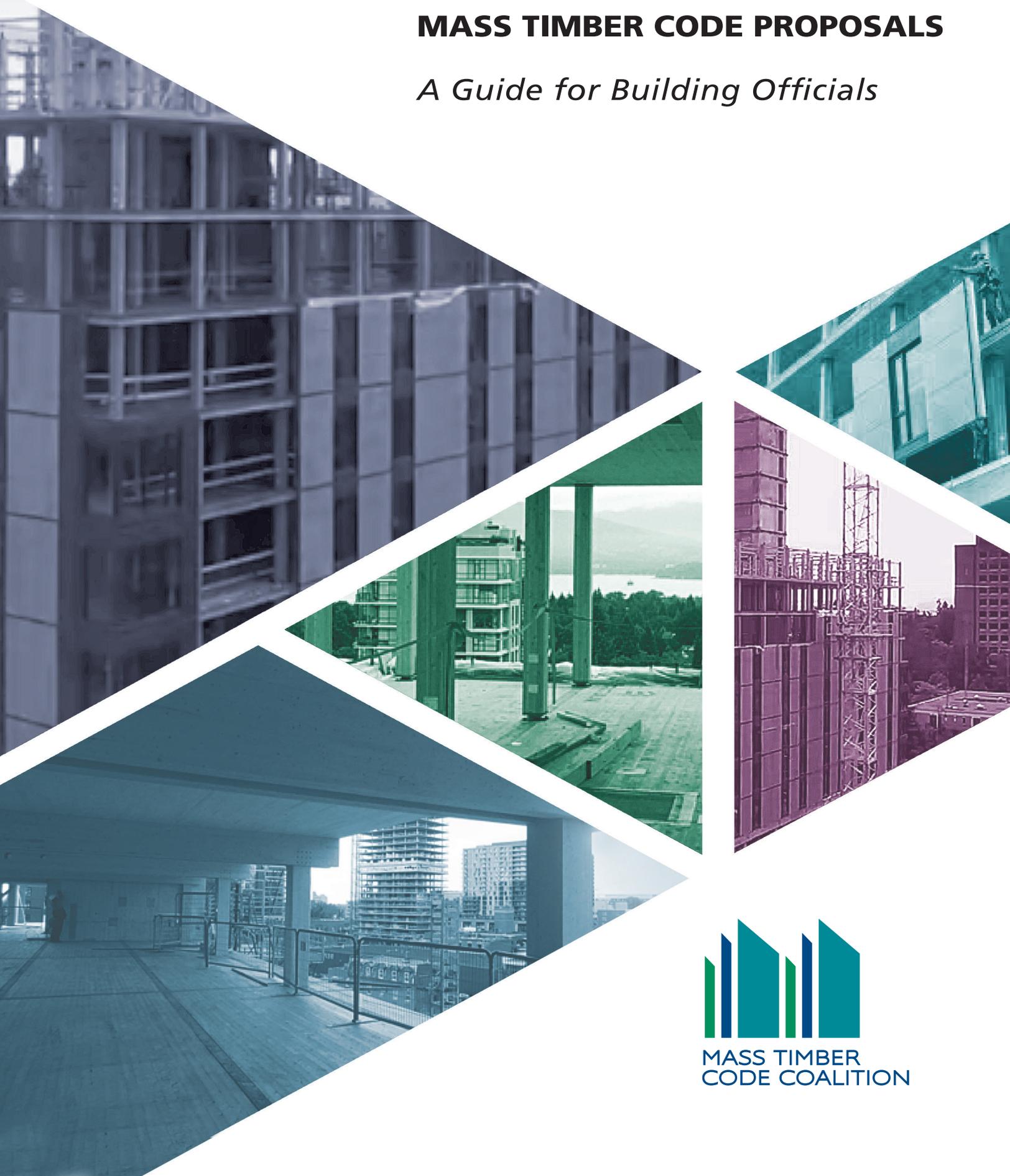


UNDERSTANDING THE MASS TIMBER CODE PROPOSALS

A Guide for Building Officials



MASS TIMBER
CODE COALITION



Background on ICC Ad Hoc Committee on Tall Wood Buildings

The Board of the International Code Council (ICC), the developer of model U.S. buildings codes and the International Building Code (IBC), created the Ad Hoc Committee on Tall Wood Buildings (AHC-TWB) to assess the science of tall wood buildings and to develop code proposals through the ICC process to ensure the safety of tall mass timber buildings. The committee included subject matter experts from the building materials, building design, building regulatory, and fire safety arenas.

Fourteen code-change proposals were submitted into cdpACCESS for the Group A Committee Action Hearings in Columbus, Ohio in the Spring of 2018. All 14 proposals were either Approved as Submitted, or Approved as Modified, by the ICC Code Development Committees.



The proposals create three new types of construction: IV-A, IV-B and IV-C. Heavy timber (Type IV-HT) remains technically unchanged by these proposals as in the current 2018 International Building Code (IBC). Importantly, none of these new types of construction permit the use of combustible light frame construction in any manner. Also, mass timber used in the new types of construction must meet the minimum dimensions assigned in the 2018 IBC for heavy timber construction. To understand the complete package of code change proposals, the changes should be reviewed in their entirety.

Fire Testing Completed by the AHC-TWB

Though mass timber has undergone significant fire testing previously, the AHC-TWB undertook new fire testing on a larger scale to confirm that the fire protection performance intended by the International Building Code were retained. **A series of full scale, multiple-story fire tests performed by the AHC-TWB at the U.S. Government's ATF Fire Research Laboratory verified that the code change proposals were conservative, and in most cases more conservative, than the present level of protection required by code.**

Five, full-scale, multiple-story fire tests simulated each new construction type proposed. The following constraints were evaluated as part of these tests.

- Contribution of mass timber to a fire,
- Integrity of structural members,
- Performance of connections,
- Performance of through-penetration protection, and
- Conditions for responding fire personnel.



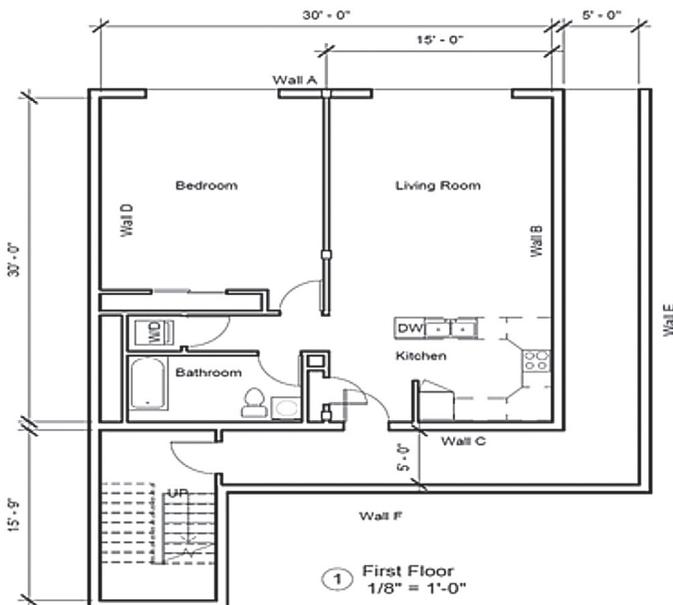


The tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The results validated the fire performance for each mass timber construction type. The results of those tests, as well as testing for structural performance in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, and additional testing by others, helped establish the basis for the AHC-TWB code change proposals.

Overall, the package of tall wood building proposals, which are described in a separate section below, recognizes recent technological improvements and provides a level of protection more conservative than presently recognized by code. These code change proposals work together; all are needed to provide the holistic approach intended for taller mass timber buildings. Adopting only a few amendments would potentially ignore details required to ensure mass timber structures are properly designed, constructed and maintained. The following list provides an overview of the primary fire protection features required for mass timber buildings and substantiates the overall conservative approach.



All mass timber buildings are required to provide at least two-hour fire-resistance for structural members, with three-hour fire-resistance required for the structural frame or bearing walls of Type IV-A buildings.



- Noncombustible protection is required on the exterior of all mass timber buildings, which is lower risk than a Type I-A or B building with combustible cladding as is currently permitted.
- All mass timber buildings require all concealed spaces to be protected with noncombustible materials.
- Type IV-A is fully protected by non-combustible material inside and outside. (No exposed surface)
- Type IV-B allows limited exposed mass timber interior members, but they must be spatially separated.
- Type IV-C is limited to the same height as existing HT and only allows an increased number of stories in lower hazard occupancies.



- Dual water supplies are required for mass timber buildings exceeding 120 feet in height, which provides a more robust fire protection package than a comparable Type I-A building of less than 420 feet in height, which only requires a single water supply.
- Dimension requirements for mass timber elements will limit smoke migration
- Stringent protections are required for mass timber buildings under construction.
- Full-scale fire testing confirmed that mass timber buildings will sustain a complete burnout of a typical residential fuel load without the aid of sprinklers
- Annual inspections are required to ensure passive protection remains in place.
- Joints and penetrations are still required to be tested, installed and inspected as presently outlined in the IBC.

More information on the fire testing of mass timber construction is available at buildtallbuildsafe.com.



Mass Timber is NOT Light-Frame Construction





Becoming Familiar with Tall Wood Code Change Proposals

It is recommended the code change proposals are reviewed in the following order starting with the basic requirements for the new types of construction:

Section 602.4 – Type of Construction **(G108-18)**;

Section 703.8 – Performance Method **(FS5-18)**;

Section 722.7 – Fire Resistance from Noncombustible Protection **(FS81-18)**;

Section 703.9 – Sealants at Edges **(FS6-18)**;

Chapter 7 – Section 718.2.1 – Fire and Smoke Protection **(FS73-18)**;

Section 403.3.2 – High Rise Sprinkler Water Supply **(G28-18)**;

Section 701.6 – Owners Responsibility **(F88-18)**;

Section 3308.4 of the IFC - Fire Safety During Construction **(F266-18)**.

It is recommended the three code change proposals dealing with height, number of stories and allowable area (Table 504.3) **(G75-18)**; Table 504.4 **(G80-18)**; and Table 506.2 **(G84-18)** are reviewed after one becomes familiar with the types of construction. Height and area has been a subject of discussion in the IBC since Legacy Codes were first combined to form the IBC. Considerable judgment was applied by the committee after fully understanding the proposed type of construction features, fire resistance, noncombustible protection, active fire sprinkler systems, and then only after full scale fire testing with and without sprinklers.

Finally there are three more code changes are primarily housekeeping, with little relevance to the overall performance of the new types of construction. It is recommended these proposals are reviewed last: Chapter 31 – Section 3102 – Special Construction **(G146-18)**; IBC Appendix D – Fire Districts **(G152-18)**; and Sections 508.4 and 509.4 (Fire Barriers) **(G89-18)**.

Code Change Proposal G108-18 – Types of Construction

Section 602.4 Type of Construction: Requirements in other regions of the world generally place tall mass timber buildings into three categories:

- The mass timber is fully protected with noncombustible materials.
- A limited amount of exposed mass timber elements is allowed.
- The mass timber is permitted to be unprotected.

Type IV-A: Mass timber construction fully protected with noncombustible materials has been designated Type IV-A. Protection is described in a new section (722.7). Testing has shown that mass timber construction protected with multiple layers of 5/8-inch Type X gypsum board, can survive a complete burnout of a residential fuel load without igniting the mass timber. The fire protection specified applies to all building elements. As such, protection of all wall and ceiling surfaces, the underside of the roof surface, the top and bottom of all floor surfaces, as well as all shafts and exterior surfaces are required to be fully protected. In addition, Type IV-A construction will have the same fire-



resistance rating as Type I-A construction. The fire-resistance rating for Type IV-A construction is conservative since the structural elements are intended to resist the fuel loads associated with the various occupancies without the benefit of automatic sprinklers, and without involving the structural members, similar to the existing strategy for Type I construction. Type IV-A also requires dual water supplies for buildings exceeding 120 feet in elevation. This provides redundancy to help ensure water is available for automatic and manual suppression systems. A noncombustible building would not have to meet this requirement until it reaches 420 feet.

Type IV-B: Some exposed wood surfaces of ceilings, walls, columns and beams are allowed in Type IV-B. The amount of exposed surfaces allowed, as well as the required spatial separation between unprotected areas, is specified to limit contribution of the structure in an interior fire. In areas where the mass timber is permitted to be exposed, it must be designed or calculated to provide the required fire resistance rating. Like the other two new construction types, exterior faces of Type IV-B are required to be protected with noncombustible materials. Concealed spaces, shafts and other specified areas are required to be fully protected with noncombustible protection. Type IV-B must meet the same fire-resistance requirements as Type I-B construction. However, the present allowance in IBC Section 403.2.1.1, to reduce I-B construction to one-hour structural elements, has not been included for Type IV-B construction. As such, two-hour structural elements are still required for Type IV-B construction.

As with Type IV-A construction, Type IV-B also requires dual water supplies for buildings exceeding 120 feet in height. This redundant water supply, coupled with the two-hour passively protected structural frame, provides a conservative approach to fire protection.

Type IV-C: Since noncombustible protection is not required for interior elements of Type IV-C, it relies on the inherent fire-resistance of the mass timber itself. Type IV-C construction is more conservative than traditional Heavy Timber construction in that Type IV-C is required to provide two-hour fire-resistance. Although IV-C permits interior mass timber elements to be fully exposed, concealed spaces, shafts, elevator hoistways, and interior exit stairway enclosures are required to be fully protected with noncombustible materials. Like the other two new construction types, exterior faces of Type IV-C are required to be protected by noncombustible materials. Due to the increased fire-resistance of Type IV-C construction, additional stories for lower hazard occupancy groups have been proposed, but height (in feet) beyond that already recognized for Type IV- HT has not been proposed. This is reflected in reduced allowable height, in both feet and stories, compared to other AHC-TWB proposals to Table 504.3 and 504.4.

Revisions are proposed to Tables 601 and 602 to recognize the performance requirements of these new types of construction. In summary:

- Type IV-A has a three-hour fire-resistance rating as presently required for Type I-A buildings.
- Type IV-B has a two-hour fire-resistance rating as presently required for Type I-B buildings.
- Type IV-C has a two-hour fire-resistance rating as presently required for Type I-B buildings and the newly proposed IV-B. The additional protection features mandated for these structures provide the primary justification for the proposed height and area increases.



Table 1 below compares the fire resistance rating for each construction type;

Table 1 Required Fire Resistance of Building Elements in Hours – New and Proposed

Construction Type	Current Construction Types			
	Exterior Walls	Structural Frame	Floor Protection	Roof Protection
Current Construction Types	TYPE I-A--Fire Resistive Protected Non-Combustible (concrete; fire-protected steel)			
	Exterior Walls 3 Hrs.*	Structural Frame 3 Hrs.*	Floor Protection 2 Hrs.*	Roof Protection 1 ½ Hrs.*
	Note: Dual water supply for fire suppression systems required at 420 feet elevation and above. *Permitted to be reduced by 1 Hr. with certain fire sprinkler controls for buildings less than 420 feet high.			
	TYPE I-B--Fire Resistive Protected Non-Combustible (concrete; fire-protected steel)			
	Exterior Walls 2 Hrs.*	Structural Frame 2 Hrs.*	Floor Protection 2 Hrs.*	Roof Protection 1 Hr.*
	Note: *Permitted to be reduced by 1 Hr. with certain fire sprinkler controls for less hazardous uses, smaller fuel loads			
	TYPE II-A--Protected Non-Combustible (fire-protected steel)			
	Exterior Walls 1 Hr.	Structural Frame 1 Hr.	Floor Protection 1 Hr.	Roof Protection 1 Hr.
	TYPE II-B--Unprotected Non-Combustible (bare steel)			
	Non-combustible materials, but no fire resistance required			
Proposed New Construction Types	TYPE III-A--Protected Combustible (protected light wood frame or masonry exterior walls)			
	Exterior Walls 2 Hrs.	Structural Frame 1 Hr.	Floor Protection 1 Hr.	Roof Protection 1 Hr.
	TYPE III-B--Unprotected Combustible (protected light wood frame or masonry exterior walls)			
	Exterior Walls 2 Hrs.	Structural Frame None	Floor Protection None	Roof Protection None
	TYPE IV-A—Fully Protected, exterior and interior			
	Exterior Walls 3 Hrs.	Structural Frame 3 Hrs.	Floor Protection 2 Hrs.	Roof Protection 1 ½ Hrs.
Note: Dual water supply for fire suppression systems required at 120 feet elevation and above. No reductions in protection permitted.				
TYPE IV-B- Mass timber protected exterior, limited exposed timber interior				
Exterior Walls 2 Hrs.	Structural Frame 2 Hrs.	Floor Protection 2 Hrs.	Roof Protection 1 Hr.	
Note: Dual water supply for fire suppression systems required at 120 feet elevation and above. No reductions in protection permitted.				
TYPE IV-C—Mass timber protected exterior, exposed timber interior				
Exterior Walls 2 Hrs.	Structural Frame 2 Hrs.	Floor Protection 2 Hrs.	Roof Protection 1 Hr.	
Note: No reductions in protection permitted.				
Current Construction	TYPE IV--Heavy Timber			
	Exterior Walls 2 Hrs.	Structural Frame Timber or 1 Hr.	Floor Protection Heavy Timber	Roof Protection Heavy Timber
	TYPE V-A--Protected wood frame			
	Exterior Walls 1 Hr.	Structural Frame 1 Hr.	Floor Protection 1 Hr.	Roof Protection 1 Hr.
TYPE V-B--Unprotected wood frame: No Fire Resistance				



Code Change Proposal FS5-18 – Performance Method

Section 703.8 - Performance Method: This proposal provides a performance path to determine the contribution to the fire resistance rating provided by noncombustible protection. The fire-resistance rating of mass timber structural members consists of the inherent fire resistance rating of the mass timber and the additional fire-resistance provided by any noncombustible protection as described in new definitions.

This proposal allows any noncombustible material to be tested to determine the time assigned for its contribution to overall fire resistance rating of the element. This procedure is neither new nor ambiguous. It was used to determine protection times for various membranes. Recent testing at the Federal ATF Fire Research Laboratory confirmed the values derived from historic testing and have been included in TR10, available as a free download at <https://www.awc.org/codes-standards/publications/tr10>.

Technical Report No.-10 (TR10)

- contains background and examples for the method

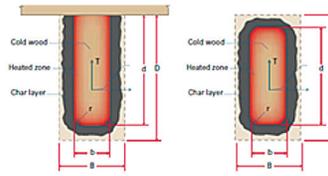
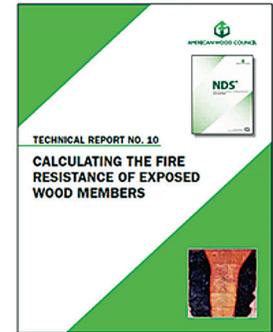


Figure 1-1 Reduction in member breadth and depth over time, t



Code Change Proposal FS81-18 – Fire Resistance from Noncombustible Protection.

Section 722.7 – Fire Resistance Rating of Mass Timber

The AHC-TWB proposals include a prescriptive approach to achieve improved fire-resistance for mass timber structures. The designer is allowed to calculate the fire resistance rating of a protected wood element by adding the fire-resistance rating of the unprotected wood member to the protection provided by noncombustible protection applied to the exposed wood.

As a prescriptive solution, the conditions of use, such as attachment, finishing and edge treatment, when bordering exposed mass timber areas, are also detailed in this section. Fire testing of beams, columns, walls and ceiling panels was conducted to establish the values in Table 722.7.1(b).

To support the imposed structural loads, mass timber elements typically have large cross-sections. In addition, mass timber panels typically incorporate odd numbered laminations, which results in excess load carrying capacity. It also provides increased fire endurance due to charring of the sacrificial layer. Thus, mass timber elements are conservative in their fire-resistance rating. Additionally, at least two-thirds of the fire-resistance rating is required to be provided by the noncombustible protection when required, which also achieves conservative results.





The contribution of noncombustible materials to fire-resistance is determined by measuring the fire resistance time to structural failure of a mass timber building element through a fire test and then conducting a second test with noncombustible protection applied. Each test is conducted with identical mass timber elements, identical loading, construction and conditions, but one of the tests includes the noncombustible protection (as defined in Section 703.5). The difference in the test results between the two samples is the contribution of the noncombustible protection. This testing procedure should not be confused with testing for “finish rating”, which is based on temperature rise on the unexposed side of an attached membrane.

Code Change Proposal FS6-18

Section 703.9 – Sealants at Edges

Mass timber has inherent fire-resistance properties, which provide both structural fire-resistance and limit the spread of fire and smoke through building components (walls and floors). Where a wall or horizontal assembly serves as the separation between fire compartments, a fire in one compartment can create sufficient pressure to force heated gases into uninvolved portions of the structure. As such, abutting edges and intersections are required to be sealed. Where mass timber panels are connected, fire tests have demonstrated the importance of sealing abutting edges and intersections. The structures tested (as part of the fire tests providing empirical support for this submittal) were sealed as proposed in the code changes by the AHC-TWB.

The *US Edition of the CLT Handbook* recommends a bead of construction adhesive. Other sealants can also prevent air flow. A newly referenced standard, ASTM Standard D3498—03 (2011) *Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems* provides direction. Where a sealant or adhesive is applied to mass timber building elements (therefore designated in the construction documents approved by the Authority Having Jurisdiction), special inspections are required during construction to ensure an appropriate sealant or adhesive is used and to provide quality control. An exception is provided for panels manufactured under a proprietary process and tested accordingly to ensure there are no voids at abutting edges. Even if the sealant is not required, but not specifically excluded, special inspections is still considered good practice.

This code change proposal does not apply to “joints” as defined in Section 202 of the IBC. Joints have an opening designed to accommodate construction tolerances or allow independent movement. Panels and members rigidly connected, as specified by this code change proposal, do not meet the definition of a joint. Joints have their own requirements for testing, installation and inspection in IBC Section 715.

Code Change Proposal FS73-18

Section 718.2.1 - Fire-blocking material

The purpose of this code change proposal is to recognize that mass timber is a suitable fire-blocking material. The current list of acceptable materials lists “nominal lumber”; therefore, since mass timber (e.g. sawn, glued-laminated, and cross laminated timber) are of greater mass, the correlation from single nominal lumber to mass timber was determined to be of equal or greater blocking resistance to reduce the movement of fire, smoke and gasses to different part of the building through combustible concealed spaces.



Code Change Proposal G28-18

Section 403.3.2 – High Rise Sprinkler Water Supply

The ICC Code Technology Committee, in response to the events of September 11, 2001, submitted proposals for redundant water supply to super high-rise buildings of 420' and higher. This requirement was adopted for mass timber buildings taller than 120 feet due to the recognized importance of insuring a continuous water supply to the active fire protection systems in the event of a fire in these structures. This recommendation was highlighted in the National Institute of Standards and Technology's (NIST) report on the structural collapses on September 11.

Code Change Proposal F88-18

Section 701.6 – Owners Responsibility

Mass timber construction is proposed to allow greater heights and areas than previously permitted for wood frame construction. Construction materials currently required for buildings of similar heights and areas will not contribute to the fuel load in the manner mass timber can. Therefore, tall mass timber buildings are required to include specific active and passive features to protect occupants and the structure from fire. *The International Fire Code (IFC)* currently requires active systems to be inspected periodically for performance and, for these unique structures, it is reasonable to require the same for the applicable passive aspects. This code change requires the owner to annually inspect, and repair or restore if needed, any required passive protection of mass timber elements that may have been damaged or removed, and also to maintain records of such inspections and repairs.



Code Change Proposal F266-18

Section 3308.4 of the IFC – Fire Safety During Construction



Additional active and passive fire protection features are required to justify the increased height and area for mass timber buildings (Types IV-A, IV-B & IV-C). The proposed changes to this section require this additional protection when these combustible buildings are under construction and, therefore, most vulnerable.

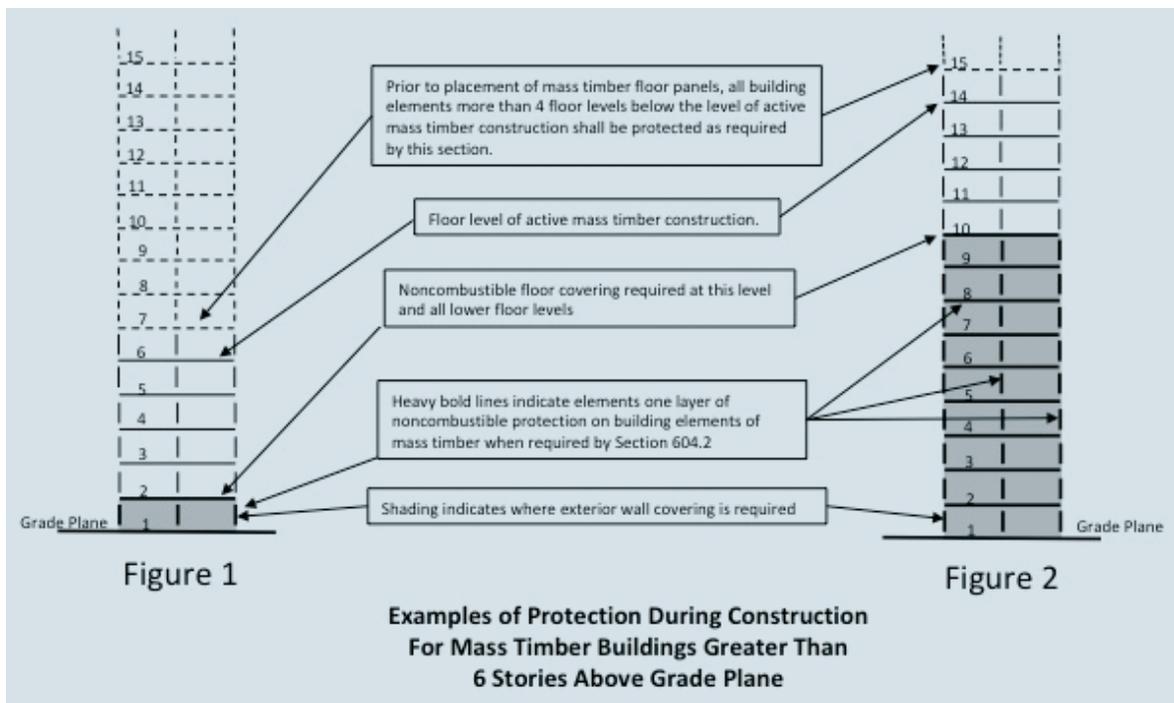
In recent years, there have been fires in buildings under construction. Most of these fires occurred in large structures of light-frame wood members prior to the installation of active and passive fire protection systems. Even though these losses were in light-frame construction, and mass timber has



inherent fire-resistance and structural integrity due to the mass of the timber elements, the potential risk of fire for mass timber construction was considered. Mass timber construction is generally installed as it arrives at the job site. Therefore, smaller amounts of combustible building materials are expected to be stored on site than on a typical construction site using combustible building materials. This proposal requires protection of the installed material before the project extends above a specified number of levels, which is very different, and more stringent, than conventional construction processes.

The AHC-TWB had extensive discussion regarding water supply to construction sites where substantial quantities of combustible building materials exist. It was agreed that developers should confer with the local fire service to establish the fire department's needs, in terms of water flow and pressure, for the specific site. Sub-sections 1 and 2 of the proposal apply to the delivery of water to the job site and structure. Sub-sections 3 and 4 are specific to the passive protection aspects of the structure. Due to the proposed increased heights and area of mass timber buildings, interior and exterior passive protection is required as construction progresses. This helps ensure lower portions of the combustible structure have redundant, active and passive protection as greater heights are reached.

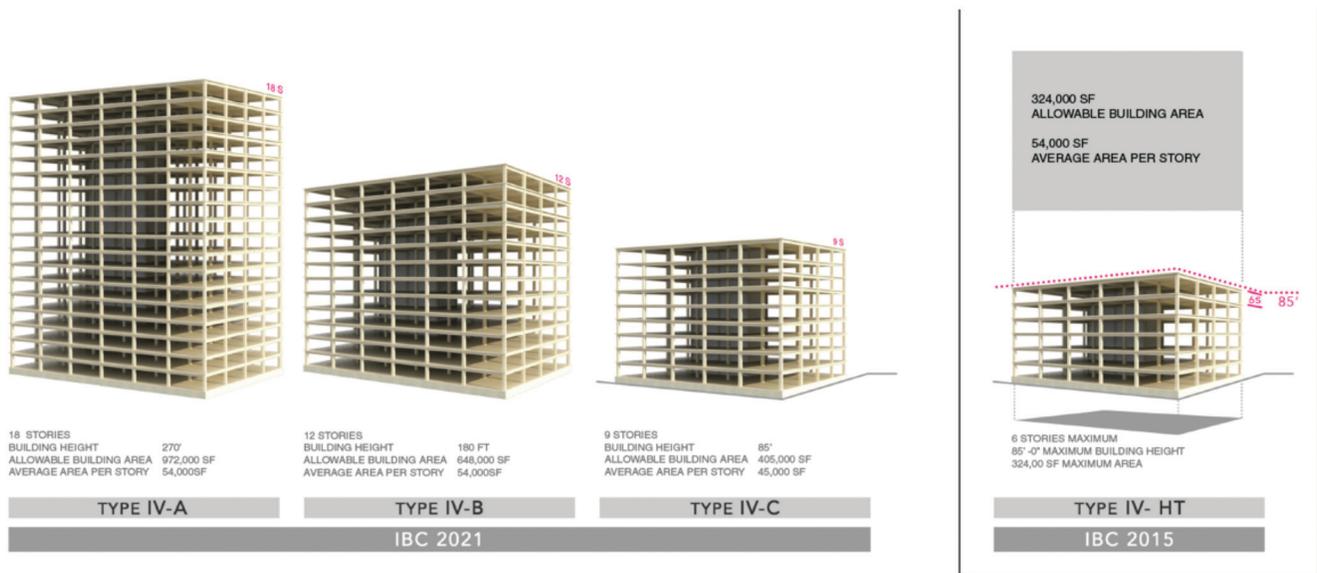
The likelihood of structural failure during a fire and adverse impact to surrounding structures will be significantly reduced. The AHC-TWB included two figures with the proposed amendments to illustrate the requirements for passive protection of mass timber structures under construction. When buildings under construction exceed six stories, protection is required on building elements in accordance with the associated construction type, as well as exterior wall coverings, more than four floor levels below before additional levels can be erected. For example, prior to placing level seven floor panels, meaning construction is being performed on level six, passive protection must be provided for the elements under level two. Similarly, when level 14 is the active level of construction, prior to placement of floor panels at level 15, protection is required at the underside of and below level 10.





Code Change Proposals G75-18, G80-18 and G84-18

It was recommended the three code change proposals dealing with height, number of stories and allowable area (Table 504.3) (**G75-18**); Table 504.4 (**G80-18**); and Table 506.2 (**G84-18**) should be reviewed only after one becomes familiar with the types of construction.



BUSINESS OCCUPANCY [GROUP B]

*BUILDING FLOOR-TO-FLOOR HEIGHTS ARE SHOWN AT 12"-0" FOR ALL EXAMPLES FOR CLARITY IN COMPARISON BETWEEN 2015 TO 2021 IBC CODES.

General Facts Concerning Type IV Construction

Type IV-A

- Maximum 18 stories (but many occupancies, such as M and S, are less)
- Noncombustible Protection for 2/3 of the FRR time. (GWB)
- Sprinkler system operation provides a redundant level of protection
- Tests show fuel load contents burn-out without fire service intervention

Type IV-B

- Maximum 12 stories (but many occupancies, such as M and S, are less)
- Limited area exposed mass timber (ceiling, wall, both)
- Sprinkler system operation provides a redundant level of protection
- Tests show fuel load contents burn-out without fire service intervention

Type IV-C

- Maximum of 9 stories (in Group B, all other occupancies are less)
- Limited to current HT height, in feet
- Two-hour fire resistance rating (E 119 or calculated)
- Proven performance with sprinklers for buildings of this height



Enhancements for Types IV-A and IV-B that are more conservative than Types I-A and I-B

- All material outboard of the CLT exterior wall must be non-combustible (except weather resistive barrier)
- No one-hour reduction allowed in required Table 601 fire resistance rating for supervised sprinkler valves as in IBC 403.2.1
- No combustible light frame walls, floors, shafts or roofs
- In addition to the noncombustible protection with a minimum contribution to required fire resistance rating of 2/3 of table 601 ratings, mass timber has its own redundant fire resistance rating calculated based on size
- Limitations on height, area and number of stories (tall buildings of mass timber can't be unlimited area like Type I A and I B)
- Minimum of 80 minutes of noncombustible protection also provided for roof construction
- Owner responsibilities for maintenance
- Limits on exposed combustible materials during construction

Code Change Proposals G75-18 and G80-18

Allowable Height in Feet and Number of Stories: The proposals take a conservative approach to height limits for the new construction types. The majority of the recommendations were based on a review of fire safety and structural integrity performance for occupancy groups A, B, E, R, and U. Type IV-B is equated to existing Type I-B for height (in feet and number of stories). Although Section 403.2.1.1 of the IBC allows many occupancies of Type I-B construction to be reduced to one-hour fire-resistance rating, the same reductions were not proposed for Type IV-B. As a result, the comparison is between two-hour mass timber construction, which allows a limited amount of exposed mass timber, versus one-hour Type I-B construction.

In general, the two-hour mass timber construction, which is partially exposed per the limits of proposed Section 602.4, was determined to warrant the same heights as allowed for one-hour Type I-B construction. Even though Type IV-A construction is entirely protected (no exposed mass timber permitted) and the required rating of the structure is equivalent to Type I-A construction (three-hour rating for the structural frame), the AHC-TWB determined that it was not appropriate to allow Type IV-A to be of unlimited heights like Type I-A.

The committee also determined that Type IV-A should be somewhat larger than IV-B. To establish reasonable height allowances for IV-A construction, a multiplier of 1.5 was applied to the heights proposed for Type IV-B construction (rounded up or down based on the professional judgment of the committee).

While interior elements of both Type IV-C and Type IV-HT (no change from current code) may be unprotected, Type IV-C provides a two-hour rating of structural elements. It was the conservative judgment of the AHC-TWB to treat Type IV-C similarly to Type IV-HT, which uses traditional large dimensional lumber and is considered to provide approximately one-hour fire-resistance based on the member sizes and charring. Even though additional stories for some lower hazard occupancies have been proposed for IV-C in recognition of its greater fire-resistance rating, the height in feet is proposed to be the same as already allowed for Type IV-HT. A multiplier of 1.5 was applied to the Type IV-HT to provide a reasonable increase for lower hazard occupancies in Type IV-C buildings. More hazardous uses were limited to the number of stories permitted for Type IV-HT. Fully sprinklered mercantile was only use recognized for a single additional story.





Tables 504.3 and 504.4 currently allow a height of 160 feet and 11 stories for non-sprinklered (NS) Type I-B construction for many occupancy classifications; the heights proposed for Types IV-A, IV-B, and IV-C are the same as those presently allowed for Type IV NS. Unprotected mass timber is required to provide at least a two hour fire-resistance rating or twice that of the one hour fire-resistance rating required for many occupancies of Type I-B (when using the reduction in 403.2.1.1). As such, the proposed new construction types are more conservative than present requirements.

Reduced heights were proposed for specific occupancies which, in the professional judgement of the AHC-TWB, were deemed to be more hazardous.

Code Change Proposal G84-18

Table 506.2 Allowable Area: Allowable area should be considered a companion proposal to the height proposals. Each new construction type proposed was examined for its fire safety characteristics and compared with existing Type IV-HT for allowable area. A multiplier was developed for each to reflect the additional fire protection provided.

- Type IV-C is proposed to be 1.25 times the Type IV-HT allowable area,
- Type IV-B is proposed to be 2.00 times the Type IV-HT allowable area, and
- Type IV-A is proposed to be 3.00 times the Type IV-HT allowable area.

These multipliers were then reexamined by the AHC-TWB on a case-by-case basis based on relative hazard and occupancy classification. Where hazards were perceived to be greater, allowable areas were adjusted downward. Hazardous and Institutional occupancies were reduced from what the multiplier method would allow. In addition, allowable area and the associated height proposals were reconsidered by the AHC-TWB to ensure a conservative approach to the combined allowances.

Also, the committee reconsidered this proposal with respect to the companion height proposal. This review was to be sure that allowable areas were commensurate with the risk posed by being allowed on some particular story or at some height above grade plane.

Code Change Proposals G146-18 and G152 – Membrane Structures

Chapter 31 – Section 3102 – Special Construction (Membrane Structures) and Appendix D D102.2.5 – Fire Districts.

These code changes were developed to retain the current Type IV-HT provisions and do not modify existing requirements.

Code change Proposal G89-18 – Fire Barriers

Fire Barriers Sections 508.4 and 509.4.

Where mass timber serves as a fire barrier or horizontal assembly, the AHC-TWB required additional protection measures to meet the performance-based objectives. Without modification to the provisions regulating separated occupancies and incidental uses, a fire barrier or horizontal assembly in Types IV-B and IV-C construction could be



designed using mass timber that complies with the fire-resistance rating, but would allow exposed mass timber to contribute to the fuel load. The proposal forestalls this.

Section 508.4 provides a new option for separating mixed occupancies within a building. Section 509.4 discusses the fire-resistance-rated separation required for incidental uses within a larger use group. Section 509 also permits, when stated, protection by an automatic sprinkler system without a fire barrier, however, the construction enclosing the incidental use must resist the passage of smoke in accordance with Section 509.4.2.

The AHC-TWB incorporated the existing thermal barrier requirements into these two sections. The intent of the thermal barrier is to delay or prevent ignition of the mass timber, thus delaying or preventing the mass timber's contribution to the fuel load. Mass timber walls or floors serving as fire barriers for separated uses (Section 508.4) are required to have a thermal barrier on both faces of the assembly. The thermal barrier is only required to cover exposed wood surfaces and is not required in addition to noncombustible protection required by Section 602.4 (i.e. materials providing the fire-resistance rating can also serve as the thermal barrier). In addition, the thermal barrier is not recognized as adding a fire-resistance rating to the mass timber.

Section 509.4 (separation of incidental uses) requires the thermal barrier on the side where the hazard exists, that is, the side facing the incidental use. For example, a mass timber floor assembly with a noncombustible topping would not require a thermal barrier on the mass timber floor assembly when the incidental use area is located on that specific floor. In addition, the thermal barrier would not be required if the optional substitution of fire suppression for the thermal barrier is exercised. It should be noted that this proposal only addresses the protection of exposed mass timber and does not relax any of the fire-resistance requirements of Sections 508 or 509 or other mass timber provisions.

Final Comments:

The International Code Council, through an ad hoc committee of diverse subject matter experts, has proposed a comprehensive set of changes to the *International Building Code* (IBC) for the safe construction and use of mass timber buildings. The process involved years of study, peer-review, full-scale fire testing at the ATF Fire Research Laboratory, and the review and approval by code experts at the ICC Committee Action Hearings in 2018. Final consideration of the proposed code changes will be held at the ICC Public Comment Hearings and through the ICC's cdpACCESS online voting.

The ICC process was undertaken recognizing that taller mass timber structures are being approved at the local level already, without specific support by the IBC. The AHC-TWB proposals require highly redundant and rigorous package of active and passive systems of fire protection to permit taller and larger buildings made from mass timber materials. The fire protection requirements are intended to ensure that, under any reasonable fire scenarios, life safety is accomplished, and in addition no structural collapse will occur despite complete burn-out of content fuels. Conservatively, this performance was dictated without consideration of the automatic sprinkler system required for mass timber buildings. Fire testing has also demonstrated that the charring property of exposed mass timber elements provides a reliable and predictable measure of fire-resistive performance even without added noncombustible protection.



The result of the ICC process is that each of the proposed three new types of construction, Type IV-A, Type IV-B, and Type IV-C tall mass timber buildings has fire protection requirements more robust than those required for comparable noncombustible buildings.



THE MASS TIMBER CODE COALITION (MTCC)

MTCC's mission is to provide complete information on the code proposals from the ICC Ad Hoc Committee on Tall Wood Buildings. The ICC Committee's proposals will keep the IBC relevant and give code officials the tools they need to ensure that Tall Mass Timber Buildings meet the highest standards.

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