	30	30	30	30	30
Walls	Above Grade Frame and Band Joists	*R*	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19 / 5.4	19 / 7.2	19 / 7.2
	Above Grade Concrete Exterior or Integral Insulation	*R*	3.4	3.4	3.4	3.4	3.4	3.4	3.4	7.6	3.4	3.4	10	7.6	10	10	10	10	10	10	10	10
	Above Grade Concrete Interior Insulation	*R*	3.4	10	10	3.4	10	10	3.4	10	10	10	10	10	13	13	13	13	13	15	15	15
	Frame Adjacent Unconditioned Space	*R*	11	11	11	11	11	11	11	11	11	11	11	11	11	11	19	11	19	19	19	19
	Mass Adjacent Unconditioned Space	*R*	1.9	3.4	1.9	1.9	1.9	1.9	0	3.4	1.9	1.9	3.4	1.9	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Basement	Exterior or Integral Insulation	*R*	4	4	4	4	4	4	4	8	5	5	8	8	15	15	15	15	15	15	15	15
	Interior Insulation	Depth	Half	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full
		R	11	11	11	11	11	11	11	11	11	11	13	13	13	13	13	13	13	15	15	15
Crawl Space		*R*	8	11	8	8	11	11	11	11	11	11	19	11	19	19	19	19	19	19	19	19
Floors	Frame Over Exterior Ambient Condition	*R*	19	30	19	19	30	19	19	30	30	30	30	30	30	30	30	30	30	30	30	30
	Frame Over Unconditioned Space	*R*	11	11	11	11	11	11	11	11	11	11	19	11	19	19	19	19	19	19	19	19
	Slab on Grade	*R*	4	5	4	4	4	4	4	5	5	5	5	5	5	5	8	8	8	8	8	8
		Ft	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4
Fenestration		*U*	1.31	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.49	0.87	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
		SHGC	0.44	0.44	0.44	0.44	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61

For SI units, 1 ft = 305 mm; HDD65/1.8 = HDD18; CDH74/1.8 = CDH23;
R-val*0.1761 = *R*(SI); *U*-val*5.678 = *U*(SI).

Table 51.3.2.2(d) Envelope Criteria for Heating Degree Days Greater than 10,000

Heating Degree Days 65°F	Ceilings		Walls					Floor			Doors	Fenestration	
	With Attic	Without Attic	Above Grade	Below Grade	Crawl Space	Frame Adjacent Unconditioned Space	Mass Adjacent Unconditioned Space	Slab	Frame Over Exterior Ambient Condition	Frame Over Unconditioned Space			
	R	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*U*	*U*	SHGC
10,001 to 12,000	49	30	19 / 7.2	15	19	19	3.4	8	30	30	0.19	0.36	0.60
12,001 to 15,000	49	30	19 / 7.2	15	19	19	3.4	10	30	30	0.19	0.36	0.60
15,001 to 18,000	60	30	19 / 10	15	19	19	10	12	30	30	0.19	0.36	0.60
18,001 to 21,000	60	30	19 / 10	15	19	19	10	14	30	30	0.19	0.36	0.60

For SI units, HDD65/1.8 = HDD18; *R*-val*0.1761 = *R*(SI); *U*-val*5.678 = *U*(SI).

(B) Where an added *R*-value of 3.4 or less is required, concrete block walls in accordance with ASTM C 90, *Standard Specification for Loadbearing Concrete Masonry Units*, with cores filled with material having a maximum thermal conductivity of 0.44 Btu/(hr × ft^2 × °F) shall be permitted to be used.

51.3.2.3 Metal Stud Walls. The *R*-value of framed walls that contain metal stud framing shall be calculated using Table 51.3.2.3 and the following equation:

$$R_{opaquewall} = \frac{1}{R_i + R_e}$$

where:

$R_{opaquewall}$ = the total thermal transmittance of the envelope assembly
R_i = the thermal resistance of the elements in series along the path of heat transfer, excluding the parallel path element(s)
R_e = the equivalent resistance of the element containing the parallel path, as shown in Table 51.3.2.3

51.3.2.4 Doors. The requirements of 51.3.2.4 shall apply to all door assemblies that allow entry or exit from heated or mechanically cooled spaces, or both.

51.3.2.4.1 Opaque Portion of Wood Doors. The opaque portion of a wood door assembly shall provide a *U*-factor of 0.40 for up to 10,000 HDD65.

51.3.2.4.2 Opaque Portion of Non-wood Doors. The opaque portion of a non-wood door assembly shall provide a *U*-factor of 0.19 for up to 10,000 HDD65.

51.3.2.4.3 Glazed Portion of Any Door. The glazed portion of any door assembly shall provide a maximum *U*-factor as shown in the column entitled "fenestration" in Table 51.3.2.2(b), Table 51.3.2.2(c), or Table 51.3.2.2(d).

51.3.2.5 Windows. The requirements of this subsection shall apply to all operable or fixed glazed assemblies, including windows, skylights, and glass doors, and shall not exceed the maximum *U*-factors (*U*) and the solar heat gain coefficient (SHGC) values as shown in Table 51.3.2.2(b), Table 51.3.2.2(c), or Table 51.3.2.2(d). The *U*-factor of fenestration shall be determined in accordance with NFRC 100, *Procedures for Determining Fenestration Product U-factors*, and the SHGC of fenestration shall be determined in accordance with NFRC 200, *Procedures for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*, by an accredited, independent laboratory, and the fenestration shall be labeled and certified by the manufacturer.

Table 51.3.2.3 Wall Sections with Metal Studs Parallel Path Equivalent Resistance (R_e)

Size of Members*	Spacing of Framing (in.)	Cavity Insulation *R*-Values	Effective Framing/Cavity *R*-Values (R_e)
2 × 4	16 oc	11	5.5
		13	6.0
		15	6.4
	24 oc	11	6.6
		13	7.2
		15	7.8
2 × 6	16 oc	19	7.1
		21	7.4
	24 oc	19	8.6
		21	9.0
2 × 8	16 oc	25	7.8
	24 oc	25	9.6

For SI units, 1 in. = 25 mm; 1 ft = 305 mm.
* Applicable to 0.064-in. thick (16-gauge) framing or thinner.

51.3.2.6 Air Leakage. The building envelope shall meet the provisions of 51.3.2.6.1 through 51.3.2.6.4.

51.3.2.6.1 Windows and Doors. Window and door assemblies shall comply with Table 51.3.2.6.1.

51.3.2.6.2 Access Openings. Openings in the building envelope, other than windows and doors, shall be sealed using weatherstripping and be provided with a latch or some other positive means of closure. The level of insulation provided with the access opening shall be equivalent to that of the building envelope assembly in which it is installed.

Table 51.3.2.6.1 Maximum Allowable Air Infiltration Rates, Windows and Doors

Description	Air Infiltration Limit (ft^3/min)[a]	Reference Standard[a]
1. Aluminum sliding windows and doors	0.37[b]	ANSI/AAMA 101-88, *Voluntary Specifications for Aluminum Prime Windows & Sliding Glass Doors*
2. PVC windows/sliding doors	0.37[b]	AAMA 101V-86, *Voluntary Specifications for Poly Vinyl Chloride (PVC) Prime Windows and Sliding Glass Doors*
3. Wood windows	0.34[b]	ANSI/NWWDA I.S-2, *Industry Standard for Wood Window Units*
4. Wood doors	0.34[b]	ANSI/NWWDA I.S-13, *Industry Standard for Wood Sliding Patio Doors*
5. Windows not covered by 1 through 4	0.34/ft of sash crack	
6. Fixed windows	0.34/ft^2 of window area	
7. Swinging windows	0.50/ft^2 of door area	

For SI units, 1 in. = 25 mm; 1 ft^2 = 0.093 m^2; 1 ft^3 = 0.0283 m^3.
[a]Air infiltration as determined in accordance with ASTM E 283, *Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen,* at a pressure differential of 1.57 lb/ft^2 (75 Pa).
[b]For windows, the limit is ft^3/min/linear ft (m^3/min/linear m) of sash crack, and, for sliding doors, the limit is ft^3/min/ft^2 (m^3/min/m^2) of door area.

51.3.2.6.3 Foundations. Foundation walls, crawl space walls, and other building envelope walls below grade shall have all cracks, and the intersection of above-grade construction assemblies with below-grade construction materials, sealed.

51.3.2.6.4 Joints and Penetrations. Joints and penetrations in the building envelope that are sources of air leakage shall be sealed with caulking, gasketing, weather stripping, or other materials compatible with the construction materials, location, and anticipated conditions.

51.3.2.7 Water Vapor Retarders and Moisture Barriers.

51.3.2.7.1 A durable continuous moisture barrier at least 6-mil thick shall be placed over exposed soils in crawl spaces and extend 1 ft (305 mm) up the crawl space walls. Joints in the moisture barrier shall overlap a minimum of 1 ft (305 mm).

51.3.2.7.2 A moisture barrier shall be installed beneath a heated slab.

51.3.2.7.3* In other than humid climates, vapor retarders and moisture barriers shall be installed in the following locations:

(1) On the conditioned-space side of the thermal insulation in the floors over unconditioned spaces
(2) In the walls and ceilings separating unconditioned spaces from conditioned spaces

51.3.2.7.4 Vapor retarders shall have a water permeance of less than 1.0 perm when tested in accordance with ASTM E 96, *Standard Test Method for Water Vapor Transmission of Materials.*

51.3.2.8 Heating, Ventilating, and Air-Conditioning Systems and Equipment. The requirements of 51.3.2.8 shall regulate only equipment using single-phase electric power, air-conditioners and heat pumps with rated cooling capacities less than 65,000 Btu/hr (19 kW), warm air furnaces of less than 225,000 Btu/hr (66 kW), boilers of less than 300,000 Btu/hr (88 kW) input, and heating-only heat pumps with rated heating capacities less than 65,000 Btu/hr (19 kW).

51.3.2.8.1 Balancing. The air distribution system design, including outlet grilles, shall provide a means for balancing the air distribution system, unless the design procedure provides a system intended to operate within plus or minus 10 percent of design air qualities.

51.3.2.8.2 Insulation for Ducts. All portions of the air distribution system installed in or on buildings shall meet the provisions in Table 51.3.2.8.2.

Table 51.3.2.8.2 Minimum Duct Insulation

	Climatic Zones		Insulation Levels* $F \times ft^2 \times hr/Btu$	
Duct Location	HDD65	CDH74	Heating	Cooling
On roof or exterior of building	All	All	R-6	R-6
Attic or garage	<3,000	<15,000	R-4	R-4
	3,001–6,000	15,000–30,000	R-6	R-6
	>6,000	>30,000	R-6	R-6
Basement under insulated floor or crawl space	<3,000	<15,000	R-4	R-2
	3,001 – 6,000	15,000–30,000	R-4	R-2
	>6,000	>30,000	R-6	R-4

For SI units, HDD65/1.8 = HDD18; CDH74/1.8 = CDH23; 1 ft^2 = 0.093 m^2; R*0.176 = R(SI).
*The insulation values are for the insulation only.

(A) Where used for both heating and cooling, the insulation shall be as required for the more severe condition.

(B) When the mean outdoor dewpoint temperature in any month exceeds 60°F (15.5°C), vapor retarders shall be installed on conditioned-air supply ducts.

(C) Vapor retarders shall have a water vapor permeance not exceeding 0.5 perm when tested in accordance with Procedure A in ASTM E 96.

(D) Insulation shall not be required in any of the following cases, except where required to minimize condensation:

(1) Where the ducts are within the conditioned space
(2) Where supply or return air ducts are used for heating only and are installed in basements or unvented crawl spaces (plenums) having insulated walls

(E) For exhaust air ducts, the insulation shall be installed between the ducts and the surface exposed to the unconditioned space or exterior ambient condition.

51.3.2.9 Insulation for Piping. HVAC system piping installed to serve buildings and within buildings shall be thermally insulated in accordance with Table 51.3.2.9. For materials with thermal resistivity less than $4.0°F \times ft^2 \times hr/(Btu \times in.)$ (27.7 m × K/W), the minimum insulation thickness shall be increased in accordance with the following equation:

$$\text{New minimum thickness} = \frac{4.0 \times \text{thickness [from Table 51.3.2.9]}}{\text{Actual } R\text{-value/in.}}$$

Table 51.3.2.9 Minimum Pipe Insulation

Piping System Types	Fluid Temp. Range (°F)	Insulation Thickness (in.)		
			Pipe Size[1]	
		Runouts[2]	≤1.0 in.	1.25 in.–2.0 in.
Heating Systems—Steam and Hot Water				
Low pressure /temperature	201–250	1.0	1.5	1.5
Low temperature	120–200	0.5	1.0	1.0
Steam condensate (for feed water)	Any	1.0	1.0	1.5
Cooling Systems—Chilled				
Water, refrigerant	40–55	0.5	0.5	0.75
Brine	<40	1.0	1.0	1.5

For SI units, (°F – 32)/1.8 = °C; 1 in. = 25 mm.
[1]Pipe sizes are nominal dimensions. For piping larger than 1.0-in. (26-mm) diameter and exposed to outdoor ambient temperatures, increase thickness by 0.5 in. (13 mm).
[2]Runouts to individual thermal units not exceeding 12 ft (3.6 m) in length.

51.3.2.10 Insulation Not Required. Insulation shall not be required in any of the following cases, except where required to minimize condensation:

(1) Where the piping is within the conditioned space or within HVAC equipment
(2) Where the piping contains fluids at temperatures between 55°F and 120°F (13°C and 49°C)
(3) Where the piping is within basements or unvented crawl spaces (plenums) having insulated walls

51.3.2.11 Ventilation and Combustion Air.

(A) The building shall be designed to have the capability to provide the ventilation and combustion air specified in Table 51.3.2.11.

Table 51.3.2.11 Ventilation and Combustion Air

Category	Minimum Requirement	Conditions
Mechanical ventilation[a]	50 ft^3/min outdoor air	Where summer design infiltration rate calculated in accordance with either of the reference standards is less than 0.35 air change/hr[b]
Additional combustion air	ANSI Z223.1/ NFPA 54, *National Fuel Gas Code*	
Kitchen exhaust	100 ft^3/min intermittent	All conditions
Bath exhaust	50 ft^3/min intermittent	All conditions

For SI units, $ft^3/min \times 0.00047 = m^3/s$.
[a]Mechanical ventilation is calculated in accordance with the equation in 51.3.2.11(B). The kitchen and bath exhaust requirements are an acceptable means of meeting mechanical ventilation requirements.
[b]Reference standards are *Residential Load Calculation, Manual J,* 7th Edition, 1988, and *Cooling and Heating Load Calculation Principles,* ASHRAE, 1998.

(B) Mechanical ventilation shall be calculated in accordance with the following equation:

$$\text{Mechanical ventilation} = \frac{(0.35 - \text{summer}) \times \text{volume}}{60}$$

51.3.2.12 Electric Heating Systems. The following requirements shall apply where the prescribed conditions are met:

(1) Where wall, floor, or ceiling electric resistance heating units are used, the structure shall be zoned and heaters installed in each zone in accordance with the heat loss of that zone.
(2) Where living and sleeping zones are separate, the minimum number of zones shall be two. If two or more heaters are installed in any one room, they shall be controlled by one thermostat.
(3) Where electric warm air heating is to be installed, an electric heat pump or an off-peak electric heating system with thermal storage shall be used, unless the electric resistance heating system meets both of the following criteria:
   (a) It does not rely on ducts located outside the conditioned space.
   (b) For other than living units with one room, it has a minimum of two separately controlled thermal zones.

51.3.2.12.1 Baseboard Heaters. The watt density of baseboard heaters shall be limited to 250 W per linear foot (305 linear millimeters) of heater. Exterior walls on which recessed baseboard heaters are installed shall be insulated in accordance with 51.3.2.2.

51.3.2.12.2 Wall Heaters. Exterior walls in which recessed wall heaters are installed shall be insulated in accordance with 51.3.2.2.

51.3.2.12.3 Low-Density Radiant Ceiling Systems. Low-density radiant ceiling systems shall be installed only within the ceiling assemblies that are insulated in accordance with 51.3.2.2 and shall be controlled by a thermostat located on an interior wall. Ceiling cable installations shall have heat-conducting plaster applied over the cable prior to the finish coat or bottom layer of gypsum board.

51.3.2.12.4 Bath Ceiling Units. Bath ceiling units providing any combination of heat, light, or ventilation shall be provided with controls that allow separate operation of each function. In an assembly that is part of the building envelope, they shall be insulated to the outside in accordance with 51.3.2.2.

51.3.2.12.5 Central Electric Furnaces. Central electric furnaces shall be installed within the conditioned space, unless they are specifically designed for use outside the conditioned space. Electric furnaces greater than 12 kW shall be divided into at least two stages. A central electric furnace shall not rely on ducts located outside the conditioned space and, except for one-room living units, shall have a minimum of two separately controlled thermal zones.

51.3.2.12.6 Thermal Storage Heating Units. Central units shall be installed within the conditioned space and have a thermal performance in accordance with ANSI/ASHRAE 94.2-1981, *Method for Testing Thermal Storage Devices with Electrical Input and Thermal Output Based on Thermal Performance*. The unit capacity and sizing for the structure shall conform to any requirements of the serving utility. The installation of room thermal storage units shall be based on a zoned concept, and sizing shall conform to the requirements of the utility supplying power to the structure.

51.3.2.12.7 Fireplaces. Fireplaces shall be equipped with a tight-fitting damper, firebox doors, and an outside combustion air source with the firebox.

51.3.2.13 HVAC Equipment, Rated Combinations. HVAC system equipment and system components shall be furnished with the input(s), the output(s), and the value of the appropriate performance descriptor of all such HVAC products as specified in Table 51.3.2.13. This information shall be based on equipment or components in new condition. The manufacturer's recommended maintenance instructions shall be furnished with, and attached to, the equipment. The manufacturer of electric resistance heating equipment shall also furnish full-load energy input over the range of voltages at which the equipment is intended to operate.

Table 51.3.2.13 Minimum Requirements of HVAC System Equipment and System Components

Product Type	Category	Minimum Performance[1]	Reference Standard
Warm-air furnaces with or without air-conditioning	Gas or oil <225,000 Btu/hr	78 percent AFUE[2]	DOE test procedure
Boiler	Gas, hot water, or oil <300,000 Btu/hr	80 percent AFUE[2]	DOE test procedure
	Gas, steam <300,000 Btu/hr	75 percent AFUE[2]	DOE test procedure
Unitary air–source heat pump	Split system	10.0 SEER 6.8 HSPF	DOE test procedure
	Package system	9.7 SEER 6.6 HSPF	DOE test procedure
Groundwater-source heat pump[3]	Cooling mode	11.0 EER @ 70°F entering water 11.5 EER @ 50°F entering water	ARI 325, *Ground Water-Source Heat Pumps*
	Heating mode	3.4 COP @ 70°F entering water 3.0 COP @ 50°F entering water	ARI 325, *Ground Water-Source Heat Pumps*

(continues)

Table 51.3.2.13 ***Continued***

Product Type	Category	Minimum Performance[1]	Reference Standard
PTAC and PTHP	Cooling mode[4]	EER = 10 – [0.16 Cap /1000] @ 95°F outdoor ambient	ARI 310 *for Packaged Terminal Air-Conditioners*, ARI 380 *for Packaged Terminal Heat Pumps*
		EER = 12.2 – [0.20 Cap/1000] @ 82°F outdoor ambient	ARI 310 *for Packaged Terminal Air-Conditioners*, ARI 380 *for Packaged Terminal Heat Pumps*
	Heating mode[4,5]	COP = 1.3 + 0.16 [10 – 0.16 Cap/1000] @ 47°F outdoor ambient	ARI 380 *for Packaged Terminal Heat Pumps*
Unitary air-conditioner	Air-cooled package system	9.7 SEER	DOE test procedure
	Air-cooled split system	10.0 SEER	DOE test procedure
	Water-cooled split system	9.3 EER @ 85°F entering water 8.3 IPLV @ 75°F entering water	ARI 210/240, *Unitary Air-Conditioning and Air-Source Heat Pump Equipment*
	Evaporatively cooled split system	9.3 EER @ 95°F outdoor ambient 8.5 IPLV @ 80°F outdoor ambient	ARI 210/240, *Unitary Air-Conditioning and Air-Source Heat Pump Equipment*
Built-in room air-conditioners	Without reverse cycle and with louvered sides:		DOE test procedure
	<6,000 Btu	8.0 EER	
	6,000–7,999 Btu	8.5 EER	
	8,000–13,999 Btu	9.0 EER	
	14,000–19,999 Btu	8.8 Btu	
	≥20,000 Btu	8.2 Btu	
Built-in room air-conditioners	Without reverse cycle and without louvered sides:		DOE test procedure
	<6,000 Btu	8.0 EER	
	6,000–7,999 Btu	8.5 EER	
	8,000–13,999 Btu	8.5 EER	
	14,000–19,999 Btu	8.5 EER	
	≥20,000 Btu	8.2 EER	
Built-in room air-conditioners	With reverse cycle and with louvered sides	8.5 EER	DOE test procedure
Built-in room air-conditioners	With reverse cycle and without louvered sides	8.0 EER	DOE test procedure

For SI units, Btu/hr × 0.0002928 = kW; (°F – 32)/1.8 = °C.

[1]For equipment in which capacity reduction is provided and allowed by the controls.

[2]*National Appliance Energy Conservation Act of 1987*, Public Law 100-12, 42 U.S.C. 6295, in which AFUE is defined as follows: The efficiency descriptor for furnaces and boilers, determined using DOE test procedures found in 10 CFR 430 and based on the following assumptions: (a) weatherized warm-air furnaces or boilers are located outdoors; (b) warm-air furnaces that are not weatherized are located indoors, and all combustion and ventilation air is admitted through grilles or ducts from the outdoors and does not communicate with air in the conditioned space; and (c) boilers that are not weatherized are located within the heated space.

[3]Performance for electrically powered equipment with capacity less than 65,000 Btu/hr (19 kW) when rated in accordance with ARI 325, Air-Conditioning and Refrigeration Institute, Arlington, VA.

[4]Performance for electrically powered equipment rated in accordance with ARI 310, Air-Conditioning and Refrigeration Institute, Arlington, VA, or ARI 380, Air-Conditioning and Refrigeration Institute, Arlington, VA. If the unit's capacity is less than 7000 Btu/hr (2.05 kW), use 7000 Btu/hr (2.05 kW) in the calculations. If the unit's capacity is greater than 15,000 Btu/hr (4.4 kW), use 15,000 Btu/hr (4.4 kW) in the calculations.

[5]For heat pumps rated in the heating mode in accordance with ARI 380, Air-Conditioning and Refrigeration Institute, Arlington, VA.

51.3.2.14 Controls.

51.3.2.14.1 Temperature Control. Each system or each zone within a system shall be provided with at least one thermostat capable of being set at 55°F to 85°F (13°C to 29°C) and capable of operating the system's heating and cooling. The thermostat or control system, or both, shall have an adjustable deadband, the range of which includes a setting of 10°F (5.6°C) between heating and cooling when automatic changeover is provided. Wall-mounted temperature controls shall be mounted on an inside wall.

51.3.2.14.2 Ventilation Control. Each mechanical ventilation system (supply or exhaust, or both) shall be equipped with a readily accessible switch or other means for shutoff. Manual or automatic dampers installed for the purpose of isolating outside air intakes and exhausts from the air distribution system shall be designed for tight shutoff.

51.3.2.14.3 Other Controls. Where setback, zone, humidity, and cooling controls and equipment are provided, they shall be designed and installed in accordance with ASHRAE 90.2.

51.3.2.15 Service Water Heating.

51.3.2.15.1 Application. Water heaters, pool heaters, and hot water heater storage tanks shall meet the minimum performance requirements listed in Table 51.3.2.15.1.

51.3.2.15.2 Pump Operation. Circulating hot water systems shall be arranged so that the circulating pump(s) can be turned off (automatically or manually) when the hot water system is not in operation.

51.3.2.16 Swimming Pools, Hot Tubs, and Spas.

51.3.2.16.1 Pool Covers. Heated pools shall be equipped with a pool cover.

51.3.2.16.2 Outdoor pools that derive over 70 percent of the energy for heating (computed over an operating season) from nondepletable sources or from recovery of energy that would otherwise be wasted shall not be required to have pool covers.

51.3.2.16.3 Time Clock. Time clocks shall be installed so that the pump can be set to run in the off-peak electric demand period and can be set for the minimum time necessary to maintain the water in a clear and sanitary condition in keeping with applicable health standards.

51.3.2.16.4 Pumps used to operate solar pool heating systems shall not be required to have time clocks installed.

51.3.2.16.5 Heat Traps. Heat traps shall be installed on both the inlet and outlet of water heaters that have vertical pipe risers connected to the top of the heater, unless the water heater is equipped with an integral heat trap or is part of a circulating system. The heat trap shall be installed as close as possible to the inlet and the outlet fitting. The heat trap shall be permitted to be an arrangement of piping and fittings, such as elbows, or a commercially available heat trap that prevents the thermosiphoning of the hot water during standby periods.

51.3.2.16.6 Piping Insulation. Hot water piping shall be insulated with 1 in. (25.4 mm) of material having a maximum thermal conductivity of 0.30 Btu × in./(hr × ft^2 × °F) (0.043 W/m × K).

51.3.2.16.7 Insulation Not Required. Where it can be demonstrated that the heat loss of the piping, without insulation, does not cause a net increase in the annual energy requirements of the building, the insulation shall not be required.

Table 51.3.2.15.1 Standard Rating Conditions and Minimum Requirements of Water-Heating Equipment

Type	Fuel	Storage Capacity (gal)	Input Rating	Applicable Test Procedure	Minimum Performance Required [a]
Storage	Electricity	≤120[b]	≤12 kW	DOE test procedure	$EF \geq 0.93\text{-}0.00132\ V$
	Gas	≤100[b]	≤75,000 Btu/hr	DOE test procedure	$EF \geq 0.62\text{-}0.0019\ V$
	Oil	≤50	≤105,000 Btu/hr	DOE test procedure	$EF \geq 0.59\text{-}0.0019\ V$
Instantaneous	Gas	NA	≤200,000 Btu/hr	DOE test procedure	$EF \geq 0.62\text{-}0.0019\ V$
Swimming pools, hot tubs, and spas	Gas	NA	All inputs	ANSI Z21.56,[c] *Gas Fired Pool Heaters*	E_t 78 percent
	Oil	NA	All inputs	ANSI Z21.56	E_t 78 percent
Unfired storage	All	Any	NA	$\Delta T = 90°$ (stored water and ambient temperature difference)	$HL < 6.5$ Btu/hr × ft^2

For SI units, Btu/hr × 0.0002928 = kW.

Notes:

1. NA = not applicable.
2. *EF* = energy factor, overall heater efficiency by DOE test procedure, 10 CFR 430, Subpart B, Appendix E.
3. E_t = thermal efficiency.
4. *HL* = heat loss through tank surface area (Btu/hr ft^2).
5. *V* = rated storage volume (gal).

[a]Revisions to the DOE test procedure, 10 CFR 430, Subpart B, Appendix E, might supersede values listed.

[b]While the *National Appliance Energy Conservation Act* covers all residential water heaters in this capacity range, the U.S. Department of Energy has not yet issued test procedures for water heaters of less than 20 gal (75.7 L) capacity.

[c]Maximum design temperature is 65°F (18.3°C).

51.4 Manufactured Homes. One- and two-family dwellings shall meet the requirements of Chapter 6, Thermal Protection, and Chapter 8, Heating, Cooling, and Fuel Burning Systems, of NFPA 501, *Standard on Manufactured Housing*.

51.5 Day Care.

51.5.1 Day-care homes located within a one- or two-family dwelling shall be classified as residential occupancies for the purposes of this chapter and shall comply with the requirements of 51.3.1.

51.5.2 Day-care occupancies, other than those specified in 51.5.1, shall be classified as commercial occupancies for the purposes of this chapter and shall comply with the requirements of 51.2.1.

51.6 Residential Board and Care.

51.6.1 Small facilities located within a one- or two-family dwelling shall be classified as residential occupancies for the purposes of this chapter and shall comply with the requirements of 51.3.1.

51.6.2 Residential board and care facilities, other than those specified in 51.6.1, shall be classified as commercial occupancies for the purposes of this chapter and shall comply with the requirements of 51.2.1.

Chapter 52 Electrical Systems

52.1* General. All electrical systems and equipment shall be designed and constructed in accordance with NFPA 70, *National Electrical Code*.

52.2 Flood Resistance. For new construction of buildings and structures that are located wholly or partly within flood hazard areas established by 39.4.2, including substantial improvements and restoration of substantial damage, electrical systems and equipment below the design flood elevation shall meet the requirements of Section 8 of SEI/ASCE 24, *Flood Resistant Design and Construction*.

Chapter 53 Plumbing Systems

53.1 General. All plumbing systems and equipment shall be designed and installed in accordance with the following:

(1) The installation of fuel gas distribution piping and equipment, fuel gas—fired water heaters, and water heater venting systems shall be designed and installed in accordance with NFPA 54/ANSI Z233.1, *National Fuel Gas Code*.
(2) The installation of liquefied gas distribution piping, equipment, and systems shall be designed and installed in accordance with NFPA 58, *Liquefied Petroleum Gas Code*.
(3) The installation of piping and equipment in health care facilities shall be designed and installed in accordance with NFPA 99, *Standard for Health Care Facilities*.
(4) All other plumbing systems shall be designed and installed in accordance with the 2000 *Uniform Plumbing Code*.

53.2 Flood Resistance. For new construction of buildings and structures that are located wholly or partly within flood hazard areas established by 39.4.2, and substantial improvements and restoration of substantial damage to plumbing systems and equipment below the design flood elevation shall meet the requirements of Section 8 of SEI/ASCE 24, *Flood Resistant Design and Construction*.

Chapter 54 Elevators and Conveying Systems

54.1 General. An elevator shall not be considered a component in a required means of egress but shall be permitted as a component in an accessible means of egress and as permitted by 11.2.13.

54.2 Installation. Except as modified herein, elevators, escalators, dumbwaiters, and moving walks shall be installed in accordance with the requirements of ASME A17.1, *Safety Code for Elevators and Escalators*.

54.3 Openings to Exits. Conveyors, elevators, dumbwaiters, and pneumatic conveyors serving various stories of a building shall not open to an exit.

54.4 Elevator Machine Rooms and Machinery Spaces. Elevator machine rooms and machinery spaces that contain solid-state equipment for elevators that have a travel distance of more than 50 ft (15 m) above the level of exit discharge or more than 30 ft (9.1 m) below the level of exit discharge shall be provided with independent ventilation or air-conditioning systems to maintain the required temperature during fire fighter service operations for elevator operation.

54.4.1 The operating temperature shall be established by the elevator equipment manufacturer's specifications.

54.4.2 Where standby power is connected to the elevator, the machine room ventilation or air-conditioning shall be connected to standby power.

54.4.3 Elevator machine rooms and machinery spaces shall be enclosed with construction having a fire resistance rating of not less than the required rating of the hoistway enclosure they serve.

54.4.4 Openings shall be protected with assemblies having a fire-resistive rating not less than that required for the hoistway enclosure doors.

54.5 Number of Cars in a Hoistway.

54.5.1 Where four or more cars serve all or the same portion of a building, the elevators shall be located in at least two separate hoistways.

54.5.2 Not more than four elevator cars shall be located in any single hoistway enclosure.

54.6* Flood Resistance. For new construction of buildings and structures that are located wholly or partly within flood hazard areas established by 39.4.2, including substantial improvements and restoration of substantial damage, all elevator equipment shall meet the requirements of Section 8 of SEI/ASCE 24, *Flood Resistant Design and Construction*.

54.7 Vents Required. Hoistways of elevators and dumbwaiters penetrating more than three stories shall be provided with a means of venting smoke and hot gases to the outer air in case of fire.

54.7.1 Location of Vents. Vents shall be located below the floor or floors at the top of the hoistway and shall open either directly to the outer air or through noncombustible ducts to the outer air.

54.7.1.1 Noncombustible ducts shall be permitted to pass through the elevator machine room, provided that portions of the ducts located outside of the hoistway or machine room are

enclosed by construction having not less than the fire resistance rating required for the hoistway.

54.7.1.2 Holes in machine room floors for the passage of ropes, cables, or other moving elevator equipment shall be limited so as not to provide greater than 2 in. (51 mm) of clearance on all sides.

54.7.2 Area of Vents.

(A) The area of vents shall be not less than 3½ percent of the area of each elevator car in the hoistway or not less than 3 ft^2 (0.028 m^2), whichever is greater.

(B) The area of vents shall be not less than 3½ percent of the area of each dumbwaiter car in the hoistway or not less than 0.5 ft^2 (0.047 m^2), whichever is greater.

(C) The requirements of 54.7.2(A) and 54.7.2(B) shall not apply where mechanical ventilation conforming to the 2000 *Uniform Mechanical Code* provides equivalent venting, in which case the required vent area shall be permitted to be reduced, provided that the building is not used for healthcare, hotel, apartment, lodging or rooming house, residential board and care, or similar occupancies with overnight sleeping accommodations.

(D) Of the total required vent area, not less than one-third shall be of the permanently open type, unless all vents activate upon the detection of smoke from any of the elevator lobby smoke detectors.

54.7.3 Closed Vents. Closed portions of the required vent area shall consist of windows or duct openings glazed with annealed glass not more than 0.125 in. (3.2 mm) thick.

54.8 Conveying Systems. Conveying systems shall be installed in accordance with ASME B20.1, *Safety Standard for Conveyors and Related Equipment.*

54.9 Wheelchair Lifts. Wheelchair lifts shall be installed in accordance with ASME A18.1, *Safety Standard for Platform Lifts and Stairway Chair Lifts.*

Chapter 55 Fire Protection Systems and Equipment

55.1 General.

55.1.1 Referenced Standards. Fire protection systems and equipment shall be designed, installed, and maintained in operating condition in accordance with the requirements of this chapter and the referenced documents.

55.1.2 Required Systems. Fire protection systems installed to make use of alternatives permitted by this *Code* shall be considered required systems and shall meet the provisions of this *Code* applicable to required systems.

55.1.3 Existing Systems. Existing installations of fire protection systems and equipment shall be permitted to continue in use subject to the approval of the authority having jurisdiction and in accordance with 1.7.5.

55.1.4 Inspection, Maintenance, and Testing. Fire protection systems and equipment shall have an approved inspection, maintenance, and testing program complying with the requirements of the standards referenced herein.

55.1.5 Documentation. All required documentation regarding the design and procedures for maintenance, inspection, and testing of fire protection systems shall be maintained in a secured location on the premises for the life of the fire protection systems.

55.1.6 Conflicts between the fire safety requirements of this chapter and the flood resistance requirements of Chapter 39 shall be resolved according to 39.1.2.

55.2 Fire Detection, Alarm, and Communication Systems.

55.2.1* General.

55.2.1.1 The provisions of Section 55.2 shall apply only where specifically required by another section of this *Code*.

55.2.1.2 A fire alarm system shall be installed in accordance with the applicable requirements of Chapter 52 and *NFPA 72®*, *National Fire Alarm Code®*.

55.2.1.3 For the purposes of this *Code*, a complete fire alarm system shall be used for initiation, notification, and control and shall provide the following:

(1) The initiation function shall provide the input signal to the system.
(2) The notification function shall be the means by which the system advises that human action is required in response to a particular condition.
(3) The control function shall provide outputs to control building equipment to enhance protection of life.

55.2.2 Signal Initiation. Where required by other sections of this *Code*, actuation of the complete fire alarm system shall occur by any or all of the following means of initiation, but shall not be limited to such means:

(1) Manual fire alarm initiation
(2) Automatic detection
(3) Extinguishing system operation

55.2.2.1 Manual Fire Alarm Boxes. Manual fire alarm boxes shall comply with 55.2.2.1.1 through 55.2.2.1.7.

55.2.2.1.1 Manual fire alarm boxes shall be approved for the particular application and shall be used only for fire-protective signaling purposes.

55.2.2.1.2 Combination fire alarm and guard's tour stations shall be permitted to meet 55.2.2.1.1.

55.2.2.1.3 A manual fire alarm box shall be provided in the natural exit access path near each required exit from an area, unless modified by another section of this *Code*.

55.2.2.1.4* Additional manual fire alarm boxes shall be located so that, from any part of the building, no horizontal distance on the same floor exceeding 200 ft (60 m) shall be traversed to reach a manual fire alarm box.

55.2.2.1.5 For fire alarm systems using automatic fire detection or waterflow detection devices, not less than one manual fire alarm box shall be provided to initiate a fire alarm signal.

55.2.2.1.6 The manual fire alarm box described in 55.2.2.1.5 shall be located where required by the authority having jurisdiction.

55.2.2.1.7* Each manual fire alarm box on a system shall be accessible, unobstructed, and visible.

55.2.2.2 Sprinkler System Alarm Initiation. Where a sprinkler system provides automatic detection and alarm system initiation, it shall be provided with an approved alarm initiation

device that operates when the flow of water is equal to or greater than that from a single automatic sprinkler.

55.2.2.3 Total Coverage Smoke Detection. Where a total (complete) coverage smoke detection system is required by another section of this *Code*, automatic detection of smoke in accordance with *NFPA 72* shall be provided in all occupiable areas, common areas, and work spaces in those environments suitable for proper smoke detector operation.

55.2.2.4 Partial Smoke Detection. Partial smoke detection systems shall comply with 55.2.2.4.1 and 55.2.2.4.2.

55.2.2.4.1 Where a partial smoke detection system is required by another section of this *Code*, automatic detection of smoke in accordance with *NFPA 72* shall be provided in all common areas and work spaces, such as corridors, lobbies, storage rooms, equipment rooms, and other tenantless spaces in those environments suitable for proper smoke detector operation.

55.2.2.4.2 Selective smoke detection unique to other sections of this *Code* shall be provided as required by those sections.

55.2.2.5 Hazardous Areas. Where required by Chapter 16 through Chapter 30, an automatic fire detection system shall be provided in hazardous areas for initiation of the signaling system.

55.2.2.6 Smoke Alarms. Smoke alarms shall comply with 55.2.2.6.1 through 55.2.2.6.5.

55.2.2.6.1 Where required by another section of this *Code*, single-station and multiple-station smoke alarms shall be in accordance with *NFPA 72*, and system detectors in accordance with *NFPA 72*, arranged to function in the same manner, shall be permitted in lieu of single-station or multiple-station smoke alarms.

55.2.2.6.2 Smoke alarms, other than battery-operated devices as permitted by other sections of this *Code*, or battery-operated devices complying with 55.2.1.2 and the low-power wireless system requirements of *NFPA 72*, shall receive their operating power from the building electrical system.

55.2.2.6.3* Where two or more smoke alarms are required within a dwelling unit, suite of rooms, or similar area, they shall be arranged so that operation of any smoke alarm shall cause the alarm in all smoke alarms within the dwelling unit, suite of rooms, or similar area to sound, unless otherwise permitted by another section of this *Code* or unless the configuration provides equivalent distribution of the alarm signal.

55.2.2.6.4 The alarms described in 55.2.2.6.3 shall sound only within an individual dwelling unit, suite of rooms, or similar area and shall not actuate the building fire alarm system, unless otherwise permitted by the authority having jurisdiction.

55.2.2.6.5 Smoke alarms shall be permitted to be connected to the building fire alarm system to provide remote annunciation.

55.2.3 Occupant Notification.

55.2.3.1 Occupant notification shall be provided to alert occupants of fire or other emergency where required by other sections of this *Code*.

55.2.3.2 Occupant notification shall be in accordance with 55.2.3.3 through 55.2.3.11, unless otherwise provided in 55.2.3.2.1 through 55.2.3.2.4.

55.2.3.2.1 Elevator lobby, hoistway, and associated machine room smoke detectors used solely for elevator recall, and heat detectors used solely for elevator power shutdown, shall not be required to activate the building evacuation alarm if the power supply and installation wiring to these detectors are supervised by the building fire alarm system, and the activation of these detectors results in an audible and visible alarm signal at a constantly attended location.

55.2.3.2.2 Smoke detectors used solely for closing dampers or heating, ventilating, and air-conditioning system shutdown shall not be required to activate the building evacuation alarm.

55.2.3.2.3 Detectors located at doors for the exclusive operation of automatic door release shall not be required to activate the building evacuation alarm.

55.2.3.2.4 Detectors in accordance with 21.3.4.3.1(B) shall not be required to activate the building evacuation alarm.

55.2.3.3 Where permitted by Chapter 16 through Chapter 30, a presignal system shall be permitted where the initial fire alarm signal is automatically transmitted without delay to a municipal fire department, a fire brigade (if provided), and an on-site staff person trained to respond to a fire emergency.

55.2.3.4 Where permitted by Chapter 16 through Chapter 30, a positive alarm sequence shall be permitted, provided that it is in accordance with *NFPA 72*.

55.2.3.5 Unless otherwise provided in 55.2.3.5.1 through 55.2.3.5.4, notification signals for occupants to evacuate shall be by audible and visible signals in accordance with *NFPA 72* and ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities*, or other means of notification acceptable to the authority having jurisdiction.

55.2.3.5.1 Visible-only signals shall be provided where specifically permitted in health care occupancies in accordance with Chapter 19.

55.2.3.5.2 Visible signals shall not be required in lodging or rooming houses in accordance with Chapter 23.

55.2.3.5.3 Visible signals shall not be required in exit stair enclosures.

55.2.3.5.4 Visible signals shall not be required in elevator cars.

55.2.3.6 The general evacuation alarm signal shall operate in accordance with one of the methods prescribed by 55.2.3.6.1 through 55.2.3.6.4.

55.2.3.6.1 The general evacuation alarm signal shall operate throughout the entire building other than the locations described in 55.2.3.6.5 and 55.2.3.6.6.

55.2.3.6.2* Where total evacuation of occupants is impractical due to building configuration, only the occupants in the affected zones shall be initially notified, and provisions shall be made to selectively notify occupants in other zones to afford orderly evacuation of the entire building.

55.2.3.6.3 Where occupants are incapable of evacuating themselves because of age, physical or mental disabilities, or physical restraint, the following shall apply:

(1) The private operating mode as described in Chapter 4 of *NFPA 72* shall be permitted to be used.

(2) Only the attendants and other personnel required to evacuate occupants from a zone, area, floor, or building shall be required to be notified.
(3) Notification of personnel as specified in 55.2.3.6.3(2) shall include means to readily identify the zone, area, floor, or building in need of evacuation.

55.2.3.6.4 In mall buildings complying with Chapter 27, notification within the covered mall shall be permitted in accordance with 27.4.4.10.3.1.

55.2.3.6.5 The general evacuation signal shall not be required to operate in exit stair enclosures.

55.2.3.6.6 The general evacuation signal shall not be required to operate in elevator cars.

55.2.3.7 Audible alarm notification appliances shall be of such character and so distributed as to be effectively heard above the average ambient sound level occurring under normal conditions of occupancy.

55.2.3.8 Audible alarm notification appliances shall produce signals that are distinctive from audible signals used for other purposes in the same building.

55.2.3.9 Automatically transmitted or live voice evacuation or relocation instructions to occupants shall be permitted and shall be in accordance with *NFPA 72*.

55.2.3.10 Unless otherwise permitted by another section of this *Code*, audible and visible fire alarm notification appliances shall comply with either 55.2.3.10.1 or 55.2.3.10.2.

55.2.3.10.1 Audible and visible fire alarm notification appliances shall be used only for fire alarm system or other emergency purposes.

55.2.3.10.2 Voice communication systems shall be permitted to be used for other purposes, subject to the approval of the authority having jurisdiction, if the fire alarm system takes precedence over all other signals.

55.2.3.11 Alarm notification signals shall take precedence over all other signals.

55.2.4 Emergency Forces Notification.

55.2.4.1 Where required by another section of this *Code*, emergency forces notification shall be provided to alert the municipal fire department and fire brigade (if provided) of fire or other emergency.

55.2.4.2 Where fire department notification is required by another section of this *Code*, the fire alarm system shall be arranged to transmit the alarm automatically via any of the following means acceptable to the authority having jurisdiction and shall be in accordance with *NFPA 72*:

(1) Auxiliary alarm system
(2) Central station connection
(3) Proprietary system
(4) Remote station connection

55.2.4.3* Where fire alarm systems are required to provide emergency forces notification, supervisory signals and trouble signals shall sound and be visibly displayed either at an approved, remotely located receiving facility or at a location within the protected building that is constantly attended by qualified personnel.

55.2.5 Emergency Control.

55.2.5.1 A fire alarm and control system, where required by another section of this *Code*, shall be arranged to actuate automatically the control functions necessary to make the protected premises safer for building occupants.

55.2.5.2 Where required by another section of this *Code*, the following functions shall be actuated by the complete fire alarm system:

(1) Release of hold-open devices for doors or other opening protectives
(2) Stairwell or elevator shaft pressurization
(3) Smoke management or smoke control systems
(4) Emergency lighting control
(5) Unlocking of doors

55.2.5.3 The functions specified in 55.2.5.2 shall be permitted to be actuated by any fire alarm and control system where otherwise not required by this *Code*.

55.2.5.4 Any fire alarm and control system shall be permitted to recall elevators if the activation of the system for this purpose comes only from elevator lobby, hoistway, or associated machine room detectors.

55.2.5.5* Installation of emergency control devices shall be in accordance with *NFPA 72*.

55.2.5.6 The performance of emergency control functions shall not impair the effective response of any required alarm notification functions.

55.2.6 Location of Controls. Operator controls, alarm indicators, and manual communications capability shall be installed in a control center at a convenient location acceptable to the authority having jurisdiction.

55.2.7 Annunciation.

55.2.7.1 Where alarm annunciation is required by another section of this *Code*, it shall comply with 55.2.7.2 through 55.2.7.7.

55.2.7.2 Alarm annunciation at the control center shall be by means of audible and visible indicators.

55.2.7.3 For the purposes of alarm annunciation, each floor of the building shall be considered as not less than one zone, unless otherwise permitted by 55.2.7.4.3, 55.2.7.4.4, or another section of this *Code*.

55.2.7.4 If a floor area exceeds 22,500 ft^2 (2090 m^2), additional fire alarm zoning shall be provided, and the length of any single fire alarm zone shall not exceed 300 ft (91 m) in any direction, except as provided in 55.2.7.4.1 through 55.2.7.4.4, unless modified by another section of this *Code*.

55.2.7.4.1 Where permitted by another section of this *Code*, alarm zones shall be permitted to exceed 22,500 ft^2 (2090 m^2), and the length of a zone shall be permitted to exceed 300 ft (91 m) in any direction.

55.2.7.4.2 Where the building is protected by an automatic sprinkler system in accordance with 55.3.1.1(1), the area of the fire alarm zone shall be permitted to coincide with the allowable area of the sprinkler system.

55.2.7.4.3 Where the building is protected by an automatic sprinkler system of this *Code* in accordance with 55.3.1.1(2), the sprinkler system shall be permitted to be annunciated on the fire alarm system as a single zone.

55.2.7.4.4 Where the building is protected by an automatic sprinkler system in accordance with 55.3.1.1(3), the sprinkler system shall be permitted to be annunciated on the fire alarm system as a single zone.

55.2.7.5 A system trouble signal shall be annunciated at the control center by means of audible and visible indicators.

55.2.7.6 A system supervisory signal shall be annunciated at the control center by means of audible and visible indicators.

55.2.7.7 Where the system serves more than one building, each building shall be annunciated separately.

55.3 Automatic Sprinklers.

55.3.1 General.

55.3.1.1* Each automatic sprinkler system required by another section of this *Code* shall be in accordance with one of the following:

(1) NFPA 13, *Standard for the Installation of Sprinkler Systems*
(2) NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*
(3) NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*

55.3.1.2 Sprinkler piping serving not more than six sprinklers for any isolated hazardous area shall be permitted to be connected directly to a domestic water supply system having a capacity to provide at least 0.15 gpm/ft^2 (6.1 mm/min) of floor area throughout the entire enclosed area.

55.3.1.3 Sprinkler piping serving isolated hazardous areas as described in 55.3.1.2 shall be provided with an indicating shutoff valve supervised in accordance with 55.3.2 or 55.3.3 and installed in an accessible, visible location between the sprinklers and the connection to the domestic water supply.

55.3.1.4* In areas protected by automatic sprinklers, automatic heat-detection devices required by other sections of this *Code* shall not be required.

55.3.1.5 Automatic sprinkler systems installed to make use of an alternative permitted by this *Code* shall be considered required systems and shall meet the provisions of this *Code* that apply to required systems.

55.3.1.6 In high-rise buildings, a sprinkler control valve and a waterflow device shall be provided for each floor.

55.3.2 Electrical Supervision.

55.3.2.1* Supervisory Signals. Where electrically supervised automatic sprinkler systems are required by another section of this *Code*, supervisory attachments shall be installed and monitored for integrity in accordance with *NFPA 72*, and a distinctive supervisory signal shall be provided to indicate a condition that would impair the satisfactory operation of the sprinkler system.

55.3.2.1.1 Monitoring shall include, but shall not be limited to, monitoring of control valves, fire pump power supplies and running conditions, water tank levels and temperatures, tank pressure, and air pressure on dry-pipe valves.

55.3.2.1.2 Supervisory signals shall sound and shall be displayed either at a location within the protected building that is constantly attended by qualified personnel or at an approved, remotely located receiving facility.

55.3.2.2 Alarm Signal Transmission.

55.3.2.2.1 Where electrical supervision of automatic sprinkler systems is required by another section of this *Code*, waterflow alarms shall be transmitted to an approved, proprietary alarm-receiving facility, a remote station, a central station, or the fire department.

55.3.2.2.2 The connection described in 55.3.2.2.1 shall be in accordance with 55.2.1.2.

55.3.3 Other Supervision. Where electrical supervision is not required by another section of this *Code*, supervision shall be permitted in accordance with NFPA 13.

55.4 Standpipe Systems.

55.4.1 Class I standpipe systems shall be provided in buildings four or more stories in height, or having four or more basement levels, and shall be in accordance with NFPA 14, *Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems.*

55.4.2 Where required by another section of this *Code*, Class II and Class III standpipe systems shall be in accordance with NFPA 14.

55.4.3 Where standpipe and hose systems are installed in combination with automatic sprinkler systems, installation shall be in accordance with NFPA 13 and NFPA 14.

55.5 Other Automatic Extinguishing Equipment.

55.5.1 Alternative Systems. In any occupancy where the character of the fuel for fire is such that extinguishment or control of the fire is accomplished by a type of automatic extinguishing system in lieu of an automatic sprinkler system, such extinguishing system shall be installed in accordance with the applicable standard referenced in Table 55.5.1.

Table 55.5.1 Fire Suppression System Installation Standards

Fire Suppression System	Installation Standard
Low-, medium-, and high-expansion foam systems	NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam Systems*
Carbon dioxide systems	NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*
Halon 1301 systems	NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*
Water spray fixed systems	NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*
Deluge foam-water sprinkler systems	NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*
Dry chemical systems	NFPA 17, *Standard for Dry Chemical Extinguishing Systems*
Wet chemical systems	NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*
Water mist systems	NFPA 750, *Standard on Water Mist Fire Protection Systems*
Clean agent extinguishing systems	NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*

55.5.2 Alarm Activation.

55.5.2.1 If the extinguishing system is installed in lieu of a required, electrically supervised automatic sprinkler system, the activation of the extinguishing system shall activate the building fire alarm system, where provided.

55.5.2.2 The actuation of an extinguishing system that is not installed in lieu of a required, electrically supervised automatic sprinkler system shall be indicated at the building fire alarm system, where provided.

55.5.3 Construction Alternatives. Construction alternatives for automatic sprinkler systems shall not be permitted for those portions of buildings protected by alternative extinguishing systems unless equivalency is demonstrated in accordance with Section 1.5.

55.6 Portable Fire Extinguishers. Where required by another section of this *Code*, portable fire extinguishers shall be installed, inspected, and maintained in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

55.7 Smoke Control.

55.7.1* Installation, Inspection, Testing, and Maintenance. Where required by another section of this *Code*, smoke control systems shall be installed, inspected, tested, and maintained in accordance with nationally recognized standards, engineering guides, or recommended practices, as approved by the authority having jurisdiction.

55.7.2 System Design. The engineer of record shall clearly identify the intent of the system, the design method used, the appropriateness of that method, and the required means of inspecting, testing, and maintaining the system.

55.7.3 Smoke Control System Operation.

55.7.3.1 Floor- or zone-dependent smoke control systems shall be automatically activated by sprinkler waterflow or smoke detection systems.

55.7.3.2 Means for manual operation of smoke control systems shall be provided at an approved location.

55.7.4 Acceptance Testing. Acceptance testing shall be performed by a special inspector in accordance with Section 55.11.

55.8 Fire Hydrants. Where required by another section of this *Code*, fire hydrants shall be installed in accordance with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*.

55.9 Private Fire Service Mains. Private fire service mains that provide fire protection water to a site shall be in accordance with NFPA 24.

55.10 Protection of Cooking Hazards. Where required by another section of this *Code*, commercial cooking operations shall be protected in accordance with NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*.

55.11 Special Inspections and Tests.

55.11.1 System Verification. When required by another section of this *Code*, special inspections and tests shall be performed to verify the operation of the fire protection system in its final condition for acceptance by the authority having jurisdiction.

55.11.2 Documentation. The design documents shall provide the procedures and methods to be used and items subject to special inspections and tests.

55.11.3 Report. The special inspector shall submit an inspection and test report to the authority having jurisdiction and registered design professional in responsible charge.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 The *Code* does not address features that solely affect economic loss to private property.

A.1.2 It is not the purpose of the *Code* to provide design regulations that solely affect economic loss to private property.

A.1.7.6.6.3.4(C) In order to complete the elevation certificate, additional subsequent inspections might be required to determine the lowest elevation of machinery or equipment servicing the building, adjacent grade elevations, and floor opening information.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 Code. The decision to designate a standard as a "code" is based on such factors as the size and scope of the document, its intended use and form of adoption, and whether it contains substantial enforcement and administrative provisions.

A.3.2.5 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.20 Aisle. An aisle might be bounded on one side only, but not both sides, by partitions of ceiling height or higher located along the path of travel. Typically, aisles are bordered by seating, furniture, or partitions of less than ceiling height.

A.3.3.21 Aisle Accessway. *Aisle accessway* is the term used for the previously unnamed means of egress component leading to an aisle or other means of egress. For example, circulation space between parallel rows of seats having a width of 1 ft to 2 ft (0.3 m to 0.6 m) and a length not exceeding 100 ft (30 m) is an aisle accessway. Some of the circulation space between tables or seats in restaurants might be considered aisle accessway.

Depending on the width of aisle accessway, which is influenced by its length and expected utilization, the movement of a person through the aisle accessway might require others to change their individual speed of movement, alter their postures, move their chairs out of the way, or proceed ahead of the person.

A.3.3.25.2 Alteration (Accessibility). Alterations include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historic restoration, resurfacing of circulation paths or vehicular ways, changes or rearrangement of the structural parts or elements, and changes or rearrangement in the plan configuration of walls and full-height partitions. Normal maintenance, reroofing, painting or wallpapering, or changes to electrical systems are not alterations unless they affect the usability of the building or facility.

A.3.3.32.5 Fabrication Area (Fab Area). Fabrication areas are permitted to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fab area processes.

A.3.3.32.8.1 Gross Floor Area. Where the term *floor area* is used, it should be understood to be gross floor area, unless otherwise specified.

A.3.3.32.10 Hazardous Area. Hazardous areas include those areas used for the storage or use of combustibles or flammables; toxic, noxious, or corrosive materials; or heat-producing appliances.

A.3.3.32.12.1 Employee Work Area (Accessibility). Corridors, toilet rooms, kitchenettes, and break rooms are not employee work areas.

A.3.3.32.12.2 Rehabilitation Work Area. A rehabilitation work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this *Code*.

A.3.3.33 Area of Refuge. An area of refuge has a temporary use during egress. It generally serves as a staging area that provides relative safety to its occupants while potential emergencies are assessed, decisions are made, and mitigating activities are begun. Taking refuge within such an area is, thus, a stage in the total egress process, that is, a stage between egress from the immediately threatened area and egress to a public way.

An area of refuge might be another building connected by a bridge or balcony, a compartment of a subdivided story, an elevator lobby, or an enlarged story-level exit stair landing. An area of refuge is accessible by means of horizontal travel or, as a minimum, via an accessible route meeting the requirements of ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities.*

This *Code* recognizes any floor in a building protected throughout by an approved, supervised automatic sprinkler system as an area of refuge. This recognition acknowledges the ability of a properly designed and functioning automatic sprinkler system to control a fire at its point of origin and to limit the production of fire products.

The requirement for separated rooms or spaces can be met on an otherwise undivided floor by enclosing the elevator lobby with ordinary glass or other simple enclosing partitions that are smoke resisting.

For some occupancies, one accessible room or space is permitted.

A.3.3.38 Atrium. As defined in NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, a large-volume space is an uncompartmented space, generally two or more stories in height, within which smoke from a fire either in the space or in a communicating space can move and accumulate without restriction. Atria and malls are examples of large-volume spaces.

A.3.3.44 Barricade. "Natural barrier" means the natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that need protection cannot be seen from the magazine when the trees are bare of leaves. "Artificial barrier" means an artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m).

A.3.3.45.1 Fire Barrier. A fire barrier, such as a wall or floor assembly, might be aligned vertically or horizontally.

A.3.3.45.2 Smoke Barrier. A smoke barrier, such as a wall, floor, or ceiling assembly, might be aligned vertically or horizontally. A smoke barrier might or might not have a fire resistance rating. Application of smoke barrier criteria where required elsewhere in the *Code* should be in accordance with Section 8.11.

A.3.3.45.3 Thermal Barrier. Finish ratings, as published in the UL *Fire Resistance Directory,* are one way of determining thermal barrier.

A.3.3.52 Birth Center. A birth center is a low-volume service for healthy, childbearing women, and their families, who are capable of ambulation in the event of fire or fire-threatening events. Birth center mothers and babies experience minimal analgesia, are not generally or regionally anesthetized, and are capable of ambulation, even in second-stage labor.

A.3.3.58 Buildings. The term *building* is to be understood as if followed by the words "or portions thereof" *(see also 3.3.530, Structure).* Each portion of a building that is separated from other portions by a fire wall is considered to be a separate building. *(This annex note is not extracted from ASCE 7.)*

A.3.3.58.4 Apartment Building. The *Code* specifies that, wherever there are three or more living units in a building, the building is considered an apartment building and is required to comply with Chapter 24. Townhouse units are considered to be apartment buildings if there are three or more units in the building. The type of wall required between units in order to consider them to be separate buildings is normally established by the authority having jurisdiction. If the units are separated by a wall of sufficient fire resistance and structural integrity to be considered as separate buildings, then the provisions of Chapter 22 apply to each townhouse. Condominium status is a form of ownership, not occupancy; for example, there are condominium warehouses, condominium apartments, and condominium offices.

A.3.3.58.7 Existing Building. With respect to judging whether a building should be considered existing, the deciding factor is not when the building was designed or when construction started but, rather, the date plans were approved for construction by the appropriate authority having jurisdiction.

A.3.3.58.8 Flexible Plan and Open Plan Educational or Day-Care Building. Flexible plan buildings have movable corridor walls and movable partitions of full-height construction, with doors leading from rooms to corridors. Open plan buildings have rooms and corridors delineated by tables, chairs, desks, bookcases, counters, low-height partitions, or similar furnishings. It is the intent that low-height partitions not exceed 5 ft (1.5 m).

A.3.3.58.9 High-Rise Building. It is the intent of this definition that, in determining the level from which the highest occupiable floor is to be measured, the enforcing agency should exercise reasonable judgment, including consideration of overall accessibility to the building by fire department personnel and vehicular equipment. Where a building is situated on a sloping terrain and there is building access on more than one level, the enforcing agency might select the level that provides the most logical and adequate fire department access.

A.3.3.58.10 Historic Building. Designation for a historic building might be in an official national, regional, or local historic register, listing, or inventory.

A.3.3.58.11 Mall Building. Mall buildings are occupied primarily by mercantile occupancies. However, they can include other occupancies such as drinking and dining establishments, entertainment and amusement facilities, offices, and occupancies with similar uses that are incidental to the primary use of the building.

A.3.3.58.14 Special Amusement Building. Special amusement buildings include amusements such as a haunted house, a roller coaster–type ride within a building, a multilevel play structure within a building, a submarine ride, and similar amusements where the occupants are not in the open air.

A.3.3.84 Common Path of Travel. Common path of travel is measured in the same manner as travel distance but terminates at that point where two separate and distinct routes become available. Paths that merge are common paths of travel.

A.3.3.86.1 Fire Compartment. Additional fire compartment information is contained in 8.2.2.

In the provisions for fire compartments utilizing the outside walls of a building, it is not intended that the outside wall be specifically fire resistance rated, unless required by another section of this *Code* or by other standards. Likewise, it is not intended for outside windows or doors to be protected, unless specifically required for exposure protection by another section of this *Code* or by other standards.

A.3.3.86.2 Smoke Compartment. The provision of smoke compartments using the outside walls or the roof of a building does not intend that outside walls or roofs, or any openings therein, are to be capable of resisting the passage of smoke.

A.3.3.106 Critical Radiant Flux. Critical radiant flux is the property determined by the test procedure of NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*. The unit of measurement of critical radiant flux is watts per square centimeter (W/cm^2).

A.3.3.110.3 Fire Damper. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that operate in the event of a fire. A dynamic fire damper is tested and rated for closure under airflow.

A.3.3.134 Development. The man-made changes might include, but are not limited to, the erection of buildings or other structures, the temporary or permanent storage of materials, and mining, dredging, filling, grading, paving, excavation, drilling, or other land-disturbing activities.

A.3.3.135.2 Special Industrial Explosive Device (SIED). The term *special industrial explosive device* includes, but is not limited to, explosive rivets; explosive bolts; explosive charges for driving pins or studs; cartridges for explosive-actuated power tools; and charges of explosives used in automotive airbag inflators, jet tapping of open hearth furnaces, and jet perforation of oil well casings.

A.3.3.140 Dormitory. Rooms within dormitories intended for the use of individuals for combined living and sleeping purposes are guest rooms or guest suites. Examples of dormitories are college dormitories, fraternity and sorority houses, and military barracks.

A.3.3.148 Electroluminescent. This light source is typically contained inside the device.

A.3.3.157.1 Exhausted Enclosure. Exhausted enclosures include laboratory hoods, exhaust fume hoods, and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors, and mists that could be released. Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.

A.3.3.157.2 Smokeproof Enclosure. For further guidance, see the following publications:

(1) ASHRAE *Handbook of Fundamentals*
(2) *Design of Smoke Management Systems*, by Klote and Milke
(3) NFPA 105, *Recommended Practice for the Installation of Smoke-Control Door Assemblies*

A.3.3.159 Equipment or Fixture. Equipment or fixtures do not include manufacturing, production, or process equipment, but do include connections from building service to process equipment.

A.3.3.164 Existing. See A.3.3.58.7, *Existing Building*.

A.3.3.167 Exit. Exits include exterior exit doors, exit passageways, horizontal exits, exit stairs, and exit ramps. In the case of a stairway, the exit includes the following:

(1) Stair enclosure
(2) Door to the stair enclosure
(3) Stairs and landings inside the enclosure
(4) Door from the stair enclosure to the outside or to the level of exit discharge
(5) Any exit passageway and its associated doors, if such are provided, so as to discharge the stair directly to the outside. In the case of a door leading directly from the street floor to the street or open air, the exit comprises only the door.

Doors of small individual rooms, as in hotels, while constituting exit access from the room, are not referred to as exits, except where they lead directly to the outside of the building from the street floor.

A.3.3.167.1 Horizontal Exit. Horizontal exits should not be confused with egress through doors in smoke barriers. Doors in smoke barriers are designed only for temporary protection

against smoke, whereas horizontal exits provide protection against serious fire for a relatively long period of time in addition to providing immediate protection from smoke. *(See 11.2.4.)*

A.3.3.171 Exposure Fire. An exposure fire usually refers to a fire that starts outside a building, such as a wildlands fire or vehicle fire, and that consequently exposes the building to a fire.

A.3.3.176.7 Limited Care Facility. Limited care facilities and residential board and care occupancies both provide care to people with physical and mental limitations. However, the goals and programs of the two types of occupancies differ greatly. The requirements in this *Code* for limited care facilities are based on the assumption that these are medical facilities, that they provide medical care and treatment, and that the patients are not trained to respond to the fire alarm; that is, the patients do not participate in fire drills but, rather, they await rescue. The requirements for residential board and care occupancies are based on the assumption that the residents are provided with personal care and activities that foster continued independence, that the residents are encouraged and taught to overcome their limitations, and that most residents are trained to respond to fire drills, to the extent they are able.

A.3.3.181 Fiberboard. The lignocellulosic fibers are usually wood or cane.

A.3.3.190 Fire Model. Due to the complex nature of the principles involved, calculative models are often packaged as computer software to perform the complex calculations.

A.3.3.194 Fire Scenario. A fire scenario defines the conditions under which a proposed design is expected to meet the fire safety goals. Factors typically include fuel characteristics, ignition sources, ventilation, building characteristics, and occupant locations and characteristics. The term *fire scenario* includes more than the characteristics of the fire itself but excludes design specifications and any characteristics that do not vary from one fire to another, the latter of which are called assumptions. The use of the term *fire scenario* in this *Code* refers only to those specifications required to calculate the fire's development and effects but, in other contexts, the term might be used to mean both the initial specifications and the subsequent development and effects (that is, a complete description of fire from conditions prior to ignition to conditions following extinguishment).

A.3.3.200 Fireworks. The regulations referred to limit the explosive content of each toy cap to not more than an average of 0.25 gr (16.2 mg). Also, each package containing such caps has to be labeled to indicate the maximum explosive content per cap. For information on the use of model rockets and model rocket motors, see NFPA 1122, *Code for Model Rocketry*.

A.3.3.200.1 Consumer Fireworks, 1.4G. Consumer Fireworks 1.4G contain limited quantities of pyrotechnic composition per unit and do not pose a mass explosion hazard where stored. Therefore, they are not required to be stored in a magazine.

Consumer Fireworks 1.4G are normally classed as Explosive 1.4G and described as Fireworks UN0336 by the U.S. Department of Transportation (U.S. DOT). *(See Appendix C of NFPA 1124.)*

A.3.3.200.2 Display Fireworks, 1.3G. Display Fireworks 1.3G are described as Fireworks UN0335 and classed as Explosive 1.3G by the U.S. Department of Transportation (U.S. DOT). *(See Appendix C of NFPA 1124.)*

A.3.3.201 Flame Spread. See 10.3.2.

A.3.3.205 Flammable Solid. Flammable solids include finely divided solid materials that, when dispersed in air as a cloud, could be ignited and cause an explosion and combustible fibers.

A.3.3.208 Flashover. Flashover occurs when the surface temperatures of combustible contents rise, producing pyrolysis gases, and the room heat flux becomes sufficient to heat all such gases to their ignition temperatures.

A.3.3.221.2 Street Floor. Where, due to differences in street levels, there are two or more stories accessible from the street, each is a street floor. Where there is no floor level within the specified limits for a street floor above or below ground level, the building has no street floor.

A.3.3.235.1 Compressed Gas. The states of a compressed gas are categorized as follows:

(1) Nonliquefied compressed gases are gases, other than those in solution, that are in a compressed gas container under the charged pressure and are entirely gaseous at a temperature of 68°F (20°C).
(2) Liquefied compressed gases are gases that are in a compressed gas container under the charged pressure and are partially liquid at a temperature of 68°F (20°C).
(3) Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.
(4) Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a compressed gas container, the hazard properties of which are represented by the properties of the mixture as a whole.

A.3.3.236 Gas Cabinet. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are permitted to be included.

A.3.3.243.1 Grade (Ground Level, Flood Resistance). Note that the average of surrounding grade elevations is not used for flood-resistant design and construction. Flood provisions frequently refer to "adjacent grade," which is the grade elevation adjacent to a wall, or to "highest adjacent grade," which is the highest grade elevation adjacent to any of the walls.

A.3.3.244 Grandstand. Where the term *grandstand* is preceded by an adjective denoting a material, it refers to a grandstand the essential members of which, exclusive of seating, are of the material designated.

A.3.3.270 Heat Release Rate (HRR). The heat release rate of a fuel is related to its chemistry, its physical form, and the availability of oxidant and is ordinarily expressed as British thermal units per second (Btu/s) or kilowatts (kW).

A.3.3.272 Heliport. The term *heliport* applies to all sites used or intended to be used for the helicopter takeoff and landing.

A.3.3.280.1 Day-Care Home. A day-care home is generally located within a dwelling unit.

A.3.3.284 Hot Tub. A hot tub is distinct from a spa unit formed of plastic, concrete, metal, or other materials.

A.3.3.285 Hotel. So-called apartment hotels should be classified as hotels because they are potentially subject to the same transient occupancy as hotels. Transients are those who occupy accommodations for less than 30 days.

A.3.3.287.1 Externally Illuminated. The light source is typically a dedicated incandescent or fluorescent source.

A.3.3.287.2 Internally Illuminated. The light source is typically incandescent, fluorescent, electroluminescent, photoluminescent, light-emitting diodes, or self-luminous.

A.3.3.294 Interior Finish. Interior finish is not intended to apply to surfaces within spaces, such as those that are concealed or inaccessible. Furnishings that, in some cases, might be secured in place for functional reasons should not be considered as interior finish.

A.3.3.294.2 Interior Floor Finish. Interior floor finish includes coverings applied over a normal finished floor or stair treads and risers.

A.3.3.307.1 Ceiling Limit. The ceiling limits utilized are to be those published in 29 CFR 1910.1000.

A.3.3.307.2 Lower Flammable Limit (LFL). The LFL is also referred to as the *lower explosive limit*. Mixtures below this limit are said to be lean.

A.3.3.307.3 Permissible Exposure Limit (PEL). The maximum permitted time-weighted average exposures to be utilized are those published in 29 CFR 1910.1000.

A.3.3.313.1 Combustible Liquid. The category of combustible liquids does not include compressed gases or cryogenic fluids. Classification of combustible liquids is as follows:

(1) Class II—liquids having closed-cup flash points at or above 100°F (37.8°C) and below 140°F (60°C)
(2) Class IIIA—liquids having closed-cup flash points at or above 140°F (60°C) but below 200°F (93°C)
(3) Class IIIB—liquids having closed-cup flash points at or above 200°F (93°C)

A.3.3.313.2 Flammable Liquid. The category of flammable liquids does not include compressed gases or cryogenic fluids. Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

(1) Class I-A liquids are those having a flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C).
(2) Class I-B liquids are those having a flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C).
(3) Class I-C liquids are those having a flash point at or above 73°F (22.8°C) and below 100°F (37.8°C).

A.3.3.317.3 Fuel Load. Fuel load includes interior finish and trim.

A.3.3.340.3 Corrosive Material. A chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described in Appendix A to CFR 49, Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of 4 hours. The term *corrosive material* does not refer to action on inanimate surfaces.

A.3.3.340.4 Explosive Material. The term *explosive material* includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, igniters, and Display Fireworks 1.3G (Class B, Special). The term *explosive* includes any material determined to be within the scope of Title 18, United States Code, Chapter 40, and also includes any material classified as an explosive, other than Consumer Fireworks 1.4G (Class C, Common), by the Hazardous Materials Regulations of the U.S. Department of Transportation in Title 49, Code of Federal Regulations.

The former classification system used by the U.S. Department of Transportation (DOT) included the terms *high explosive* and *low explosive* as further defined in A.3.3.340.4.2. These terms remain in use by the U.S. Bureau of Alcohol Tobacco and Firearms (BATF). Explosive materials classified as hazard Class 1 are further defined under the current system applied by DOT. Compatibility group letters are used in concert with division numbers to specify further limitations on each division noted. For example, the letter G (as in 1.4G) identifies substances or articles that contain a pyrotechnic substance and similar materials. UN/DOT Class 1 Explosives are defined as follows:

(1) Division 1.1 explosives are explosives that are a mass explosion hazard, which is a hazard that instantaneously affects almost the entire load.
(2) Division 1.2 explosives are explosives that are a projection hazard but not a mass explosion hazard.
(3) Division 1.3 explosives are explosives that are a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.
(4) Division 1.4 explosives are explosives that pose a minor explosion hazard and meet both of the following criteria:
    (a) The explosive effects are largely confined to the package, and no projection of fragments of appreciable size or range is to be expected.
    (b) An external fire cannot cause virtually instantaneous explosion of almost the entire contents of the package.
(5) Division 1.5 explosives are very insensitive explosives that are comprised of substances that are a mass explosion hazard, but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.
(6) Division 1.6 explosives are extremely insensitive articles that are not a mass explosion hazard, that are comprised of articles that contain only extremely insensitive detonating substances, and that demonstrate a negligible probability of accidental initiation or propagation.

A.3.3.340.4.2 Low Explosive (Material). A low explosive material is characterized by a reaction rate that is less than the speed of sound. Examples of low explosives are black powder, safety fuses, igniters, igniter cords, fuse lighters, Fireworks 1.3G (Class B, Special), and propellants 1.3C (Class B, Solid Propellants).

A.3.3.340.10 Limited-Combustible (Material). Material subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition are considered combustible. See NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* and NFPA 220, *Standard on Types of Building Construction.*

A.3.3.340.18.1 Highly Toxic Material. Mixtures of highly toxic materials with ordinary materials, such as water, might not warrant classification as highly toxic. While categorization is basically simple in application, any hazard evaluation that is required for the precise categorization of highly toxic material is required to be performed by experienced, technically competent persons.

A.3.3.340.19 Unstable (Reactive) Material. Unstable (reactive) material is classified as follows:

(1) Class 4 unstable (reactive) materials are those that, in themselves, are readily capable of detonation, explosive decomposition, or explosive reaction at normal temperatures and pressures and include, among others, materials that are sensitive to localized thermal or mechanical shock at normal temperatures and pressures.

(2) Class 3 unstable (reactive) materials are those that, in themselves, are capable of detonation, explosive decomposition, or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation and include, among others, materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.
(3) Class 2 unstable (reactive) materials are those that readily undergo violent chemical change at elevated temperatures and pressures and include, among others, materials that exhibit an exotherm at temperatures less than or equal to 30°F (–1°C) when tested by differential scanning calorimetry.
(4) Class 1 unstable (reactive) materials are those that, in themselves, are normally stable, but that can become unstable at elevated temperatures and pressures and includes among others, materials that change or decompose on exposure to air, light, or moisture and that exhibit an exotherm at temperatures greater than 30°F (–1°C), but less than or equal to 57°F (14°C), when tested by differential scanning calorimetry.

A.3.3.340.20 Water-Reactive Material. Water-reactive materials are subdivided as follows:

(1) Class 3 materials are those that react explosively with water without requiring heat or confinement.
(2) Class 2 materials are those that might form potentially explosive mixtures with water.
(3) Class 1 materials are those that might react with water with some release of energy, but not violently.

A.3.3.341 Materials and Methods Requirements. Applicable codes include this *Code*, *Mechanical Code*, *Plumbing Code*, *Fire Code*, *Electrical Code*, *Boiler Safety Code*, *Energy Code*, *Elevator Code*, and *Accessibility Code*. The required quantity, fire resistance, flame spread, acoustic or thermal performance, and other performance attributes are excluded from materials and methods requirements.

A.3.3.343 Means of Egress. A means of egress comprises the vertical and horizontal travel and includes intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, elevators, enclosures, lobbies, escalators, horizontal exits, courts, and yards.

A.3.3.360.1 Nominal Dimension (Masonry). Nominal dimensions are usually stated in whole numbers. Thickness is given first, followed by height and then length.

A.3.3.368 Number of Stories. Building levels below the primary level of exit discharge are not counted as stories.

A.3.3.370 Objective. Objectives define a series of actions necessary to make the achievement of a goal more likely. Objectives are stated in more specific terms than goals and are measured on a more quantitative, rather than qualitative, basis.

A.3.3.371.1 Assembly Occupancy. Assembly occupancies might include the following:

(1) Armories
(2) Assembly halls
(3) Auditoriums
(4) Bowling lanes
(5) Club rooms
(6) College and university classrooms, 50 persons and over
(7) Conference rooms
(8) Courtrooms
(9) Dance halls
(10) Drinking establishments
(11) Exhibition halls
(12) Gymnasiums
(13) Libraries
(14) Mortuary chapels
(15) Motion picture theaters
(16) Museums
(17) Passenger stations and terminals of air, surface, underground, and marine public transportation facilities
(18) Places of religious worship
(19) Pool rooms
(20) Recreation piers
(21) Restaurants
(22) Skating rinks
(23) Special amusement buildings, regardless of occupant load
(24) Theaters

Assembly occupancies are characterized by the presence or potential presence of crowds with attendant panic hazard in case of fire or other emergency. They are generally open or occasionally open to the public, and the occupants, who are present voluntarily, are not ordinarily subject to discipline or control. Such buildings are ordinarily occupied by able-bodied persons and are not used for sleeping purposes. Special conference rooms, snack areas, and other areas incidental to, and under the control of, the management of other occupancies, such as offices, fall under the 50-person limitation.

Restaurants and drinking establishments with an occupant load of fewer than 50 persons should be classified as mercantile occupancies.

For special amusement buildings, see 16.4.7.

A.3.3.371.2 Business Occupancy. Business occupancies include the following:

(1) Air traffic control towers (ATCTs)
(2) Ambulatory outpatient clinics
(3) City halls
(4) College and university instructional buildings, classrooms under 50 persons, and instructional laboratories
(5) Courthouses
(6) Dentists' offices
(7) Doctors' offices
(8) General offices
(9) Town halls

Doctors' and dentists' offices are included, unless of such character as to be classified as ambulatory health care occupancies. *(See 3.3.371.6.1.)*

Birth centers occupied by fewer than four patients, not including infants, at any one time; not providing sleeping facilities for four or more occupants; and not providing treatment procedures that render four or more patients, not including infants, incapable of self-preservation at any one time should be classified as business occupancies. For birth centers occupied by patients not meeting these parameters, see Chapter 19.

Service facilities common to city office buildings such as newsstands, lunch counters serving fewer than 50 persons, barber shops, and beauty parlors are included in the business occupancy group.

City halls, town halls, and courthouses are included in the business occupancy group insofar as their principal function is the transaction of public business and the keeping of books and records. Insofar as they are used for assembly purposes, they are classified as assembly occupancies.

A.3.3.371.3 Day-Care Occupancy. Day-care occupancies include the following:

(1) Adult day-care occupancies, except where part of a health care occupancy
(2) Child day-care occupancies
(3) Day-care homes
(4) Kindergarten classes that are incidental to a child day-care occupancy
(5) Nursery schools

In areas where public schools offer only half-day kindergarten programs, many child day-care occupancies offer state-approved kindergarten classes for children who need full-day care. As these classes are normally incidental to the day-care occupancy, the requirements of the day-care occupancy should be followed.

A.3.3.371.4 Detention and Correctional Occupancy. Detention and correctional occupancies include the following:

(1) Adult and juvenile substance abuse centers
(2) Adult and juvenile work camps
(3) Adult community residential centers
(4) Adult correctional institutions
(5) Adult local detention facilities
(6) Juvenile community residential centers
(7) Juvenile detention facilities
(8) Juvenile training schools

A.3.3.371.5 Educational Occupancy. Educational occupancies include the following:

(1) Academies
(2) Kindergartens
(3) Schools

An educational occupancy is distinguished from an assembly occupancy in that the same occupants are regularly present.

A.3.3.371.6 Health Care Occupancy. Health care occupancies include the following:

(1) Ambulatory health care facilities
(2) Hospitals
(3) Limited care facilities
(4) Nursing homes

Occupants of health care occupancies typically have physical or mental illness, disease, or infirmity. They also include infants, convalescents, or infirm aged persons.

A.3.3.371.7 Industrial Occupancy. Industrial occupancies include the following:

(1) Dry cleaning plants
(2) Factories of all kinds
(3) Food processing plants
(4) Gas plants
(5) Hangars (for servicing/maintenance)
(6) Laundries
(7) Power plants
(8) Pumping stations
(9) Refineries
(10) Sawmills
(11) Telephone exchanges

In evaluating the appropriate classification of laboratories, the authority having jurisdiction should treat each case individually, based on the extent and nature of the associated hazards. Some laboratories are classified as occupancies other than industrial; for example, a physical therapy laboratory or a computer laboratory.

A.3.3.371.7.1 General Industrial Occupancy. General industrial occupancies include multistory buildings where floors are occupied by different tenants or buildings suitable for such occupancy and, therefore, are subject to possible use for types of industrial processes with a high density of employee population.

A.3.3.371.8 Mercantile Occupancy. Mercantile occupancies include the following:

(1) Auction rooms
(2) Department stores
(3) Drugstores
(4) Restaurants with fewer than 50 persons
(5) Shopping centers
(6) Supermarkets

Office, storage, and service facilities incidental to the sale of merchandise and located in the same building should be considered part of the mercantile occupancy classification.

A.3.3.371.10 Multiple Occupancy. Multiple occupancy describes a situation where more than one occupancy classification exists in a building. *Mixed occupancies* and *separated occupancies* are subdivisions of multiple occupancies, and include their own unique protection requirements.

A.3.3.371.11 Residential Occupancy. Residential occupancies are treated as separate occupancies in this *Code* as follows:

(1) One- and two-family dwellings (Chapter 22)
(2) Lodging or rooming houses (Chapter 23)
(3) Hotels, motels, and dormitories (Chapter 24)
(4) Apartment buildings (Chapter 25)

A.3.3.371.12 Residential Board and Care Occupancy. The following are examples of facilities that are classified as residential board and care occupancies:

(1) A group housing arrangement for physically or mentally handicapped persons who normally attend school in the community, attend worship in the community, or otherwise use community facilities
(2) A group housing arrangement for physically or mentally handicapped persons who are undergoing training in preparation for independent living, for paid employment, or for other mainstream community activities
(3) A group housing arrangement for the elderly that provides personal care services but that does not provide nursing care
(4) Facilities for social rehabilitation, alcoholism, drug abuse, or mental health problems that contain a group housing arrangement and that provide personal care services but do not provide acute care
(5) Assisted living facilities
(6) Other group housing arrangements that provide personal care services but not nursing care

A.3.3.371.14 Storage Occupancy. Storage occupancies include the following:

(1) Barns
(2) Bulk oil storage
(3) Cold storage
(4) Freight terminals
(5) Grain elevators
(6) Hangars (for storage only)
(7) Parking structures
(8) Stables
(9) Truck and marine terminals
(10) Warehouses

Storage occupancies are characterized by the presence of relatively small numbers of persons in proportion to the area.

A.3.3.384 Organic Peroxide. Some organic peroxides can present an explosion hazard (detonation or deflagration), or they can be shock sensitive. Organic peroxides will decompose over time at a rate that increases with increasing temperature. Decomposition products might be flammable. Organic peroxides are subdivided into classes as follows:

(1) Unclassified, detonatable organic peroxides are peroxides that are capable of detonation, that present an extremely high explosion hazard through rapid explosive decomposition, and that are regulated as explosives.
(2) Class I Organic peroxides are peroxides that are capable of deflagration, but not detonation, and that present a high explosion hazard through rapid decomposition.
(3) Class II Organic peroxides are peroxides that burn very rapidly and present a severe reactivity hazard.
(4) Class III Organic peroxides are peroxides that burn rapidly and present a moderate reactivity hazard.
(5) Class IV Organic peroxides are peroxides that burn in the same manner as ordinary combustibles and present a minimum reactivity hazard.
(6) Class V Organic peroxides are peroxides that burn with less intensity than ordinary combustibles or do not sustain combustion and do not present a reactivity hazard.

A.3.3.386 Outside Stair. See 11.2.2.

A.3.3.387 Oxidizer. Oxidizer liquids and solids are subdivided as follows:

(1) A Class 4 oxidizer is an oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock, enhances the burning rate, and might cause spontaneous ignition of combustible materials.
(2) A Class 3 oxidizer is an oxidizer that causes a severe increase into the burning rate of combustible materials with which it comes into contact or that undergoes vigorous, self-sustained decomposition due to contamination or exposure to heat.
(3) A Class 2 oxidizer is an oxidizer that causes a moderate increase in the burning rate or that might cause spontaneous ignition of combustible materials with which it comes into contact.
(4) A Class 1 oxidizer is an oxidizer whose primary hazard is that it slightly increases the burning rate but does not cause spontaneous ignition when it comes into contact with combustible materials.

A.3.3.389.1.1 Light-Transmitting Plastic Roof Panel. Skylights are not considered light-transmitting plastic roof panels.

A.3.3.389.1.2 Light-Transmitting Plastic Wall Panel. Plastic glazing is not considered a light-transmitting plastic wall panel.

A.3.3.394 Particleboard. The cellulosic material is usually wood.

A.3.3.395 Partition. A partition can be permanent or temporary. *(This annex note is not extracted from ASCE 7.)*

A.3.3.395.2 Smoke Partition. Depending on specific occupancy chapter requirements, a smoke partition might or might not be required to have fire resistance rating.

A.3.3.397.1 Membrane Penetration. A membrane penetration identifies those openings that are to accommodate cables, cable trays, cabinets, conduits, electrical fixtures and outlets, pipes, wires, vents, and similar items.

A.3.3.397.2 Through-Penetration. Blank openings and openings for ducts, chimneys, vents, and similar items can also be through-penetrations. The term *through-penetrations* identifies those openings that are to accommodate cables, cable trays, cabinets, conduits, electrical fixtures and outlets, pipes, wires, vents, and similar items.

A.3.3.398 Penthouse. When the area of a penthouse exceeds one-third of the roof area, it is considered a story.

A.3.3.399 Performance Criteria. Performance criteria are stated in engineering terms. Engineering terms include temperatures, radiant heat flux, and levels of exposure to fire products. Performance criteria provide threshold values used to evaluate a proposed design.

A.3.3.404 Personal Care. Personal care involves responsibility for the safety of the resident while inside the building. Personal care might include the following:

(1) Daily awareness by the management of a resident's functioning and whereabouts
(2) Making and reminding a resident of appointments
(3) Ability and readiness for intervention in the event of a resident experiencing a crisis
(4) Supervision in the areas of nutrition and medication
(5) Actual provision of transient medical care

A.3.3.405 Photoluminescent. The light source is considered internally illuminated.

A.3.3.410.1 Coal Preparation Plant. Coal preparation includes separation, crushing, screening, washing, drying, storage, and loadout of coal to ready it for market. This preparation does not include other facilities such as those containing coal pulverizers used to condition coal for firing in boilers at power-generating plants, for gasification plants, or for utilization purposes.

A.3.3.412 Plastic. Plastics are usually made from resins, polymers, cellulose derivatives, caseins, and proteins. The principal types are thermosetting and thermoplastic.

A.3.3.412.1 Cellular or Foamed Plastic. Cellular or foamed plastic might contain foamed and unfoamed polymeric or monomeric precursors (prepolymer, if used), plasticizers, fillers, extenders, catalysts, blowing agents, colorants, stabilizers, lubricants, surfactants, pigments, reaction control agents, processing aids, and flame retardants.

A.3.3.414 Platform. Platforms also include the head tables for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the-round; and items used for similar purposes wherein there are no overhead drops, pieces of scenery, or stage effects other than lighting and a screening valance. A platform is not intended to be prohibited from using a curtain as a valance to screen or hide the electric conduit, lighting track, or similar fixtures, nor is a platform prohibited from using curtains that are used to obscure the back wall of the stage; a curtain between the auditorium and the stage (grand or house curtain), a maximum of four leg drops; or a valance to screen light panels, plumbing, and similar equipment from view.

A.3.3.417.1 Boiling Point. At the boiling point, the surrounding atmospheric pressure can no longer hold the liquid in the liquid state, and the liquid boils. A low boiling point is indicative of a high vapor pressure and a high rate of evaporation. Where an accurate boiling point is unavailable for the material in question, or for mixtures that do not have a constant