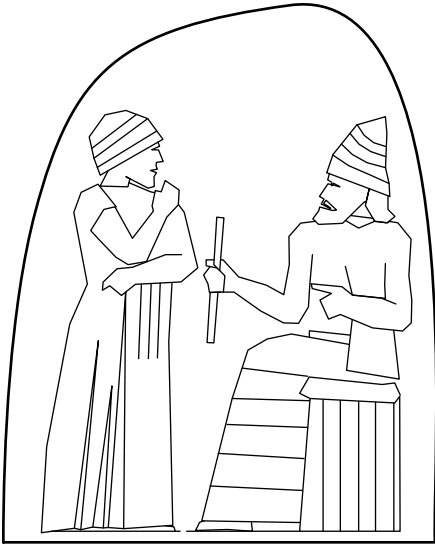


1

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 must 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 professional licensure and the reason that building regulations exist.

HISTORY AND PRECEDENTS



"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 cities regularly in the 1800s. Concerns about fire regulations in urban areas can even be seen dating as far back as the Great Fire of London in 1666. 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.

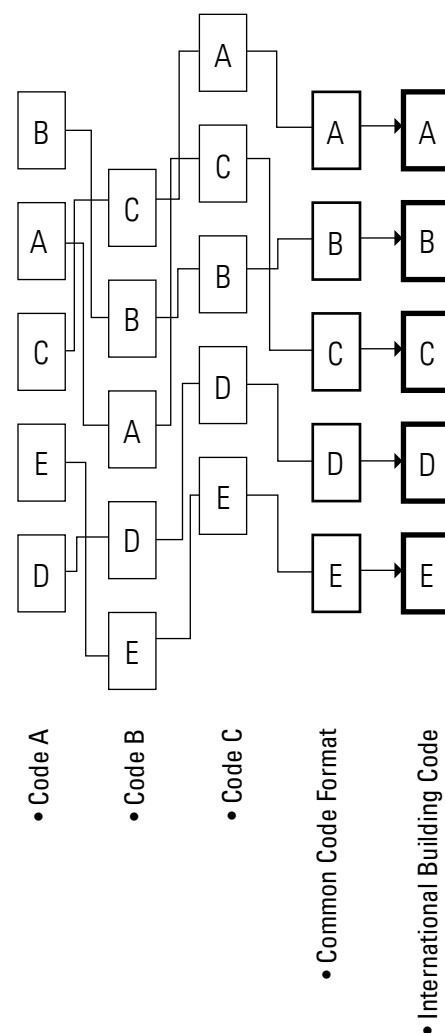


The various and often conflicting city codes were refined over the years and began to be brought together by regional nongovernmental organizations to develop so-called “model codes.” These model codes were developed and written by members of the code organizations. The codes were then published by those code organizations. 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. They published the *BOCA National Building Code*. Next was the International Conference of Building Officials (ICBO), formed in 1922. The first edition of their *Uniform Building Code* was published in 1927. The Southern Building Code Congress, founded in 1940, published the *Standard (Southern) Building Code*.

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, design professionals and life safety experts 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 have merged together to form the International Code Council and have ceased maintaining and publishing their own codes. Also included in this merger was the incorporation of the Council of American Building Officials (CABO) into the International Code Council. CABO published the *One- and Two-Family Dwelling Code*. This code, which was limited in coverage to the types of occupancies noted in its title, was the closest thing to a national model building code in the decades preceding the development of the *International Building Code*.

The International Building Code

Over the past few years a real revolution has taken place in the development of model codes. There was recognition in the early 1990s that the nation would be best served by comprehensive, coordinated national model building codes 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 reformat- ted 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 after 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 *International Building Code* (IBC), first published in 2000. There is now a single national model building code, maintained by a group composed of representatives of the three prior model-code agencies, the International Code Council, headquartered in Washington, D.C. This group was formed from a merger of the three model-code groups and CABO into a single agency to update and maintain the “I Code” family, which includes the *International Building Code* and the *International Residential Code*.



The International Residential Code

In addition to the *International Building Code* (IBC) there is the *International Residential Code* (IRC). This stand-alone code is meant to regulate construction of detached one- and two-family dwellings and townhouses that are not more than three stories in height with a separate means of egress. This code is designed to supplant residential requirements contained in the IBC in jurisdictions where the IRC is adopted.

The IRC is derived from a predecessor residential building code published by the Council of American Building Officials (CABO), the *One- and Two-Family Dwelling Code*. In 1996 CABO and the predecessor code organizations that ultimately became the International Code Council agreed to begin development of an updated stand-alone national model residential building code. This resulted in the first publication of the *International Residential Code* in 2000. This code includes provisions that replace the requirements of the *International Building Code* with requirements specific to buildings within the scope of the IRC. The IRC includes provisions for code requirements for all the systems typically contained in the one- and two-family buildings and townhouses regulated by the IRC. Among these “external” codes are the electrical sections of the IRC, which are taken from NFPA 70: *National Electrical Code*. The electrical chapters are produced under the auspices of the National Fire Protection Association (NFPA), which produces and copyrights the *National Electrical Code*. The IRC also contains materials regarding fuel gas provisions included through an agreement with the American Gas Association (AGA). [Note this book focuses on the first 10 chapters of the IRC, the requirements related to building design and construction, and does not address IRC requirements for such things as electrical or plumbing work.]

Note also that many local jurisdictions make other modifications to the codes in use in their communities. For example, many jurisdictions make amendments to require fire sprinkler systems, even in single-family residences, where they may be optional, or not even required, in the model codes. In such cases mandatory sprinkler requirements may change the design options 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 amend-

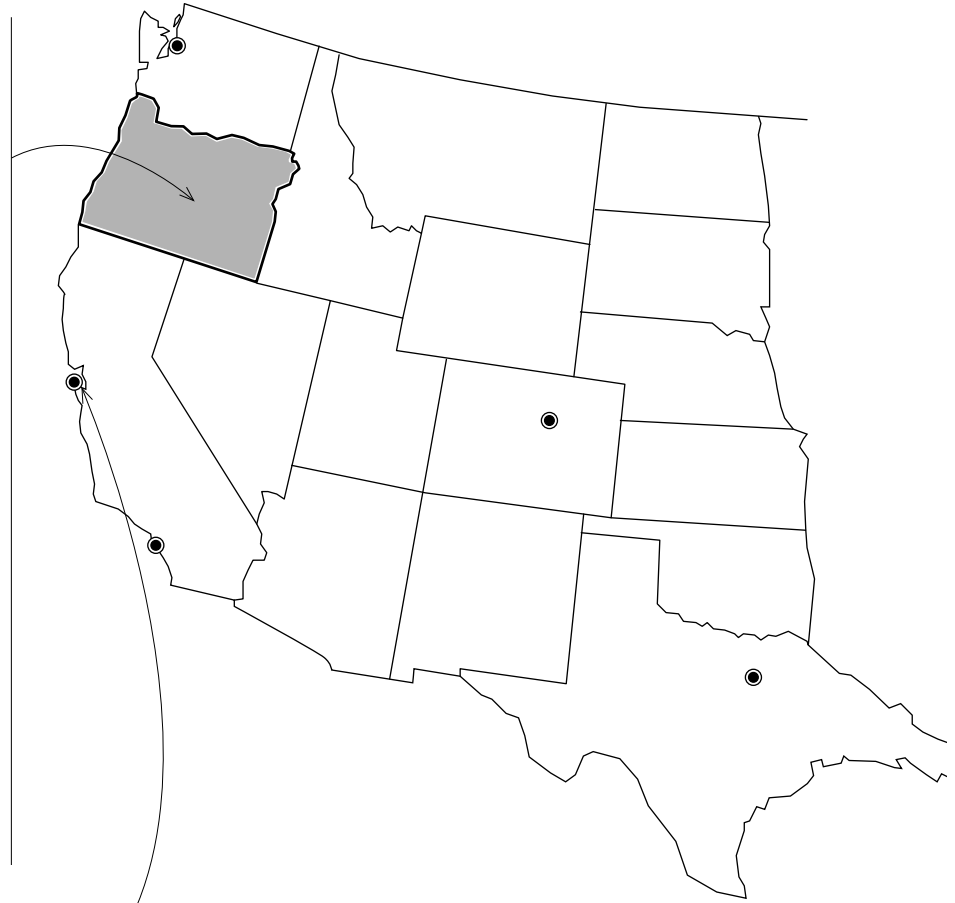
ments have been made in order to be certain which codes apply to a specific project.

There are also specific federal requirements that may need to 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. While knowledge of these regulations will promote universal design for access to housing for persons with disabilities, note that these regulations typically do not apply to the types of buildings regulated by the *International Residential Code*. Accordingly they will not be discussed in any detail in this book.



State Building Codes

Each state has a separate and distinct code adoption process. Many states may have adopted one of the three previous model codes and perhaps the CABO *One- and Two-Family Dwelling Code* in the past but some states have their own building codes. The geographic areas for current state model-code adoptions correspond roughly to the areas of influence of the three previous model codes as noted previously on page 3. The BOCA *National Building Code* predominated in the northeastern United States. The *Standard (Southern) Building Code* was adopted throughout the southeastern United States. West of the Mississippi River, the *Uniform Building Code* was adopted in most states. These adoption-area boundaries were loosely defined and flexible. Note also that the predecessor document to the IRC, the CABO *One- and Two-Family Dwelling Code* had a broader national adoption than the three predecessor model building codes. Many states allow local adoption of codes so that in some states, such as Texas, adjacent jurisdictions in the same state may have different building codes based on different model codes. State processes often defer completely to local adoption. Make certain you know what code you are working with at the permitting level.



Local Building Codes

Many localities adopt 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, Chicago and San Francisco adopt much more sweeping revisions to the model codes. In the past, codes in such large cities were often not based on model codes and bore little resemblance to them. Many cities make local amendments to the model codes due to local conditions or building traditions. Also, since codes are general and building projects occur in specific places, the codes must be interpreted by both the designer and by code officials to apply the intent of the code to the project at hand. Coupled to local modifications, the need to interpret how the code applies to a specific project should be expected as part of the code review process. 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 verification of 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 they are applied to specific projects.

The IRC is much more than just a “building” code. It contains code requirements taken from various codes for other design and construction disciplines beyond architecture and structural engineering. The Building Code regulations are usually the

focus of interest for architectural and structural work and as noted above are the focus of this book, but you need to be aware of the existence of additional requirements in the IRC 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. While these other requirements are contained in separate stand-alone codes for buildings other than those regulated by the IRC, the intent of the IRC is to provide a single source for all construction regulations related to one- and two-family dwellings and townhouses as defined in the IRC scope descriptions.

OTHER CODES

Code Interactions

The Authorities Having Jurisdiction (AHJ)—a catch-all phrase for all planning, zoning, fire and building officials having something to say about buildings—may not inform the designer of overlapping jurisdictions or duplicate regulations. Fire departments often do not check plan drawings at the time building permit documents are reviewed by the building department. Fire and life-safety 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 state or local statutes 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. There are typically cost thresholds for when permits are required. These are usually set by local amendments to model code provisions. 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. For renovation work it is critical to define the scope of alteration or addition work to be able to define the area where the code applies to the work. The code does not come

into effect in those areas not impacted by the work. The code requires new work to meet the current code, but does not require remedial work in those areas not affected by the new work. It is typically not required to bring a whole house up to the new code in those areas not impacted by new work. Again, this should be verified against local code requirements.

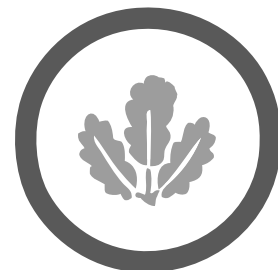
Standard of Care

The designer should always remember that codes are legally and ethically considered to be the 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. Registered design professionals and licensed contractors will be held by legal and ethical precedents to a much higher standard than the code minimum.

This concept is best described by the legal term "Standard of Care," which holds that the code is the minimum standard for practitioners, but that they also must respond to all of the other conditions affecting the project at hand. 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 building life safety provisions or from structural collapse. 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 a 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. Security measures to prevent

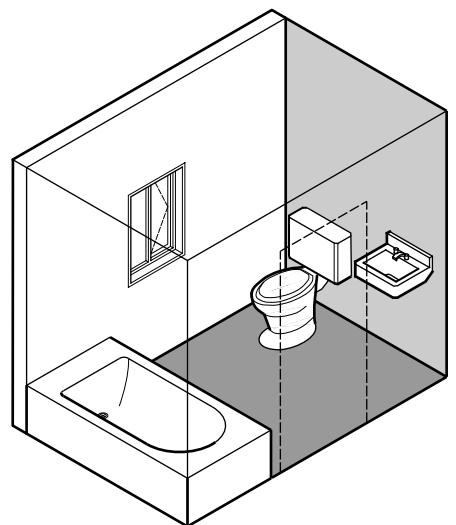
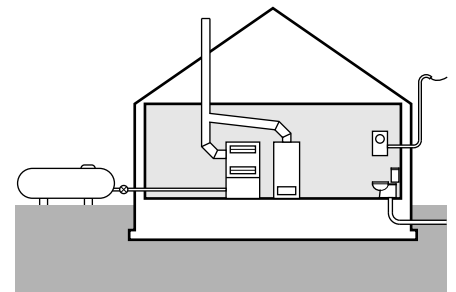
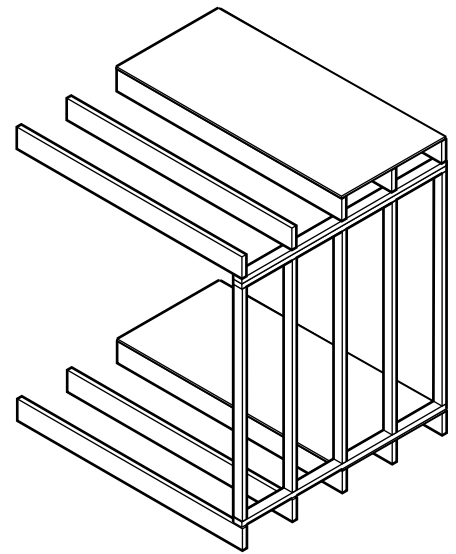


intrusion into a structure may become hazards to life safety. A prime example of this is burglar bars on the exterior of ground-floor windows that can trap inhabitants of the building in an emergency if there is not an interior release to allow occupants to escape while still maintaining the desired security. In no case should property-protection considerations ever have primacy over life safety.

The Code Development Process

As described above, the three previously existing model-code development agencies and CABO have merged into one organization. These agencies modified their code development processes into a unified national format. This new format has been modified slightly over the past few years as it had been developed, but it now seems well settled.

As in the past, 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, general, plumbing, mechanical 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 ICC annual business meeting. At the annual business meeting, testimony will be heard from interested parties, both from non-voting industry representatives and building officials who are given voting privileges. Only governmental members of the organization—typically public employees serving as building officials, fire officials or mechanical and plumbing officials—are allowed to vote on the proposed changes. This is described by the ICC as a “governmental consensus process.”



THE FUTURE OF CODE DEVELOPMENT

The *International Residential Code* is a living document. It is subject to yearly 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 constant during the design-and-construction process. The code development cycle allows the code to respond to new information, growing by accretion and adaptation.

Performance vs. Prescriptive Codes

The *International Residential Code* is, as were the codes that preceded it, “prescriptive” in nature. It is developed to mitigate concerns by creating specific and prescribed responses to problems that have been identified. Designers identify the problem to be addressed, such as the size of egress windows, and then they look up the prescribed response in the applicable code section. For example, guard heights are prescribed to be 42" (1067) high in non-residential buildings and 36" (914) high in residential buildings 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. We will discuss briefly the distinctions between prescriptive and performance codes.

Performance codes 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 guard requirements stat-

ed above are 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 guard rails 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 guard rail. 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 guard rail 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 many typical, repetitive designs will continue to use prescriptive code for speed, clarity and assurance of compliance during design review. Also, given the current legal climate, designers are often reluctant to assume the responsibility for long-term code compliance for innovative systems.

