

Study Session

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2018 IBC Chapter 6 Types of Construction

OBJECTIVE: To gain an understanding of how a building is classified as a specific type of construction, based on the construction materials and the various building elements' resistance to fire.

REFERENCE: Chapter 6, 2018 *International Building Code*

- KEY POINTS:**
- What do the various types of construction indicate?
 - How are the required fire-resistance ratings of building elements determined?
 - Why are exterior walls regulated by additional criteria?
 - Why are exterior walls protected differently based on fire separation distance?
 - At what minimum distance is the protection of exterior walls unnecessary?
 - Which types of materials are required to be used as building elements of a Type I or II building?
 - How do the two different categories of Type I construction differ in fire protection? Type II construction?
 - Which types of materials are required for use in the exterior walls of a Type III structure? In the interior building elements?
 - What is another name for Type IV construction?
 - How shall exterior walls be constructed? Interior building elements?
 - What are the minimum construction details for columns used in a building of Type IV construction?
 - In Type IV buildings, what is the minimum size of heavy-timber members used in the floor and roof framing? Floors? Roofs? Partitions?
 - Where the minimum dimensions for Type IV solid sawn members are prescribed, how are the equivalent sizes established for glued laminated members?
 - Which requirements apply to cross-laminated timber used as a Type IV member?
 - Type V buildings may be constructed of which building materials?

KEY POINTS:
(Cont'd)

- How does a Type VA building differ from a Type VB building?
- In noncombustible Type I and II buildings, where may fire-retardant-treated wood be used?
- Which specific allowances are provided for combustible materials in Type I and Type II buildings?
- What are the limitations for the use of fire-retardant-treated wood in the roof construction of noncombustible buildings? In nonbearing partitions? In nonbearing exterior walls?
- Which building elements are considered primary structural frame elements for the determination of fire resistance? Secondary members?
- When are bracing members considered part of the structural frame?
- Under which conditions may the required fire resistance of roof supports be reduced?
- At what height may the required fire resistance of roof construction be eliminated? In which occupancies is the elimination not applicable?
- For which building elements are heavy-timber members and 1-hour fire-resistance-rated construction interchangeable?
- Does a sprinkler system affect a building's type of construction classification?
- How are interior nonbearing walls regulated for fire resistance based on construction type? Exterior nonbearing walls?

Code Text: *Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5.*

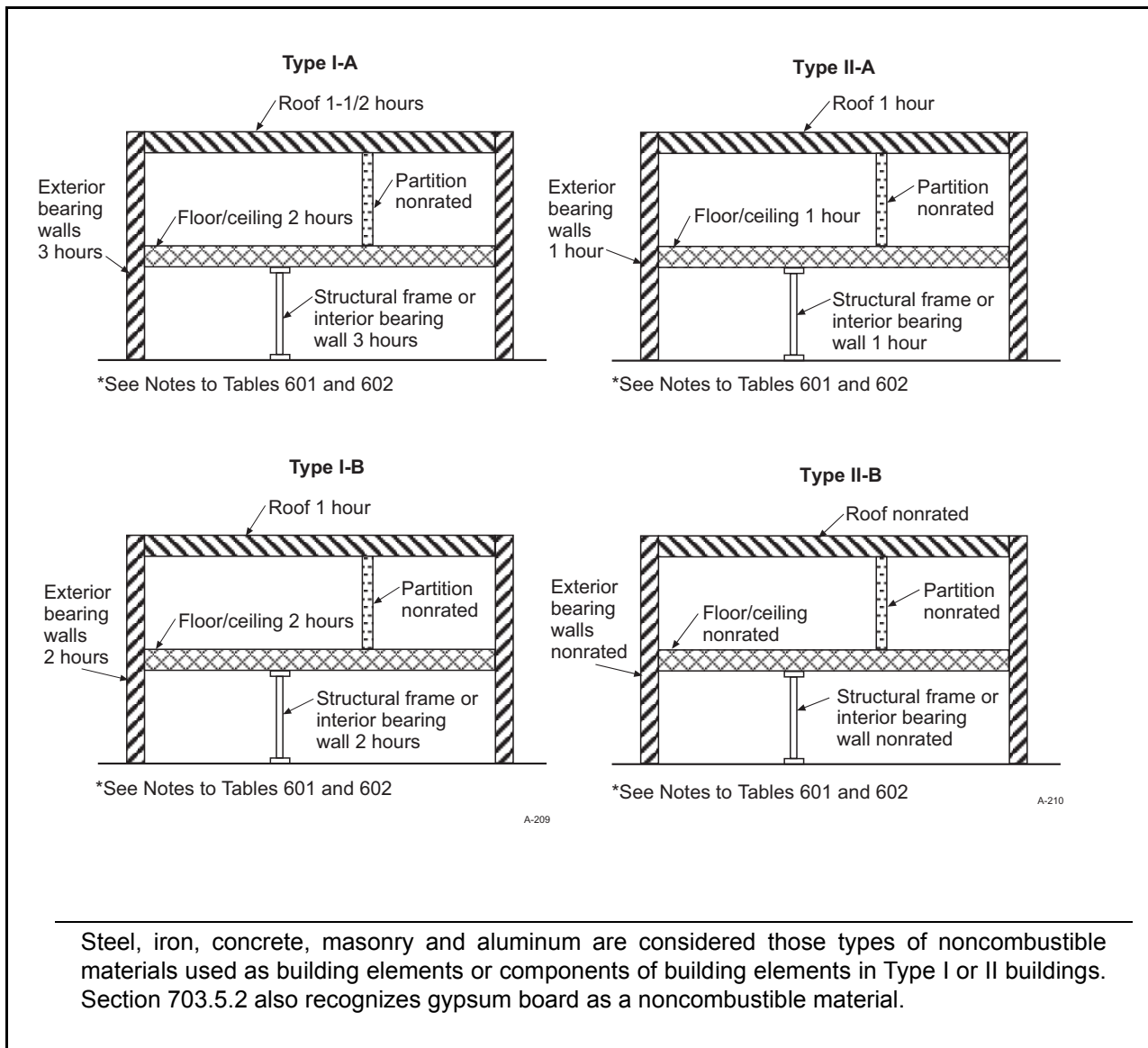
Discussion and Commentary: There are two major groupings based on the construction materials: noncombustible construction (Types I and II) and noncombustible or combustible construction (Types III, IV and V). These groupings are divided into two more categories: protected, where the major structural elements are provided with some degree of fire resistance, and unprotected, where no fire protection of the building elements is typically mandated. Protected construction is further distinguished in Type I buildings where the required protection for many structural elements exceeds a 1-hour fire-resistance rating.

Noncombustible	Exterior and interior (bearing or nonbearing) walls, floors, roofs and structural elements are to be of noncombustible materials	I	A	B
		II	A	B
Noncombustible or combustible	Exterior walls are to be of noncombustible materials	III	A	B
		IV	HT	
	V	A	B	

It is the intent of the *International Building Code* that each building be classified as a single type of construction. The construction materials and the degree to which such materials are protected determine the classification based on the criteria of Table 601 and Chapter 6.

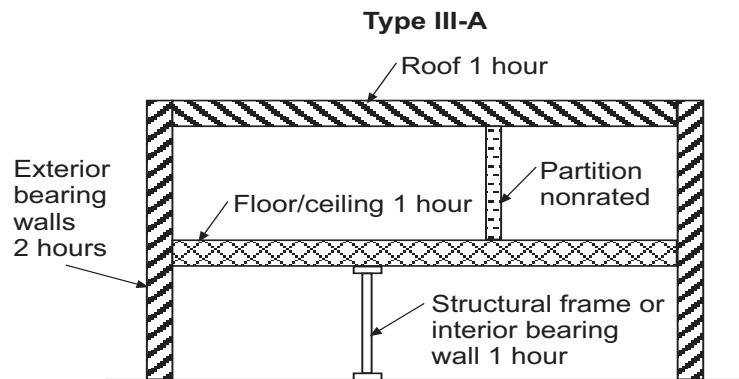
Code Text: *Types I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in the IBC.*

Discussion and Commentary: Type I buildings are noncombustible, and the building elements are also provided with a mandated degree of fire resistance. This type of construction requires the highest level of fire protection specified in the code. Type II buildings are also of noncombustible construction; however, the level of fire resistance is usually less than that required for Type I structures. Buildings of Type II construction may have a limited degree of fire resistance (Type IIA) or no fire resistance whatsoever (Type IIB). There are limited allowances for the use of fire-retardant-treated wood in nonbearing partitions, nonbearing exterior walls and roof construction.

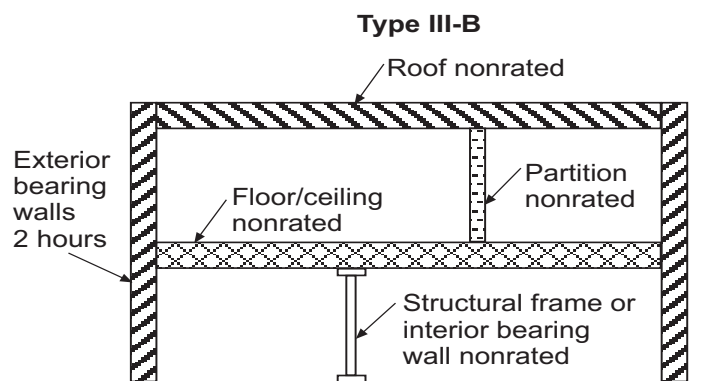


Code Text: *Type III construction is that type of construction in which the exterior walls are of non-combustible materials and the interior building elements are of any material permitted by the IBC. Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.*

Discussion and Commentary: Type III buildings are considered combustible buildings and are either protected or unprotected. This building type was developed out of the necessity to prevent conflagrations in heavily built-up areas where buildings were erected side-by-side in congested downtown business districts. To limit the spread of fire from building to building, exterior walls were required to be of both noncombustible and fire-resistant construction.



*See Notes to Tables 601 and 602



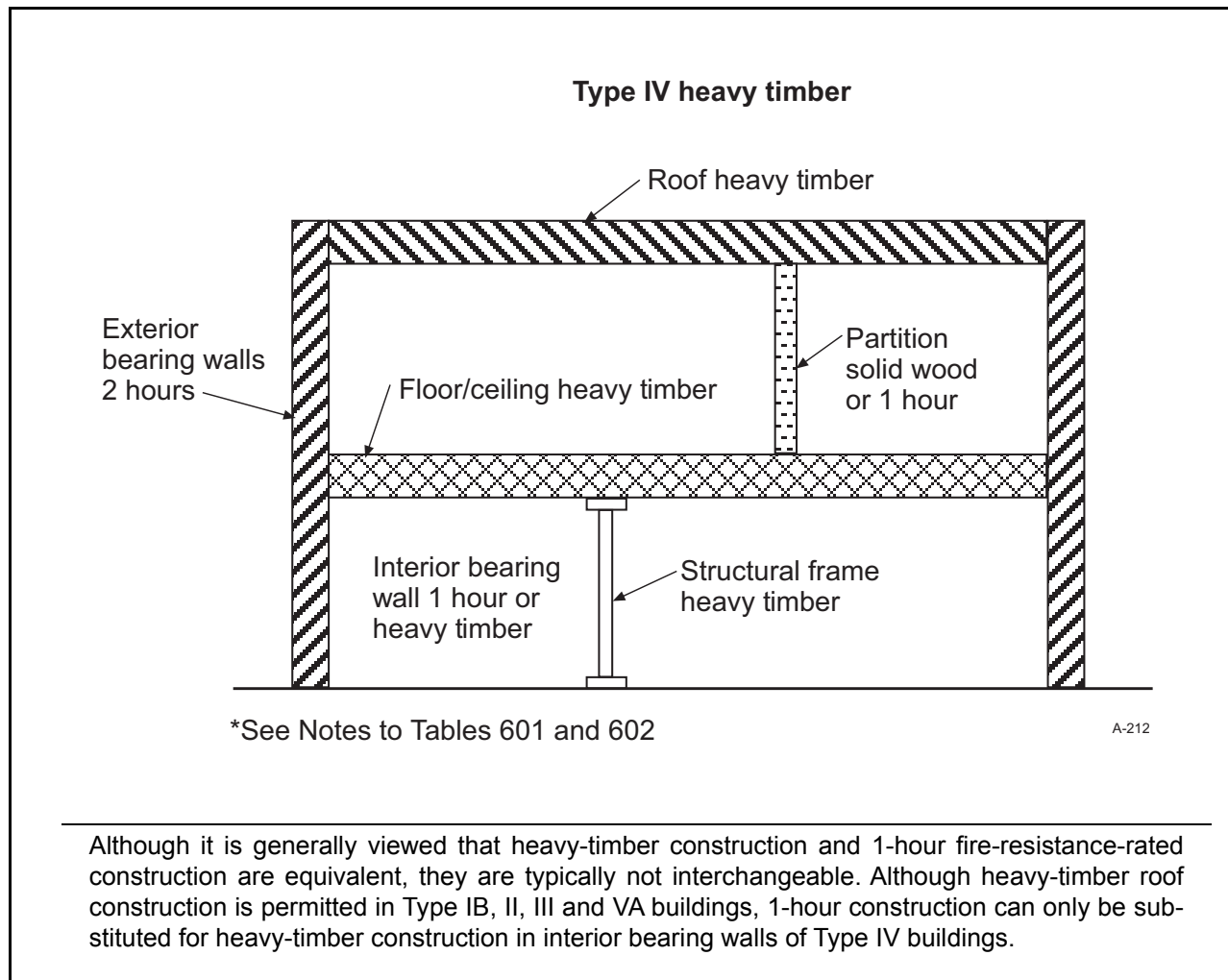
*See Notes to Tables 601 and 602

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Historically referred to as “ordinary masonry construction,” Type III buildings usually consist of concrete or masonry exterior walls with wood floor and roof systems. However, the IBC permits such walls to contain fire-retardant-treated wood as an element of the exterior wall construction.

Code Text: *Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated wood, heavy timber (HT) or structural composite lumber (SCL) without concealed spaces. The details of Type IV construction shall comply with the provisions of Section 602.4 and Section 2304.11. Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies not less than 6 inches (152 mm) in thickness with a 2-hour rating or less.*

Discussion and Commentary: Often referred to as “heavy-timber,” buildings of Type IV construction are essentially Type III buildings with an interior of wood members of significant mass. To conform to Type IV construction, building members must be of substantial thickness. Given the characteristics of massive wood members, there is little chance for sudden structural collapse during or after a fire.



Code Text: *Where a structure, portion thereof or individual structural elements are required by provisions of the IBC to be of heavy timber, the building elements therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimensions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or in Sections 2304.11.2 through 2304.11.4.*

Discussion and Commentary: Solid-sawn wood members, glued-laminated timbers and structural composite lumber are manufactured with different methods and procedures: therefore, they do not have the same dimensions. However, they both have the same inherent fire-resistive capability that has been long recognized in the code.

**TABLE 2304.11
MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS**

SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
		Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	6 ³ / ₄	8 ¹ / ₄	7	7 ¹ / ₂
	Wood beams and girders	6	10	5	10 ¹ / ₂	5 ¹ / ₄	9 ¹ / ₂
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	8 ¹ / ₄	5 ¹ / ₄	7 ¹ / ₂
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	5 ¹ / ₄	5 ¹ / ₂
	Framed timber trusses and other roof framing; ^a Framed or glued-laminated arches that spring from the top of walls or wall abutments	4 ^b	6	3 ^b	6 ¹ / ₈	3 ¹ / ₂ ^b	5 ¹ / ₂

For SI: 1 inch = 25.4 mm.

- a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.
- b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width.

Table 2304.11 in the IBC, which sets forth the minimum net sizes for glued-laminated members necessary to comply as Type IV construction elements, also identifies the minimum net sizes for structural composite lumber (SCL).

Topic: Cross-Laminated Timber

Category: Types of Construction

Reference: IBC 602.4.2, 2304.11.3.1

Subject: Type IV Construction

Code Text: *Cross-laminated timber complying with Section 2303.1.4 shall be permitted within exterior wall assemblies not less than 6 inches in thickness with a 2-hour rating or less, provided the exterior surface of the cross-laminated timber is protected by 1) fire-retardant-treated wood not less than $1\frac{5}{32}$ inch (12 mm) thick; 2) gypsum board not less than $\frac{1}{2}$ inch (12.7 mm) thick; or 3) a noncombustible material. Cross-laminated timber floors shall be not less than 4 inches (102 mm) in actual thickness. Cross-laminated timber roofs shall be not less than 3 inches (76 mm) nominal in thickness.*

Discussion and Commentary: Cross-laminated timber (CLT) is a prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or structural composite lumber where the adjacent layers are cross oriented and bonded with structural adhesive to form a solid wood element. First developed in Europe about 15 years ago, CLT has been used extensively there for a large section of structural lumber. When of the specified size, it is considered as Type IV heavy-timber construction.



Cross-laminated timber floors regulated as Type IV heavy-timber construction must be continuous from support to support and mechanically fastened to one another. Unlike sawn or glued-laminated plank floors, CLT is permitted to be connected to walls without a shrinkage gap if swelling or shrinking is considered in the design.