

Code Conforming Wood Design

Wood Use Provisions in the 1999 *BOCA NBC* and 2000 *IBC*



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Expanding the Use of Wood Construction: A Comparative Analysis

2000 ICC *International Building Code* and the 1999 BOCA *National Building Code*

Development of the *International Building Code*

The publication of the 2000 Edition of the *International Building Code* (IBC) (1) marked the end of regional code development by Building Officials and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI). The publication of the *IBC* signals a new era in model construction codes. The publication of the *IBC* completes the family of national model construction codes developed cooperatively by the three model code organizations.

In 1994 the three regional model code organizations created the International Code Council (ICC), a nonprofit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes. The goal of the ICC was to have the new family of national model construction codes available by the year 2000 and they have met this goal. And, so, in 1996 work began on the creation of the *IBC*, developed primarily from the provisions of the three nationally recognized model building codes: the *BOCA National Building Code* (*BNBC*) (2) promulgated by BOCA, *Standard Building Code* (*SBC*) (3) promulgated by SBCCI, and *Uniform Building Code* (*UBC*) (4) promulgated by ICBO. The model code organizations agreed that once the 2000 *IBC* was published, no further editions of their own codes would be maintained. In accordance with this agreement, ICBO published the last edition of the *UBC* in 1997 while BOCA and SBCCI halted publication of their codes in 1999.

The *IBC* is a comprehensive code and coordinating document for the suite of *I-Codes*. In certain instances, *IBC* provisions are identical to those of the three regional model codes. In other instances, the provisions are a modification of requirements from one or more of the three regional model codes. Some provisions are entirely new and unique to the *IBC*.

This Brochure

This brochure highlights some of the differences between the 1999 *BOCA National Building Code* and the 2000 *International Building Code*. It is one of a series of three brochures that compare the *IBC* to each of the three model codes. Where significant provisions of the *IBC* are identical or similar to those of the *BNBC*, this fact is noted. Where provisions are significantly different, a comparison is provided.

The format of this document is intended to assist the reader in applying the information contained herein to the actual text of the code. For that reason the various sections of this brochure are titled to correspond with the code chapters to which they apply. Chapter subject matter and number in the *IBC* are the same as in the *BNBC* since both are based on the common code format utilized by the three model code organizations. Developed in 1988, the common code format was implemented by each of the model code organizations in subsequent editions of their codes. BOCA, for example,

adopted the common code format in its 1993 edition of the *BNBC*. This common code format, in turn, simplified the development of the *IBC* and should be an aid to users in the transition from one of the regional model codes to the *IBC*.

This publication is intended to give the reader insight into the provisions of the *IBC* that regulate wood products and it is based on the 2000 edition of the code. Although most of the information provided in this publication pertains to 2000 *IBC* provisions that address wood and wood construction, some of what is discussed has general application. The reader is encouraged to consult the current edition of the code and to consult the authority having jurisdiction for possible local amendments.

Comparing the IBC and the BNBC

ADMINISTRATION (CHAPTER 1)

As mentioned above, the goal of the ICC is to have a “family” of model *International Code (I-Codes)* available for adoption. At the time of publication of this brochure, there are 11 codes published by the ICC. Of these, four have applications to wood products: *International Building Code (IBC)*, *International Residential Code (IRC)* (5), *International Fire Code (IFC)* (6), and *International Performance Code for Buildings and Facilities (IPCBF)* (7). The most significant to wood products are the *IBC* and the *IRC*.

The *IBC* is the general building code and coordinating document for the suite of *I-Codes*. The purpose of the *IBC* is to establish minimum requirements for structural strength, means of egress, stability, energy conservation, and safety to life from fire and other hazards attributed to buildings and structures. The provisions of the *IBC* do not, however, apply to one- and two-family dwellings and to certain multiple-family dwellings. The construction of those types of residential structures is addressed in the *IRC*.

The ICC has specifically established a separate document, the *IRC*, for regulation of detached one- and two-family dwellings, multiple-single family townhouses, and their accessory structures. Structures more than three stories high are outside the scope of the *IRC*. The format of the *IRC* closely resembles that of the Council of American Building Officials’ (*CABO One- and Two-family Dwelling Code*) (8). Under the scoping section of the *IBC*, use of the *IRC* is mandatory for residential buildings meeting its scope. This differs from the *BNBC*, which contains all necessary provisions for the regulation of all structures, including single-family dwellings, two-family dwellings, and townhouses. In the *BNBC*, compliance with the *CABO* code was permitted for detached dwellings and townhouses as an alternative in accordance with Section 310.6.

Unlike the *BNBC*, the *IBC* makes use of optional appendix chapters, which can play an important role in the regulatory process if specifically adopted. Appendix chapters are not enforceable, unless specifically adopted by the authority having jurisdiction.

DEFINITIONS (CHAPTER 2)

Definitions for terms used in the *IBC* were primarily compiled using terms from the three existing model codes. Similar to the *BNBC*, in the *IBC* all defined words are listed in Chapter 2, but only words of general application are actually defined there. Words that are specific to the technical provisions of a chapter are cross referenced in Chapter 2 but defined in the corresponding chapter. Therefore words unique to wood construction are defined in Chapter 23, Section 2302.

USE & OCCUPANCY CLASSIFICATIONS (CHAPTER 3)

Although occupancy classifications used in the *IBC* are similar to those of the *BNBC*, there are a few differences that are highlighted in the following paragraphs.

Assembly. The *IBC*, like the *BNBC*, has five divisions of assembly occupancy. However, the descriptions of the five groups have changed. Three primary differences in the *IBC* are as follows:

- Group A-2 is expanded to include any assembly use intended for food and drink consumption, such as banquet halls, night clubs, restaurants, and bars. In the *BNBC*, A-2 was reserved for night-club style establishments only. Therefore restaurants, which were A-3 under the *BNBC*, are classified as A-2 in the *IBC*.

- The separate classification for places of worship, A-4 in the *BNBC*, is eliminated as a separate classification in the *IBC*; churches and other places of worship are included in the general assembly category, A-3.

- A-4 in the *IBC* is reserved for assembly uses intended for viewing of indoor sports events and activities with spectator seating, such as arenas, skating rinks, and swimming pools.

In summary, the assembly occupancy classifications in the *IBC* are as follows:

A-1: Uses intended for the production and viewing of performing arts or motion pictures.

A-2: Uses intended for food and/or drink consumption.

A-3: Uses intended for public assembly such as museums, auditoriums, places of worship, meeting halls, libraries, places of amusement, and other uses not classified elsewhere.

A-4: Uses intend for viewing of indoors sporting events and activities with spectator seating.

A-5: Uses intended for outdoor assembly such as amusement park structures and stadiums.

Educational. As in the *BNBC*, the *IBC* reserves Group E for schools, up through the 12th grade. However, there is no exception to the E classification for spaces occupied by less than 50 persons which is accessory to another use group as there is in the *BNBC*.

Another change is the way that day care facilities are classified. The *BNBC* had three possible categories for day care: Group E, if the children were over 2 /12 years old and there were more than 16 children; Group R-2 or R-3 Residential Care facility if there were between more than 5 and not more than 16 children (with additional occupancy classifications depending on the age of the children); Group I-2 for more than 16 infants. The *IBC* splits day care operations (care for less than 24 hours) into only two separate groups, depending on the age and number of children. Occupancy group E is reserved for day care facilities with children over 2 ½ years of age, with an exception that infant day care facilities with no more than 100 children where all care rooms have an exterior door and are located on the level of exit discharge could also be classified as E. If the exception is not met, day care for infants is classified as I-4.

High-Hazard. The *IBC* contains a new high-hazard occupancy classification for semiconductor fabrication facilities, H-5, the uses of which are similar to what was regulated under Section 416.0 of the *BNBC* for Hazardous Production Material (HPM) facilities.

Institutional and Residential. More specific day-care descriptions for both children and adults who need supervision are introduced in the *IBC*, creating differences in occupancy designations between the *IBC* and the *BNBC*. The R-4 designation, in the *BNBC*, was used for detached dwellings complying with the alternative CABO code. In the *IBC*, R-4 represents Residential Care/Assisted Living Facilities with not more than 16 persons, which were classified as either R-2 or R-3 under the *BNBC*.

Mixed Use. The *IBC*, for the most part, adopts the *BNBC* approach to mixed use buildings, which can be summarized as shown in Table I:

Table I Mixed Use Occupancies in the <i>IBC</i> and the <i>BNBC</i>	
Separated Uses	Allows mixed occupancies if they are separated as per 302.3.3 and the sum of the occupancy ratios ¹ does not exceed one.
Nonseparated Uses	Allows uses to be unseparated within a fire area ² if the fire area does not exceed the allowable height and area for the type of construction, based on the more restrictive occupancy group

1. Occupancy ratios is the actual occupancy floor area divided by the tabular area permitted for that occupancy group in specific construction type
2. Fire area is the aggregate floor area enclosed and bounded by exterior walls or fire resistive building elements as defined in *IBC* Section 702.

GENERAL BUILDING HEIGHTS & AREAS (CHAPTER 5)

IBC provisions regulating allowable building heights and areas are generally based on the least restrictive provision of any of the three model codes. The ICC recognized that each code had rationale for establishment of its values. So, in the absence of fire loss data indicating that an allowable building area in one of the three model codes was problematic, the largest building area permitted by any of the model codes for an occupancy group was generally chosen.

General Height and Area Limitations (Section 503)

Because of the approach taken by the ICC to generally retain the least restrictive building area allowances of the model building codes for any particular occupancy, the *IBC* generally provides larger per-floor areas for low-rise buildings than is allowed in the *BNBC*. In some cases *IBC* floor areas represent a substantial increase over that found in the *BNBC*. Table II provides maximum unmodified height and area limits in the *IBC* (as contained in *IBC* Table 503) for certain use groups constructed of combustible construction (see Chapter 6 - Types of Construction for definitions of combustible construction). Too often, designers see this table as a barrier to using wood construction. However, the code permits very large wood frame buildings if designers apply the permitted modifications to the areas of the *IBC*.

In addition to the single-story floor areas being different in some instances as discussed above, provisions for calculating allowable areas of multistory buildings are handled slightly differently in the two codes. In the *BNBC*, per-floor area reductions for multistory buildings are specified in Table 506.4 Reduction of Area Limitations. In this way, the allowable area of each floor is reduced for taller buildings, and they are still subject to the story and heights “caps” of Table 503. The *IBC* contains no such reduction table, but instead Section 503.3 limits the aggregate floor area of all stories to not more than three times the maximum adjusted allowable single story area. This necessitates a check of the aggregate floor area after the allowable area per story is determined.

Permitted modifications of height and area limitations are discussed in the following sections of

this brochure. Comparisons of modified allowable building areas based on use groups are presented in Appendix A of this brochure.

Height Modifications (Section 504)

Table 503 in both codes contains height limitations in both number of stories and vertical distance from grade for each occupancy group and type of construction. Both the *IBC* and *BNBC* provide for modifications to this allowable building height, if the building is equipped with sprinklers. Section 504 of both codes provide for an additional story and an additional 20 feet of height for most occupancies when an automatic sprinkler system in accordance with the NFPA 13 (9) standard is installed. However, the special height increases found in subsections of 504 in the *BNBC* for auditoriums, day care centers, and high-hazard use groups are not found in the *IBC*. In the case of group R occupancies, both codes permit an additional story and an extra 20 feet, up to 4 stories and 60 feet maximum, with the use of an automatic sprinkler system in accordance with the NFPA 13R (10) standard. Neither code permits increases when an NFPA 13D (11) system is used.

Area Modifications (Section 506)

As is the case with building height, the *IBC* and *BNBC* provide for modifications to allowable floor area. Although permitted area increases of both codes rely on the installation of automatic sprinkler systems and/or the provision of large open spaces at the perimeter of the building, the methods for determining the increase and the amount of increases differ.

The *BNBC* provides for a two percent increase in floor area for every one percent of open perimeter beyond the minimum required percentage of open perimeter (a minimum of 25 percent open perimeter is required). The open space must be at least 30 feet in width, measured perpendicular to the face of the building. Standard floor area increases of 200 percent for one and two story buildings and 100 percent for buildings with three or more stories are granted when an NFPA 13 sprinkler system is installed. To account for the increased hazard in taller buildings, these floor area increases in buildings of three or more stories are reduced in accordance with Table 506.4, based on number of stories and construction type.

The *IBC* combines these same area modifications into a formula, as follows:

$$A_a = A_t + \left[\frac{A_t I_f}{100} \right] + \left[\frac{A_t I_s}{100} \right]$$

Where:

A_a = Allowable area per floor (square feet)

A_t = Tabular area per floor

I_f = Area increase due to frontage (percent)

I_s = Area increase due to sprinkler protection

The frontage increase (I_f) allows for the tabular areas to be increased when the open space is a minimum of $w = 20'$ in width for at least 25 percent of the total perimeter, in accordance with the following formula:

$$I_f = 100 \left[\frac{F}{P} - 0.25 \right] \frac{w}{30}$$

Where:

w = Minimum fire separation distance

F = Building perimeter which fronts on a public way or open space having open space with a minimum width of 20 feet

P = Perimeter of entire building

This area increase can be taken for sprinkler systems even if these systems are required by other section of the code (such as the occupancy-based sprinkler thresholds in Chapter 9); however, the area increase is not applicable for sprinkler systems installed in accordance with the NFPA 13R or 13D standards. Both the *IBC* and the *BNBC* require a full NFPA 13 system for the area increase.

Table II reflects the essential differences between the two codes in the amount of increase given for sprinklers or open perimeter, and the conditions of open perimeter:

Table II Code Comparison - Area Increases		
Feature	IBC	BNBC
Minimum open space for increase credit	20 feet	30 feet
Basis of open space increase credit	Ratio of total perimeter to open perimeter	same
Maximum possible area increase with total open perimeter of at least 20 feet in width	50 percent	no increase permitted (30 feet minimum width required for open perimeter)
Maximum possible area increase with total open perimeter of at least 30 feet in width	75 percent	150 percent
Automatic sprinkler system increase credit (NFPA 13 system)	300% increase for one-story buildings, 200% increase for multi-story buildings	200% increase for one and two-story buildings 100% increase for buildings three or more stories
Additional area limits for multistory buildings	Aggregate floor area limited to not more than three times the single-story allowable area, basements excluded	Percent reduction applied to single story area, based on construction type and number of stories, per Table 506.4

Unlimited Area Buildings (Section 507)

Unlimited area building provisions for non-combustible buildings are similar in the *IBC* and *BNBC*. However, the *IBC* greatly expands the unlimited area building provisions for construction types that allow combustible materials. *IBC*, for example, permits unlimited area single- and two-story buildings of use groups B, F, M and S of any construction type, including traditional wood frame construction (*IBC* Type V), when the building is equipped with an automatic sprinkler system and has the required 60 feet of open space around the entire perimeter. The *BNBC* does not permit buildings of Type V construction to be unlimited in area under any conditions, and has no provisions for two-story unlimited area buildings of any construction type or occupancy.

Some of the other *IBC* provisions for unlimited area buildings are as follow:

Unsprinklered Uses

One-story buildings of low hazard storage (S-2) or factory/industrial low hazard (F-2) occupancy are permitted to be of unlimited area regardless of construction type if the building is surrounded by a minimum of 60 feet of open space. The *BNBC* permitted only S-2 buildings (not F-2) to be unlimited in area under these conditions, and did not permit Type V construction.

Sprinklered, One-story Uses

The area of a one-story Group A-4 (assembly), B (business), F (factory/industrial), M (mercantile) or S (storage) buildings is permitted to be unlimited if the building is provided with an automatic sprinkler system and if the building is provided with 60 feet of open space surrounding the entire perimeter of the building. There are no construction type restrictions as there are in the *BNBC*.

Sprinklered, Two-story Uses

A two-story buildings of use group B (business), F (factory), M (mercantile) or S (storage) is permitted to be of unlimited area if the building is built with an automatic sprinkler system and if the building is surrounded on all sides with not less than 60 feet of open space. Again, there is no restriction of construction type. The *BNBC* did not permit multistory unlimited area buildings under any circumstances.

In short, the *IBC* provides many new opportunities for unlimited area buildings, particularly those of combustible construction. Table III compares the unlimited building provisions of the *IBC* and *BNBC* (see Section 507 of the *IBC* for a complete list of exceptions and conditions):

Special Provisions (Section 508)

Both *IBC* and *BNBC* have special provisions for parking structures below B, M, A, and R occupancies, which permit increased height or a relaxation of the normal construction type limitations. Similar provisions were found in the subsections of 313 in the *BNBC*, and for the most part these parking garage provisions are identical to what is found in the *BNBC*, with some additional alternatives added.

**Table III
Code Comparison - Unlimited Area Buildings**

Feature	IBC	BNBC
Open space for entire perimeter (no sprinklers, two story)	F-2, S-2, regardless of type of construction Group A-4 used for sports (without spectator seating), with a fire alarm system, regardless of construction type	no two story unlimited area buildings permitted
Open space for entire perimeter (no sprinklers, one story)	F-2, S-2, regardless of type of construction Group A-4 used for sports (without spectator seating), with a fire alarm system, regardless of construction type	Group S-2 and agricultural buildings of type 2 (noncombustible) or 4 (heavy timber) construction, not more than one story Group A-3 of other than Type 5 construction used for sports (without spectator seating), with 50 feet of open space on all sides and a fire alarm system
Open space for entire perimeter, NFPA 13 sprinkler system (two story)	Group B, F, M, or S regardless of construction type	no two story unlimited area buildings permitted
Open space for entire perimeter, NFPA 13 sprinkler system (one story)	Group A-4, B, F, M, or S regardless of construction type; motion picture theaters of Type I or II construction	Groups A-3, B, F, I-2, M, S, and motion picture theaters of other than Type 5 construction (I-2 must be other than Type 5 and 3B) Group E of Types 2, 3A and 4 construction, if all classrooms are provided with exterior exits
Required Width of Open Space	60 feet; permitted reduction to 40 feet with rated wall and opening protection	50 feet; permitted reduction to 30 feet with rated walls and opening protection

TYPES OF CONSTRUCTION (CHAPTER 6)

Many of the requirements related to construction type will look familiar to *BNBC* users. Both codes have five basic construction types, with subcategories. The difference is that in the *IBC*, there is no 4-hour construction type (a type which would require 4-hour exterior walls and structural frame) corresponding to *BNBC* Type 1A. The highest rating required for structural frame and exterior bearing walls in the *IBC* is 3 hours (Type IA construction in the *IBC*). The *BNBC* Type 2A construction type is “bumped up” to correspond to Type 1B in the *IBC*, and the *IBC* contain only two subcategories in the Type II classification (as opposed to three in the *BNBC*.) The “shift” that has taken place for *BNBC* users can be seen in Table IV:

Table IV Comparison of Construction Types in the IBC and the BNBC		
Feature	BNBC	IBC
Noncombustible, 4 hours	Type 1A	none in IBC
Noncombustible, 3 hours	Type 1B	Type 1A
Noncombustible, 2 hours	Type 2A	Type 1B
Noncombustible, 1 hour	Type 2B	Type 2A
Noncombustible, unprotected	Type 2C	Type 2B
Noncombustible/combustible and combustible construction types	Types 3A, 3B, 4, 5A, and 5B	Types IIIA, IIIB, IV, VA, and VB (corresponds to <i>BNBC</i> construction types)

The *IBC* combustible construction types, IIIA, IIIB, IV, VA, and VB correspond closely to the *BNBC* types 3A, 3B, 4, 5A and 5B in regard to required ratings.

A significant difference occurs between the two codes where fire-retardant treated wood is permitted to be used. Table V summarizes these applications. While the *BNBC* permits the use of fire-retardant wood in some applications in noncombustible types of construction, the *IBC* has broadened those applications.

As mentioned above, designers often believe that using a combustible type of construction brings with it restrictions in building size that may not meet building needs. While wood frame construction (*IBC* Type V) is the most limited in building area, much of the restriction can be offset by adding sprinklers or providing open space around the building. Further, using heavy timber construction (*IBC* Type IV) can provide floor areas comparable to noncombustible construction and *IBC* Type III construction permits the use of a significant amount of wood, particularly if the building is located away from the property line.

In Section 602.3 the *IBC* defines Type III Construction as being “... that type ... in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by the code.” However, the section goes on to say that fire-retardant treated wood is permitted in exterior wall assemblies in lieu of noncombustible materials when the rating of the wall is required to be 2-hours or less. Therefore, for many of the most common occupancies, buildings constructed entirely of wood can be just as large and as high as noncombustible buildings. Table VI below shows that buildings of *IBC* Type III-B in many occupancies may be just as large as buildings of Type IIB (noncombustible unprotected). Buildings of Type III-B, for the occupancies shown, may be entirely of wood if FRTW is used in the exterior walls.

Table V
Comparison of Allowable Use of Fire Retardant Treated Wood in the *IBC* and the *BNBC*

IBC Construction Type	Building Assembly	IBC	BNBC
Type I and II Construction	Roof structures	Permitted in buildings not over two-stories (T601, note c3)	Permitted in Type 1 construction when more than 15' in height from floor below to the lowest member (T602, note d). Permitted in Type 2 construction (T602, note d)
	Exterior walls	Permitted when the wall is non-load bearing and a fire rating is not required (603.1.1.2)	Not permitted
	Interior walls	Permitted in non-load bearing partitions where the fire rating is 2 hours or less (603.1.1.1)	Permitted in non-load bearing partitions when the fire rating is 1 hour or less (T602, note d).
Type III and IV Construction	Exterior walls	Permitted in exterior walls when the required rating is 2-hours or less.	Not permitted
Type V Construction	All assemblies	Requirements for <i>IBC</i> Type V construction and <i>BNBC</i> Type 5 are identical: use of FRTW is unrestricted	

**Table VI
Comparison of IBC Type IIB and Type III Construction
Allowable Areas and Heights**

IBC Occupancy Group	Table 503 Base Allowable Area (sq ft)		Table 503 Base Allowable Height (stories/feet)	
	Type IIB	Type IIIB	Type IIB	Type IIIB
A-3	9500	9500	2/55	2/55
B	23000	19000	4/55	4/55
E	14500	14500	2/55	2/55
M	12500	12500	4/55	4/55
R-1	16000	16000	4/55	4/55
R-2	16000	16000	4/55	4/55
S-1	17500	17500	3/55	3/55

The area and height modifications discussed above for sprinklers and open perimeter are applicable to these values.

FIRE-RESISTANCE-RATED CONSTRUCTION (CHAPTER 7)

Chapter 7 of the *IBC* differs from the *BNBC* in a few significant ways, but for the most part is similar in content and structure. Similar to the *BNBC*, fire resistance rated assemblies in the *IBC* are given specific names in accordance with their purpose— whether it be to provide a separation for mixed occupancies groups, exit elements, smoke compartments, dwelling units, or even entire buildings. Thus chapter seven contain separate sections for fire barriers, smoke barriers, fire partitions, and fire walls. See Table VII below for a summary of how the *IBC* and the *BNBC* compare regarding fire rated assemblies:

Also similar to the *BNBC*, the Chapter 7 of the *IBC* contains separate sections for ratings criteria and testing, opening protection, penetration protection, shaft protection, and exit enclosures.

To summarize some significant fire wall requirements in *IBC* which differ from *BNBC* requirements: fire walls in Type V construction may be framed of combustible materials; fire walls are required to have horizontal extensions of 18 inches beyond exterior walls; and fire wall ratings are increase by one hour for most occupancy groups.

A significant feature of the *IBC* not found in the *BNBC* is a prescriptive table listing common fire resistance rated assemblies of all types of construction, including wood frame walls. Table 719 came from the *Uniform Building Code* and was constructed by extracting similar characteristics of hundreds of tested wall assemblies, thereby creating a table of prescriptive assemblies which can be assumed to have certain fire resistive characteristics and ratings. This information is useful to the building designer, reducing the need to look for this information in other publications such as fire resistance directories published by testing laboratories or publications of trade associations such as GA or AF&PA. In addition, Section 720.6.2 incorporates the provisions of the “component additive method” and Section 720.6.3 specifies procedures for use of the design methodology for exposed heavy timber members (large-section wood members).

TABLE VII
Code Comparison - Fire Rated Assemblies

Feature	IBC	BNBC
Fire Partition	A rated vertical assembly with specific continuity and opening protection provisions, required for separation of dwellings and corridors, among other uses	Same
Fire Barrier (BNBC Fire Separation Assembly)	A rated horizontal or vertical assembly with specific continuity and opening protection provisions, required for separation of mixed occupancies, shaft protection, exit stair separation, and elevator lobbies among other uses	Mostly the same; separated elevator lobbies are not required
Party Wall	Any wall located on a property line between adjacent buildings which is used or adapted for joint service between the two buildings. Party walls create separate buildings. Party walls are constructed as fire walls without openings.	The same, except openings protected as for fire walls are permitted
Fire Wall	A rated wall extending from the foundation to the roof, of combustible or non-combustible construction, able to withstand collapse of construction on either side. Used to separate buildings for area limitations, fire walls are required to be continuous and extend beyond the exterior walls of the building. The required rating depends on the construction type and the occupancy groups involved, but for most occupancies is 3 hours	The same, except that fire walls must be of noncombustible construction, are not required to extend beyond exterior walls, and for most occupancies the required rating is 2 hours
Smoke Barrier	A 1-hour rated horizontal or vertical element with opening and penetration protection designed to restrict the passage of smoke, required to subdivide floor areas in institutional occupancies.	Same

STRUCTURAL DESIGN (CHAPTER 16)

Chapter 16 of both codes prescribe minimum design loads for building and the design criteria required for structural safety. The purpose of Chapter 16 is to insure that every building and structure has sufficient strength to support the loads and forces it will likely encounter during its life without any structural elements being unduly stressed. Chapter 16 covers general requirements, loads, load combinations, serviceability and deflections of structural members. Although the structure of the chapter is similar, there are significant differences between the design criteria in the *IBC* and that in the *BNBC*, due primarily to revisions in the structural design standards referenced in the code, such as ASCE 7 (16). The *IBC* references the 1998 edition of ASCE 7, whereas previous editions of that standard were referenced in the *BNBC*, depending on the topic. Below are some of the significant differences:

Live loads (Section 1607)

The design live loads prescribed in the *IBC* are taken from three sources: ASCE 7-98, the 1997 Uniform Building Code, and the 1997 Standard Building Code. Live load criteria in the *BNBC* was derived from the 1995 and 1993 editions of the ASCE 7 standard.

Snow loads (Section 1608)

Snow load criteria in the *IBC* is based on the ASCE7-98 standard, where in the *BNBC* it was based on ASCE 7-95 criteria.

Wind loads (Section 1609)

Among the new technical requirements in the *IBC* resulting from reference to the ASCE 7-98 standard is a new wind load map with contours using 3-second gust wind speeds as opposed to fastest-mile wind speeds. To assist the user of the code in transitioning 3-second gust wind speeds from fastest mile wind speeds, the *IBC* provides a convenient conversion table (Table 1609.3.1). This table enables the continued use of industry design standards such as AF&PA's *Wood Frame Construction Manual: SBC High Wind Edition (WFCM) (14)*, which is referenced as an alternate methodology for the design of one- and two-family buildings in both codes. In addition, the *IBC* contains a simplified procedure for determining the wind loads on low-rise buildings (buildings with a mean roof height not exceeding 60 ft). The special low-rise provisions in the *IBC* were developed from ASCE 7-98 and provisions in the *Standard Building Code*. Included are tables of calculated wind pressures.

Earthquake loads (Sections 1613-1623)

IBC seismic design issues much are more extensive than that of *BNBC*. Seismic criteria are based on the 1997 National Earthquake Hazard Reduction Program (1997 NEHRP) (13), and contain a revised design methodology and risk map, expanded soil types and earthquake load effects, expanded criteria for non-building structures such as towers, and provisions for seismically isolated structures. Many provisions come from the *Uniform Building Code*. Earthquake provisions in the *BNBC* were based on the 1991 NEHRP and ASCE 7-93. In addition, the *IBC* contains a simplified analysis technique for buildings not more than three stories high. The *IBC* specifically exempts from analysis those seismic-force-resisting systems of wood frame buildings that conform to the conventional light-frame construction seismic provisions of Section 2308.

Flood loads (Section 1612)

The *IBC* requires structures located in flood hazard areas to be designed in accordance with ASCE 24-98, Flood Resistance Design and Construction Standard (15), a standard which is not referenced in the *BNBC*.

WOOD (CHAPTER 23)

Chapter 23 of both the *IBC* and the *BNBC* govern the materials, design, construction, and quality of wood members and their fasteners. Both codes reference a number of design specifications intended to provide guidance to nonprofessional as well as professional users of the code. Both the *IBC* and the *BNBC* give alternatives for structural design criteria by requiring the use of the allowable stress design methodology (ASD) of the *AF&PA National Design Specification for Wood Construction (NDS)*, the load and resistance factor design methodology (LRFD) of *AF&PA/ASCE 16*, or prescriptive conventional light-frame provisions. The conventional light-frame provisions referenced in the *IBC* are *IBC* Sections 2304 and 2308; the *BNBC* does not contain a specifically defined set of prescriptive provisions, but does require compliance with the prescriptive 1995 *AF&PA Wood Frame Construction Manual-SBC High Wind Edition* for structures in areas subject to wind speeds of 90 mph (fastest mile) or greater. In addition, the 1998 *International One- and Two Family Dwelling Code (IOTFDC)* (12), a prescriptive code, is permitted as an alternative to the *BNBC* for one- and two-family detached dwellings and townhouses. Buildings built in accordance with that code are not required to be designed in accordance with either of the engineering design standards, but are assumed to provide a minimum acceptable level of safety and welfare to occupants in accordance with accepted engineering principles and practice.

The expansion of prescriptive provisions for wood frame structures is one of the significant differences between the *IBC* and the *BNBC*. Prescriptive requirements in the *BNBC* were by no means comprehensive, and needed to be used in conjunction with the design standards mentioned above. For instance, the *BNBC* contained no prescriptive provisions for wall bracing to resist wind loads. (However, it did contain prescriptive provisions for seismic bracing as an alternative to providing an analysis of the seismic force-resisting system.) Design was required for structures subject to wind pressures and no prescriptive bracing alternative was available. In general, the *BNBC* required compliance with a limited set of prescriptive requirements such as for bearing, fastening, use of wood structural panels, protection from decay, and limitations on cutting and notching— but there were no rafter or joist span tables, no header tables, or stud sizing requirements. Design of the structure in accordance with the *NDS* (or the *LRFD* standard) was necessary and assumed.

Similarly, for most wood frame structures other than one- and two-family dwellings and townhouses, the *IBC* requires compliance with prescriptive provisions in the text of the code along with design in accordance with the *NDS* or the *LRFD*. However, the organization and extent of these prescriptive requirements differs greatly. Generally applicable prescriptive provisions such as minimum requirements for bearing, framing, wood structural panel use, connections, etc., are found in Section 2304, and Section 2304 also references additional prescriptive provisions such as for wall bracing and limitation on cutting and notching found in Section 2308, a section which has a distinct purpose (discussed below). Expanded design requirements for lateral-force-resisting systems are found in Section 2305, and additional expanded design criteria for wind resistance, wood diaphragms, and shear walls designed utilizing allowable stress design (ASD) methods are found in Section 2306. Seismic provisions are incorporated into the lateral force resistance provisions, and reflect the broadened geographical basis of the *International* codes.

Section 2308, Conventional Light-Frame Construction, contains a set of comprehensive provisions for the design and construction of low-rise residential-type wood frame structures, and compliance with this section is specifically permitted as an alternative (for buildings within the scope of the section) to design in accordance with the *NDS* or the *LRFD* standard. It contains some of the prescriptive wood framing provisions found in Chapter 23 of the *BNBC*, but is greatly expanded and is similar in scope to the wood framing provisions found in the 1995 *CABO* code or the 1998 *IOTFDC*. Originally, this section was intended as a stand-alone set of provisions for residential structures that would eliminate the need for structural design in

accordance with one of the design standards. However, its application is currently severely limited by the scoping sections of the *IBC* and the *International Residential Code (IRC)*, which prohibit the use of *IBC* provisions for any structure within the scope of the *IRC*. The *IRC* itself is intended as a stand-alone prescriptive code for one- and two-family detached dwellings and townhouses, compliance with which precludes the need for structural design. Since the provisions of the *IRC* are, with a few minor exceptions, the same as the provisions in Section 2308, this scoping restrictions are not problematic. Buildings that fall within the current scoping limitations of Section 2308 would also fall within the scope of the *IRC*, and would therefore be required to comply with the *IRC* in any case.

Conclusion

The arrival of the *International Building Code* brings increased opportunity for design and construction with wood. It allows greater building areas for combustible construction types, increased alternatives for wood in fire resistance rated assemblies, and more definitive design criteria. The advantages for wood construction, in contrast to the limitations imposed by the *BOCA National Building Code*, can be dramatic—especially for designs which incorporate contemporary fire protection features such as automatic sprinkler systems. The *International Building Code* enhances the opportunities already rendered by the *BNBC*, and which are often overlooked by designers of commercial structures. See the tables contained in the Appendix of this brochure.

The opportunities for wood construction will continue to become evident as the *IBC* gains acceptance from widespread use and scrutiny. Even as states and jurisdictions across the U.S. and North America are adopting the *IBC* into law, the development of the second edition is nearing completion. For comparisons of requirements for wood construction in the *IBC* to the *Uniform Building Code* or the *Standard Building Code*, see the companion brochures found on the website of the American Wood Council, www.awc.org.

Special effort has been made to assure the accuracy of the information presented. However, the American Forest & Paper Association does not assume responsibility for particular designs or calculations prepared from this publication.
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Appendix - Comparison of Allowable Areas for Various Occupancies

Assembly (A-3)

Churches

Restaurants

Business Use Group

Multifamily Use Group

Mercantile

Day Care (with infants)

Educational Use Group

Storage (S-1) Use Group

Hotels

Assembly (A-3)							
Allowable Total Building Area (square feet) based on percentage of open perimeter ¹							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		11,550/3	8,400/2	12,600/3	8,925/1	4,200/1	
IBC Tabular Areas		14,000/3	9,500/2	15,000/3	11,500/2	6,000/1	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter¹	25%	NBC	27,720	16,800	30,240	8,925	4,200
		IBC	42,000	19,000	45,000	23,000	6,000
	50%	NBC	45,045	25,200	49,140	13,387	6,300
		IBC	52,500	23,750	56,250	28,750	7,500
	75%	NBC	62,370	33,600	68,040	17,850	8,400
		IBC	63,000	28,500	67,500	34,500	9,000
	100%	NBC	79,695	42,000	86,940	22,312	10,500
		IBC	73,500	33,250	78,750	40,250	10,500
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter¹	25%	NBC	83,160	45,360	90,720	53,550
IBC			126,000	85,500	135,000	103,500	36,000
50%		NBC	106,260	57,960	115,920	62,475	29,400
		IBC	136,500	92,625	146,250	112,125	39,000
75%		NBC	129,360	70,560	141,120	71,400	33,600
		IBC	147,000	99,750	157,500	120,750	42,000
100%		NBC	152,460	83,160	166,320	80,325	37,800
		IBC	157,500	106,875	168,750	129,375	45,000

¹ The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Churches							
Allowable Total Building Area (square feet) based on percentage of open perimeter ¹							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		19,800/3	14,400/2	21,600/3	15,300/1	7,200/1	
IBC Tabular Areas		14,000/3	9,500/2	15,000/3	11,500/2	6,000/1	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter¹	25%	NBC	47,520	28,800	51,840	15,300	7,200
		IBC	42,000	19,000	45,000	23,000	6,000
	50%	NBC	77,220	43,200	84,240	22,950	10,800
		IBC	52,500	23,750	56,250	28,750	7,500
	75%	NBC	106,920	57,600	116,640	30,600	14,400
		IBC	63,000	28,500	67,500	34,500	9,000
	100%	NBC	136,620	72,000	149,040	38,250	18,000
		IBC	73,500	33,250	78,750	40,250	10,500
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter¹	25%	NBC	142,560	77,760	155,520	91,800
IBC			126,000	85,500	135,000	103,500	36,000
50%		NBC	182,160	99,360	198,720	107,100	50,400
		IBC	136,500	92,625	146,250	112,125	39,000
75%		NBC	221,760	120,960	241,920	122,400	57,600
		IBC	147,000	99,750	157,500	120,750	42,000
100%		NBC	261,360	142,560	285,120	137,700	64,800
		IBC	157,500	106,875	168,750	129,375	45,000

¹ The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Restaurants							
Allowable Total Building Area (square feet) based on percentage of open perimeter ¹							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		11,550/3	8,400/2	12,600/3	8,925/1	4,200/1	
IBC Tabular Areas		14,000/3	9,500/2	15,000/3	11,500/2	6,000/1	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter¹	25%	NBC	27,720	16,800	30,240	8,925	4,200
		IBC	42,000	19,000	45,000	23,000	6,000
	50%	NBC	45,045	25,200	49,140	13,387	6,300
		IBC	52,500	23,750	56,250	28,750	7,500
	75%	NBC	62,370	33,600	68,040	17,850	8,400
		IBC	63,000	28,500	67,500	34,500	9,000
	100%	NBC	79,695	42,000	86,940	22,312	10,500
		IBC	73,500	33,250	78,750	40,250	10,500
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter¹	25%	NBC	83,160	45,360	90,720	53,550
IBC			126,000	85,500	135,000	103,500	36,000
50%		NBC	106,260	57,960	115,920	62,475	29,400
		IBC	136,500	92,625	146,250	112,125	39,000
75%		NBC	129,360	70,560	141,120	71,400	33,600
		IBC	147,000	99,750	157,500	120,750	42,000
100%		NBC	152,460	83,160	166,320	80,325	37,800
		IBC	157,500	106,875	168,750	129,375	45,000

¹ The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Business Use Group							
Allowable Total Building Area (square feet) based on percentage of open perimeter ¹							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		19,800/4	14,400/3	21,600/5	15,300/3	7,200/2	
IBC Tabular Areas		28,500/5	19,000/4	36,000/5	18,000/3	9,000/2	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter¹	25%	NBC	63,360	34,560	75,600	36,720	14,400
		IBC	85,500	57,000	108,000	54,000	18,000
	50%	NBC	102,960	56,160	129,600	59,670	21,600
		IBC	106,875	71,250	135,000	67,500	22,500
	75%	NBC	142,560	77,760	183,600	82,620	28,800
		IBC	128,250	85,500	270,000	81,000	27,000
	100%	NBC	182,160	99,360	237,600	105,570	36,000
		IBC	149,625	99,750	315,000	94,500	31,500
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter¹	25%	NBC	168,300	103,680	207,360	110,160
IBC			256,500	171,000	324,000	162,000	81,000
50%		NBC	217,800	132,480	272,160	140,760	49,680
		IBC	277,875	185,250	351,000	175,500	87,750
75%		NBC	267,300	155,520	336,960	171,360	60,480
		IBC	299,250	199,500	378,000	189,000	94,500
100%		NBC	316,800	190,080	401,760	201,960	71,280
		IBC	320,625	99,750	405,000	202,500	101,250

¹ The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Multi-Family Use Group							
Allowable Total Building Area (square feet) based on percentage of open perimeter ¹							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		13,200/4	9,600/3	14,400/4	10,200/3	4,800/2	
IBC Tabular Areas		24,000/4	16,000/4	20,500/4	12,000/3	7,000/2	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter¹	25%	NBC	42,240	23,040	46,080	24,480	9,600
		IBC	72,000	48,000	61,500	36,000	14,000
	50%	NBC	68,640	37,440	74,880	39,780	14,400
		IBC	90,000	60,000	76,875	45,000	17,500
	75%	NBC	95,040	51,840	103,680	55,080	19,200
		IBC	108,000	72,000	92,250	54,000	21,000
	100%	NBC	121,440	66,240	132,480	70,380	24,000
		IBC	126,000	84,000	107,625	63,000	24,500
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter¹	25%	NBC	168,300	103,680	207,360	110,160
IBC			216,000	156,000	184,000	108,000	63,000
50%		NBC	217,800	132,480	272,160	140,760	18,720
		IBC	234,000	168,000	199,875	117,000	68,250
75%		NBC	267,300	155,520	336,960	171,360	25,920
		IBC	252,000	180,000	215,250	126,000	73,500
100%		NBC	316,800	190,080	401,760	201,960	36,000
		IBC	270,000	180,000	230,625	135,000	78,750

¹ The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Mercantile							
Allowable Total Building Area (square feet) based on percentage of open perimeter ¹							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		13,200/3	9,600/2	14,400/4	10,200/2	4,800/1	
IBC Tabular Areas		18,500/4	12,500/4	20,500/4	14,000/3	9,000/1	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter¹	25%	NBC	31,680	19,200	46,080	20,400	4,800
		IBC	55,500	37,500	61,500	42,000	9,000
	50%	NBC	51,480	28,800	74,880	30,600	7,200
		IBC	69,375	46,875	76,875	52,500	11,250
	75%	NBC	71,280	38,400	103,680	40,800	9,600
		IBC	83,250	56,250	92,250	63,000	13,500
	100%	NBC	91,080	48,000	132,480	51,000	12,000
		IBC	97,125	65,625	107,625	73,500	15,750
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter¹	25%	NBC	95,040	51,840	122,400	55,080
IBC			166,500	112,500	184,500	126,000	54,000
50%		NBC	121,440	66,240	158,400	70,380	33,600
		IBC	180,375	121,875	199,875	136,500	58,500
75%		NBC	147,840	80,640	194,400	85,680	38,400
		IBC	194,250	131,250	215,250	147,000	63,000
100%		NBC	174,240	95,040	230,400	100,980	43,200
		IBC	208,125	140,625	230,625	157,500	67,500

¹ The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Day Care (with infants)								
Allowable Total Building Area (square feet) based on percentage of open perimeter								
		Type of Construction						
		3A	3B	4	5A	5B		
NBC Tabular Areas (I-2)		9,900/1	NP	10,800/1	7,650/1	NP		
IBC Tabular Areas (I-4)		23,500/3	13,000/2	25,500/3	18,500/1	9,000/1		
Unsprinklered Building Aggregate Floor Area (square feet)								
Percent Open Perimeter	25%	NBC	9900	NP	10800	7650	NP	
		IBC	70500	26000	76500	18500	9000	
	50%	NBC	14850	NP	16200	11475	NP	
		IBC	88125	32500	95625	23125	11250	
	75%	NBC	19800	NP	21600	15300	NP	
		IBC	105750	39000	114750	27750	13500	
	100%	NBC	24750	NP	27000	19125	NP	
		IBC	123375	45500	133875	32375	15750	
	Sprinklered Aggregate Floor Area (square feet)							
	Percent Open Perimeter	25%	NBC	29700	NP	32400	22950	NP
			IBC	282000	104000	306000	98666	48000
		50%	NBC	34650	NP	37800	26775	NP
IBC			305500	112666	331500	104833	51000	
75%		NBC	39600	NP	43200	30600	NP	
		IBC	329000	121333	357000	111000	54000	
100%		NBC	44550	NP	48600	34425	NP	
		IBC	352500	130000	382500	117166	57000	

1 The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Educational Use Group							
Allowable Total Building Area (square feet) based on percentage of open perimeter							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		19,800/3	14,400/2	21,600/3	15,300/1	7,200/1	
IBC Tabular Areas		23,500/3	14,500/2	25,500/3	18,500/1	9,500/1	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter	25%	NBC	47520	28800	51840	15300	7200
		IBC	70500	29000	76500	18500	9500
	50%	NBC	77220	43200	84240	22950	10800
		IBC	88125	36250	95625	23125	11875
	75%	NBC	106920	57600	116640	30600	14400
		IBC	105750	43500	114750	27750	14250
	100%	NBC	136620	72000	149040	38250	18000
		IBC	123375	50750	133875	32375	16625
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter	25%	NBC	142560	77760	155520	91800
IBC			211500	130500	229500	111000	57000
50%		NBC	182160	99360	198720	107100	50400
		IBC	229125	141375	248625	120250	61750
75%		NBC	221760	120960	241920	122400	57600
		IBC	246750	152250	267750	129500	66500
100%		NBC	261360	142560	285120	137700	64800
		IBC	264375	163125	286875	138750	71250

1 The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Storage (S-1) Use Group							
Allowable Total Building Area (square feet) based on percentage of open perimeter							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		11,550/3	8,400/2	12,600/4	8,925/2	4,200/1	
IBC Tabular Areas		26,000/3	17,500/2	25,500/4	14,000/3	9,000/1	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter	25%	NBC	27720	16800	40320	17850	4200
		IBC	78000	35000	76500	42000	9000
	50%	NBC	45045	25200	65520	26775	6300
		IBC	97500	43750	95625	52500	11250
	75%	NBC	62370	33600	90720	35700	8400
		IBC	117000	52500	114750	63000	13500
	100%	NBC	79700	42000	115920	44625	10500
		IBC	136500	61250	133875	73500	15750
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter	25%	NBC	83160	45360	107100	48195
IBC			234000	157500	229500	126000	54000
50%		NBC	106260	57960	138600	61580	29400
		IBC	253500	170625	248625	136500	58500
75%		NBC	129360	70560	170100	74970	33600
		IBC	273000	183750	267750	147000	63000
100%		NBC	152460	83160	201600	88360	37800
		IBC	292500	196875	286875	157500	67500

1 The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.

Hotels							
Allowable Total Building Area (square feet) based on percentage of open perimeter							
		Type of Construction					
		3A	3B	4	5A	5B	
NBC Tabular Areas		13,200/4	9,600/3	14,400/4	10,200/3	4,800/2	
IBC Tabular Areas		24,000/4	16,000/4	20,500/4	12,000/3	7,000/2	
Unsprinklered Building Aggregate Floor Area (square feet)							
Percent Open Perimeter	25%	NBC	42240	23040	46080	24480	9600
		IBC	72000	48000	61500	36000	14000
	50%	NBC	68640	37440	74880	39780	14400
		IBC	90000	60000	76875	45000	17500
	75%	NBC	95040	51840	103680	55080	19200
		IBC	108000	72000	92250	54000	21000
	100%	NBC	121440	66240	132480	70380	24000
		IBC	126000	84000	107625	63000	24500
	Sprinklered Aggregate Floor Area (square feet)						
	Percent Open Perimeter	25%	NBC	112200	69120	122400	73440
IBC			216000	144000	184500	108000	63000
50%		NBC	145200	88320	158400	93840	33120
		IBC	234000	156000	199875	117000	68250
75%		NBC	178200	107520	194400	114240	40320
		IBC	252000	168000	215250	126000	73500
100%		NBC	211200	126720	230400	134640	47520
		IBC	270000	180000	230625	135000	78750

1 The NBC requires a minimum fire separation distance of 30 feet for open space increase; the IBC requires a minimum of 20 feet.