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The *International Building Code* and Its Impact on Wood-Frame Design and Construction

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Summary: The first International Building Code (IBC) is scheduled for publication in the year 2000. It is being developed by the International Codes Council (ICC), a new entity formed by the three U.S. model building code agencies. The IBC will contain revisions and new provisions that will impact wood design and construction. Possible benefits of the new code will also be discussed.

Keywords: International Building Code, IBC, model building code, wood design, wood construction.

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ABSTRACT

This article 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.

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. As such, although they are generally broad based, they are not truly consensus documents. The *International Building Code* represents a further 'marriage' of the three model code groups in the United States. It is intended to supplant existing codes early in the next millennium, bringing with it uniformity across the United States.

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 the owner of the house, that builder shall be put to death*[1]. It also contained a number of other punishments related to various types of failure.[2] Surely this was the purest form of a "Performance Building Code" and a genuine incentive to meet or even exceed minimum standards. In the centuries after the benevolent rule of the king, little changed in the building code business. In Western societies, the nobility ruled in a manner similar to Hammurabi, with death or dismemberment as possible consequences of transgressions.

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. However, certain construction practices were less than ideal with regard to safety to life and limb. The most common example was the textile industry of New England. Tragic losses of life in textile mills in the nineteenth century led to innovations such as sprinkler systems and multiple exits. It became clear that better regulation of the built environment was required. New social order demanded increased vigilance in protecting both property and life. 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.

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[1] The Oldest Code of Laws in the World, Translated by S. H. W. Johns, M.A.; T & T Clark, 38 George Street, Edinburgh, 1903.

[2] The laws also provided fixed fees for design and construction, among other things.

That character and philosophy were reflected in the written model building code promulgated by each of these non-profit groups.

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). Use of performance-based requirements is intended to encourage use of innovative building designs, materials, and construction systems while at the same time recognizing the merits of more traditional materials and systems. This concept is intended to promote maximum flexibility in building design and construction as well as assuring a high degree of life safety. The *NBC* is one of a family of codes including, mechanical, plumbing, housing, zoning, fire and fire prevention, which are interrelated and correlated to work together to achieve complete regulation of the built environment.

ICBO, like the western United States it represents, developed the self-contained, freestanding *Uniform Building Code* (UBC), within which standards are transcribed and most materials needed to enforce or interpret the code are contained. The *UBC* is a mix of performance and prescriptive requirements. Much of the structural provisions, for example, reflect the area's exposure to earthquakes and need for proper seismic design. Like the building codes promulgated by the other two model code organizations, the *UBC* is designed to be compatible with related publications to provide a complete set of documents for regulatory use, e.g., mechanical, plumbing, housing, fire.

SBCCI developed the *Standard Building Code* (*SBC*, originally known as the *Southern Standard Building Code*) reflecting the needs of code enforcement in the south. 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. Like the other two model building codes, the *SBC* is a member of a family of interrelated and correlated codes that are intended as a comprehensive set of regulatory standards for the built environment. Since the southeastern states are subject to intense winds from tropical storms and hurricanes, SBCCI developed extensive provisions for improved wind-resistive design and construction including a companion standard of prescriptive, 'deemed to comply' methods for residential construction in high wind areas (*Standard for Hurricane Resistant Residential Construction,* SSTD 10).

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 appearance, despite the fact that they imposed very similar regulations on many construction aspects. Although this regional code development was effective and responsive to the country's needs at the time national building construction interests began to call for improved commonality of provisions and format, as the differences created difficulties for contractors, building products companies and professional designers who worked on a nationwide or interregional basis.

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!

Never lacking in ambition, the AIA did not back away from this goal throughout the ensuing turbulent decades. With considerable tribulation, the three code groups formed a voluntary, quasi-umbrella group to study major code issues with a goal of developing a unified solution to the problem issues. This group was called the Board for the Coordination of the Model Codes (BCMC). BCMC eventually included representatives of the National Fire Protection Association (NFPA) in its membership. BCMC tackled numerous problems in codes, one of the biggest being their differing format. The challenge was to develop a new format which made sense from the perspective of the three model codes. BCMC met and eventually developed a common format based on organizing the codes around similar materials and life safety.[3] BOCA reorganized its documents into this new format in 1993 and SBCCI and ICBO in 1994.

At about the same time, the three model code groups formed a new umbrella organization called the International Code Council (ICC). ICC was incorporated as a not-for-profit corporation in 1994, dedicated to developing a family of comprehensive and coordinated codes. Subsequently, they rolled their separately constituted residential code body, the Council of American Building Officials (CABO), into the ICC. The development of a comprehensive and coordinated family of codes was certainly a bold and ambitious projects in code-making. The 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, the Building Code Development Committees were established by ICC with the 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 three member delegations and one staff member to the committees. The committees were charged with meeting every other month, or as necessary, to meet the time line set forth by the ICC Steering Committee. The time schedule 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

[3] 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.

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 and other groups to develop the loads contained in Chapter 16. In one of the more ambitious projects, they extracted much of the so-called "Conventional Construction" elements which appear in the UBC. It was an ambitious undertaking because the provisions had to be reevaluated with respect to all environmental and occupancy conditions. The committee also required revisions to make prescriptive provisions compatible with performance-based code language because it was the goal of ICC to develop a performance-oriented code.

As in the 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 design standards of AF&PA. It includes many of the familiar requirements for wood construction that are common to all three existing model codes, including design provisions of 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*. In that respect, provisions should be familiar to any user.

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 limits into a single set of requirements and definitions. The height and area (H&A) limits were generally regarded as the single biggest stumbling block to the whole IBC process. In each of its nine meetings, the Occupancies Committee began with some discussion of the H&A issue. In early stages, they postponed debate and worked on other issues. This included 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 known 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. A similar provision exists within the *UBC* and is included in the definition of Heavy Timber Construction (Type IV).

As stated, the single biggest problem was resolution of differences regarding H&A limits. The Committee, in its debates, 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.

The philosophical decision to accept the least restrictive height and area provision of the three model codes, however, created a tabular format problem. Unless some adjusting was done to the table, there would be little or no relationship between the tabular values for the various types of construction based on fire exposure. To address this problem, the Occupancy Committee made a decision to utilize the basic format of the BCMC Report on height and area limits issued in 1989. They agreed to make limited modifications to the area increase formula and to the “unlimited area building” provisions in the three model codes. With the framework in place, all that remained was to determine numeric values to be used in the table of H&A limits. During these Committee discussions, members recognized that restrictive H&A limits were antiquated, as life and building safety was largely covered by other sections of the code through such provisions as travel distance limits, multiple egress requirements and fire protection features. As a result, the concept of “excluding no building currently permitted” was made the policy and the task was reduced to identifying numbers to use in the table. Although this task might sound simple and straightforward, it was anything but, since each one of the three model codes employed its own unique tabular format and construction types differed from code to code.

In order to identify appropriate height and area figures, a task group was formed within the Occupancies Committee to develop a method of analyzing the existing codes and deriving an IBC table of H&A limits. The support staff members of each of the three model code groups were given the task of determining which of the code’s construction types most closely resembled construction types of the proposed IBC and then to calculate the maximum permitted height and area used for a sprinklered building with 100% open perimeter and unobstructed access. Further, staff members were directed to ignore the special unlimited area building provisions of the model code. The result of this exercise was to place into the table the largest height (in stories) and area (in square feet) permitted by the three codes. The largest number was placed into a table and the area increase formula was simply “solved backwards” to determine the values for each tabular cell.

The Committee accepted the work of the task group in concept but became uncomfortable with several ‘anomalies’ which manifested themselves through the analytical process. In order to address these anomalies, the task group met a last time to ‘smooth’ the transition of values from fully noncombustible construction to completely combustible construction. The Committee also developed some new values for use groups which do not exist in any of the three model codes and thus were not available for selection. Twelve of the one hundred thirty eight values needed further adjustment. As reported earlier, this process guaranteed that two of the three code regions would realize larger permitted H&A limits than they had previously experienced. The BCMC area increase calculation method coupled with research by the staff members resulted in the tabular values being rounded higher than the model code values. The result is that IBC height and area limits have increased the allowable area for nearly every type of construction involving wood structural members for almost every use group. For eastern and southern parts of the country, for example, the IBC will contain the first ever unlimited area building provisions for wood frame buildings. This has been permitted to some degree in the western states through the *UBC*.

Areas allowed for agricultural buildings are similar to those for moderate hazard storage. To genuinely be considered agricultural, no general occupancy by people may occur. Equipment sheds and livestock buildings are all examples of this. A poultry processing plant, however, is not deemed an Agriculture building. It is, instead, classified as a factory, or Use Group F building. Still, the areas permitted in some agriculture buildings will be suitably large. In fact, in some cases, it may be more beneficial to seek a classification of an optional use like Use Group S-1, moderate hazard storage for equipment sheds. Regardless of the ultimate use group classification, many of the buildings will be permitted to be larger and taller in most parts of the United States.

However, it is important to note that the IBC will not regulate agricultural buildings directly. Agriculture building requirements have been placed in an appendix chapter. As an appendix chapter, the provisions will not be enforceable as code text unless it is separately and specifically adopted by a jurisdiction. In other words, it will be randomly adopted, somewhat defeating the purpose of a uniform, national building code.

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 the 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. 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 geographic 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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