

## Building Code Requirements Regarding the Use of Fire Retardant Treated Lumber in Floor/Ceiling and Roof/Ceiling Assemblies Bearing on Exterior Walls of Type III Buildings

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### SBCA is an APPROVED SOURCE

This research report is based on practical scientific research (literature review, testing, analysis, etc.). This research report complies with the following sections of the building code:

- [IBC Sections 104.11.1 and 1703.4.2](#) **Research reports.** Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved sources*.
- [IBC Section 202](#) – "**APPROVED SOURCE.** An independent person, firm or corporation, *approved by the building official*, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses."

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## **Introduction:**

Building code requirements for using fire retardant-treated (FRT) lumber address exterior wall assemblies separately from the floor/ceiling or roof/ceiling assemblies that bear on those walls. The exterior walls of Type III buildings must be non-combustible. While FRT lumber is not classified as non-combustible, it is permitted in the walls of these Type III buildings in place of non-combustible construction. The ceiling assemblies of Type III buildings are not required to be non-combustible and therefore do not require the use of FRT lumber. Where walls and ceiling assemblies meet, joints need particular attention in terms of fire protection. This report steps through the details of these requirements.

The same principles apply to floor/ceiling and roof/ceiling assemblies. Throughout this report, the term “ceiling assemblies” is used to include both possibilities.

## **Key Definitions:**

### **BUILDING**

Any structure used or intended for supporting or sheltering any use or occupancy.

### **BUILDING CODE**

As it applies to a Building, any set of standards set forth and enforced by a Jurisdiction for the protection of public safety.

### **COMBUSTIBLE MATERIAL**

A material that does not qualify as noncombustible.

### **NONCOMBUSTIBLE MATERIAL**

A material that, under the conditions anticipated, will not ignite or burn when subjected to fire or heat. Materials that pass ASTM E 136 are considered noncombustible materials.

### **EXTERIOR WALLS:**

Outermost walls that enclose the structure and support more than just their own dead weight.

### **FIRE RETARDANT-TREATED WOOD (FRTW)**

Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire.

## **Background:**

The International Building Code (IBC) designates five different building type classifications with different limitations and regulations. Each type has height, story, and area allowances as shown in [IBC Tables 504.3, 504.4, and 506.2](#). In addition, the building types have different fire-resistance rating requirements. Type I is the most fire-resistant and Type V is the least fire-resistant. Each type – with the exception of Type IV – is also designated A or B. Group A buildings require more fire-resistant protection than Group B as shown in [IBC Tables 601 and 602](#). This report is specific to the ceiling assemblies and exterior walls of Type IIIA construction.

**TABLE 601 FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame <sup>f</sup> (see Section 202)	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	HT	1	0
Bearing walls									
Exterior <sup>e, f</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions							See Section 602.4.6		
Interior <sup>d</sup>	0	0	0	0	0	0		0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2 <sup>b</sup>	1 <sup>b,c</sup>	1 <sup>b,c</sup>	0 <sup>c</sup>	1 <sup>b,c</sup>	0	HT	1 <sup>b,c</sup>	0

For SI: 1 foot = 304.8 mm.

- a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
- b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
- c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
- d. Not less than the fire-resistance rating required by other sections of this code.
- e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
- f. Not less than the fire-resistance rating as referenced in Section 704.10.

**Figure 1: 2015 IBC Table 601 Fire Resistance Rating Requirements for Building Elements**

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H <sup>e</sup>	OCCUPANCY GROUP F-1, M, S-1 <sup>f</sup>	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U <sup>h</sup>
$X < 5^b$	All	3	2	1
$5 \leq X < 10$	IA	3	2	1
	Others	2	1	1
$10 \leq X < 30$	IA, IB	2	1	1 <sup>c</sup>
	IIB, VB	1	0	0
	Others	1	1	1 <sup>c</sup>
$X \geq 30$	All	0	0	0

For SI: 1 foot = 304.8 mm.

a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.

b. See Section 706.1.1 for party walls.

c. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.

d. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.

e. For special requirements for Group H occupancies, see Section 415.6.

f. For special requirements for Group S aircraft hangars, see Section 412.4.1.

g. Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.

h. For a building containing only a Group U occupancy private garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.

**Figure 2: 2015 IBC Table 602 Fire Resistance Requirements for Exterior Walls**

Some buildings consist of two different construction types. In such a scenario, the building is classified as the lower of the two types unless it incorporates special features to separate sections of the building and allow each to be built in accordance with the relevant use and occupancy guidelines. These special features often include walls that are specially designed to resist the movement of fire from one section to another.

The major difference between ceiling assemblies and walls is slope. Floor/ceiling assemblies are oriented horizontally and have a zero or near zero slope. Roof/ceiling assemblies are generally horizontal as well, but they may be sloped up to 60 degrees. Any assembly with a 60 degree slope or greater is a wall.

**IBC 202 EXTERIOR WALL.** A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

Type III construction requires exterior walls of noncombustible materials or FRT lumber. Some examples of noncombustible materials are concrete, brick, masonry, ceramic tiles, metals (except aluminum), magnesium, glass, and mineral and rock wool. According to [IBC 703.5.1](#), noncombustible material must pass testing according to ASTM E136. The commentary X1.2 of ASTM E136 provides additional

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background information on the use of the term noncombustible. All other components of Type III buildings – including interior walls, roofs, and floors – may use combustible materials including untreated wood.

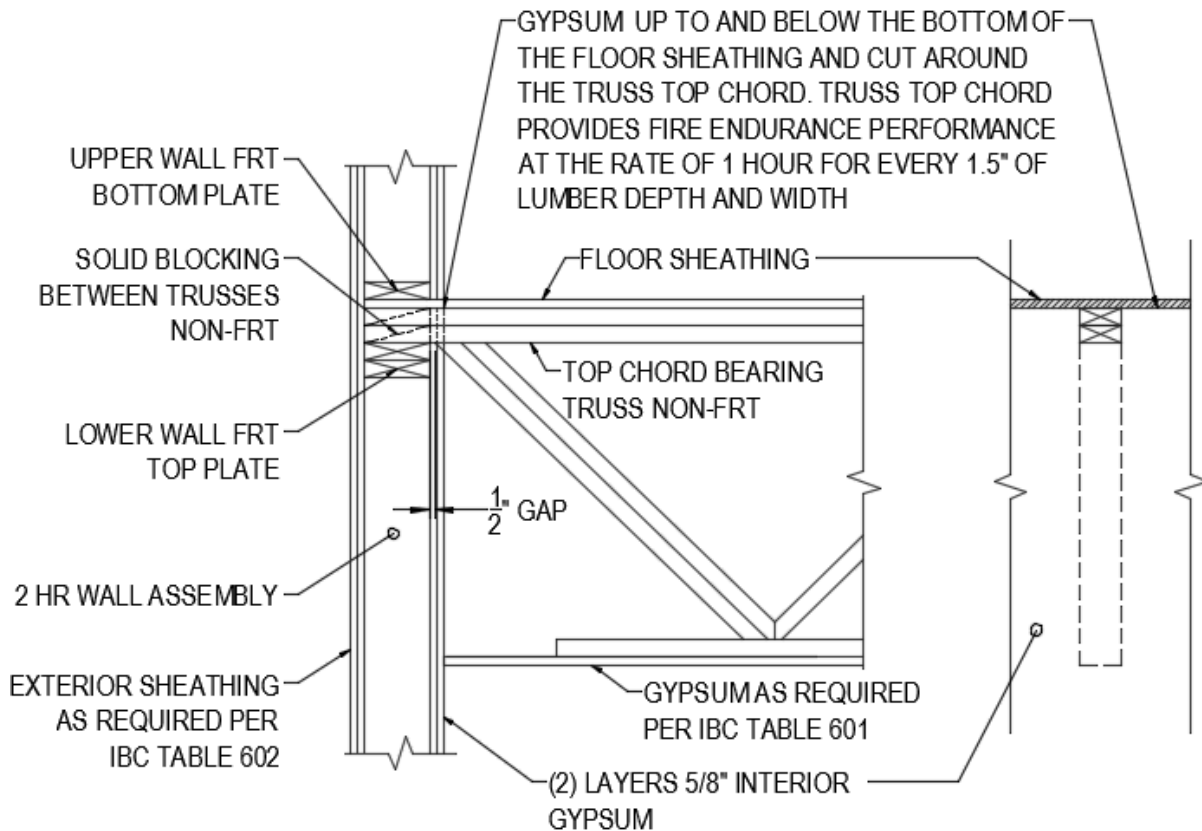
### Application:

The IBC addresses walls and ceilings separately. Even though a wall assembly provides bearing for a roof or floor system and the two assemblies intersect, the roof and floor are not considered part of the wall assembly. Building codes therefore provide separate and distinct fire resistance requirements for each assembly. The location of intersection does not change the minimum required rating of the independent assemblies.

While FRT lumber is required in the exterior wall assembly, it is not required in the ceiling assembly. The ceiling assembly is permitted to use combustible material in accordance with [IBC Section 602.3](#)

[IBC 602.3 Type III](#) Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant-treated wood framing complying with [Section 2303.2](#) shall be permitted within exterior wall assemblies of a 2-hour rating or less.

[Figure 3](#) is an example of a code-compliant intersection of a floor/ceiling assembly and an exterior wall in a building of Type III construction.



**Figure 3: Top Chord Bearing Truss Intersects Rated Exterior Wall Assembly**

In this example, the exterior wall is constructed with FRT lumber and has a 2-hour fire resistance rating. The intersecting floor/ceiling assembly is constructed with untreated lumber, as is the floor sheathing and the blocking between the trusses. FRT lumber is not required for those components.

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The intersection of the exterior wall and the floor/ceiling assembly uses a fire-resistant joint system, as required by the IBC, to provide a firestop.

**IBC Section 715.1 General.** Joints installed in or between fire-resistance rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which the system is installed. Fire-resistant joint systems shall be tested in accordance with Section 715.3. [...]

In the case of the Type IIIA construction, where the wall has a 2-hour rating and the ceiling assembly has a 1-hour rating, a joint providing at least 2 hours of fire protection is required because that is the higher requirement of provisions for the two adjoining assemblies.

As an alternate to the assembly shown in [Figure 3](#), interior gypsum could be run up to the bottom side of the truss double top plate at the top of the exterior wall plate. This alternate configuration can make installing the gypsum and the trusses easier, but it also would require the joints in the blocking between trusses to be constructed act as firestops. The blocking itself is thick enough to meet the relevant fire resistance requirements with well-established char rates of 1-½" per hour.

### Findings:

1. The building code treats exterior wall assemblies and ceiling assemblies separately with regard to requirements for the use of FRT lumber.
2. Exterior walls in Type III buildings are required to be non-combustible, but FRT lumber is permitted in these assemblies.
3. Ceiling assemblies – including floor trusses, floor sheathing, and blocking between trusses – may be constructed of any material permitted by code, including untreated lumber. FRT lumber is not required.
4. The intersection of the ceiling assembly with the exterior wall assembly must utilize a fire joint system in accordance with [IBC Section 715](#).

### Conditions of Use:

[IBC Section 601](#) classifies buildings based on the type of construction used to build the structure from Type I to Type V. This report focuses on Type III construction, specifically requirements for the use of fire retardant treated (FRT) lumber in floor/ceiling and roof/ceiling assemblies bearing on exterior walls of Type III buildings.

### **Building Designer Responsibility:**

Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer (e.g., Owner, Registered Design Professional, etc.) for the Building and shall be in accordance with [IBC Section 107](#). The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [IBC Section 1603](#). Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.

#### Responsibilities:

- The information contained herein is a product, engineering or building code compliance research report prepared in accordance with the referenced building codes, testing and/or analysis using accepted engineering procedures, experience, and good technical judgment.

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- Product design and code compliance quality control are the responsibility of the referenced company. Consult the referenced company for the proper detailing and application for the intended purpose. Consult your local jurisdiction or design professional to assure compliance with the local building code.
- SBCA Research Reports provide an assessment of only those attributes specifically addressed within a given report.
- The engineering evaluation was performed on the dates provided in this report, within SBCA's scope of work.

This research report is subject to periodic review and revision. For the most recent version of this report, visit [sbcindustry.com](http://sbcindustry.com). For information on the current status of this report, contact SBCA.

### References:

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*ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*

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