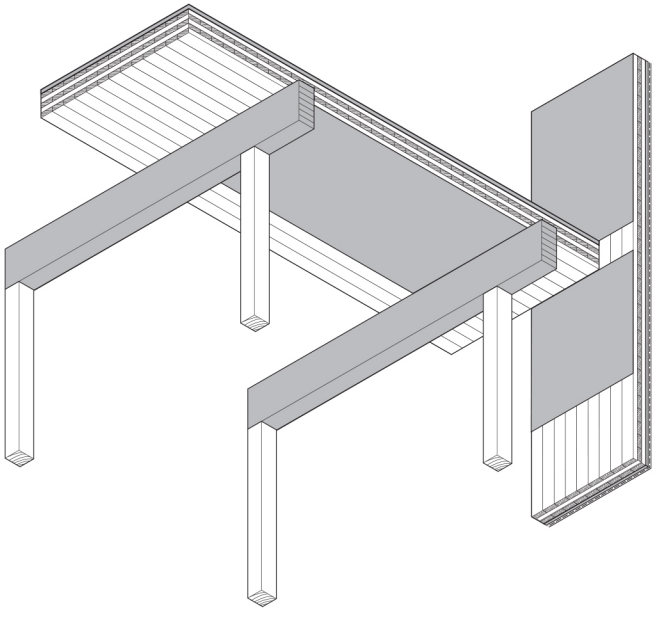
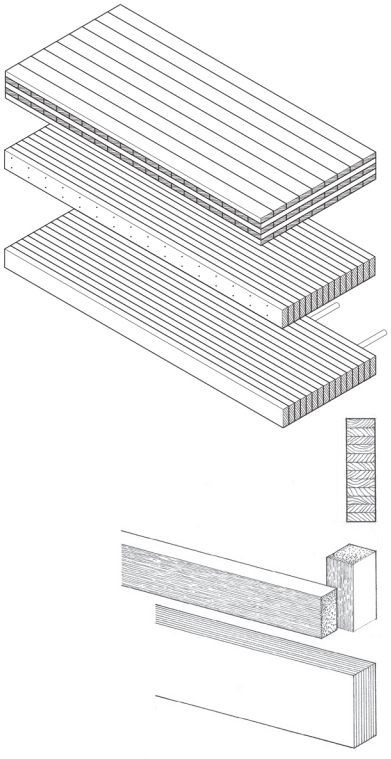
FRANCIS D.K. CHING
STEVEN R. WINKEL, FAIA, PE, CASp

# BUILDING CODES ILLUSTRATED

## A GUIDE TO UNDERSTANDING THE 2021 INTERNATIONAL BUILDING CODE®

SEVENTH EDITION





WILEY

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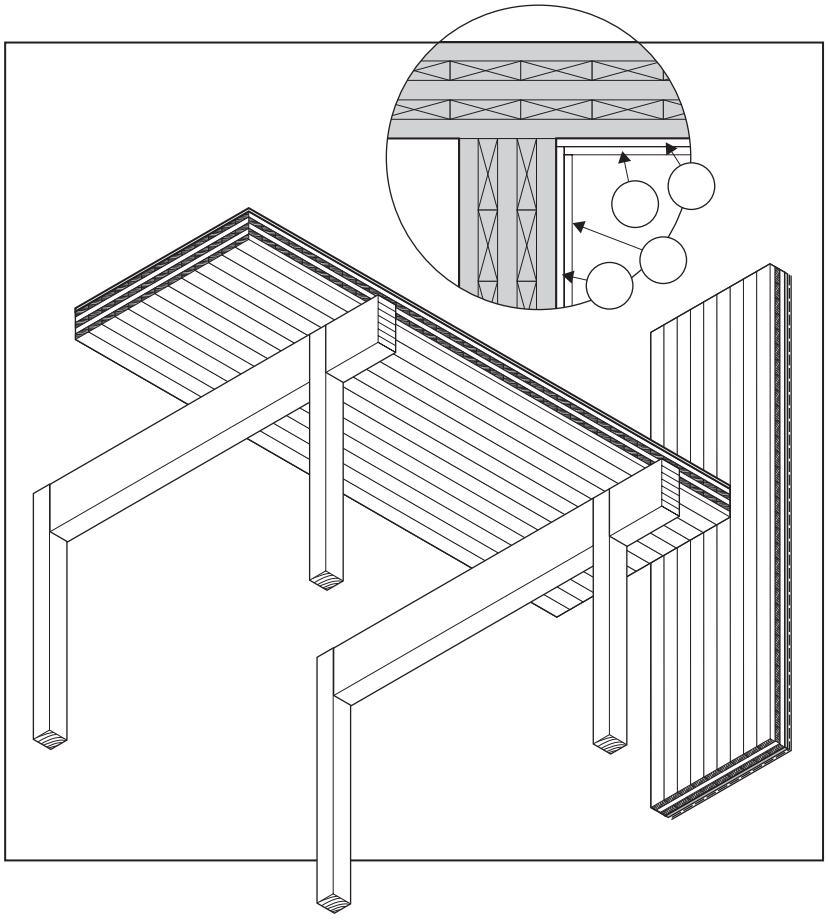
## *A Guide to Understanding the 2021 International Building Code®*



**FRANCIS D. K. CHING / STEVEN R WINKEL, FAIA**

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**Disclaimer**

The book contains the authors' analyses and illustrations of the intent and potential interpretations of the *2021 International Building Code*® (IBC). The illustrations and examples are general in nature and not intended to apply to any specific project without a detailed analysis of the unique nature of the project. As with any code document, the IBC is subject to interpretation by the Authorities Having Jurisdiction (AHJ) for their application to a specific project. Designers should consult the local building official early in project design if there are questions or concerns about the meaning or application of code sections in relation to specific design projects.

The interpretations and illustrations in the book are those of the authors. The authors do not represent that the illustrations, analyses, or interpretations in this book are definitive. They are not intended to take the place of detailed code analyses of a project, the exercise of professional judgment by the reader, or interpretive application of the code to any project by permitting authorities. While this publication is designed to provide accurate and authoritative information regarding the subject matter covered, it is sold with the understanding that neither the publisher nor the authors are engaged in rendering professional services. If professional advice or other expert assistance is required, the services of a competent professional person should be sought.

**Acknowledgments**

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We would also like to thank David Collins, FAIA, of The Preview Group, Inc., for his insightful review. The book was made clearer and our interpretations were improved by his comments and suggestions.

**About the International Code Council®**

The International Code Council is the leading global source of model codes and standards and building safety solutions that include product evaluation, accreditation, technology, codification, training, and certification. The Code Council's codes, standards, and solutions are used to ensure safe, affordable, and sustainable communities and buildings worldwide. The International Code Council family of solutions includes the ICC Evaluation Service, the International Accreditation Service, General Code, S. K. Ghosh Associates, NTA Inc., Progressive Engineering Inc., ICC Community Development Solutions, and the Alliance for National & Community Resilience. The Code Council is the largest international association of building safety professionals and is the trusted source of model codes and standards, establishing the baseline for building safety globally and creating a level playing field for designers, builders and manufacturers.

Washington DC Headquarters:
500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001

Distribution Center (Lenexa, KS)

888-ICC-SAFE (888-422-7233)
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# Contents

# Preface

The primary purpose of this book is to familiarize code users with the *2021 International Building Code*® (IBC). It is intended as an instructional text on how the code was developed and how it is organized, as well as a primer on how to use the code. It is intended to be a companion to the IBC, not a substitute for it. This book must be read in concert with the IBC.

Many designers feel intimidated by building codes. They can seem daunting and complex at first glance. It is important to know that they are a product of years of accretion and evolution. Sections start simply and are modified, and new material is added to address additional concerns or to address interpretation issues from previous code editions. The complexity of a building code often comes from this layering of new information upon old without regard to overall continuity. It is important to keep in mind that there is no single author of the building code. Each section has a different author. Building codes are living documents, constantly under review and modification. It is vital to an understanding of codes to keep in mind that they are a human institution, written by ordinary people with specific issues in mind or specific agendas they wish to advance. It is also critical in code application to be sure you are using the most current code adopted in the jurisdiction where you are working.

**BUILDING CODE**
*Webster's Third New International Dictionary* defines a building code as: "A set of rules of procedure and standards of materials designed to secure uniformity and protect the public interest in such matters as building construction and public health, established usually by a public agency and commonly having the force of law in a particular jurisdiction."

Over the past several editions of the IBC there has been an increase in the number of code revisions made to "clarify" the code. This trend has often resulted in the reorganization of code sections, often without any substantive changes. For those code users who are familiar with the previous code editions these changes can be upsetting and confusing. It may seem that familiar and well-understood code provisions have disappeared when in actuality they have just been relocated and renumbered. We strongly recommend that code users obtain electronic copies of the codes. These lend themselves to keyword searches that make it possible to find moved provisions based on the unchanged text content. For identifying and understanding the major changes from one edition of the code to the next we suggest obtaining the *Significant Changes to the IBC* published by the International Code Council. Another valuable reference we recommend to accompany this book is the *2021 IBC Code and Commentary*, also published by the International Code Council.

This book is designed to give an understanding of how the *International Building Code* is developed, how it is likely to be interpreted, and how it applies to design and construction. The intent of this book is to give a fundamental understanding of the relationship of codes to practice for design professionals, especially those licensed or desiring to become licensed as architects, engineers, or other registered design professionals. Code knowledge is among the fundamental reasons for licensing design professionals, for the protection of public health, safety, and welfare. It is our goal to make the acquisition and use of code knowledge easier and clearer for code users.

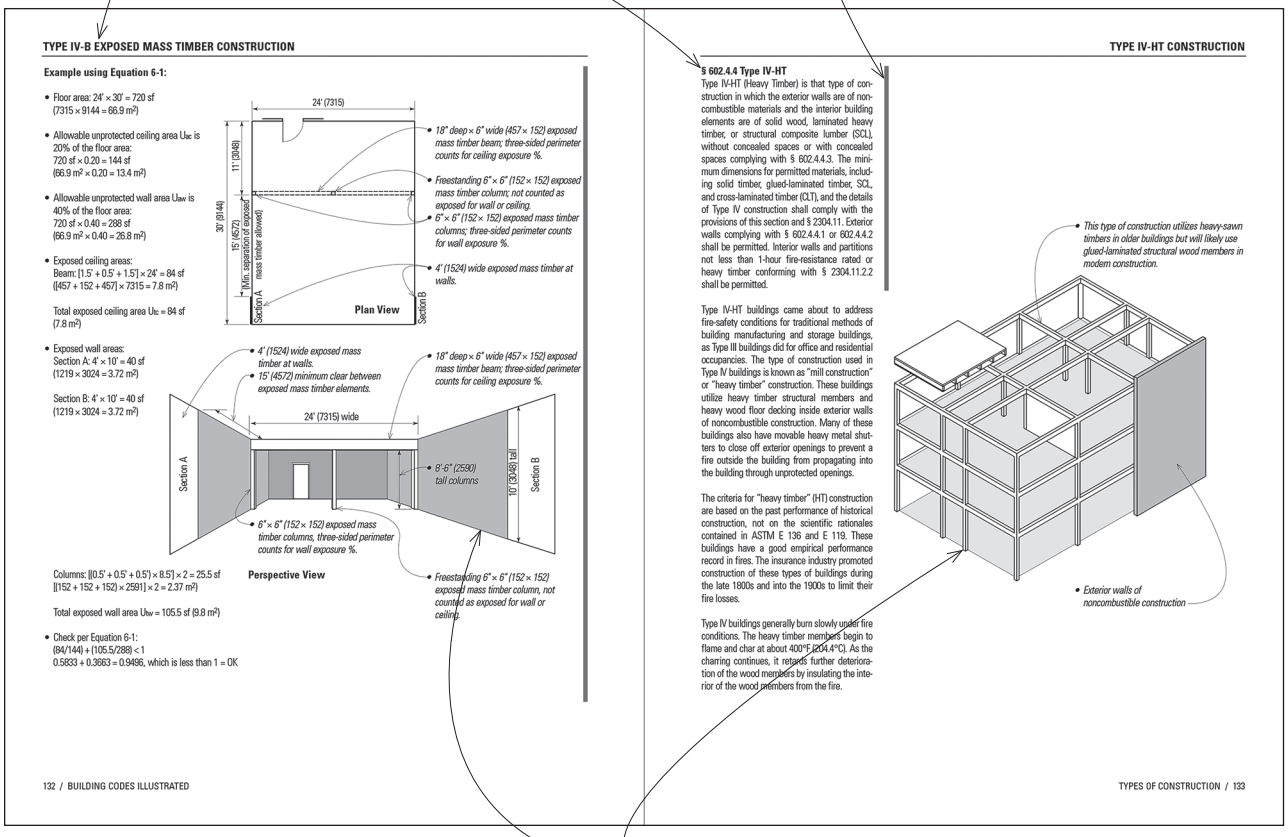
### How and Why to Participate in the ICC Code Development Process

Architects, designers, engineers, and other professionals can freely participate in the ICC Code Development Process by submitting proposed code changes, collaborating with colleagues in developing code language and submitting changes, participating in giving testimony, and becoming ICC members to have voting opportunities in person or online at the Committee Action Hearings. The Code Development Process is conducted via ICC's state of the art cloud-based cdpACCESS system. Committee Action Hearings and Public Comment Hearings are broadcast live so anyone can follow the testimonies and actions taken. All building design and construction professionals are encouraged to participate in the ICC Code Development Process and have a say in the outcome of future International Building Codes or any other of the ICC International Codes. Because architects, engineers, and other design and construction professionals apply the code to actual buildings and experience first-hand the effectiveness of code provisions, it is very critical for them to participate in the code development process and improve the code each cycle. For the details of Code Development Process go to https://www.iccsafe.org/wp-content/uploads/ICC-CDP-How-It-Works.pdf. For information on cdpACCESS go to https://www.iccsafe.org/cdpaccess/.

## How This Book Is Organized

The first two chapters of this book give background and context regarding the development, organization, and use of the IBC. Chapters 3 through 18 are organized and numbered the same as the corresponding subject-matter chapters in the IBC. Chapters 19–22 summarize the requirements in the remaining IBC chapters. Chapter 13 refers briefly to the energy provisions of the International Code family, which are contained in a separate code, the *International Energy Conservation Code* (IECC), and which are beyond the scope of this book. Chapter 23 touches on the code provisions for existing buildings, which are no longer included in the IBC, but occur in the *International Existing Building Code* (IEBC). While not addressed exhaustively in this book, new design work often takes place in existing buildings and we want to make code users aware of how the IBC and IEBC are to be applied in such cases.

- *Text that is new or revised for the seventh edition is denoted by a vertical gray bar ▌ in the margins. This is similar to markings used in the IBC to indicate changes in code provisions.*
- *The IBC uses solid black vertical bars ▌ to denote changes and arrows ➡ to denote deletions. We strongly recommend that users study the code very carefully for changes and compare old copies of the code to the new copies as you become familiar with the new code.*
- *Page headings refer to major sections within each chapter of the Code.*
- *Text is arranged in columns, typically on the left side of a single page or of two facing pages.*
- *Note that relocated items in the IBC are marked with an arrow indicating a deletion from that section, with no cross-reference about where the section was moved. This can be very confusing, especially when requirements are merely relocated without any substantive technical changes.*



TYPE IV-B EXPOSED MASS TIMBER CONSTRUCTION

**Example using Equation 6-1:**

- Floor area: 24′ × 30′ = 720 sf (7315 × 9144 = 66.9 m²)
- Allowable unprotected ceiling area $U_{ac}$ is 20% of the floor area: 720 sf × 0.20 = 144 sf (66.9 m² × 0.20 = 13.4 m²)
- Allowable unprotected wall area $U_{aw}$ is 40% of the floor area: 720 sf × 0.40 = 288 sf (66.9 m² × 0.40 = 26.8 m²)
- Exposed ceiling areas: Beam: [1.5′ + 0.5′ + 1.5′] × 24′ = 84 sf ([457 + 152 + 457] × 7315 = 7.8 m²)

  Total exposed ceiling area $U_{ec}$ = 84 sf (7.8 m²)
- Exposed wall areas: Section A: 4′ × 10′ = 40 sf (1219 × 3024 = 3.72 m²)

  Section B: 4′ × 10′ = 40 sf (1219 × 3024 = 3.72 m²)

  Columns: [(0.5′ + 0.5′ + 0.5′) × 8.5′] × 2 = 25.5 sf ([152 + 152 + 152] × 2591] × 2 = 2.37 m²)

  Total exposed wall area $U_{ew}$ = 105.5 sf (9.8 m²)
- Check per Equation 6-1: (84/144) + (105.5/288) < 1 0.5833 + 0.3663 = 0.9496, which is less than 1 = OK



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TYPE IV-HT CONSTRUCTION

**§ 602.4.4 Type IV-HT**

Type IV-HT (Heavy Timber) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated heavy timber, or structural composite lumber (SCL), without concealed spaces or with concealed spaces complying with § 602.4.4.3. The minimum dimensions for permitted materials, including solid timber, glued-laminated timber, SCL, and cross-laminated timber (CLT), and the details of Type IV construction shall comply with the provisions of this section and § 2304.11. Exterior walls complying with § 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rated or heavy timber conforming with § 2304.11.2.2 shall be permitted.

Type IV-HT buildings came about to address fire-safety conditions for traditional methods of building manufacturing and storage buildings, as Type III buildings did for office and residential occupancies. The type of construction used in Type IV buildings is known as "mill construction" or "heavy timber" construction. These buildings utilize heavy timber structural members and heavy wood floor decking inside exterior walls of noncombustible construction. Many of these buildings also have movable heavy metal shutters to close off exterior openings to prevent a fire outside the building from propagating into the building through unprotected openings.

The criteria for "heavy timber" (HT) construction are based on the past performance of historical construction, not on the scientific rationales contained in ASTM E 136 and E 119. These buildings have a good empirical performance record in fires. The insurance industry promoted construction of these types of buildings during the late 1800s and into the 1900s to limit their fire losses.

Type IV buildings generally burn slowly under fire conditions. The heavy timber members begin to flame and char at about 400°F (204.4°C). As the charring continues, it retards further deterioration of the wood members by insulating the interior of the wood members from the fire.



TYPES OF CONSTRUCTION / 133

- *Drawings are typically to the right, accompanied by captions or explanatory notes. The illustrations are intended to help the reader visualize what is described in the text. They should therefore be considered to be diagrams that explain and clarify design relationships rather than represent specific design solutions.*

### For the Student

The book is part of the introduction to building codes that are an integral part of professional studies in architecture, structural engineering, and civil engineering. It will serve as explanatory text to accompany analysis of the organization, intent, and use of codes in general and the *International Building Code* in particular. The introductory chapters will instill in undergraduate design students the reasons codes exist and how they form an integral part of the design process for every building project. Most design problems in school are at the schematic design level, so that detailed code analysis will not typically be undertaken in most undergraduate classes. In graduate classes the book can serve to organize and facilitate a deeper understanding of detailed requirements common to all building codes. The book also gives guidance on best practices for code analysis to lay a foundation for future practitioners to better meet the health, safety, and welfare criteria that are the basis for professional licensure.

### For Emerging Professionals

Whether you are engaged in design, production, management, or construction administration, codes and standards are an integral and inescapable part of the practice of architecture and engineering. New practitioners need to refine their skills and knowledge of codes to make their projects safe and buildable with few costly changes. The more practitioners know about the code, the more it can become a tool for design rather than an impediment. The better the underlying criteria for code development and the reasons for code provisions are understood, the easier it is to create code-compliant designs. Early understanding and incorporation of code-compliant design provisions in a project reduces the necessity for costly and time-consuming rework or awkward rationalizations to justify dubious code decisions late in project documentation, or even during construction. Code use and understanding should be part of accepted knowledge for professionals, so that it becomes a part of the vocabulary of design.

### For Experienced Practitioners

The greatest value of this book is that it is based on the widely adopted *International Building Code*. This code is similar but by no means identical to the three model codes—the *Uniform Building Code*, the *National Building Code*, and the *Standard Building Code*—that were used in the past. Various jurisdictions may be using differing editions of the IBC. Also, as noted, items have been moving around in recent editions of the IBC and this book can serve as a guide in keeping track of reorganized code sections. This book will guide experienced practitioners out of the old grooves of code use they may have fallen into with the old model codes, or with older editions of the IBC. The code-analysis methods and outcomes may vary from prior IBC editions to the new IBC. While there are seemingly familiar aspects from prior code editions interspersed throughout the new code, the actual allowable criteria and how they are determined are often quite different. It is likely that the illustrations and the underlying reasons for the development of each code section will look familiar to experienced practitioners. The experienced practitioner must not rely on memory or old habits of picking construction types or assemblies based on prior practice. Each building must be looked at anew until the similarities and sometimes-critical differences between the new code and old habits are understood and acknowledged. This admonition also applies to the need to determine local modifications to codes and not assume new projects in new locations are identical to similar prior projects.

### How to Use This Book

This book focuses on the use and interpretation of the nonstructural provisions of the *International Building Code*. There are references to basic structural requirements, but this book does not attempt to go into structural requirements in depth. That is the subject for another volume.

The organization of this book presumes that the reader has a copy of the latest version of the IBC itself as a companion document. The book is intended to expand on, interpret, and illustrate various provisions of the code. The IBC has been adopted in many jurisdictions. As it has now been extensively applied, there is an evolving body of precedent in application and interpretation. It is our hope that the analysis and illustrations in the book will aid the designer and the Authorities Having Jurisdiction (AHJ) in clarifying their own interpretations of the application of code sections to projects.

The book is not intended to take the place of the *2021 International Building Code*® (IBC) in any way. The many detailed tables and criteria contained in the IBC are partially restated in the book for illustrative purposes only. For example, we show how various tables are meant to be used and how we presume certain parts will be interpreted. When performing a code analysis for a specific project, we anticipate the reader will use our book to understand the intent of the applicable code section and then use the code itself to find the detailed criteria to apply. One can, however, start with either the IBC or this book in researching a specific topic.

Beginning with the *2021 International Building Code*®:
- Search Contents or Index.
- Read relevant section(s).
- For further explanation and/or clarification, refer to this book.

Beginning with *Building Codes ILLUSTRATED*:
- Search Code Index for section number or Subject Index for topic.
- Refer back to specific text of *2021 International Building Code*®.

The text is based on the language of the code and interprets it to enhance the understanding of the user. The interpretations are those of the authors and may not correspond to those rendered by the AHJ or by the International Code Council (ICC). This book, while based on a publication of the ICC, does not in any way represent official policies, interpretations, or positions of the ICC. We would encourage the users of the book to confer with the AHJ, using the illustrations from this book to validate interpretations. Reconciling text with construction drawings often benefits from additional illustrations. We trust that this will be the case with the explanations and graphics in this book.

Note that the text of the 2021 IBC contains terms in *italic type*. These italicized terms appear in the definitions in Chapter 2 of the IBC. Where defined terms are used in ways intended by their definitions, they are italicized in the body of the IBC. Italicized type is not used in this book in the same way. The IBC publisher's intent for this notification method is to highlight for the code user that the definitions should be read carefully to facilitate a better understanding of how they are used in the context where they appear in italics. It is critical that the code user go back to the IBC's definitions when attempting to understand the literal and figurative meaning of code requirements. All code definitions are now located in Chapter 2 of the IBC.

The primary purpose of the *International Building Code* (IBC) is to provide reasonable safeguards for the design, construction, use, occupancy, and maintenance of buildings. Participation by numerous volunteers representing all segments of the building community continue to log countless hours to ensure the code is updated every three years and reflects the current state of the art advances in building safety, resiliency, and performance. Developed through an open and transparent process, the IBC provides a balanced approach to safety, affordability, sustainability, and resiliency of buildings.

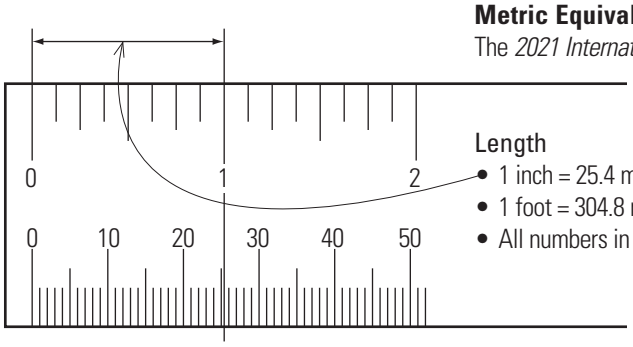
To the uninformed, building codes can appear limiting or even serve as a roadblock to building design and construction. Building codes have also been accused of being too rigid or static and unable to stay abreast of innovation or the latest advances in technology. While no one denies the need for a building regulatory system to address the safety and welfare of the public, everyone wants it to be effective, flexible, and allow for innovation. To the informed user of the IBC, the opportunity has always existed for designers, builders, manufacturers, and code officials to apply the performance-based provisions of the code in a manner that allows for creativity, flexibility, and affordability in building construction. The current *2021 International Building Code* states the following:

*"The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material and method of work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety."*

With advances in technology, competition, and the globalization of our economy, it is critical that building codes be dynamic and provide a pathway for the approval of new and innovative materials, designs, and methods of construction. Often, Code officials utilize research reports, listings, and/or test reports from approved sources providing verification of code compliance. The independent source that code officials frequently use to verify that a product is certified to a standard within the code, or an innovative or new product is evaluated to criteria that meet the building code requirements in terms of strength, effectiveness, fire resistance, durability, and safety, is the ICC Evaluation Service, Inc. (ICC-ES). Functioning as a subsidiary of the International Code Council, ICC-ES works closely with manufacturers, code officials, and the design community in an effort to facilitate the acceptance of products in the marketplace without compromising public safety. Information on products that have been reviewed by ICC-ES for code compliance can be downloaded at no cost by visiting http://www.icc-es.org/Evaluation_Reports/ or http://www.icc-es.org/.

The seventh edition of *Building Codes Illustrated* builds on the successful foundation laid by previous editions. Codes by their very nature tend to be tedious, dry documents that can also serve the late-night insomniac in search of relief. *Building Codes Illustrated* brings the code to life through its use of numerous illustrations accompanied with clear, concise, easy-to-understand text that spares the reader the normal legalese contained in regulatory documents. This updated guide continues its long tradition of serving as a key resource for those interested in not only understanding the code, but applying it as well.

Mark A. Johnson
Executive Vice President and Director of Business Development
International Code Council, Inc.

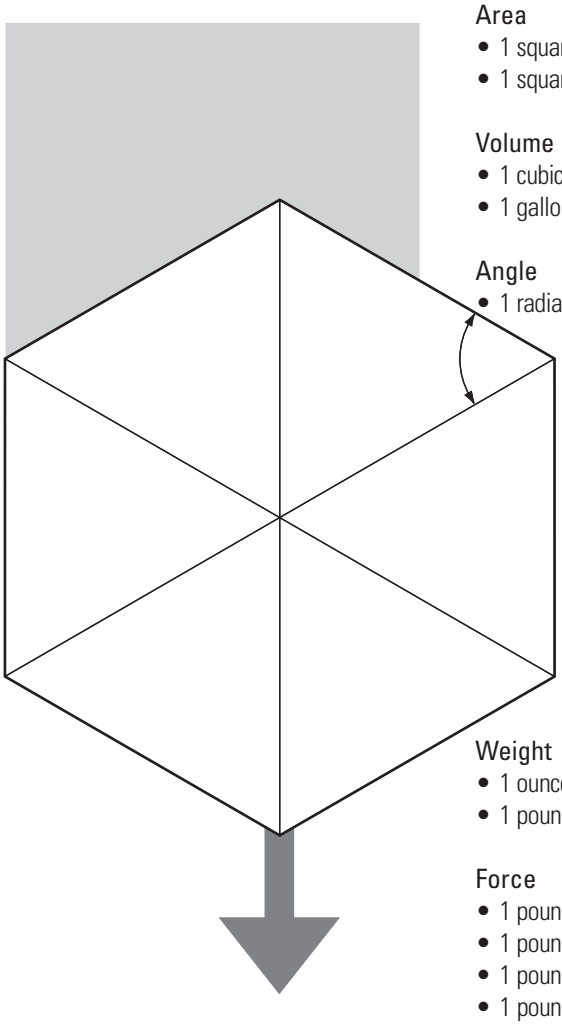



## Metric Equivalencies

The *2021 International Building Code*® uses the following SI units.

### Length

- 1 inch = 25.4 mm
- 1 foot = 304.8 mm
- All numbers in parentheses are millimeters unless otherwise noted.



### Area

- 1 square inch = 645.2 $mm^2$
- 1 square foot (sf) = 0.0929 $m^2$

### Volume

- 1 cubic foot (cf) = 0.028 $m^3$
- 1 gallon (gal) = 3.785 L

### Angle

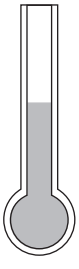
- 1 radian = 360/2 $\pi \approx 57.3°$; 1 degree = 0.01745 radian (rad)

### Weight

- 1 ounce = 28.35 g
- 1 pound = 0.454 kg = 0.004448 kN

### Force

- 1 pound per square inch (psi) = 6.9 kPa
- 1 pound per linear foot (plf) = 1.4882 kg/m = 0.01459 kN/m
- 1 pound per square foot (psf) = 4.882 $kg/m^2$ = 0.0479 $kN/m^2$ = 0.0479 kPa
- 1 pound per cubic foot (pcf) = 16.02 $kg/m^3$



### Light

- 1 foot-candle = 10.76 lux

### Speed

- 1 mile per hour (mph) = 0.44 m/s = 1.609 km/h

### Heat

- 1 British thermal unit (Btu) = 0.293 watts (w)
- °C = [(°F) – 32]/1.8

# 1
# Building Codes

The existence of building regulations goes back almost 4,000 years. The Babylonian Code of Hammurabi decreed the death penalty for a builder if a house he constructed collapsed and killed the owner. If the collapse killed the owner's son, then the son of the builder would be put to death; if goods were damaged, then the contractor would have to repay the owner, and so on. This precedent is worth keeping in mind as you contemplate the potential legal ramifications of your actions in designing and constructing a building in accordance with the code. The protection of the health, safety, and welfare of the public is the basis for licensure of design professionals and the reason that building regulations exist.

*"If a builder build a house for some one, and does not construct it properly, and the house which he built fall in and kill its owner, then that builder shall be put to death.*

*If it kill the son of the owner, the son of that builder shall be put to death.*

*If it kill a slave of the owner, then he shall pay slave for slave to the owner of the house.*

*If it ruin goods, he shall make compensation for all that has been ruined, and inasmuch as he did not construct properly this house which he built and it fell, he shall re-erect the house from his own means.*

*If a builder build a house for some one, even though he has not yet completed it; if then the walls seem toppling, the builder must make the walls solid from his own means."*

Laws 229–233
*Hammurabi's Code of Laws*
(ca. 1780 BC)

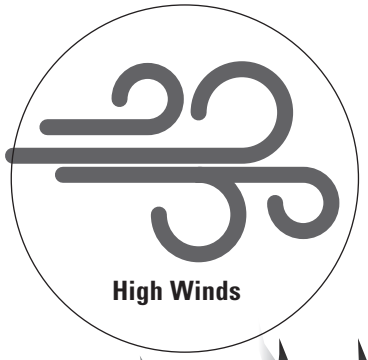
From a stone slab discovered in 1901 and preserved in the Louvre, Paris.

Various civilizations over the centuries have developed building codes. The origins of the codes we use today lie in the great fires that swept American cities regularly in the 1800s. Chicago developed a building code in 1875 to placate the National Board of Fire Underwriters, who threatened to cut off insurance for businesses after the fire of 1871. It is essential to keep the fire-based origins of the codes in mind when trying to understand the reasoning behind many code requirements.

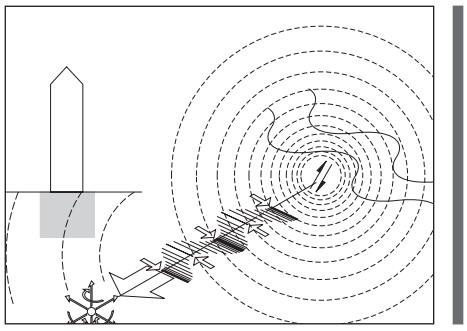
As the nation's population has increased, people have moved nearer to bodies of water, to regions subject to high winds, and into wooded areas on the edges of towns. Mitigating the impact of hazards such as floods, high winds, earthquakes, and wildland fires in populated areas, has increasingly been included in each new edition of the model codes. While fire safety is still a very large component in model codes, new model code documents now also include many provisions above and beyond the traditional fire-based requirements.

The often conflicting city codes were refined over the years and began to be brought together by regional nongovernmental organizations to develop so-called model codes. The first model codes were written from the point of view of insurance companies to reduce fire risks. Model codes are developed by private code groups for subsequent adoption by local and state government agencies as legally enforceable regulations. The first major model-code group was the Building Officials and Code Administrators (BOCA), founded in 1915 and located in Country Club Hills, Illinois. Next was the International Conference of Building Officials (ICBO), formed in 1922, located in Whittier, California. The first edition of their *Uniform Building Code* (UBC) was published in 1927. The Southern Building Code Congress (SBCCI), founded in 1940 and headquartered in Birmingham, Alabama, first published the *Southern Building Code* in 1946. The first BOCA *National Building Code* was published in 1950.

**Flooding**



**High Winds**



**Earthquakes**

**Fire**

These three model-code groups published the three different building codes previously in widespread use in the United States. These codes were developed by regional organizations of building officials, building materials experts, life safety experts, and design professionals to provide communities and governments with standard construction criteria for uniform application and enforcement. The ICBO *Uniform Building Code* was used primarily west of the Mississippi River and was the most widely applied of the model codes. The BOCA *National Building Code* was used primarily in the north-central and northeastern states. The SBCCI *Standard Building Code* was used primarily in the Southeast. The model-code groups merged in the late 1990s to form the International Code Council and BOCA, ICBO, and SBCCI ceased maintaining and publishing their "legacy" codes.

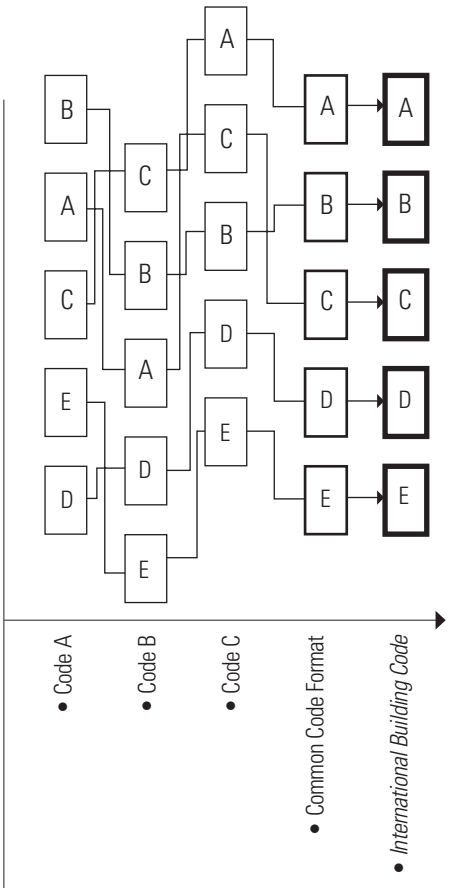
**The International Building Code**

The new ICC process was a real revolution in the development of model codes. There was recognition in the early 1990s that the nation would be best served by a comprehensive, coordinated national model building code developed through a general consensus of code writers. There was also recognition that it would take time to reconcile the differences between the existing codes. To begin the reconciliation process, the three model codes were reformatted into a common format. The International Code Council, made up of representatives from the three model-code groups, was formed in 1994 to develop a single model code using the information contained in the three current model codes. While detailed requirements still varied from code to code, the organization of each code became essentially the same during the mid-1990s. This allowed direct comparison of requirements in each code for similar design situations. Numerous drafts of the new *International Building Code* were reviewed by the model-code agencies along with code users. From that multiyear review grew the original edition of the *International Building Code* (IBC), first published in 2000. There is now a single national model code maintained by a group composed of representatives of the three prior model-code agencies, the International Code Council, headquartered in Washington, D.C. The three organizations accomplished many years ago a full merger of the three model-code groups into a single agency to update and maintain the IBC.

When working on existing buildings constructed under one of the "legacy" codes, research will be required to locate corresponding chapters and sections in the older codes, which will need to be rearranged to correlate with the current IBC.

Note that in addition to the *International Building Code*, most code users should also be familiar with two other "I" codes. The first is the *International Residential Code* (IRC). This code is meant to regulate construction of detached one- and two-family dwellings and townhouses that are not more than three stories in height. This code supplants residential requirements in the IBC in jurisdictions where it is adopted.

The second code is the *International Existing Building Code* (IEBC), which contains provisions for additions, alterations, and repairs to existing buildings as discussed further below.




Note also that most local jurisdictions make other modifications to the codes in use in their communities. For example, many jurisdictions make amendments to require fire sprinkler systems where they may be optional in the model codes. In such cases, mandatory sprinkler requirements may change the design trade-offs offered in the model code for inclusion of sprinklers where "not otherwise required" by the code. It is imperative that the designer determines what local adoptions and amendments have been made to be certain which codes apply to a specific project.

Many jurisdictions have not adopted the latest versions of the model codes. It is critical that designers familiarize themselves with the applicable edition of the model codes. All too often, practitioners assume that codes they have been using in one jurisdiction are the same as those in a new locale for their practice. That is often not the case and can lead to a lack of code compliance for some projects.

A major revision took place in the 2015 IBC. The provisions for existing buildings, contained in Chapter 34 of the previous code, were removed. Therefore the IBC applies only to new buildings. The provisions for existing buildings are now contained exclusively in the *International Existing Building Code* and refer back to the IBC or adopt similar requirements, but the two codes are now intended to be used separately. For the purposes of this book, assume that the requirements discussed are to apply to new buildings or to additions to new buildings unless noted otherwise. See Chapter 23 for a more detailed discussion on how to use the IBC and the IEBC together.

There are also specific federal requirements that must be considered in design and construction in addition to the locally adopted version of the model codes. Among these are the Americans with Disabilities Act of 1990 and the Federal Fair Housing Act of 1988.

**Americans with Disabilities Act**

The Americans with Disabilities Act (ADA) of 1990 is federal civil-rights legislation requiring that buildings be made accessible to persons with physical disabilities and certain defined mental disabilities. The original *ADA Accessibility Guidelines* (ADAAG) were administered by the Architectural and Transportation Barriers Compliance Board (ATBCB), and the regulations are administered by the US Department of Justice. Enforcement of the law is through legal actions brought by individuals or groups asserting violations of their rights of access, as civil rights. A new version of the ADA accessibility guidelines known as the *2010 ADA Standards for Accessible Design* (ADAS) went into effect on March 15, 2012. Designers can obtain copies of the new guidelines from the Access Board at www.access-board.gov/ada.

It is critical for designers to understand that unless adopted as the access regulations for a jurisdiction or state, the ADA is not subject to interpretation by local building officials; it is enforced by legal action, through the courts. Access is to be provided for all disabilities, not just for people with mobility impairments. These include hearing, vision, speech, and cognitive impairments, as well as persons of short stature and with limited mobility not necessarily requiring the use of a wheelchair. The ADA applies to all new construction. The ADA also requires that barriers to access be removed from existing buildings where such work is readily achievable. The definition of readily achievable is an economic one and should be addressed by the building owner, not by the building architect.

The ADA is one of the few building regulations—in this case a law, not a code—that requires retrofitting of projects apart from upgrading facilities during remodeling or renovation. Most codes apply to existing buildings only when renovation is undertaken. Under the ADA, those access improvements that are readily achievable should be undertaken by the owner, whether or not any other remodeling work is to be done. The ***owner***, not the architect, must make this determination.

As the ADA is not enforced by local building officials, we will concentrate here only on those accessibility codes that are enforced locally and subject to review and interpretation as part of the permit process. Designers must first concentrate on complying with codes and standards adopted locally but must also keep national statutory requirements such as the ADA in mind. It is prudent to review design work against the 2010 ADAS at the same time as the model-code review. It is often a judgment call as to which is the most stringent requirement where requirements between codes and legislation differ. In these situations, it is essential and prudent to make the client aware of these discrepancies and have them actively participate in any decisions as to which part of which requirements will govern the design of project components.

Space requirements for accessibility are related to ergonomics. Bigger is not automatically better. The 16"–18" (406–457) required range between the centerline of a water closet to a side wall or partition with grab bars, is based on reach ranges and leverage for movement using one's arms. A longer reach reduces leverage and thus may be worse than too little space.

**Federal Fair Housing Act**

The Federal Fair Housing Act (FFHA) of 1988 includes Department of Housing and Urban Development (HUD) regulations requiring all residential complexes of four or more dwelling units constructed after March 13, 1991, to be adaptable for use by persons with disabilities. For example, residential complexes must provide access to all units on the ground floor, and all units must be accessible from grade by a ramp or elevator. Many state housing codes also incorporate these requirements. A very good reference for the FFHA is the *Fair Housing Act Design Manual*, which can be obtained free of charge at https://www.huduser.gov/portal/publications/PDF/FAIRHOUSING/fairfull.pdf.


### State Building Codes

Each state has a separate and distinct code adoption process. In the past, many states adopted one of the three previous model codes, and some states even had their own building codes. The geographic areas for state model-code adoptions corresponded roughly to the areas of influence of the three previous model codes. The BOCA *National Building Code* predominated in the northeastern United States. The *Southern Building Code* was adopted throughout the southeastern United States. The *Uniform Building Code* was adopted in most states west of the Mississippi River. Many states allowed local adoption of codes so that in some states, such as Texas, adjacent jurisdictions in the same state had different building codes based on different model codes. Now, the advent of the International Codes has altered this landscape drastically. The "I Codes" are now the basic model codes in essentially every state. However, be aware that most state processes still allow amendments to the IBC, which means that there will likely be state-adopted amendments to the IBC. Make certain you know what code you are working with at the permitting level. Also, as noted, in states or localities that adopt a model code, be sure to verify which edition of the model code has been adopted.


### Local Building Codes

Many localities adopt the model-code documents with little modification except for the administrative chapters that relate to local operations of the building department. Larger cities, such as Los Angeles, New York City, Chicago, and San Francisco, typically adopt much more sweeping revisions to the model codes. The codes for such cities often bear little resemblance to the underlying model codes and in some cases have no basis in them at all. Interpretations, even of the unaltered model code made by big-city building departments, often tend to be very idiosyncratic and nonuniform when compared to smaller jurisdictions that use less modified versions of the model codes. The adoption of the IBC at the state level has generated a review of big-city building codes so that these city codes are moving toward greater conformity with the model codes. For example, San Francisco and Los Angeles previously used a UBC-based state code, which has now been converted to an IBC-based, locally modified state code. This will require a careful analysis of the city-code amendments to ensure conformance with the new model code. This redevelopment of codes has also been occurring in other large cities, such as Dallas and New York, as their states adopt the IBC. Be aware of local modifications and be prepared for varying interpretations of the same code sections among various jurisdictions. Do not proceed too far in the design process based on review of similar designs in another jurisdiction without verifying the code interpretation in the jurisdiction where the project is located. Similarly, although this book offers opinions of what code sections mean, all such opinions are subject to interpretation by local authorities as codes are applied to specific projects.

## OTHER CODES AND STANDARDS

Codes and standards are related, but serve different purposes. A building code (e.g., the *International Building Code*) establishes a jurisdictional "floor" relative to occupants' health, safety, and welfare. A building standard (e.g., NFPA 13, which addresses fire sprinkler requirements) is a "standard practice" often referred to within the codes. In short, a *code* is what you must do (sprinklers, yes or no, per which standard); a *standard* is a guide on how you do it (sprinkler head flow rates, spacing, etc.). There are thus a number of other codes and standards that the designer must be familiar with. They are mentioned here in brief to remind users of the *International Building Code* that other documents must also be consulted during project design.

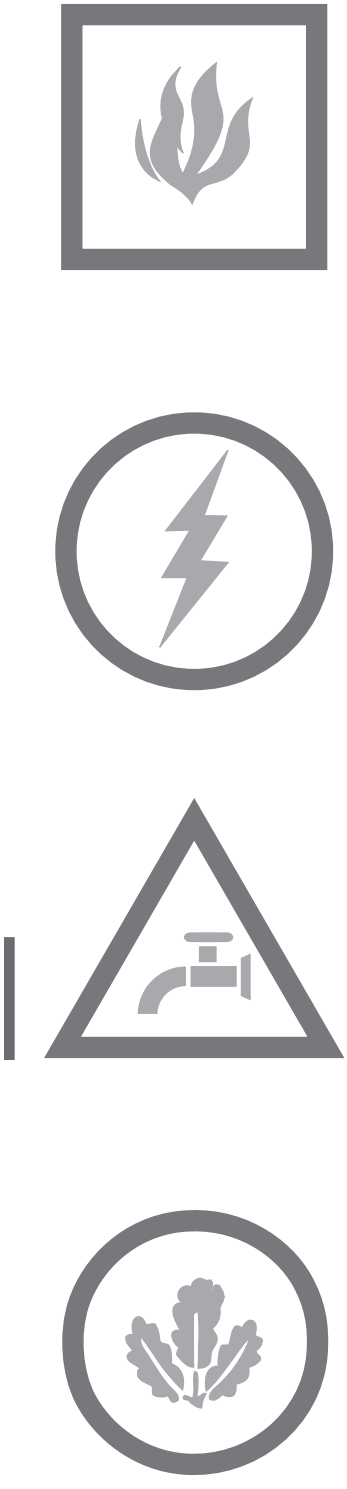
While building code and accessibility regulations are usually the focus of interest for architectural and structural work, you need to be aware of the existence of other separate codes and standards for such work as electrical, plumbing, mechanical, fire sprinklers, and fire alarms. Each of these may impact the work of design consultants and in turn the work of the architect. Detailed consideration of the requirements in these other codes is beyond the scope of this book.

Among other specialized codes is the *Life Safety Code* (NFPA-101) published by the National Fire Protection Association. This code serves as a basis for the egress provisions in the other model codes. Designers may encounter NFPA-101 when doing federal and hospital work. The NFPA also publishes various other standards that are adopted to accompany the model codes. Primary examples are NFPA-13: Standard for the Installation of Sprinkler Systems, and NFPA-70, which is the National Electrical Code.

The National Fire Protection Association has developed a model building code, NFPA 5000, to rival the *International Building Code*. The development of this code is meant to offer an alternative to the "I" codes. The NFPA 5000 has, to date, been adopted in only a few jurisdictions. Some jurisdictions may move to adopt either the International Code family or the NFPA family of codes, or even portions of each. This is yet another reason for designers to verify in detail what model code documents are adopted by the Authorities Having Jurisdiction (AHJ)—a catch-all phrase for all planning, zoning, fire, and building officials having something to say about building—where a project is located.

Fire codes are typically considered maintenance codes. They are intended to provide for public health and safety in the day-to-day operation of a structure. They are also meant to assure that building life-safety systems remain operational in case of emergency. The various model-code agencies have developed model fire codes for these purposes. They are developed with primary input from the fire services and less input from design professionals. Note, however, that fire codes can have an impact on building design. They contain requirements for such elements as fire-truck access, locations and spacing of fire extinguishers, as well as requirements for sprinklers and wet or dry standpipes. The fire code also may contain requirements for added fire protection related to the ease or difficulty of fire equipment access to structures.

Plumbing codes often dictate the number of plumbing fixtures required in various occupancies. Some codes place this information in the building code, some in the plumbing code, and some in appendices that allow local determination of where these requirements may occur in the codes. The designer must determine which course of legal adoption the local authority has chosen. The determination of the required number of plumbing fixtures is an important design consideration. It is essential to use the adopted tables and not automatically assume those in the model building code apply. A discussion of the use of the fixture counts found in Chapter 29 of the 2021 IBC are found in Chapter 20 of this book.



### Code Interactions

The AHJ may not always inform the designer of overlapping jurisdictions or duplication of regulations. Fire departments often do not thoroughly check plan drawings at the time building permit documents are reviewed by the building department. Fire-department plan review deficiencies are often discovered at the time of field inspections by fire officials, usually at a time when additional cost and time is required to fix these deficiencies. The costs of tearing out noncomplying work and replacing it may be considered a designer's error. Whenever starting a project, it is therefore incumbent upon the designer to determine exactly which codes and standards are to be enforced for the project and by which agency. It is also imperative to obtain copies of any revisions or modifications made to model codes by local or state agencies. This must be assured for all AHJs.

The model codes have no force of law unto themselves. Only after adoption by a governmental agency are they enforceable under the police powers of the state. Enforcement powers are delegated by statute to officials in various levels of government. Designers must verify local amendments to model codes to be certain which code provisions apply to specific projects.

There are many different codes that may apply to various aspects of construction projects. Typically, the first question to be asked is whether the project requires a permit. Certain projects, such as interior work for movable furniture or finishes, are usually exempt. Carpeting may be replaced and walls painted without a permit, but moving walls, relocating doors, or doing plumbing and electrical work will require a permit in most jurisdictions.

Traditionally, codes have been written with new construction in mind. In recent years more and more provisions have been made applicable to alteration, repair, and renovation of existing facilities. One of the emerging trends in code development is the creation of an *International Existing Building Code*. The relocation of IBC Chapter 34, which dealt with existing building provisions, into the IEBC has greatly increased the need to refer to this code for many projects. The reuse of existing buildings is also of concern for accessibility issues. One of the most crucial aspects of remodeling work is to determine to what extent and in what specific parts of your project do the building codes and access regulations apply. Most codes are not retroactive. They do not require remedial work apart from remodeling or renovation of a building. Providing access to spaces like toilets serving altered areas may require work outside of the area of alteration.

A notable exception to this is the ADA, which requires that renovation be undertaken to provide access for persons with disabilities if access can be readily provided. However, this is a civil-rights law and not a code. As such, it is not enforced by building officials. In existing buildings it is critical for the designer to determine with the AHJ what the boundaries of the project are to be and to make certain that the AHJ, the designer, and the client understand and agree on the requirements for remedial work to be undertaken in the project area.

**Rating Systems**

There are also rating systems, the most well known and widespread of which is the *Leadership in Energy and Environmental Design*, or LEED program, developed by the US Green Building Council (USGBC). LEED is not intended to be a code, although some jurisdictions have adopted LEED criteria as code language. Typically, a rating system is a voluntary program based on options selected by the owner and the design team rather than being a set of requirements. Rating systems serve as an ever-being-raised "ceiling" for practice.

**Standard of Care**

The designer should always remember that codes are legally and ethically considered to be minimum criteria that must be met by the design and construction community. The protection of health, safety, and welfare is the goal of these minimum standards. It is important to also understand that registered design professionals will be held by legal and ethical precedents to a much higher standard than the code minimum.

The so-called "standard of care" is a legal term defining the level of quality of service that a practitioner is expected to meet. This is higher than the minimum standard defined by the code. The code is the level that a practitioner must never go below. Because professional work involves judgment, perfection is not expected of a design professional. The standard of care is defined for an individual designer as being those actions that any other well-informed practitioner would have taken given the same level of knowledge in the same situation. It is a relative measure, not an absolute one.

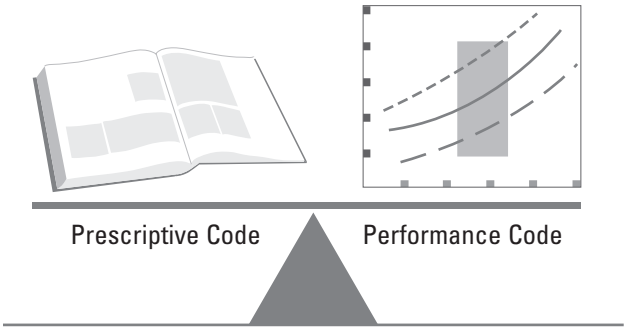
**Life Safety vs. Property Protection**

The basis for building-code development is to safeguard the health, safety, and welfare of the public. The first and foremost goal of building codes is the protection of human life from the failure of life safety provisions in a building, or from structural collapse. But there is also a strong component of property protection contained in code requirements. Sprinkler provisions can serve both purposes. When buildings are occupied, sprinklers can contain or extinguish a fire, allowing the building occupants to escape. The same sprinkler system can protect an unoccupied structure from loss if a fire occurs when the structure is not occupied.

While many systems may perform both life safety and property protection functions, it is essential that code developers keep the issue of life safety versus property protection in mind. For example, security measures to prevent intrusion into a structure may become hazards to life safety. A prime example of this is burglar bars on the exterior of ground-floor windows that can trap inhabitants of the building in an emergency if there is not an interior release to allow occupants to escape while still maintaining the desired security. In no case should property-protection considerations have primacy over life safety.

## THE FUTURE FOR CODE DEVELOPMENT

The *International Building Code* is a living document. It is subject to regular review and comment cycles. A new code is published at regular intervals, usually every three years. This publication cycle gives some measure of certainty for building designers that the code will remain unchanged during the design-and-construction process. The code responds to new information, growing by accretion and adaptation. Since the three model-code agencies merged into one organization, detailed changes in the code-development process have evolved and have been refined. We will give only a general description of the code-development process. For a detailed description of the current code development process, see the ICC website.




Any person may propose a code revision. Any designer, material supplier, code official, or interested member of the public who feels they have a better way to describe code requirements or to accommodate new life-safety developments or new technology may prepare revised code language for consideration. Proposed code changes are published for review by all interested parties. They are then categorized based on what section of the code is being revised and assigned to a committee of people experienced in those matters for review and consideration. Committees are typically organized around specific issues, such as means of egress, fire safety, structural requirements, and so forth. Anyone may testify at these committee hearings regarding the merits or demerits of the code change. The committee then votes to make its recommendation to the Public Comment Hearings, which are held in conjunction with the annual business meeting. At the Final Action Hearing, testimony will be heard from all interested parties, both from non-voting industry representatives and building officials who will be able to vote on the proposed changes. After testimony is heard, only the government members of the organization, typically public employees serving as building and fire officials, are allowed to vote on the proposed changes. This is described as the "governmental consensus process" by the ICC. The ICC Code Development Process is conducted using state of the art cloud-based cdpACCESS. For details of code development process go to https://www.iccsafe.org/wp-content/uploads/ICC-CDP-How-It-Works.pdf. For information on cdpACCESS go to https://www.iccsafe.org/cdpaccess/.

### Performance vs. Prescriptive Codes

There is now an ICC *International Performance Code*. It presents regulations based on desired outcomes rather than prescriptions. It encourages new design methods by allowing a broader parameter for meeting the intent of the International Codes. Where adopted locally it may be used in place of the regular IBC provisions. We will discuss briefly the distinctions between prescriptive and performance codes.

The *International Building Code*, as were the codes that preceded it, is predominately prescriptive in nature, but it does have some performance-based criteria as well. It is developed to mitigate concerns by creating mostly specific and prescribed responses to problems that have been identified. Designers identify the problem to be addressed, such as the height of guardrails, and then they look up the prescribed response in the applicable code section. For example, guardrail heights are prescribed to be 42" (1067) high and are required when adjacent changes in grade exceed 30" (762). The designer follows the prescribed requirements to avoid the problem the code has identified—that is, preventing falls over an edge higher than 30" (762). The code provides a defined solution to an identified problem.

Performance codes, such as the ICC *International Performance Code*, define the problem and allow the designer to devise the solution. The word *performance* in this context refers to the problem definition and to the setting of parameters for deciding if the proposed solution solves the problem adequately. These standards define the problem, but do not define, describe, or predetermine the solution.

The use of performance codes has been increasing in the past few years, due in large part to the development of new modeling techniques for predicting how a building will react under certain fire, earthquake, or other stimuli. Performance codes are used in many countries around the world. Their requirements may be as broad as "the building shall allow all of its prospective occupants to safely leave the building in the event of a fire." Most performance codes in reality have much more tightly defined requirements, but the egress requirement stated above is a good example of the essence of what performance-code requirements can be.

The basic form of modern performance-code language can be described as objective-based. Each code requirement is broken into three sections. We will use fall prevention as our example. Note that provision of guardrails is only one example of many solutions to the performance objective, not the only solution.

- Objective: What is to be accomplished? In this case, the prevention of falls from heights of more than 30" (762).

- Functional Statement: Why do we want to accomplish this? We wish to safeguard building occupants by preventing them from accidentally falling from a height great enough to result in an injury.

- Performance Requirement: How is this to be accomplished? Performance codes could become prescriptive at this juncture, mandating a guardrail. More likely, such a performance standard would require that the barrier be high enough, strong enough, and continuous enough to prevent falls under the objective circumstances. Note that a guardrail meeting current code standards would be deemed to satisfy those requirements, but alternate means and methods could also achieve the same ends. For example, landscaping could prevent access to the grade change, or innovative railing substitutes could be designed to function like automobile air bags to catch falling persons without having a visible rail present in most conditions. Let your imagination provide other alternatives.

Performance codes give designers more freedom to comply with the stated goals. They also require the designer to take on more responsibility for knowing the consequences of their design actions. We anticipate that performance codes will be used in limited ways for innovative projects, but that most typical, repetitive designs will continue to use prescriptive codes for speed, clarity, and assurance of compliance during design review. Also, given the legal climate, designers are often reluctant to take on the responsibility for long-term code compliance for innovative systems.

**Alternate Means and Methods**

There is a pathway for innovation and new methods built into the IBC. The use of this process is known generically as an Alternate Means and Methods Request, typically referred to as an AMMR. The code sets out the criteria for AMMRs in § 104.11 of Chapter 1. The basis of the application of these provisions have three key components.

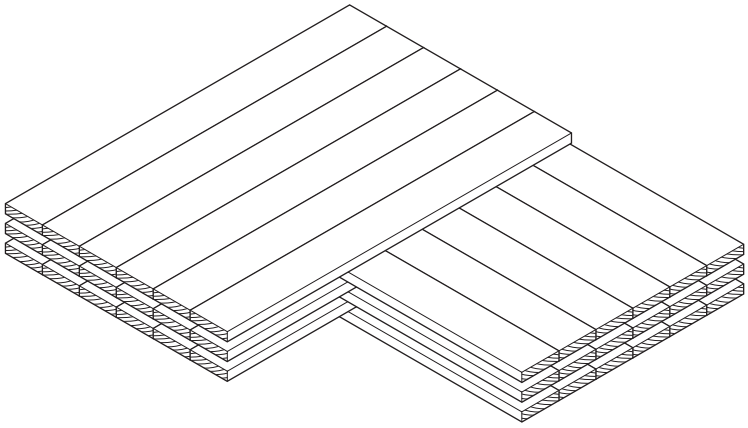
1. The code recognizes that the "intent" of the code language as written may not keep up with construction material innovations and that new methods and materials will be approved where compliance with the performance of an innovative measure can be demonstrated.

2. Key to this process is understanding that the final approval comes from the Authority Having Jurisdiction (AHJ) after the proponent of the alternative demonstrates that the alternative meets specific criteria:

3.1 The alternative complies with the intent of the provisions of this code.
3.2 The alternative is equal to the basic code for each of the following:

3.2.1. Quality
3.2.2. Strength
3.2.3. Effectiveness
3.2.4. Fire resistance
3.2.5. Durability
3.2.6. Safety

Demonstration of compliance is to be based on backup materials, such as research reports or test reports. Each jurisdiction typically has a form for AMMRs noting the necessary criteria for acceptance. The forms also provide a medium for recording the findings of acceptance of AMMRs in the permit files for each project. It is essential to the success of getting an AMMR approved to engage the AHJ early in the process to determine what backup materials or test data will be required. On the following page is an example form showing the typical range of information that will be required for this process.



A frequent recent AMMR example has been obtaining fire-rating approvals for cross laminated timber construction. The 2021 code has now caught up with this innovation and AMMRs will be less likely to be needed under the 2021 IBC for this type of construction.

**Request for Alternate Design Materials & Methods of Construction**

**1. Project Information**

| | | |
|---|---|---|
| Name of Facility: | AHJ File#: | |
| Project Scope: | AHJ App.#: | |
| School District: | Increment # *(if applicable).* | |
| School District Mailing Address: | | |
| City: | State: | Zip Code: |

**2. Contact Information**

| | |
|---|---|
| A. Facilities Director: | |
| Work Email: | Work Phone: |
| B. Firm Architect/Engineer: | |
| Work Email: | Work Phone: |
| C. Architect/Engineer of Record | |
| Work Email: | Work Phone: |

**3. Type of Review Requested**

☐ Structural ☐ Fire & Life Safety

**4. Purpose of Review Request**

☐ Use of Alternate Materials ☐ Propose Alternate Design ☐ Alternate Method of Construction

Applicable Code(s) and Edition:

Applicable Code Section(s):

**5. Description of Condition** *(Add additional pages if necessary.)*

*Description of Proposed Alternate*

**Request for Alternate Design Materials & Methods of Construction**

**6. Description of Requested Alternate** *(Describe the equivalency for each of the following criteria listed in IBC § 104.11. Indicate NA when not applicable.)*

| | |
|---|---|
| 2.1 Quality. | |
| 2.2 Strength. | |
| 2.3 Effectiveness. | |
| 2.4 Fire resistance. | |
| 2.5 Durability. | |
| 2.6 Safety. | |

**Identification of Supporting Documentation** *(List all; attach copies of data.)*

*List of supporting tests, research, and other documentation.*

*For AHJ Use Only*

| Discipline | Reviewer | Return Date | Accepted Date | Rejected Date |
|---|---|---|---|---|
| SS | | | | |
| FLS | | | | |
| ACS | | | | |

**AHJ Special Conditions or Restrictions:**

**Notes:** *(Add comments or rationale relating to above.)*

*Purpose of the form is to request validation of the request and provide for filing of disposition of the AMMR.*

- *This is an example of an AMMR form showing the typical range of information that will be required for demonstrating compliance with the intent of the provisions of the code, based on such backup materials as research reports or test reports.*

# 2

# Navigating the Code

The key word to remember about how all building codes are developed and how they all work is *intent*. As we noted in the Preface, code sections have individual authors who had some problem in mind when they wrote a code-change proposal. The intent of the author of a building-code section is to solve a specific design problem with prescriptive language. Designers are usually trying to measure visual and spatial expressions against the language of the code. During this process, the designer should ask what problem or performance criteria the code section is addressing. The language will start to make more sense as one tries to go beyond the specific language to determine why the words say what they say.

Designers also have intent. They are trying to achieve certain functional or formal goals in the design of the building. Designers should measure their own intent for the design against their interpretations of the intent of the code. When examined together, the intent of the code and that of the design solution should be concurrent.

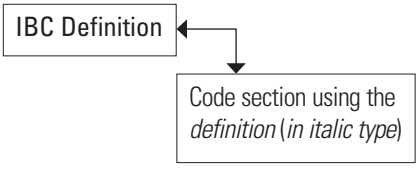
Do not try and ignore the code. Do not try and obfuscate code issues to achieve approvals. The responsibility for understanding, applying, and fulfilling the requirements of the code always rests with the design professional. Approvals by the AHJ do not relieve the designer of social and licensing responsibilities to maintain the health, safety, and welfare of society.

Each section of the code was developed to solve a certain problem. Code sections are typically written in relatively short paragraphs. Sections are organized into chapters based on common themes, but sections may be developed in isolation from one another with little attention to continuity of the entire document. As you look at the code, try and visualize the intent of the writer of that section and try to understand the problem they were addressing. Code language usually arises from a specific issue the code writer wishes to address based on experience or on an actual construction or life safety issue. The writer then makes the requirements general so that they will apply to more typical conditions than the specific instance that generated the concern.

The intent of the code is a crucial idea to understand. *Why* is a much more important question than *what* when you are puzzled by the actual language of a code passage. The code is a general document that must then be interpreted for its specific application to a specific project. If you know the code in general and think about its intent, you will be in a better position to formulate your own interpretation of code sections as they apply to your specific project. You will thus be in a position to help building officials see the validity of your opinion when interpretation of the code is required for a specific design condition. Confidence will come with experience in use of the code. Learning the code is vital to your success as a well-rounded designer.

The application of the code requires interpretation on the part of designers and the Authorities Having Jurisdiction [AHJ]. The individual's view of intent can lead to alternative interpretations of code compliance. One of the goals of resolving an unfavorable code interpretation is to convince the AHJ that the proposed design meets the intent of the writer of the code section in question and thus complies with the code.

Note that in the 2021 IBC certain terms are in *italic type*. These italicized terms appear in the definitions in Chapter 2. Where terms are used in ways intended by their definitions, they are italicized in the body of the code. Italicized type is not used in this book in the same way. The code publisher's intent for this notification method is to highlight for the code user that the code's definitions should be read carefully to facilitate better understanding of how they are used in the context where they appear in italics. It is critical that the code user go back to the code definitions when attempting to understand the literal and figurative meaning of code requirements. When attempting to interpret a code section, be sure to examine the code definitions for the terms used in the code section. Do not assume that the meanings of terms are the same as in everyday speech, especially for *italicized* text.




While definitions occur in the IBC in Chapter 2, this book discusses definitions in context with where the defined items are used in the technical requirements in the code. We believe this makes the analysis in this book easier to follow. Defined terms from the IBC are noted in [*bracketed italic type*]. Thus defined terms will be found throughout the various chapters of this book.

**intent**
**+**
**interpretation**
**=** • intent
• **intent**
• intent

Editions of the code prior to 2018 listed definitions to be found in Chapter 2. The 2018 and later editions have deleted those references, completing the move of definitions wholly to Chapter 2.

Learn the table of contents and use the index. It is very useful to get the code in electronic form for use in your practice. This allows keyword searches. Don't try and memorize passages of the code, because these may change or move around inside the code over time as the code is amended. Learn the organization of the code and learn where to find things that way. Use the index if the table of contents doesn't get you where you want to be. Think of synonyms for the topic you are researching to facilitate keyword or index searches. You may have to scan large portions of the index to locate potential items. Try to remember associations of ideas, not specific language, to facilitate your use of the code.

In the code, solid vertical lines [ ▌ ] in the margins indicate a text change from the 2018 code edition. There will be an arrow in the margin [—>] indicating a deletion in the section. A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code.

You should probably own a personal printed copy of the model code, and an electronic copy as well. Remember that the model code is often amended during adoption by local agencies. Be certain to find out what local code amendments to the code apply to your specific project. Also determine if the local AHJ has published written opinions regarding their interpretation of the code in their jurisdiction.

### Alternative Means and Methods

§ 104.11 states that the provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. While written around prescriptive descriptions of tested assemblies and rated construction, the code recognizes that there may be many different ways of solving the same design problems. It recognizes that there will be innovations in building types, such as covered malls, mixed-use buildings, and atrium buildings that do not fit neatly into prescribed occupancy classifications. The code also recognizes that there will be innovations in materials and construction technology that may happen faster than code revisions are made. Thus, the code sets up a method for the building official to approve proposed alternative designs. Deviations from prescribed standards must be submitted for review and approval of the building official. The criteria they are to use are spelled out in the code.

§ 104.11 has been reorganized in the 2021 IBC and the criteria for acceptance laid out more clearly. The section now summarizes the acceptance criteria as follows. We have highlighted them in **bold** type:

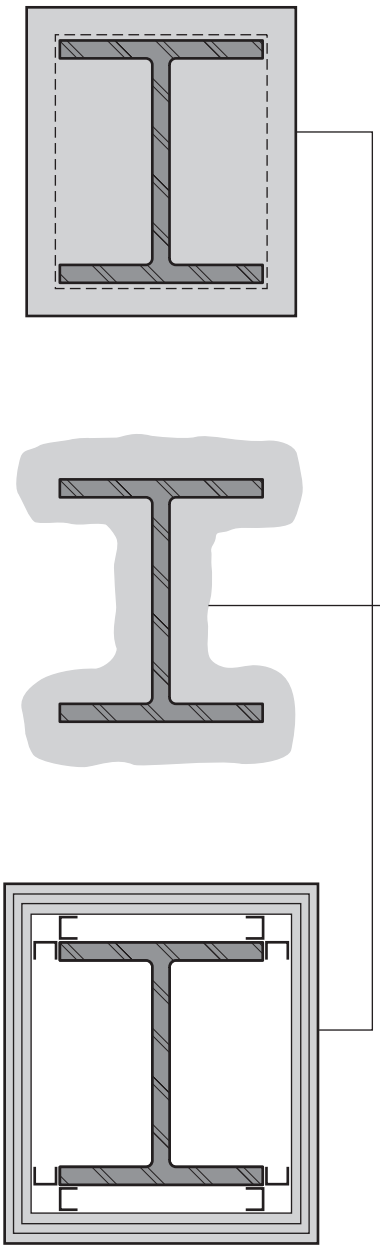
"An alternative material, design or method of construction shall be approved where the building official finds that the proposed alternative meets all of the following:

1. The alternative material, design, or method of construction is satisfactory and complies with the intent of the provisions of this code.

2. The material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code as it pertains to the following:

**2.1. Quality**
**2.2. Strength**
**2.3. Effectiveness**
**2.4. Fire resistance**
**2.5. Durability**
**2.6. Safety**"

The list of words above are also the fundamental criteria for why each and every code section is included in the basic code.



*Concrete, spray-on fireproofing, or gypsum board provide alternate means of fireproofing a structural steel member.*

### Evaluation of Innovative Products

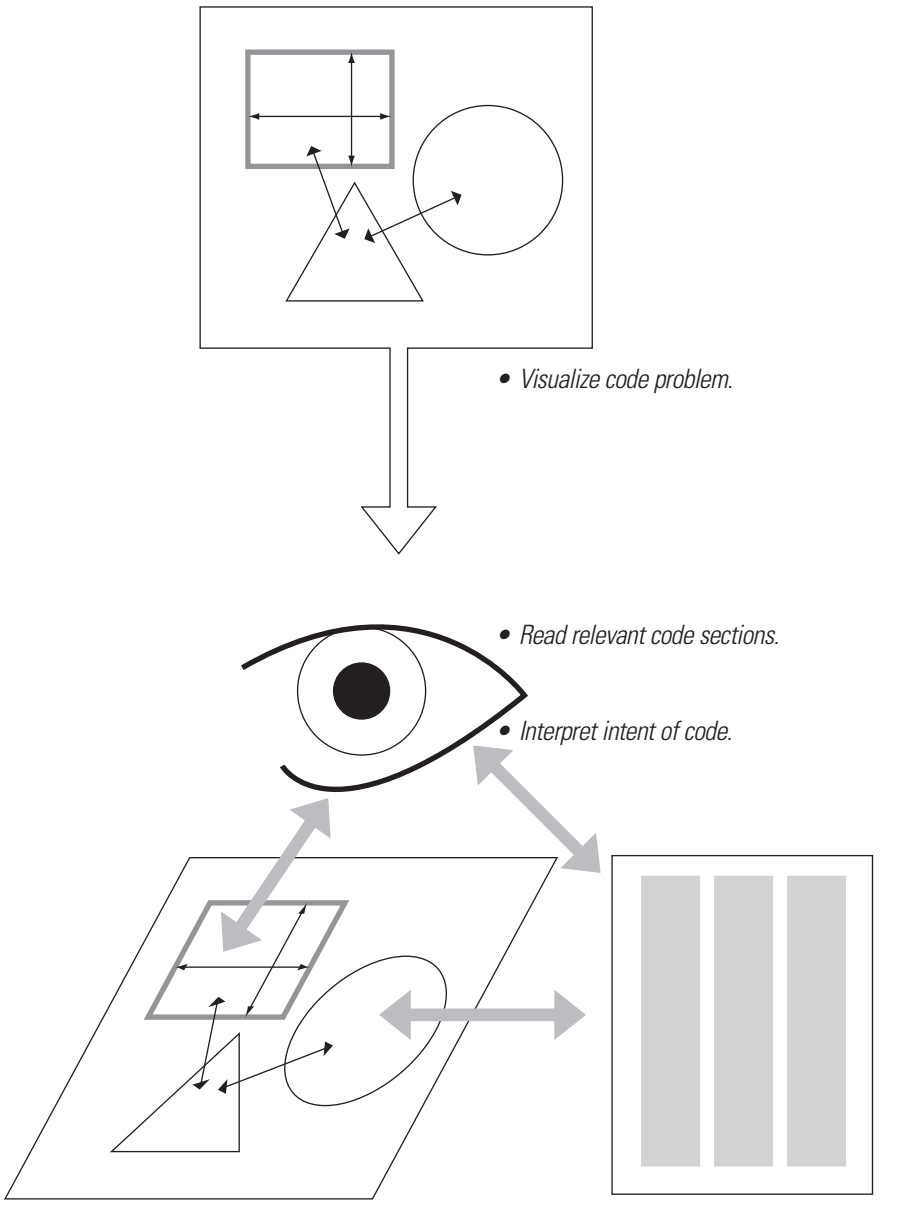
Innovations in construction materials and methods need to be evaluated for code compliance. Testing agencies often perform standardized tests on new products. These tests and data about the product must then be evaluated for code compliance. One popular way of demonstrating compliance to the AHJ for products or construction methods is through the use of ICC Evaluation Service reports.

ICC-ES is a nonprofit, limited liability company that does technical evaluations of building products, components, methods, and materials. Reports are prepared at the request of companies wishing their products to be evaluated by ICC-ES. Supporting data, such as product information and test reports, is reviewed by the ICC-ES technical staff for code compliance. The evaluation process culminates with the issuance of a report on code compliance. The reports are public documents, readily available on the internet. They may be used by designers in determining whether an innovative or unusual construction material or process is code-compliant. The designer may then use the ICC-ES report to demonstrate code compliance by submitting it for review by the AHJ.

### Code Interpretations

Designers and code officials approach interpretations from quite different perspectives. The designer is trying to make a functional or formal design code compliant while satisfying project requirements in an aesthetic, economical, and practical way. The AHJ examines completed drawings for compliance with code requirements. While the AHJ is aware of the practical requirements contained in the building design, they are charged first and foremost with protecting the health, safety, and welfare of the public by verifying code compliance. It is the responsibility of the designer to demonstrate code compliance and to modify noncompliant areas identified during plan review by the AHJ while continuing to meet the project requirements.

Both the designer and the AHJ are working to apply generalized code provisions to a specific project. It is differences in opinion about the application of the general to the specific that most often give rise to differences in interpretation. Code officials also see many more similar examples of the relationship of code sections to various designs. Thus, they may generalize interpretations from one project to another even though the projects may be different in significant ways. On the other hand, designers may find that similar designs receive quite different interpretations by the AHJ in different jurisdictions. When differences of opinion about interpretation occur, the designer must work with the AHJ to reconcile the intent of the design to the interpretations of the intent of the code. If reconciliation cannot be reached, the designer must decide whether to revise the project to obtain approval or appeal the ruling of the AHJ to some civic body prescribed in the jurisdiction for hearing appeals. Also, the AHJ can be requested to apply to the model-code agency that published the code for a ruling as to the publisher's opinion of the intent of the code section in question. Such appeals to the ICC are allowed to be made by any ICC member. It is thus prudent for design professionals to be ICC members to be able to access this service. In addition, members receive discounts on ICC codes and have access to other interpretive and educational materials. Members may also participate in the code development process and gain deeper insights into code interpretations.



**Documenting Code Interpretations**

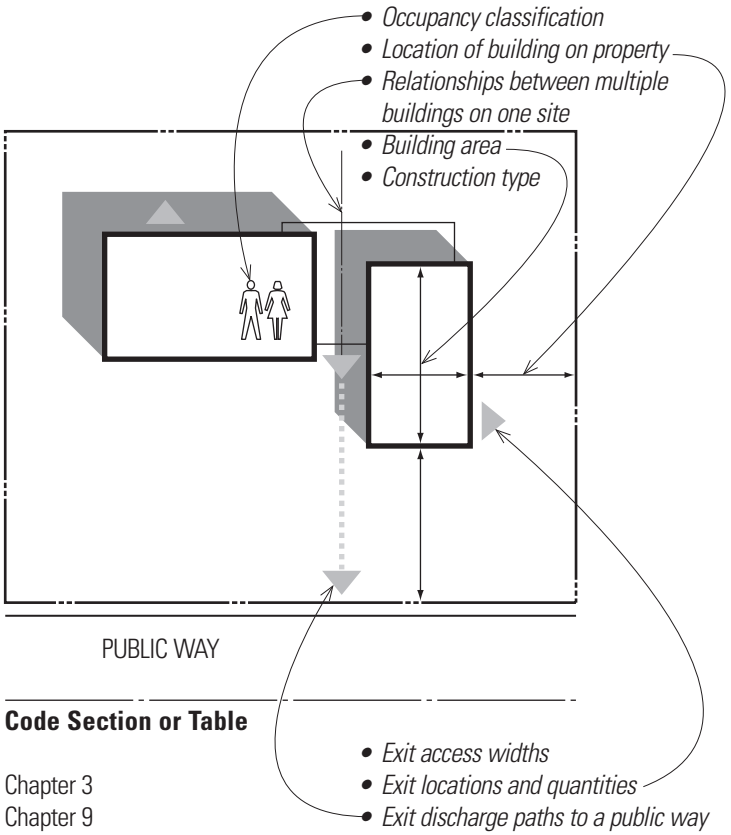
Every project should receive a detailed code analysis that is recorded as a permanent part of the permit documents. All code interpretations and citations should have a reference to the code section in question to allow retracing steps in the code analysis. Without a code section citation it is very difficult to have a productive discussion about interpretations. Recording citations focuses code issues for the designer during the design process and facilitates plan reviews by the AHJ. At the start of every code analysis, research should be undertaken to determine what, if any, local code amendments are applicable to a project.

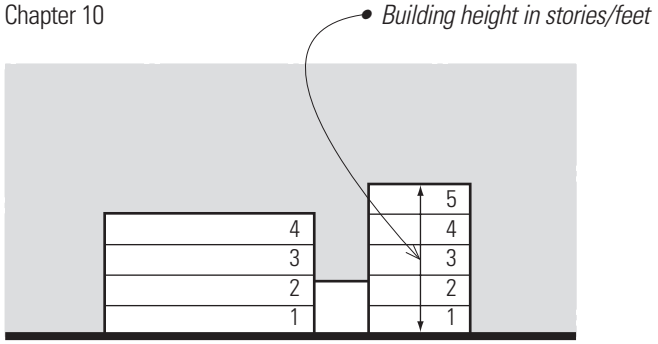
At minimum the analysis should contain the following items. We recommend the following format to unify code analysis for all projects. The code section citations used should be specific for the project and sections, not as limited as in our example.

| Proposed Condition | Allowed per Code | Code Section or Table |
|---|---|---|
| Occupancy Classification | Select from Chapter 3 | Chapter 3 |
| Fire Protection (active) | Select per occupancy | Chapter 9 |
| Building Height (feet/stories) | Allowed per proposed type | Tables 504.3 and 504.4 |
| Building Area | Select per construction type | Table 506.2, as adjusted |
| Type of Construction | Determine from design | Chapters 5, 6, 7 |
| Means of Egress | Select per occupancy | Chapter 10 |

A site plan and floor plan should be included that describe the location of the building on the property and any height, area, or construction-type credits or requirements related to location on the site and proximity to streets and other structures. The floor plan should also detail egress requirements, such as exit access widths, exit quantities and locations, and exit discharge paths to the public way. A recommended code room tag is shown below.

| | |
|---|---|
| #### | Room Number |
| Room Name | Assigned Room Use |
| Occupancy Group | Per IBC Chapter 3 |
| Area—SF | "Gross" or "Net" per IBC Chapter 2 |
| Occ. Load Factor | Per IBC Table 1004.5 |
| # of Occupants | Area/OLF |
| Door Width | Width of required door(s) at least 32" (813) clear. |




For the designer, many elements required to determine how the code should apply to a project are a given from the program and the site or zoning constraints:

- Occupancy classification—the client determines what functions they want.
- Location of building on property—determined by the building footprint, zoning, natural features, etc.
- Building height and area—given the scope of the project, the designer will note how large the building needs to be and how many floors will be required.

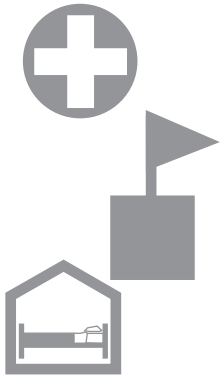
With these pieces of information, it is possible to determine how the code prescribes the minimum for:

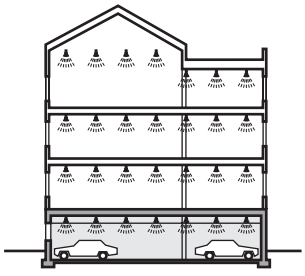
- Construction type—determined by calculation.
- Exit locations and quantities.
- Exit access widths.
- Exit discharge to a public way.

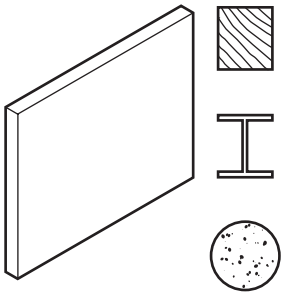
## USING THE CODE

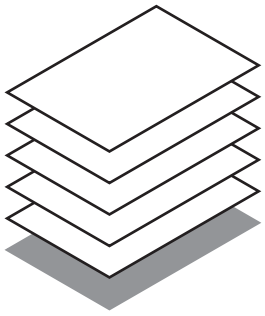
The following procedure is recommended as being helpful in using the *International Building Code* and any applicable local jurisdiction code amendments. Note that most of the major issues are interactive and that iteration of relationships will almost certainly be required to optimize design solutions and steps may not occur in precisely the same order for each iteration. The procedure can be paraphrased as follows.

**1.** Classify the building according to occupancy, type of construction, location on property, floor area, height, and number of stories.







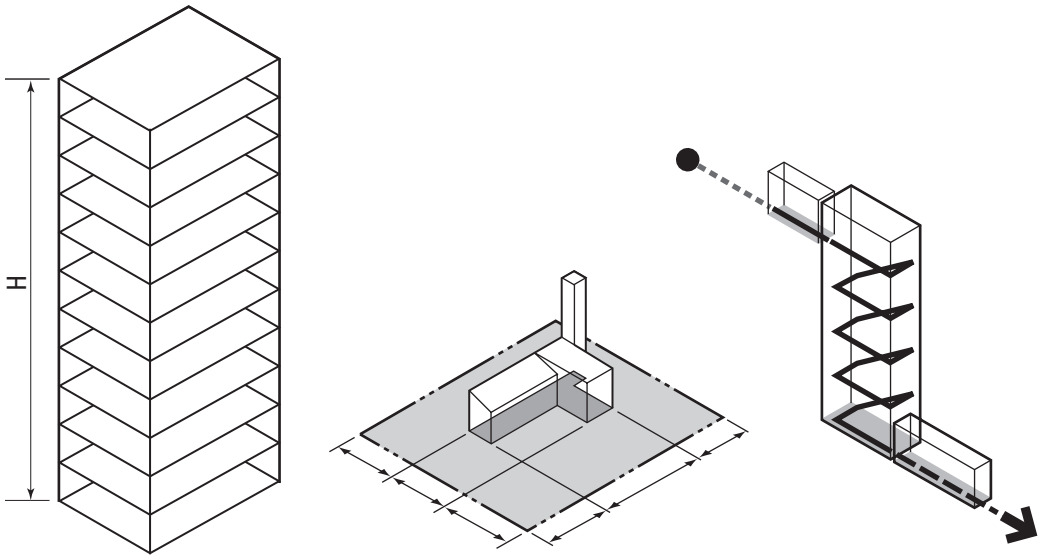


A. Occupancy Classification
Determine the occupancy group that the use of the building or portion thereof most nearly resembles. Compute the floor area and occupant load of the building or portion thereof. See the appropriate sections in Chapter 5 for requirements for buildings with mixed occupancies.

B. Sprinkler Systems
Determine if the occupancy is required to be protected by a sprinkler system and identify the threshold(s). Determine if the anticipated height of the building will require fire sprinklers. See the appropriate sections in Chapter 9 for thresholds based on the occupancy. Note also the sprinkler adjustments for heights and areas in Chapter 5 as described in Step "D." The basic model IBC requires sprinklers in many conditions. Local amendments are often made to either increase or decrease sprinkler thresholds and requirements.

C. Type of Construction
Determine the required minimum type of construction, or architecturally desired construction type, based on the occupancy, fire protection, and the designed height and area. This will dictate the materials used and the fire resistance of the parts of the building as limited in Chapter 6.

D. Allowable Floor Area
Determine the allowable floor area of the building. Use the basic allowable floor area based on occupancy group and type of construction. Determine allowable floor area of multistory buildings. Determine allowable increases based on location on property and if there is installation of an approved automatic fire-sprinkler system.




E. Height and Number of Stories
Compute the height of the building and determine the number of stories. Determine the maximum height and number of stories permitted based on occupancy group and type of construction. Determine allowable height and story increase based on the installation of an approved automatic fire-sprinkler system.

F. Location on Property
Determine the location of the building on the site and clearances to lot lines and other buildings from the plot plan. Determine the fire-resistance requirements for exterior walls and wall-opening requirements based on fire-separation distances to lot lines. The fire-resistance requirements for exterior walls and the limitations on their openings are found in Chapter 7.

G. Means of Egress
Determine the requirements for means of egress from the building found in Chapter 10.

**2.** Review requirements for fire-sprinkler protection.

**3.** Review the building for conformity with the type-of-construction requirements in relation to desired and allowable building heights and plan areas. Iteration may be required among heights, areas, and construction types.

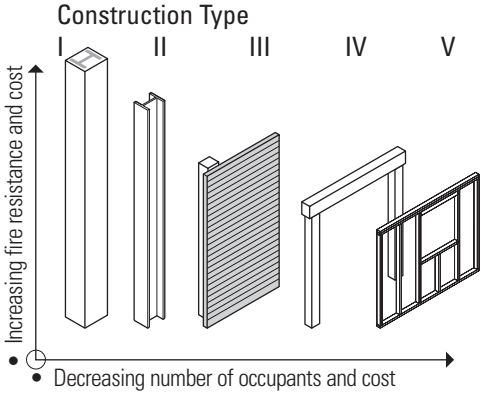
**4.** Review the effects on the building based on its location on the building site. Iteration may be required in reviewing location together with construction types and amount of openings in relation to property lines.

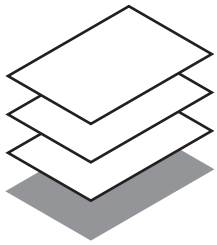
**5.** Review the building for conformity with egress requirements.

**6.** Review the building for other detailed code requirements.

**7.** Review the building for conformity with structural engineering regulations and requirements for materials of construction.

The following section is a review of the critical information required for a project code analysis, based on the analysis system noted above.



### Occupancy Type

Projects are almost invariably defined for the designer based on occupancy type. A client almost always comes to a designer with a defined need for a facility. The use of that facility determines the occupancy classification to which it belongs. Each occupancy classification or type has specific requirements related to allowable area, height, and exiting, with potential construction types growing out of these requirements. The codes are fundamentally use (occupancy) based. Other criteria are derived from the first basic classification by occupancy. Occupancy classifications are defined in Chapter 3.

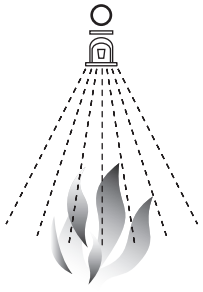
### Fire Extinguishing Systems

Fire sprinklers, standpipes, fire detection, and fire-alarm systems are an integral part of most new buildings. Use of such systems, especially automatic fire sprinklers, often results in trade-offs for additional height or area. Trade-offs are listed in the code sections related to height and areas, but other requirements are listed in separate sections of the code. Fire-protection systems are covered in Chapter 9. Note also that sprinkler system requirements are another area where local amendments are often added to the model codes. These requirements should be verified for each project. It can be critical to a trade-off to know if a system is otherwise required in the jurisdiction where you are working. Trade-offs only apply when the systems are not otherwise required by the local code to be used for a project. The idea of a trade-off recognizes that this is a mitigation measure over and above basic code requirements to achieve the desired level of safety through other means than those spelled out in the basic code.

### Construction Type

Construction types are typically categorized by materials based on their resistance to fire in structural applications. The construction type gives some indication of the amount of time available for evacuation of occupants, for fire-fighting, and for emergency response under fire conditions. Buildings of fire-protected steel or concrete will provide more fire resistance than those of wood construction. More fire-resistant construction types are allowed to be of larger area and to have more stories as the fire-resistance increases. As a rough rule of thumb, allowable occupancy quantities and construction costs will both decrease with building type from Type I to Type V.

Types of construction are defined in Chapter 6. Table 601 gives a synopsis of the minimum fire-resistive requirements of each main element of building construction. As you go through a code analysis, you will be referring to this table and to Table 506.2 to select the optimum balance of construction type, occupancy, and area requirements for a specific project. It is typically a budget goal to minimize construction costs by selecting the least costly construction type appropriate for the proposed use of the building.



### Building or Floor Area

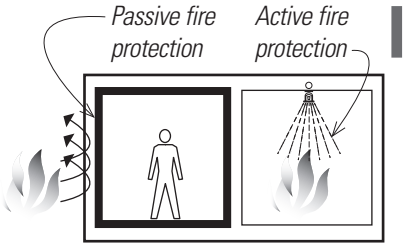
Once the occupancy classification and construction type are known, it is important to establish the permissible area for each floor, for each use, and for the total building. Certain types of construction are limited in size based on occupancy and concentration of people. As noted, selection of the appropriate allowable area and construction type may require iteration of selections of construction type and allowable area based on occupancy requirements.

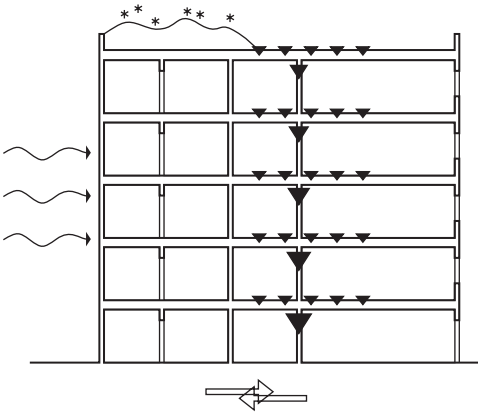
Allowable areas are tabulated in Table 506.2. See § 506 for allowable area increases based on location on the property and allowance for installation of automatic fire-sprinkler systems.

### Building Height

The allowable number of floors is tied closely to construction and occupancy classification. Total height in feet and number of stories may also be limited by planning codes, not for technical reasons but as matters of public policy.

Building heights are tabulated in Tables 504.3 and 504.4. Study the definition of height and story as noted in the IBC. Also be aware that the definition of height and story is often subject to local amendment. Be certain to check these provisions with the local AHJ to be certain of the exact requirements for your project. This is especially true in older, hilly cities like San Francisco, where topography and historical development patterns may generate definitions of height or story different than in other jurisdictions. Do not confuse zoning height definitions and limits with those in the building code. They are usually different in almost all jurisdictions.

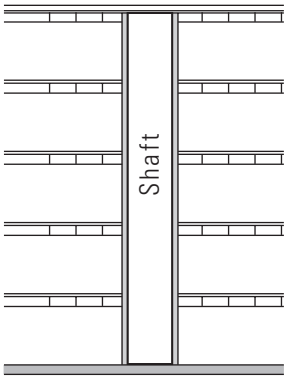


**Exits/Egress**
One of the most important functions of building codes is determining egress requirements and provision of safe means of egress for all of the anticipated occupants of a building. There are specific requirements for size, spacing, and travel distances for all components of the means of egress, such as floor plans, doors, corridors, and stairs. In simple terms, a means of egress consists of three components: an exit access, an exit, and an exit discharge. Chapter 10 of the IBC relates to means of egress.

**Building Separations and Shafts**
Where buildings have mixed occupancies, designers have the option of selecting separated occupancies, which require fire-rated partitions to separate the occupancies, or using "non-separated" occupancies. Separations may also be used to allow more area for a particular occupancy on a single floor in certain types of construction where such sizes of use would not otherwise be permitted.

Openings between floors such as for stairs, elevators, and mechanical shafts can allow the passage of smoke, heat, and flames in a fire. Therefore, the codes have requirements based on occupancy, building type, and building height related to shaft protection. Basic shaft-protection requirements are contained in Chapter 7.




**Fire Protection**
Fire protection can be divided into two broad categories: passive or active protection. Passive protection is that built into the structure, either inherent in the material or added as part of protective membranes. Thus, a steel building has more inherent passive protection capability than a wood one because steel is noncombustible whereas wood is not. Active systems are ones where a fire causes a reaction in a system that serves to combat the fire. Sprinklers are a prime example of active systems. A fire causes a sprinkler system to activate and extinguish the fire before exposing the passive systems to a fire. Code analysis and design often includes trade-offs between active and passive systems.

Fire-resistance standards include:

1. Structure Hour Rating: Requirements for the time it takes for a fire to weaken a structural element to the point of failure. These requirements are minimums based on providing enough time for firefighting and evacuation operations to take place for a specified time period without placing emergency responders and occupants in danger.
2. Area or Occupancy Separation Rating: Requirements of how long it will take for a fire to penetrate a wall partition, floor, or roof assembly.
3. Flame Spread and Smoke Generation: Requirements of how long it takes for fire to move along the surface of a building material and how much smoke is generated under fire exposure. The density and toxicity of the smoke is also a factor to be considered in these criteria.

Fire-resistance requirements are found primarily in Chapters 7 and 8.

**Engineering Requirements**
A large portion of the code is devoted to engineering requirements. One of the bases of codes is structural adequacy of buildings for both static loading such as occupants and equipment, and dynamic loading such as earthquakes, snow, and wind. Requirements for both structural systems and structural materials are contained in the code. Chapters 16–18 deal with forces, inspections, and foundations. Chapters 19–23 deal with structural materials: concrete, lightweight metals, masonry, steel, and wood.

Every project, no matter how small, should have a written code analysis included in the construction documents. We recommend organizing the code analysis in the same order as shown earlier in this chapter, so that the thought process you use in developing your code conclusions is revealed in the written code analysis. This should be done early in the design process so that any issues can be identified and discussed with the Authorities Having Jurisdiction. As noted previously, be sure to do research about local code amendments to the model code.

As noted, don't be shy about using the table of contents, index, or keyword searches of electronic documents. DO NOT TRY AND MEMORIZE PARTS OF THE CODE! As sections change and interpretations alter meanings, memorization is a recipe for trouble in the future. Clients may expect you to be able to rattle off requirements at a moment's notice, but it is not in the best interest of the project or the client to be able to make snap code decisions. Remember where to look up information and check your decisions each time you apply them; do not proceed on memory or analogy from other jobs. Even seasoned code professionals use the index or an electronic code to locate familiar phrases when they cannot quite recall where the phrase is located in the code. It is worthwhile for designers to remember that as a new model-code edition is adopted across the nation, local code officials will often have little more hands-on experience with the IBC than design professionals.

**Early Meetings**

One advantage of larger projects is that they are often large enough to warrant pre-review and consultation with the building department prior to finalizing design. No matter what the size of your project, we recommend consulting with the applicable AHJ early in the process wherever it is possible, prior to commencing detailed design, even if a fee is charged. We also recommend that both the building and fire plan reviewers be at such meetings as they often do not always interpret the building and fire codes in the same way.

Do not expect the code official to do your work for you. Compliance is the responsibility of the designer. However, codes are subject to interpretation, and it is almost always in your best interest to determine what, if any, interpretations will be needed for any project. This should be done prior to expending a lot of time and energy designing a project that may be deemed not in compliance during plan review.

# 3

# Occupancy Classification and Use

The intended use or occupancy of a building is a fundamental consideration for the building code. Typically, a client comes to an architect with a defined need for a facility. The desired use of that facility determines the occupancy group to which it is assigned under the code. Occupancy group classifications trigger specific requirements for the allowable area and height of a building, for means of egress, as well as for type of construction. The "I" codes are fundamentally occupancy based, as were the three model codes from which it was born. Most other broad sets of code criteria are derived from the basic classification by occupancy.

The code separates uses into broad groups called occupancies. Under these groups are subdivisions that further refine the detailed requirements. It is worth remembering that while the designer usually makes the first pass at categorizing uses in terms of occupancy according to the fire safety and relative hazard involved, the ultimate judge of occupancy classification is the building official per the provisions of Chapter 1 of the IBC. The intent regarding classification is best described by the language directing classification of atypical occupancies: "Such structure shall be classified in the group which the occupancy most nearly resembles, *according to the fire safety and relative hazard involved*." This reiterates the intent and purpose of the occupancy classifications that exist in the code. Each of the stated occupancy classifications was determined during the code development process by using fire-safety and relative hazard performance data to develop criteria.

This edition of the IBC contains "User Notes." At the beginning of Chapter 3, these state that "Chapter 3 provides the criteria by which buildings and structures are classified into use groups and occupancies. Through the balance of the code, occupancy classification is fundamental in the setting of features of construction; occupant safety requirements, especially building limitations; means of egress; fire protection systems; and interior finishes."

Determination of the occupancy type flows in almost every case from the program given to the designer by the client. Other code requirements flow from the number of occupants and the hazards to their safety from external and internal factors. As discussed, the code looks at property protection considerations along with life safety concerns. The occupancy's hazards are assessed relative to their impact on adjacent properties as well as on the building occupants. The code also analyzes the hazards posed by adjacent buildings; however, it places the responsibility for protection of the adjacent facilities on the building under consideration.

Among the considerations for occupancy classification are: how many people will be using a facility; whether there are assembly areas such as theaters and restaurants; whether people will be awake or asleep in the building; will they be drinking alcohol while using the building, or undergoing medical treatment, which makes them less capable of self-preservation in an emergency? The presence of hazardous materials or processes will also affect the requirements for allowable area, fire separations, and construction type.

Note that the criteria discussed in this book generally apply to non-hazardous occupancies. Hazardous occupancies are not addressed by most design professionals and are covered by a separate set of special requirements discussed in § 414 and § 415. Because they are very specialized and encountered infrequently by most designers, the requirements for hazardous occupancies will only be lightly touched on in this book.

It is essential to read the detailed requirements for each type of occupancy in a project. There are often cross-references to various other code sections in the detailed occupancy criteria. Another factor that impacts occupancy classification is the mixture of various uses in a building and their sizes relative to the predominant use of the building. The sections regarding mixed occupancies and incidental uses are not found in Chapter 3 but are located in Chapter 5 of the IBC. In the 2012 edition, incidental uses were moved to their own section, § 509. This is one of the reasons why code analysis should not be done by memorization. Code users must be able to track changes by use of the index for new code editions. Another good way to track changes is to use a PDF version of the code and use keyword searches to find code items.

Several ideas common to most occupancy classifications, discussed in detail in Chapter 5, should be understood. First is the language: "structures or portions of structures." This distinction allows the use of mixed occupancies in a single building without having to consider the entire building as a single occupancy group. The concept of separated and nonseparated uses, discussed in Chapter 5, allows the designer two options for addressing mixed-use buildings. It also allows rooms within buildings to be considered as distinct occupancies that can then be addressed as either separated or nonseparated uses at the designer's discretion.

The other concept to understand is that the laundry lists of examples in each occupancy group are not the sole definition of which uses are to be classified in which occupancy group. The code recognizes that not all occupancies are included in the lists and gives direction to the building official regarding classification of buildings not included in the examples.

The IBC establishes the following occupancy groups:

- Assembly (A)
- Business (B)
- Educational (E)
- Factory and Industrial (F)
- High Hazard (H)
- Institutional (I)
- Mercantile (M)
- Residential (R)
- Storage (S)
- Utility and Miscellaneous (U)

Code users often speak of "uses and occupancies" when describing what goes on in a building. This edition of the code introduces a discussion of "uses" in § 302.2. Occupancy group descriptions contain uses considered to have similar hazards and risks to building occupants. Uses often also have additional requirements described in Chapter 4. We recommend first identifying uses in lay terms, then looking in the descriptions of uses in Chapter 3 that are associated with various occupancies to help determine the proper occupancy classification.

**Assembly Group A (303)**

The examples noted in this group recognize that these uses bring large groups of people together in relatively small spaces. How the spaces are used in relationship to physical features and human behavior also enter into the distinction between assembly categories, which are meant to serve as cues for assigning buildings or parts of buildings to an occupancy class. The final determination of this classification, as for all classifications, is made by the building official. Note that the subcategories are examples, not a definitive or exhaustive list of possible assignments.

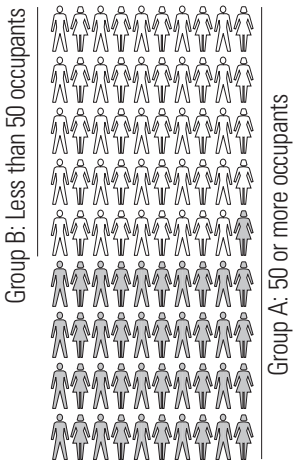
Be very careful in reading language where criteria are based on numbers. "Less than 50 persons" means that 49 or fewer people have one set of criteria and "50 or more" have another. The dividing line in this case is 50. Read such language very carefully when deciding if an issue belongs in one category or another. If in doubt, be sure to verify the interpretation with your AHJ early in the design process to avoid costly errors.

Group A occupancies are typically defined as having 50 or more occupants, but the use of the space must be examined in relation to the code language stating that these are spaces "for purposes such as civic, social or religious functions, recreation, food or drink consumption…" For instance, retail stores in M occupancies may have more than 49 occupants but are not considered as Group A. Per § 303.1.1, assembly areas with fewer than 50 occupants are to be classified as Group B occupancies. Assembly areas of less than 750 sf (69.68 $m^2$) that are accessory to other uses are also not considered as Group A areas per § 303.1.2 Item 2.

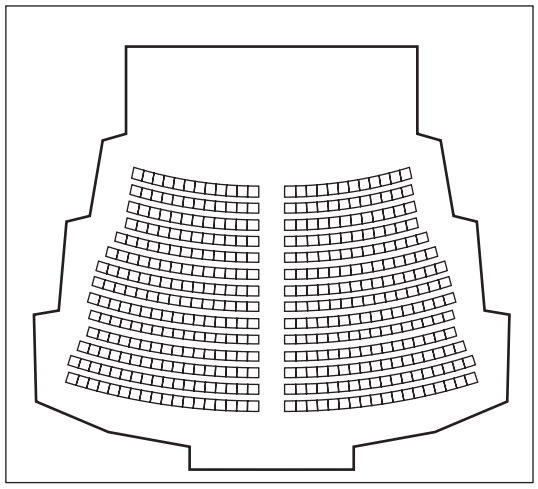
Language in § 303.1.3 clarifies that assembly occupancies associated with Group E occupancies (educational facilities) need not be considered as separate "A" occupancies.

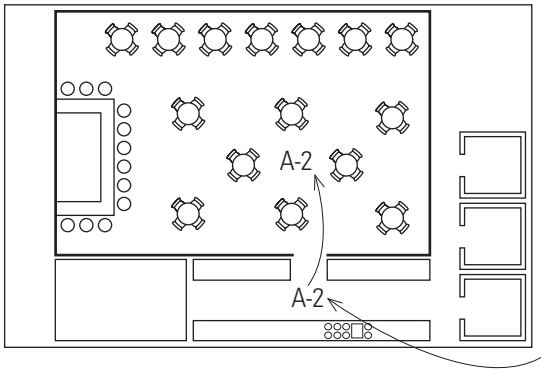
Accessory religious educational rooms and religious auditoriums with an occupant load of less than 100 are not considered separate occupancies and would be classified with the majority of the facility, likely as an A-3 occupancy.

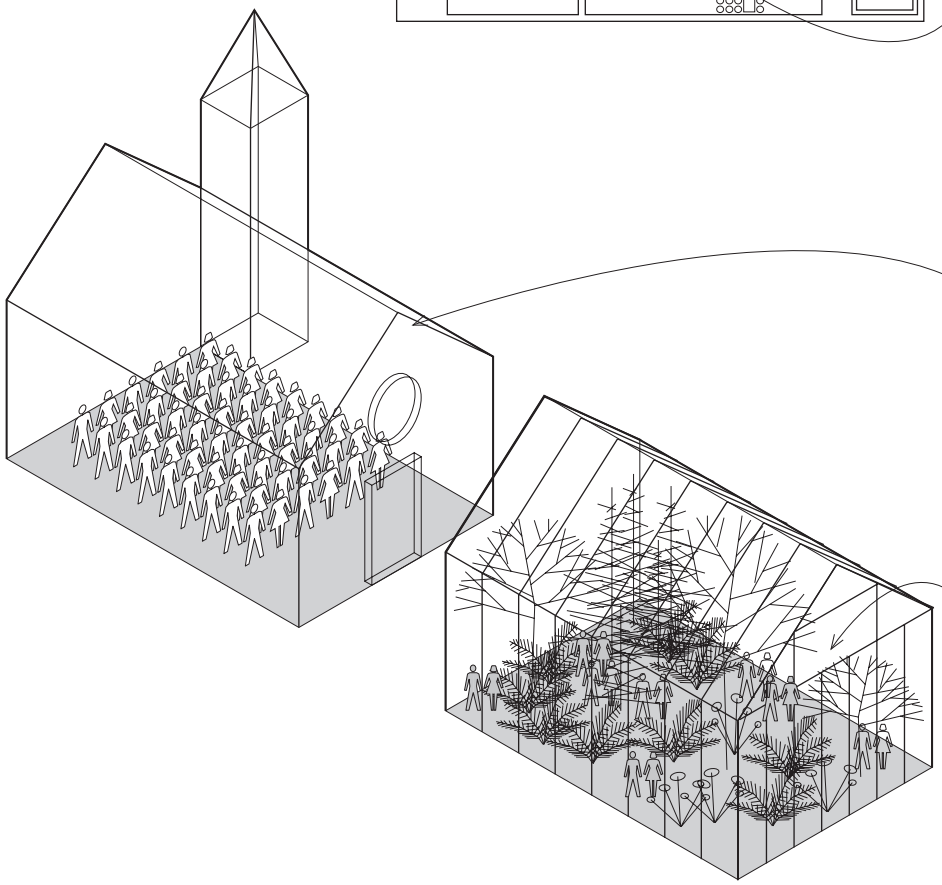
There is a new cross reference pointer added to § 303.1.5 noting that special amusement areas are to comply with § 411.




- *Group A occupancies are typically defined as having 50 or more occupants, but per § 303.1.1, assembly areas with fewer than 50 occupants are to be classified as Group B occupancies.*





- *Group A-1 per § 303.2 is for assembly areas, usually with fixed seats, intended for the viewing of performing arts or motion pictures. The presence or absence of a stage is not a distinguishing feature. Most uses classified in this occupancy will have fixed seats. The egress requirements in Group A-1 occupancies recognize that light levels may be low during performances and that people may panic in emergency situations under such circumstances.*

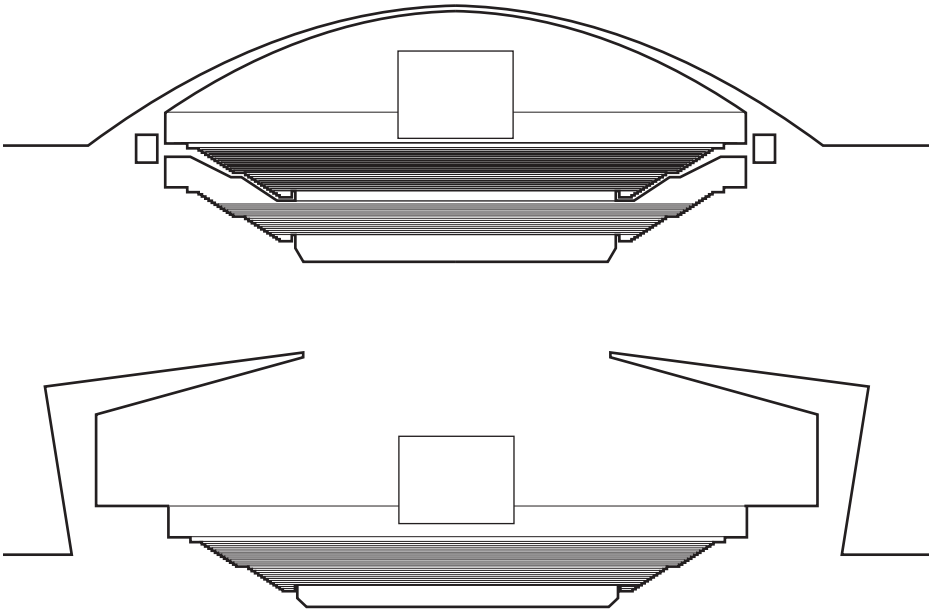
- *Group A-2 per § 303.3 is for assembly areas where food and drink are consumed. The requirements for these occupancies presume that alcoholic beverages may be served, thus potentially impairing the occupants' responses to an emergency. It also presumes that chairs and tables will be loose and may obstruct or make unclear egress pathways for patrons. The requirements also recognize the poor fire history of such occupancies.*

- *Note that in the 2012 IBC, gaming areas in casinos were added to the list of examples.*

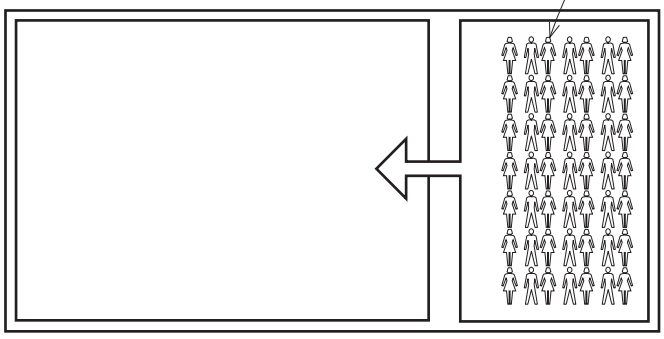
- *Also, note that the code addresses commercial kitchens. They are to be classified in the same A-2 occupancy as the dining areas they are associated with. See "B" and "F" occupancies for a discussion regarding food processing facilities and commercial kitchens not associated with assembly spaces.*

- *Group A-3 occupancies per § 303.4 are assembly areas that do not fit into the other Group A categories. It also includes spaces used for worship, recreation, or amusement. The intent of this classification is that any use that seems to be an assembly occupancy and does not fit the criteria of the other four Group A categories should be classified as an A-3 occupancy.*

- *One notable item is the classification of greenhouses having public access for such uses as botanic gardens. Note that greenhouses used for the sale of plants are to be an "M" occupancy.*



- *Group A-4 occupancies per § 303.5 are assembly areas for the viewing of indoor sporting events.*
- *Group A-5 occupancies per § 303.6 are assembly areas for the participation or viewing of outdoor sporting events.*
- *The principal distinction between Group A-4 and A-5 occupancies is one of indoor versus outdoor facilities. Note also that Group A-4 occupancies are presumed to have spectator seating. Those assembly uses that are similar to these two classifications but do not meet all their criteria would most likely be considered Group A-3 occupancies.*



- *As noted in § 303.1.2 Item 1, "small" assembly spaces with less than 50 occupants are to be considered by exclusion as part of the overall occupancy. For example, having a conference room or a lunchroom with fewer than 50 occupants serving a larger use does not trigger classifying that space as an Assembly Group A occupancy.*
- *Per the same criteria, a large conference room in an office, where the room has more than 49 occupants, would be classified as an A-3 occupancy. This may trigger code provisions related to Group A occupancies that might not otherwise apply to the other office areas. It also may trigger occupancy separation requirements per § 508.4.*

**Business Group B**

Office buildings are typically classified as Group B occupancies. Storage areas for offices, such as back-office file rooms, do not constitute a separate occupancy.

Outpatient clinics and ambulatory care facilities are also classified in this occupancy group. "Clinic-outpatient" defines a medical care facility where patients are not rendered incapable of self-preservation. Even where patients may be rendered incapable of unassisted self-preservation by anesthesia, the use could still be classified as a Group B occupancy. Such a facility, called an "ambulatory care facility," is contained in the B occupancy list. It is defined in Chapter 2 as being a facility where patients stay for less than 24 hours but where such patients are rendered incapable of self-preservation.

The definition refers only to "care" facilities to broaden the applicability of this occupancy classification to more uses. While both uses are B occupancies, there are other distinctions, such as sprinkler requirements per § 903.2.2, which depend on whether patients are rendered incapable of self-preservation and how many of such patients there are at any time. There are also varying fire-alarm and detection requirements for B occupancies depending on their use, contained in § 907.2.2.

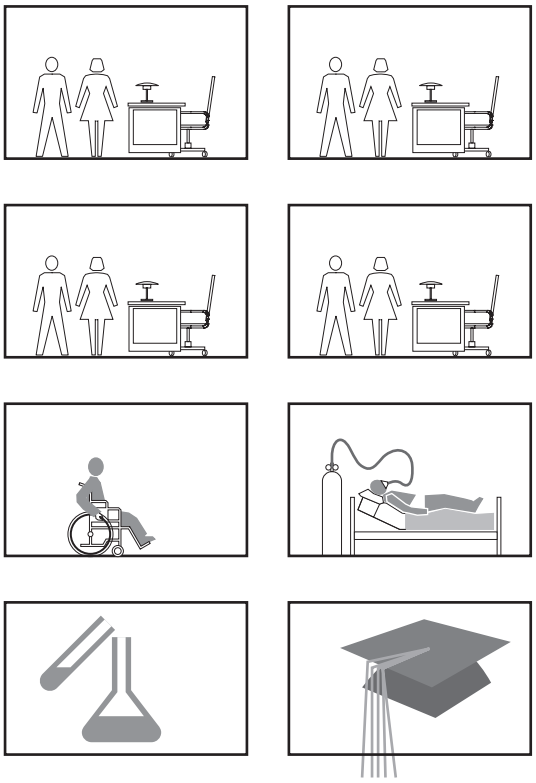
Testing and research laboratories that do not exceed the quantities of hazardous materials specified in the code are also classified as Group B occupancies. Those that exceed the quantity limits are classified as Group H occupancies.

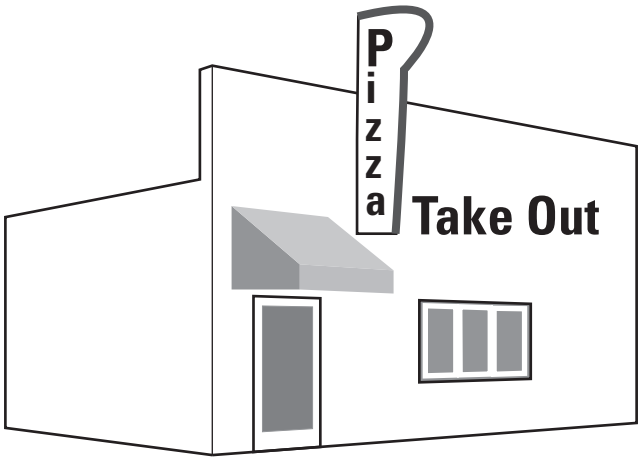
Educational facilities for junior colleges, universities, and continuing education for classes above the 12th grade are considered Group B occupancies, not Group E. Assembly rooms in these facilities should be examined for conformance with the criteria for Group A occupancies. The code has also clarified that tutoring centers not associated with schools are to be classified as Group B occupancies and not as Group E occupancies, regardless of the ages served. Prior to this change, tutoring or learning facilities for children in the ages for K–12 education had often been misclassified as Group E.

Note that procedures such as laser eye surgery or kidney dialysis should be considered as rendering patients incapable of unassisted self-preservation. Note further that facilities accommodating people incapable of unassisted self-preservation may also be classified as I-2 occupancies, based on duration of stay.

There are a number of new pointers for B occupancy uses that direct code users to additional detailed requirements to be found in Chapter 4:

- Airport traffic control towers are to comply with § 412.2.
- Ambulatory care facilities are to comply with § 422.
- Higher education laboratories are to comply with § 428.



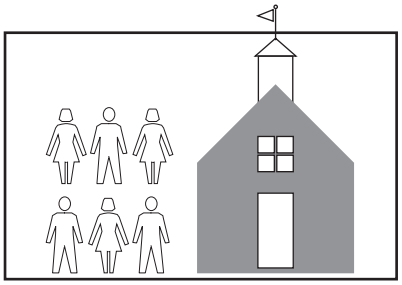



- *Small food-processing facilities, such as a take-out-only pizza shop or to-go Asian food restaurant where there are no dining or drinking areas and that are no more than 2,500 sf (232 m²) in area, are to be classified as Group B occupancies instead of an A-2 or an F-1. Stand-alone food processing facilities that are larger than 2,500 sf are to be classified as Group F-1.*

### Educational Group E

Group-E occupancies are used by six or more people for classes up to the 12th grade. Uses for the day care of six or more children over 2 1/2 years of age make up another set of Group-E occupancies. Day care uses with fewer than six children are to be classified with the larger occupancy they occur within. Those uses with fewer than six children in a dwelling unit are classified as Group R-3.

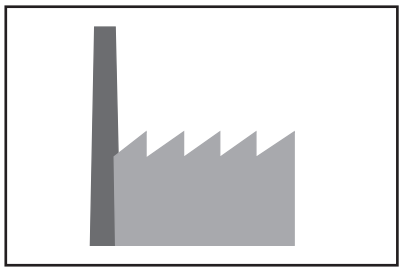
Assembly uses in school facilities are not excluded from this use group. However, most schools use their large rooms for assembly uses. Such facilities need not be considered as separate A occupancies per the provisions of § 303.1.3. Religious classrooms and auditoriums that are accessory to churches and have fewer than 100 occupants are to be considered as A-3 occupancies per § 303.1.4.



Per § 305.3, storm shelters are to be provided for Group E occupancies where such shelters are required by § 423.5. That detailed section should be carefully reviewed to determine if those additional requirements are applicable to any E occupancy group project under code analysis.

### Factory and Industrial Group F

Factory occupancies are defined in part by what they are not. The two occupancy groups, Moderate-Hazard Occupancy F-1 and Low-Hazard Occupancy F-2, are based on an analysis of the relative hazards of the operations in these occupancies and a determination that they do not fall under the criteria set for Group H. Group F-1 is classified as those operations not falling within the definitions for Group F-2. The predominant difference between F-1 and F-2 is that in F-2 occupancies the materials of manufacture are considered to be noncombustible.



The classification of Group F occupancies assumes that these are not public areas. The users are presumed to be familiar with their surroundings and not occasional visitors. The processes themselves will determine which classification the use is to receive. Uses meeting the F-2 classification are limited. Occupancy classification determinations between Groups F-1 and H often are done by a process of elimination. When analyzing whether a use or occupancy should be classified as Group F-1 or Group H, the quantities of materials used in the process under consideration will determine to which group the use belongs. For example, an F occupancy manufacturing alcoholic beverages up to 16% alcohol content is considered to be an F-2 low-hazard occupancy, while those manufacturing beverages with an alcohol content above 16% are an F-1 occupancy. This is based on the idea that the presumed level of flammability of such beverages increases with alcohol content, with 16% being established as the threshold between conventionally fermented wines and wines "fortified" with added alcohol. Large commercial cooking operations not associated with restaurants are now called out to be F-1 occupancies.

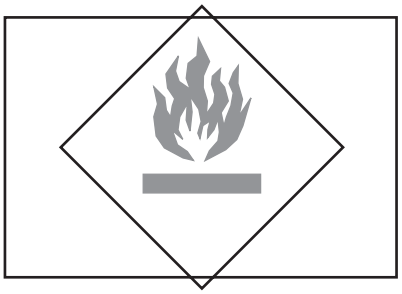
The code now places a threshold of 2,500 sf (232 $m^2$) for F-1 food-processing establishments and commercial kitchens. Facilities not exceeding the threshold, such as take-out restaurants with no seating or serving areas, are now called out to be classified as Group B occupancies.

New examples have been added to the list of F-1 occupancies:

- Energy Storage Systems (ESS), recognizing the increased presence of battery energy storage in buildings.
- Water/sewer treatment facilities.
- There is a new pointer in § 306.2.1 that aircraft manufacturing facilities are to comply with the special detailed requirements found in § 412.6.

### High-Hazard Group H

Hazardous occupancies could easily be the subject of another book and will only be touched on in an introductory fashion in this text. The uses classified under this occupancy group are very specialized and require careful code and design analysis. Understanding the products, processes, hazard levels of materials used in the occupancy, and their quantities is essential. Variations in material quantities and hazards interact to set the design criteria for hazardous occupancies. The classification of uses in this category will almost undoubtedly require consultation with the client and with the building official at an early stage of design.



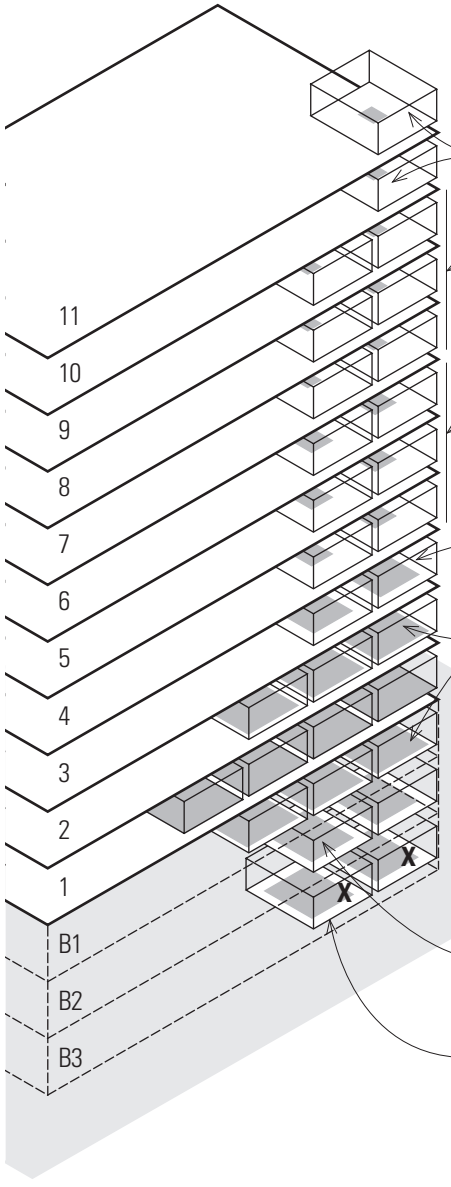
There are two sets of criteria for hazardous occupancies. The first set is related to the hazard of the materials in use and the quantities of those materials in use. High-Hazard Groups H-1 through H-4 fall in this category. The second set relates to the nature of the use as well as the quantity and nature of hazardous materials in use. This is High-Hazard Group H-5, which are semiconductor fabrication facilities and similar research and development facilities.

Areas that contain limited quantities of hazardous materials may occur in other occupancy groups when the amounts are less than the designated quantity limits. For example, small amounts of flammable cleaning fluids or paints might be stored in a room in a business occupancy. A mercantile occupancy can sell specified quantities of materials that may be considered hazardous without being designated a Group H occupancy as long as the amount of material is below the maximum allowable quantity. This exemption pertains only to occupancy classification related to quantities; it does not waive compliance with any other code provisions. Note also that the *International Fire Code* sets forth many additional construction and use requirements for Group H.

**Control Areas**

The other basic concept in the code provisions for High-Hazard Group H is that of control areas. The special detailed requirements for the separation of control areas are contained in Chapter 4 and outlined in Table 414.2.2. Chapter 4 must therefore be read in concert with Chapter 3 to determine all applicable code requirements. This applies both to subdivisions of buildings classified as hazardous occupancies and to areas where hazardous materials occur within other occupancies. The definition of this concept bears stating verbatim from § 202:

- Control areas are "spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled."
- The control area concept allows multiple parts of a building to contain an array of hazardous materials when the areas are properly separated and the quantity of materials within each area meet the specified maximums for each type of material. These criteria reinforce the concept that hazard levels are mitigated by passive and/or active fire-protection measures. This concept is based on two primary considerations. The first is the nature of the hazard of the material in question. The second is that the level of hazard is primarily related to the quantity of materials within a given area.




- *Control areas must be separated from one another by 1-hour fire-barrier walls and floors having a minimum fire-resistance rating of 2 hours. For the fourth and succeeding floors above grade, fire-barrier walls must have a 2-hour fire-resistance rating.*
- *Note that both the percentage of maximum allowable quantity of hazardous materials and the number of control areas decrease when proceeding up or down in the building to floors either above or below the first floor of a building.*
- *Higher than nine floors above grade, one control area with 5% of allowable quantity is permitted per floor.*
- *The seventh through ninth floors above grade may have two control areas per floor with 5% of allowable quantity per control area.*
- *The fourth through sixth floors above grade may have two control areas per floor with 12.5% of allowable quantity per control area.*
- *Third floor above grade may have two control areas with 50% of allowable quantity per control area.*
- *The second floor above grade and first floor below grade may have three control areas with 75% of allowable quantity per control area.*
- *The second floor below grade may have two control areas with 50% of the allowable quantity per control area.*
- *Control areas are not allowed more than two floors below grade.*

**Institutional Group I**

Institutional occupancies are those where people have special restrictions placed on them. The occupancy groups in these groups are subdivided by the abilities of the occupants to take care of themselves in an emergency. The different categories in this occupancy are determined by the number of occupants, their ages, health and personal liberty, and whether they are in the facility all day or part of the day or night. Whether or not the occupants are capable of unassisted self-preservation or are somehow incapacitated to the extent they will need help to escape danger also enters into the occupancy classification. Many of these occupancy groups have a residential character, and if they fall outside the designated thresholds for Group I occupancies, they will likely be classified as residential occupancies.

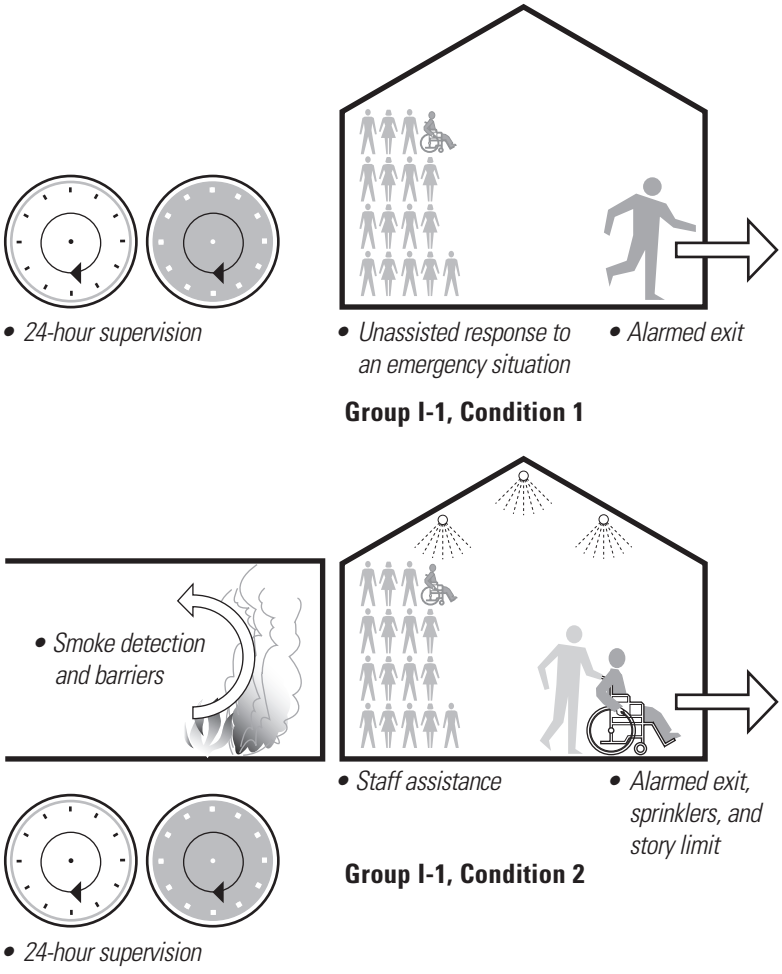
The different Group I occupancies have their distinguishing characteristics shown here in the same order to facilitate understanding the differences between them.

- *Group I-1 has more than 16 people living under supervised conditions and receiving custodial care in a residential environment on a 24-hour basis. "Custodial Care" is defined in § 202 as "Assistance with day-to-day living tasks, such as assistance with cooking, taking medication, bathing, using toilet facilities, and other tasks of daily living." Custodial care includes persons receiving care who have the ability to respond to emergency situations and evacuate at a slower rate and/or who have mental and psychiatric complications. This classification includes halfway houses, assisted-living facilities, and group homes.*

- *Note that the term "convalescent facilities" has been deleted as it is not a contemporary term and is subject to a variety of confusing usages.*

- *I-1 occupancies have been broken down into two "Conditions" based on the abilities of the occupants to respond to emergencies and evacuate a building. The conditions are as follows:*

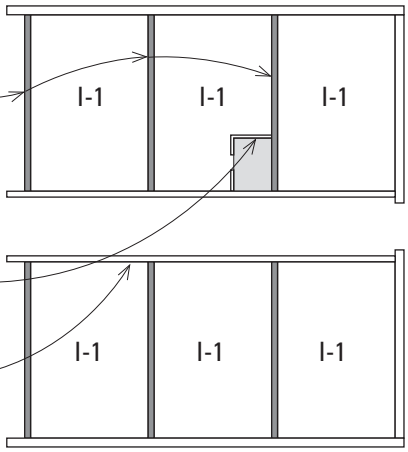
* ***Condition 1*** *occupants are presumed to be able to respond to an emergency independently and without assistance.*
* ***Condition 2*** *occupants are presumed to need "limited verbal or physical assistance" to respond to an emergency and evacuate the building.*




- *It is essential that the designer and the building client confer early in the design process to assess the capabilities of the prospective building occupants to determine the correct classification. This should also include consultation with the operator of the facility to determine what local licensing requirements may apply to the facility to assist in determining the proper classification.*

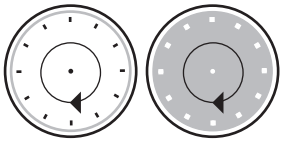
- *Because the occupants under Condition 2 will likely take more time to evacuate the building during an emergency, the code places additional limitations for such things as the number of stories allowable for a given construction type, as well as requirements for smoke barriers, sprinkler protection, and smoke detection. If the understanding of the classification of the two conditions occurs late in the design process or in the course of construction, the change can have profound consequences on the building. Thus, it is important to make this determination early in the design process. If there is any doubt about how the building will be used, it is prudent to assume it will have to meet Condition 2 criteria, which would allow the use of the building for Condition 1 occupants. The reverse would not be the case. Condition 2 occupants could not be housed in a Condition 1 facility.*

- *Similar occupancies with between 6 and 16 occupants are to be classified as an R-4 occupancy, or an R-3 if there are five or fewer occupants.*

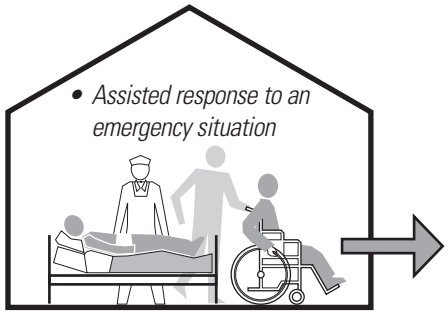



- *Walls between units to be fire partitions per § 708.*
- *Where sleeping units include private bathrooms, walls between bedrooms and the associated private bathrooms are not required to be constructed as fire partitions.*
- *Corridor walls per Table 1020.2.*

- *There are pointers for I-1 occupancies in § 420 that call out special conditions for multiple-dwelling-unit buildings, such as the fire separation of units from each other.*

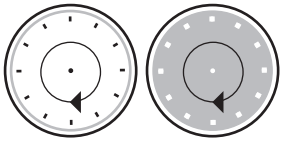


- *24-hour supervision*

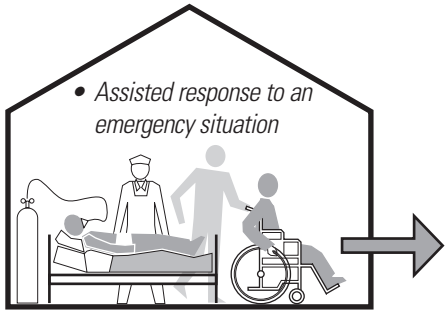


- *Assisted response to an emergency situation*
- *Staff assistance*
- *Wide exit*

**Group I-2, Condition 1**

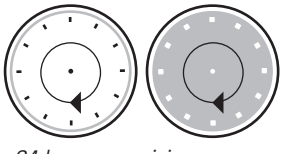


- *24-hour supervision*



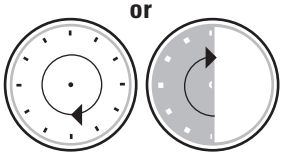
- *Assisted response to an emergency situation*
- *Hospital services*
- *Staff assistance*
- *Wide exit*

**Group I-2, Condition 2**

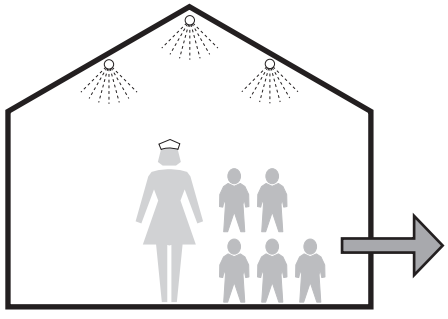


- *24-hour supervision*

**or**



- *Less than 24-hour care*



- *Supervisor*
- *Residents*

**Group R-3 under Certain Conditions**

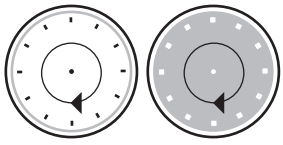
- *Group I-2 has more than five people living under supervised conditions and medical care on a 24-hour basis. The occupants are presumed under this classification to be incapable of unassisted self-preservation and thus cannot respond to emergencies without assistance from the staff. This classification includes hospitals, mental hospitals, detox facilities, and nursing homes.*

*Group I-2 occupancies are classified into two conditions. The conditions are as follows:*

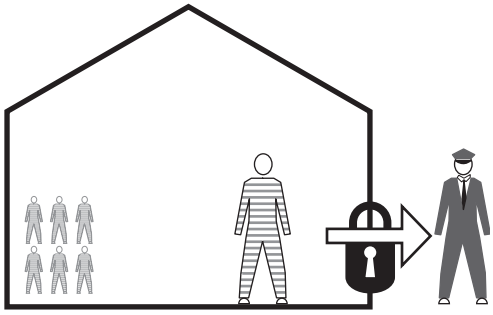
***§ 308.3.1.1, Condition 1**. This occupancy condition includes facilities that provide nursing and medical care but do not provide services typically associated with hospitals. This is considered to include nursing homes and foster care facilities.*

***§ 308.3.1.2, Condition 2**. This occupancy condition is for hospitals, and includes facilities that provide nursing and medical care and could provide emergency care, surgery, obstetrics, or in-patient stabilization units for psychiatric or detoxification.*

*Similar occupancies with fewer than six occupants or who stay for less than 24 hours are to be classified as R-3 occupancies. They may also comply with the* International Residential Code *(IRC). The designer should verify the anticipated uses with the facility operator when making occupancy classifications. This should also be reviewed with the AHJ for their concurrence. Such facilities are to be fully sprinklered.*

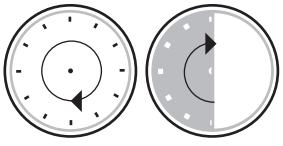


• *24-hour supervision*

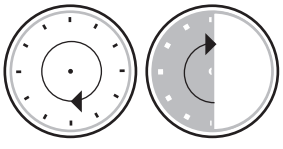


• *Controlled exit*

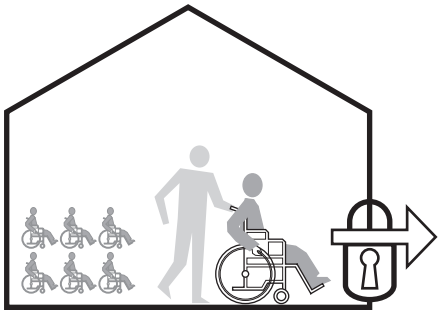
• *Group I-3 has more than five people living under supervised conditions under restraint or security on a 24-hour basis. The occupants cannot respond to emergencies without assistance from the staff, not because of illness, infirmity, or age, but due to security measures outside their control. This group includes prisons, detention centers, and mental hospitals, and is further subdivided into five conditions based on the relative freedom of movement within areas inside the facility. These conditions also presume the areas are divided into smoke compartments with differing degrees of access controls between them.*

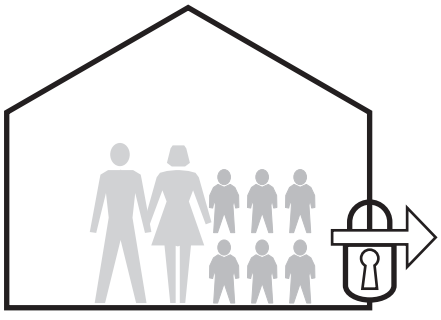


• *Less than 24-hour care*



• *Less than 24-hour care*





• *Controlled exit*

• *Group I-4 is for uses having more than five people under supervised conditions and under custodial care on a less than 24-hour basis. The occupants are presumed not to be able to respond to emergencies without assistance from the staff, although this is not stated in the code. This classification includes adult day care and child day care.*

*The group is further subdivided into care facilities for adults and for children under $2^{1/2}$ years of age. A child day-care facility for between 6 and 100 children under $2^{1/2}$ years of age, located on the exit discharge level with a direct exterior exit, is to be classified as an E occupancy.*

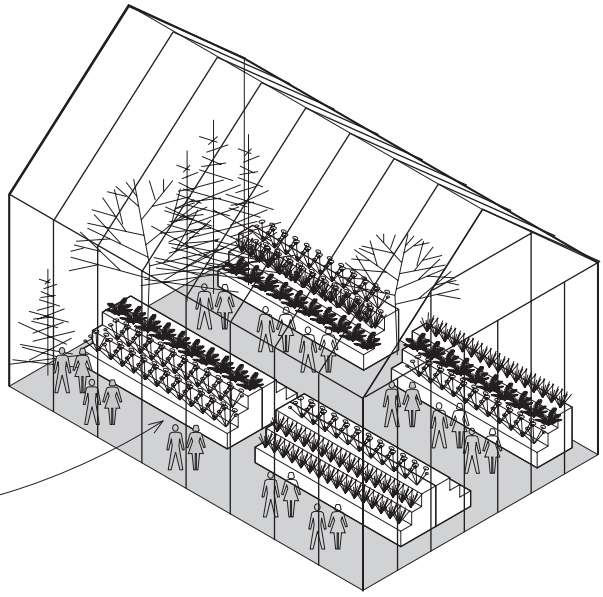
*Similar occupancies with five or fewer occupants may be classified as part of the primary occupancy, or if located within a dwelling unit, be classified as an R-3 occupancy or shall comply with the International Residential Code.*

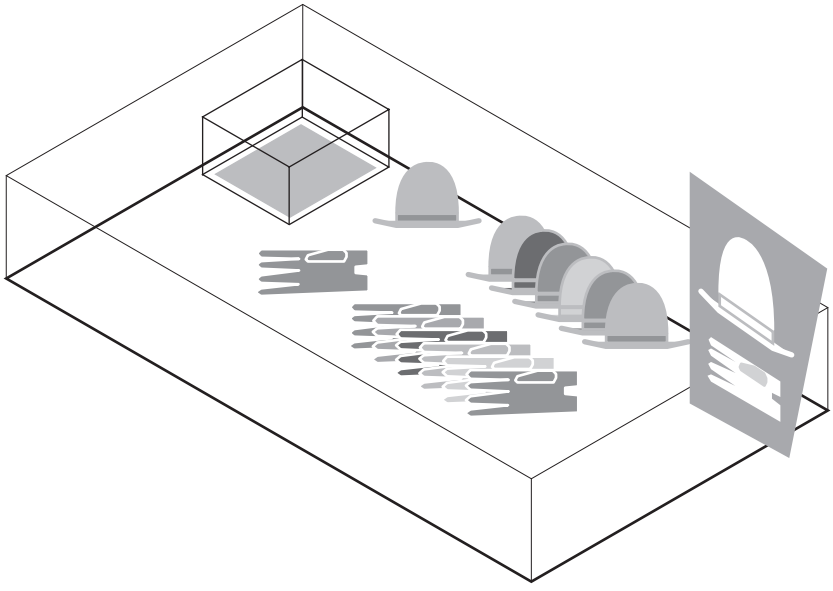
**Mercantile Group M**

Uses in these groups are fairly self-explanatory. The occupancy group includes accessory storage, which will be regulated per the mixed use provisions in § 508. Accessory occupancies are regulated by § 508.2 and must still be individually classified. Larger storage areas would be classified as Group S. Typically for larger combinations of M and S occupancies, the nonseparated provisions of § 508.3 are used.

Most retail facilities, no matter what merchandise they sell, fall into this occupancy. Newly added to this code edition is the designation of "greenhouses for display and sale of plants that provide public access" as an M occupancy.

There are limits to the quantities of hazardous materials that may be stored in mercantile occupancies without being classified as a Group H occupancy. These limits are shown in Table 414.2.5(1).





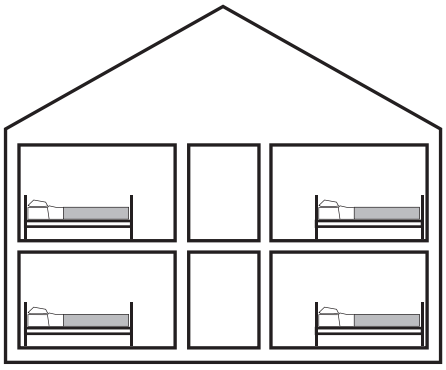
### Residential Group R

Residential occupancies include typical housing units, distinguished mainly by the total number of occupants. A key criterion for this type of occupancy is that the occupants sleep in the building. This group also includes smaller-scale institutional occupancies that fall below certain thresholds for the number of occupants.

- Note that although defined terms related to residential occupancies are listed in the residential occupancy section, the definitions are in Chapter 2 and thus apply not only to this section but also throughout the code.

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | | | | | | |

- *Less than 30 days occupancy*

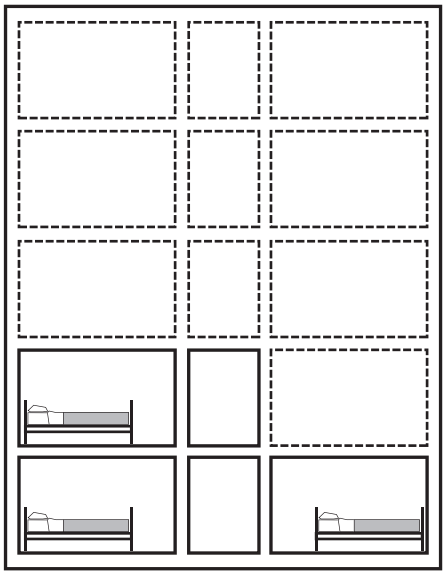


- *Group R-1 occupants are transient, sleeping in their rooms for 30 days or less, as in hotels and transient boarding houses. The requirements assume that the occupants are not familiar with the surroundings.*

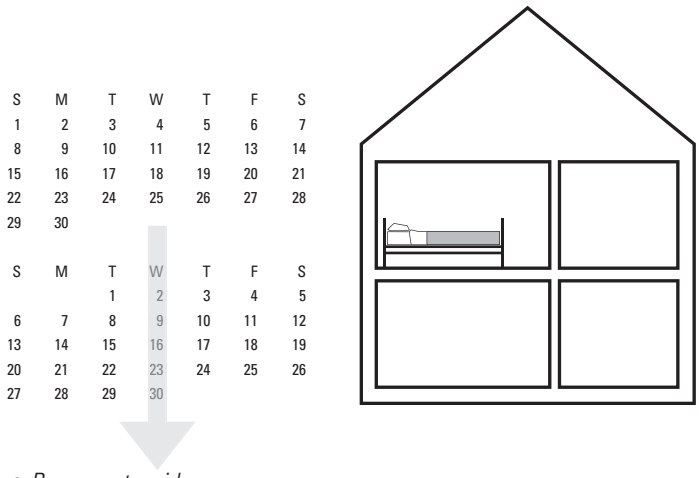
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | | | | | |

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | | | |

- *Permanent residency*



- *Group R-2 occupants are permanent, sleeping in buildings containing more than two dwelling units for more than 30 days. These include apartments, dormitories, and long-term residential boarding houses. Congregate living facilities with more than 16 occupants are to be classified as R-2 occupancies.*

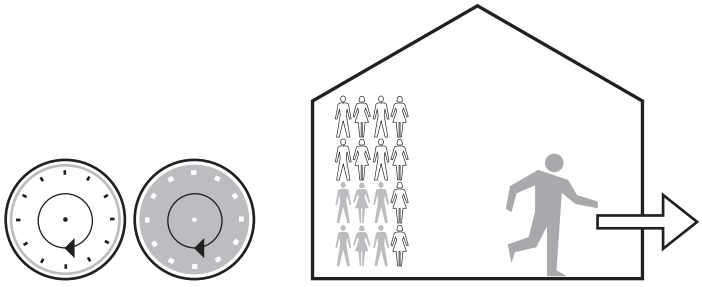



- *Permanent residency*

- *Group R-3 occupants are permanent, and the group is defined as being those not meeting the criteria for R-1, R-2, R-4, or Group I occupancy groups. These are primarily single-family residences and duplexes. Care facilities for five or fewer people also fall into this occupancy group. In many jurisdictions these occupancies are regulated under the International Residential Code (IRC) when it is adopted by the local jurisdiction.*

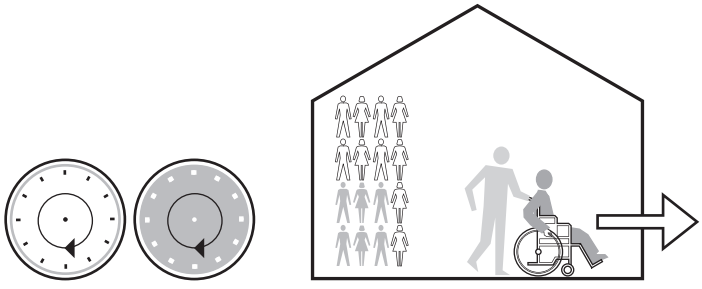
  *Congregate living facilities with 16 or fewer nontransient occupants or 10 or fewer transient occupants are also classified as R-3 occupancies. Lodging houses are a defined term for facilities having one or more permanent occupants paying rent for guest rooms.*

  *Care facilities for five or fewer persons are permitted to comply with the International Residential Code if an automatic sprinkler system is provided. Also, owner-occupied lodging houses with five or fewer guest rooms and 10 or fewer occupants are allowed to be constructed in accordance with the IRC if they meet the IRC's height criteria of three stories or less. Taller R-3 occupancies are to use the IBC. Lodging houses with more than five guest rooms are to be classified as R-1 for transient lodging and R-2 if used for nontransient use, but only if they exceed the 10 or 16 occupant load threshold. Otherwise, they are R-3s.*



- *24-hour supervision*

**Group R-4, Condition 1**



- *24-hour supervision*

**Group R-4, Condition 2**

- *Group R-4 occupancies are used for residential care or assisted-living uses with more than 5 but not more than 16 occupants receiving custodial care, excluding staff. Under these conditions, Group R-4 is used in lieu of Group I. This occupancy group is to meet the requirements for R-3 occupancies except as otherwise provided for in other sections of the IBC.*

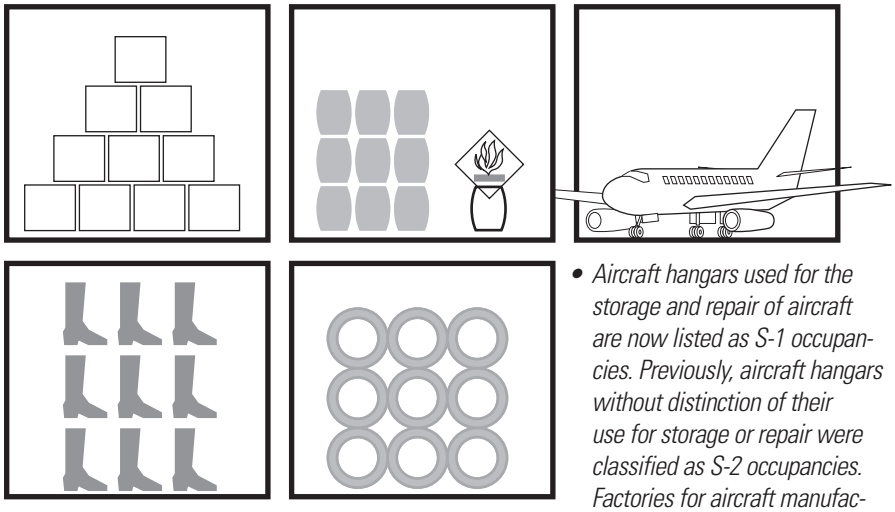
  *As for I-1 occupancies, there are now two conditions related to the ability of residents to respond to instructions:* ***Condition 1 (§ 310.5.1)*** *occurs where persons receiving custodial care are capable of responding to an emergency situation to evacuate the building.*

  ***Condition 2 (§ 310.5.2)*** *includes buildings in which there are any persons receiving custodial care who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation. See the I-1 discussion for the impact of the conditions on building design. When in doubt, uses should be classified as Condition 2.*

### Storage Group S

Storage for materials with quantities or characteristics not considered hazardous enough to be considered a Group H occupancy is classified as Group S. The two subdivisions are similar to the distinctions made for F occupancies: Moderate-Hazard S-1 occupancies and Low-Hazard S-2 occupancies. The lists of examples for each category are quite lengthy and detailed. When occupancies contain mixed groups of various products it can be quite difficult to determine which occupancy group to use. Careful consideration of projected uses for the facility and potential changes in use over time must be considered. It is useful to confer with the building official early in the design process to get concurrence on the proposed classification. As in the distinction between F-1 and F-2 occupancies, the distinction between S-1 and S-2 is that S-2 is used for the storage of noncombustible materials.

Note that "self-service storage," also known as "mini-storage" facilities, are called out to be classified as an "S-1" occupancy. This is due to the varied nature of materials that are often stored in such facilities and the likelihood of such materials being haphazardly and densely packed.

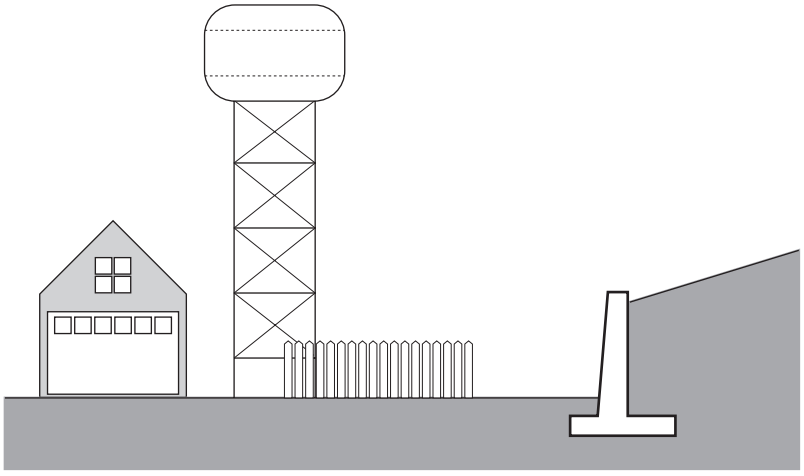


- *Per revisions to § 311.1.1, the criteria for what may be considered as "accessory storage spaces" have been simplified and made less restrictive. A room or space used for storage purposes that is accessory to another occupancy is to be classified as part of that occupancy. Prior code editions set size limits of 100 sf (9.3 $m^2$) for such accessory storage spaces. The size limitation has been removed. There are still criteria for accessory uses found in § 508.2 for accessory occupancies and § 509 for "incidental uses" that must be examined for such accessory occupancies.*

- *Aircraft hangars used for the storage and repair of aircraft are now listed as S-1 occupancies. Previously, aircraft hangars without distinction of their use for storage or repair were classified as S-2 occupancies. Factories for aircraft manufacture are now included in the list for F-1 occupancies.*

### Utility and Miscellaneous Group U

This group is for incidental buildings of an accessory nature. These structures are typically unoccupied except for short times during a 24-hour period and are typically separate from and subservient to other uses. The code now classifies "greenhouses" that are not classified as another occupancy as a "U" occupancy. This occupancy group is used sparingly. It is not meant to be a catch-all for occupancy types that are not readily categorized. The AHJ has the ultimate responsibility for determination of occupancy classification using the criteria set forth in § 302.1. Note also that this group contains items that are not buildings, such as fences over 7' (2134) in height and retaining walls.



# 4

# Special Detailed Requirements Based on Occupancy and Use

In addition to the requirements for typical occupancies, the code addresses detailed requirements for specific building types in Chapter 4. The occupancy of these buildings usually fits into one or more of the typical occupancy groups, but characteristics of these building types require additional code provisions. Examples of such building types are covered and open mall buildings, high-rise buildings, and atriums. A mall is basically a Group M occupancy, but with many stores, large occupant loads, and means of egress that also serve as pedestrian walkways. High-rise buildings are typically Group B or R occupancies with very large occupant loads and are defined as having occupied floors located above fire department ladder access. Atriums have large interior volumes open to pedestrian pathways and to occupied spaces. These buildings need added code consideration above and beyond more typical uses in the same occupancy group. The additional code requirements for these building types are determined by their configurations, not their uses.

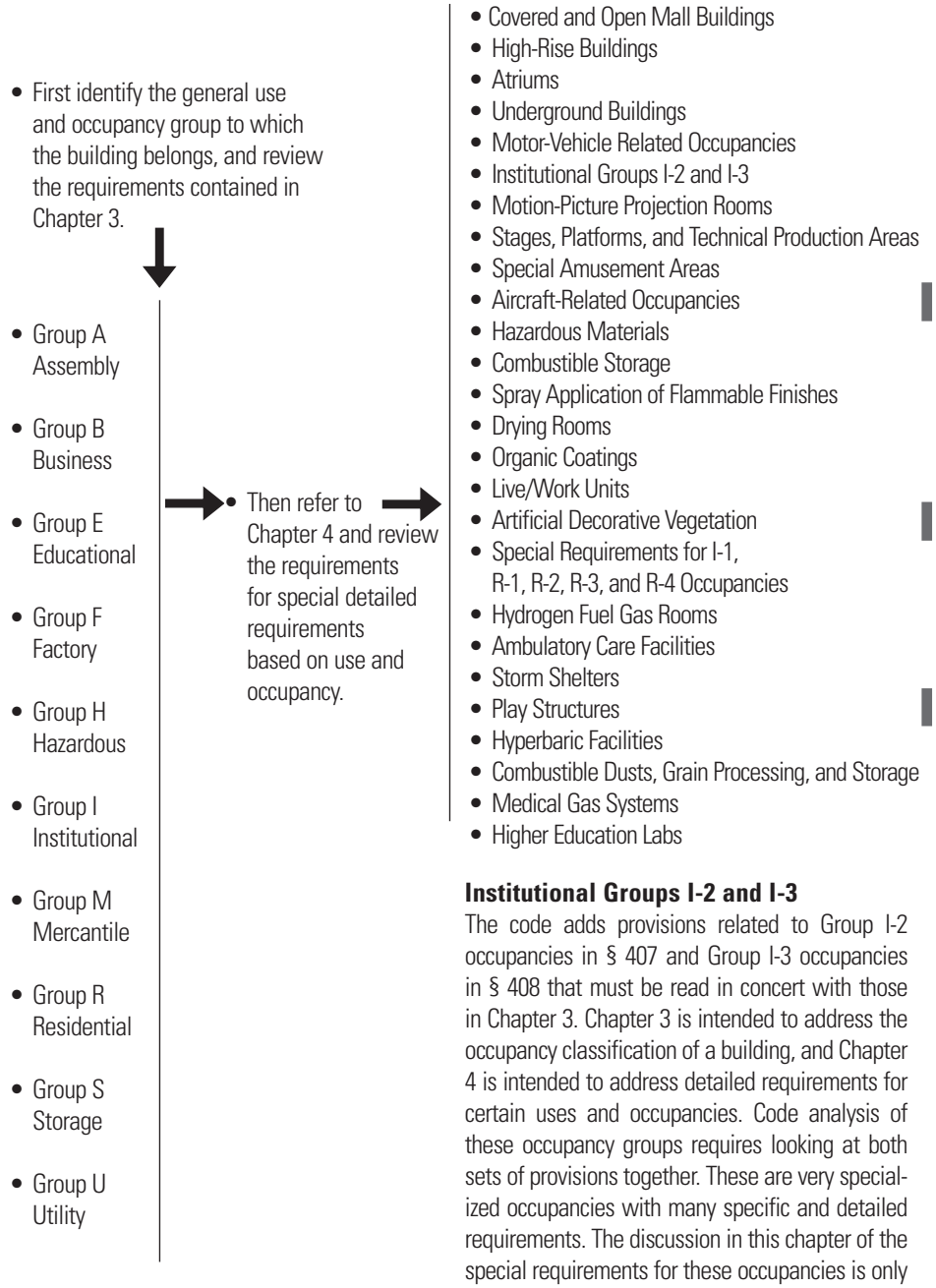
The development of new types of buildings often happens in advance of code provisions specific to them. Code officials must respond to requests by owners to build such structures by addressing them on a case-by-case basis. As these new types of buildings or new uses become more prevalent, the code responds by collecting information about how different jurisdictions have addressed these new buildings. Then the code-development process generates new code provisions to address them. These provisions are meant to apply over and above the other provisions applicable to their occupancy group classification. After the designer has classified the building by occupancy, the building type must then be examined to see if it meets the definitions for these specialized use groups and thus must also meet the added criteria for them. The process of analysis of use and occupancy should commence with an analysis of how the proposed building fits into the uses and occupancies described in Chapter 3 of the code, and then should be analyzed against the criteria in Chapter 4 to see which, if any, are applicable.

## SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

It is worth remembering that the detailed provisions of Chapter 4 of the code relate to and coordinate with the more basic requirements spelled out in Chapter 3 for use and occupancy requirements. The designer as code user should make a progression from the general to the specific in analyzing a building. Begin with the general categorization of uses and occupancies. Then proceed to review the detailed requirements of Chapter 4 for provisions applicable to the building in question. While one may begin the analysis of a specialized use by looking up the detailed requirements, the code is organized to proceed from determining the occupancy first and then applying detailed criteria. Just as one should not read up from footnotes to find table sections that may be misapplied, the user should not work backward in these analyses, as this may lead to erroneous code interpretations.

We will go through the specialized building types to describe their distinguishing criteria and touch on the major additional code provisions applicable to them. We will discuss those special uses most likely to be encountered by designers. Note that several very specialized uses have been omitted, as they are not seen frequently. Most are related to Group H occupancies or to process-related special uses. Most designers do not frequently encounter these very specialized structures, or others such as underground buildings or amusement buildings. The criteria applicable to each of these other building types are used as noted above. The occupancy must first be determined before applying the specialized requirements contained in Chapter 4.

Many of the sections in Chapter 4 contain definitions of the uses or occupancies to which the special provisions apply. These definitions are listed in Chapter 2 of the code and cross-referenced for location and explanation in the section indicated. Note that although the definitions may seem familiar and similar to common construction terminology, they have very specific meanings in the code. Examine the building design conditions and definitions carefully to determine the applicability of the definition to the building design. This analysis of the definition may also point out necessary modifications to the design to make it code-compliant or reveal the need to reclassify it.




### Institutional Groups I-2 and I-3

The code adds provisions related to Group I-2 occupancies in § 407 and Group I-3 occupancies in § 408 that must be read in concert with those in Chapter 3. Chapter 3 is intended to address the occupancy classification of a building, and Chapter 4 is intended to address detailed requirements for certain uses and occupancies. Code analysis of these occupancy groups requires looking at both sets of provisions together. These are very specialized occupancies with many specific and detailed requirements. The discussion in this chapter of the special requirements for these occupancies is only an introduction. The code user must consult the detailed requirements in the IBC to determine the specific requirements for a specific project.

### Other Specialized Uses

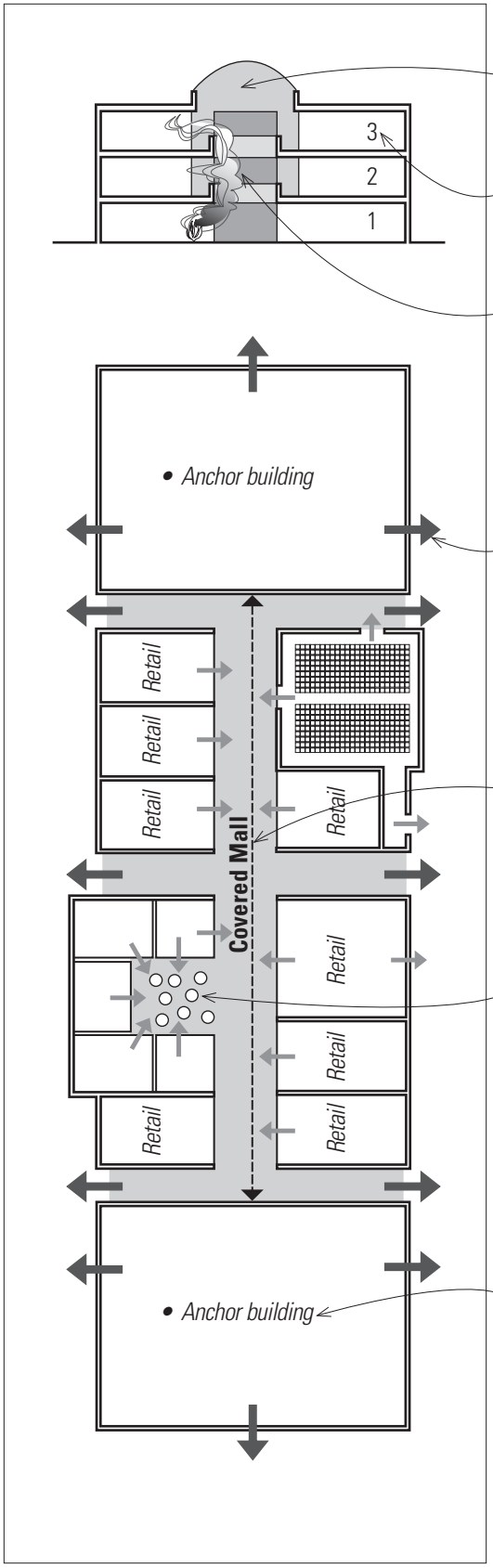
The remaining groups of uses in Chapter 4, beyond those discussed in this chapter, relate to specific uses of buildings or parts of buildings that are infrequently encountered in most occupancies. These include motion-picture projection rooms, stages and platforms, special amusement areas, aircraft-related facilities, and high-piled combustible storage. These are specialized uses not often encountered in the normal course of work and will not be addressed in this book.

**Covered and Open Mall Buildings**

The code provisions in § 402 for covered mall buildings grew out of many years of application of special interpretations of existing codes in response to a then-new building type. It did not fit into the code criteria in use at the time this use type was first developing. Covered malls came into being based on design and retailing innovations. They combine the circulation paths used for means of egress with pedestrian routes. Spaces that might be considered exit discharge areas or safe egress terminations, such as a city street, became exit access areas with enclosures. Multiple tenants have access to the common pedestrian areas. There is a mixture of large department store type uses, termed "anchor" buildings, and smaller shops that open on the mall. It is also expected that there may be a mixture of other uses such as cinema and food court assembly areas as well as major anchor uses that are interconnected by the mall.

The 2009 IBC added language clarifying that the term "covered mall building" is intended to also include open malls, which are defined as "unroofed common pedestrian ways serving two or more tenants and which do not have more than 3 levels open to each other." Thus, an open mall is essentially the same as a covered mall, but without a cover over the mall circulation spaces. The open mall is flanked by "open mall buildings," which, as for covered malls, do not include anchor buildings.

New language was added in the 2012 IBC to clarify that open malls using the provisions of § 402 are to be treated in a similar manner to covered malls in how they relate to means of egress and major stores.




- *A covered mall building is a roofed or covered pedestrian area into which two or more tenants have their main entrances.*
- *Covered malls governed by these provisions are limited to three levels at any point and not more than three stories above grade.*
- *Per § 402.7.2, where a covered mall building contains an atrium connecting three or more stories, the atrium shall be provided with a smoke control system in accordance with § 909.*
- *Anchor buildings have exits separate from the covered mall per § 402.8.4.1.*
- *A covered mall building is a single enclosure housing stores, restaurants, and other facilities, each of which has a main entrance onto the mall.*
- *A food court is a public seating area that serves adjacent food preparation tenants.*
- *Anchor buildings are not considered to be part of a covered mall building. Note that anchor stores are to be part of the analysis of open space separation distances per § 402.2.*