

## **The *International Building Code* and *International Residential Code* and Their Impact on Wood-Frame Design and Construction**

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### **ABSTRACT**

This paper presents the evolutionary history of development of a new single set of uniform building codes in the United States, and outlines the impact of these new provisions on wood design and construction. The first *International Building Code* (IBC) and *International Residential Code* (IRC) are scheduled for publication in the year 2000. Both are being developed by the International Codes Council (ICC), a new entity formed by the three U.S. model building code agencies. The IBC and IRC will contain revisions to existing code requirements and new provisions that will impact wood design and construction. Possible benefits of the new codes will also be discussed.

### **INTRODUCTION**

The purpose of a building code is to serve as a regulatory document aimed at protecting the public's life, health, and welfare in the built environment. In the U.S. this is usually accomplished by the adoption of a model set of codes through state statute or local government ordinance with enforcement being provided by state agencies and local governments having specific jurisdiction. Model building codes are most frequently used because cities and counties lack individual resources to write and maintain a comprehensive regulatory document. Model building codes represent a partnership of cities, counties, states, industries, laboratories, educational and research institutions.

### **BACKGROUND**

Discussions of building codes often begin with a reference to the Laws of Hammurabi, a Mesopotamian ruler from 2285-2242 B.C. This was the first known building code. Hammurabi's code was a simple performance code: *Law §229 - If a builder has built a house for a man and has not made strong his work, and the house he built has fallen, and he has caused the death of*

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*the owner of the house, that builder shall be put to death*<sup>3</sup>. It also contained a number of other punishments related to various types of failure.<sup>4</sup> In the centuries after the benevolent rule of the king, little changed in the building code business.

The industrial revolution, particularly as practiced in North America, brought with it changes in social order and administration of laws. In addition, building construction practices were changing. Tragic losses of life in textile mill fires in the nineteenth century led to innovations such as sprinkler systems and multiple exits. It also became clear that better regulation of the built environment was required. Code practitioners banded together to promote the concept of professionalism and to promulgate ‘model’ building codes. Three groups came to preeminence. The nation’s oldest professional organization for construction code officials, the Building Officials and Code Administrators (BOCA), International was founded in 1915. The International Conference of Building Officials (ICBO) was founded in 1922, and the Southern Building Code Congress, International (SBCCI) was founded in 1940.

Each of these three groups became dominant in their particular geographic region: BOCA in the east, SBCCI in the south, and ICBO in the west. All developed independently and came to have unique characteristics and different philosophies of building construction and code enforcement. That character and philosophy were reflected in the written model building code promulgated by these non-profit groups. Each of these building codes is one of a family of codes, including mechanical, plumbing, housing, zoning, and fire prevention codes, which are interrelated and correlated to work together to achieve complete regulation of the built environment.

BOCA reflects attitudes of the east and the needs of a highly urbanized environment. BOCA’s *National Building Code* (NBC) is primarily performance based and liberally utilizes references to consensus standards published by other entities, such as the American Society for Testing and Materials (ASTM) and American National Standards Institute (ANSI).

ICBO developed the self-contained, freestanding *Uniform Building Code* (UBC), within which standards were originally transcribed and most materials needed to enforce or interpret the code are contained. The *UBC* is a mix of performance and prescriptive requirements. Many of the structural provisions reflect the area’s exposure to earthquakes and need for proper seismic design.

SBCCI developed the *Standard Building Code* (SBC), originally known as the *Southern Standard Building Code*, reflecting the needs of code enforcement in the south, with particular emphasis placed on wind-resistive design in recognition of the southeastern states’ exposure to hurricanes. The *SBC* is also primarily performance based with liberal use of referenced consensus standards published by other entities for use in judging the performance of materials and systems.

Because these model codes reflected the characteristics of construction and the environmental conditions that were prevalent in their region, they differed in their format, content, and

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<sup>3</sup> *The Oldest Code of Laws in the World*, Translated by S. H. W. Johns, M.A.; T & T Clark, 38 George Street, Edinburgh, 1903.

<sup>4</sup> The laws also provided fixed fees for design and construction, among other things.

appearance, despite the fact that they imposed very similar regulations on many construction aspects.

In the early 1970's, the American Institute of Architects (AIA) developed a policy which called for short-term and long-term changes in the code development arena. Their short-term goal for the three model codes was merely to reorganize the documents around a common code format. In this manner, similar requirements would be located in the same chapters in each of the three model codes. The long term goal was more ambitious and initially thought to be wishful on the part of AIA. It called for development and publication of a single set of national model codes through the cooperation of the three model code groups!

In 1972 the Council of American Building Officials (CABO) was created by the three model code groups as an organization that would, among other things, provide the means to address matters of common concern among BOCA, ICBO, and SBCCI. CABO, in turn, established the Board for the Coordination of the Model Codes (BCMC) which was intended to identify conflicts between the three model codes and recommend revisions to address those conflicts. BCMC tackled numerous problems in codes, one of the biggest being their differing format. BCMC eventually developed a common format based on organizing the codes around similar materials and life safety.<sup>5</sup> BOCA reorganized its documents into this new format in 1993 and SBCCI and ICBO followed in 1994.

One of the early joint code-writing efforts by the three code groups occurred under the CABO umbrella. It was the development of the *One- & Two-Family Dwelling Code (OTFDC)*. The OTFDC is a specification code which is applicable to one- and two-family dwellings and townhouses, as defined in the code, and addresses not only the construction of the structural elements of the building, but also the plumbing, mechanical, electrical, and fuel gas systems. Although all of these elements are addressed in the larger building codes and their related codes, the OTFDC provides a single source of primarily prescriptive requirements and contains little performance language. Although it is recognized by all three code organizations, the OTFDC is not a mandatory document unless specifically adopted by a jurisdiction.

Around the time that BOCA, ICBO, and SBCCI reorganized their code books to reflect the BCMC format recommendations, the three model code groups formed a new umbrella organization called the International Code Council (ICC). Subsequently, the code groups rolled CABO into the ICC. ICC was incorporated as a not-for-profit corporation in 1994, dedicated to developing a single set of comprehensive and coordinated codes similar to what was desired by AIA. This bold and ambitious program called for a new set of model codes to be completely developed and published by the first quarter of the year 2000, in time for the new millennium.

Surprisingly, given the parochial attitudes of many of the members of the three model code organizations, the ICC code development process quickly dispatched several elements of its family of codes. The first to be promulgated was the *International Mechanical Code (IMC)* in 1995. Quickly following was the promulgation of the *International Plumbing Code (IPC)*, the *International Private Sewage Disposal Code (IPSDC)*, and an *International Zoning Code (IZC)*. Finally, in late 1996, Building Code Development Committees were established by ICC with the

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<sup>5</sup> The codes were reformatted into a common code format developed cooperatively by AIA, BOCA, ICBO, SBCCI and SFPE under the auspices of the Council of American Building Officials.

task of melding three distinctly different regional building codes into a single model code.

### ***INTERNATIONAL BUILDING CODE***

The task of developing a single model code was broken up into five technical code development committees: Structural, Occupancies, Fire Safety, Means of Egress, and General. These code development committees were formed and tasked with developing model code provisions from materials already available on each subject within the existing model codes, BCMC reports, or in rare circumstances, the work of other groups such as the Building Seismic Safety Council (BSSC). Each of the three model code groups sent a three-member delegation and one staff member to each of the committees. The time schedule set forth by the ICC Steering Committee resulted in the committees meeting between six and ten times to develop their respective draft chapters. These were then consolidated into an initial working draft of a new *International Building Code* (IBC).

As is typical in legislative processes, each committee developed its own personality and thus its own philosophy during developmental activity. The Structural Committee expressed an intention to incorporate the most current and generally accepted engineering standards for conditions such as environmental loads (wind, seismic and snow), new maps for wind and snow, and the latest in design methodologies for various materials. The Occupancy committee decided to develop use groups and height and area limits which would embrace all of the limits then existing in the various codes. The Fire Safety Committee wanted to utilize the “most restrictive” provisions of the model codes. The Egress and the General Committees developed similar independent personalities.

### **Structural Committee**

The result of the Structural Committee’s work is embodied in various chapters including: Chapter 16, “General Design Requirements;” Chapter 17, “Structural Tests and Inspections;” Chapter 18, “Soils and Foundations;” and Chapters 19 through 23 which address the particular building materials, i.e., concrete, aluminum, masonry, steel, and wood. Early on, the committee turned to the various materials groups, such as the American Forest & Paper Association (AF&PA), for guidance and input in development of related provisions of the code. The Committee also worked closely with BSSC on new seismic provisions and with engineering associations such as the Structural Engineers Association of California (SEAOC) and other groups to develop the loads contained in Chapter 16.

Prescriptive wood construction provisions, known as “conventional construction,” were included in Chapter 23. Requirements of the conventional construction section were taken primarily from the UBC. The NBC contained a limited range of prescriptive material, and while the SBC conventional construction requirements were similar to those in the UBC, the committee considered the UBC version to be more complete. Various amendments were made to the UBC provisions to address issues which were a concern in portions of the country which did not use the UBC. Since the UBC requirements address issues relating to resistance of seismic forces, most revisions were made to address wind-related issues not adequately addressed in the UBC.

As in current editions of the three model codes, Chapter 23 of the *International Building Code* governs materials, design, construction, and quality of wood members and their fasteners. Aside from prescriptive conventional construction provisions, Chapter 23 is performance-based and relies in large part on references to the design standards of AF&PA: the *National Design Specification® (NDS®) for Wood Construction, Load and Resistance Factor Design (LRFD) for*

*Engineered Wood Construction, and Wood Frame Construction Manual (WFCM) for One- and Two-Family Dwellings, SBC High Wind Edition.*

The format of the chapter is different from that of any of the three existing codes. The new format was suggested by AF&PA, and it placed the requirements into a more logical and user-friendly arrangement. Chapter 23 is now divided into sections that address definitions of terms particular to the chapter, minimum quality standards, general requirements applicable throughout the chapter, lateral force resisting systems, allowable stress design, load and resistance factor design, and conventional construction.

The section on conventional construction defines those situations in which prescriptive requirements of the section apply. It also contains requirements for lateral bracing and continuous load paths, similar to what exists in the current UBC. Engineered precalculated span tables for joists and rafters and for girders and headers have been included in the conventional construction section. Prescriptive requirements for high-seismic areas, based on the provisions of the National Earthquake Hazards Reduction Program (NEHRP) and recommended by the Code Resources Development Committee (for BSSC), have been included.

### **Occupancies Committee**

The Occupancies Committee had what some observers believed to be the most difficult task of the group. They had to find a way to meld widely divergent use group categories and extremely dissimilar height and area (H&A) limits into a single set of requirements and definitions. The H&A limits were generally regarded as the single biggest stumbling block to the whole IBC process.

The Committee consciously decided to take the approach that the H&A table ought to allow construction of any building currently permitted by any one of the three model codes. Essentially, the philosophy was for the H&A table to reflect the least restrictive provisions of the three model codes. This is a very important concept and a fairly innovative approach to codes, where the usual reaction is to use the most restrictive provision. It means that for any given occupancy, the IBC H&A limit would be almost identical to one of the existing codes. But that also means that the H&A table would permit larger buildings than presently permitted by one or two of the current model codes! In some cases, the increase from that which is currently permitted is quite significant.

Another effort by the Occupancies Committee involved combining definitions of types of construction from the three model codes and creating definitions of use groups and types of occupancies from the model codes. With few exceptions, definitions include an expanded role permitted for wood or wood products. For example, Type III construction, commonly referred to as ordinary construction with its non-combustible walls and combustible floor and roof/ceiling assemblies, allows use of fire retardant treated wood for exterior walls, notwithstanding the normal requirement for noncombustible construction.

### ***INTERNATIONAL RESIDENTIAL CODE***

In 1996, the ICC Board of Directors established the ICC/NAHB Task Force. This group, composed of ICC members and members of the National Association of Home Builders, was created to review the OTFDC and determine its place in the ICC family of codes. The task force was also charged with identifying other issues that would affect use of the code under the ICC, including whether the CABO process of updating the OTFDC should be retained. The task force

recommended that a new stand-alone residential code be developed, called the *International Residential Code*.

ICC also decided that use of the IRC would be mandatory, unlike the OTFDC. All material related only to one- and two-family dwellings and to townhouses, again, as defined in the IRC, will be deleted from the IBC and its related codes. Code provisions within that scope will only be found in the IRC.

A drafting committee was formed by ICC which contained one code official from each of the three code groups, three home builders, and three industry individuals nominated by the ICC Industry Advisory Committee. The industry members of the original drafting committee were all architects.

The IRC drafting committee conducted its first meeting in September of 1997 and met monthly through April of 1998, at which time a draft of the IRC was published for public comment. Although the 1995 edition of the OTFDC was used as a basis, the committee made substantial revisions to that document. An administrative section was added, as was a section stipulating the structural basis for the code. In many instances the technical content of the OTFDC was updated and expanded to be more complete. New provisions were taken from the IBC as well as the existing model codes, although relevant outside technical material was also considered.

The existing format of the OTFDC -- chapters based on building elements rather than on materials, as is done in the IBC -- was retained. The existing OTFDC requirements relating to wood-frame construction were retained, but updated.

The requirements in the IRC draft for high load areas are somewhat of an odd mixture. There are prescriptive requirements for light-gauge steel framing in both high-wind and high-seismic areas of the country. There are limited high-seismic requirements for masonry and concrete, and for construction in high-wind areas these buildings must either be designed to comply with the latest version of ASCE 7 or must comply with prescriptive requirements of SBCCI's SSTD 10, *Standard for Hurricane Resistant Residential Construction*. Wood frame construction has prescriptive provisions for high-seismic areas. Buildings in high-wind areas must comply with SSTD 10, AF&PA's *Wood Frame Construction Manual for One- & Two-Family Dwellings (High Wind Edition)*, or be designed in accordance with ASCE 7.

The seismic portions of the IRC draft reflect the methodology and terminology used in the IBC, but the material is somewhat simplified. The provisions of the IRC draft apply to Seismic Design Categories A, B, C, and D. A major undertaking was the inclusion of new seismic provisions from NEHRP, including new seismic maps. These proposed revisions from the BSSC Code Resource Development Committee corrected the seismic risk maps and brought them into compliance with the 1997 NEHRP provisions.

#### **ICC CODE DEVELOPMENT PROCESS**

Like the democratic processes of the three model code organizations, any interested party may submit a code change proposal to ICC and participate in the proceedings in which it and all other such proposals are considered. This open debate and broad participation before a committee comprising representatives from across the building regulatory industry, including code regulators and construction industry representatives, ensures a fair hearing in the decision-making process. A new feature of ICC's code development process is that it will allow both the

ICC code development committees and eligible voting members (code enforcement professionals) at code change hearings to participate in establishing the results of each proposal. Voting members may either ratify a committee's recommendation or make their own recommendation, with the members' recommendation being treated as a challenge to the action of the committee. The results of all votes will be published in the report of the ICC code development hearings.

Eligible voting members of the three model code groups will review recommendations of the respective ICC code development committee at their annual conference and determine final action. Following consideration of all public comments, each proposal will be individually balloted by the eligible voters. This process is intended to ensure that the International Codes reflect the latest technical advances and address concerns of those throughout industry in a fair and equitable manner.

## **CONCLUSION**

The development of the new International Codes is part of an evolutionary process to improve protection of the public's life, health and welfare in the built environment. Although, it is doubtful that a single set of codes will successfully discourage states and localities from attempting to amend the International Codes or adopting the International Codes with technical amendments, it is hoped that uniform adoption will lead to consistent code enforcement and higher quality construction. By combining the efforts of the three model code organizations to produce a single set of codes, architects, engineers, designers and contractors will be better able to expand and market their services to broader geographical areas, rather than being limited to a small region. Manufacturers of building products will also be better able to place their efforts into research and development rather than designing products to meet differing sets of regional standards. This, in turn, should enable manufacturers to improve their competitiveness in worldwide markets. Further, uniform education and certification programs should benefit the mobility of code enforcement professionals to market their skills nationally, and uniform adoption should improve mutual aid disaster relief efforts of code enforcement professionals.

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