

G165-15

510.12 (New)

Proposed Change as Submitted

Proponent : Dennis Richardson, representing American Wood Council (drichardson@awc.org)

2015 International Building Code

Add new text as follows:

510.12 Group R-1 and R-2 buildings of Type IV HT construction.

The height and story limitations for buildings of Type IV HT construction in Groups R-1 and R-2 shall be increased to nine stories and 100 feet (30 480 mm) provided all of the following are met:

1. The heavy timber construction shall be not less than 2 hour fire resistance rated and protected with a minimum of one layer of 5/8 inch type X gypsum board on all interior wall surfaces and a minimum of two layers of 5/8 inch type X gypsum board on the ceiling side of all horizontal assemblies.
2. The building has a fire separation distance of not less than 50 feet (15 240 mm).
3. The exits are segregated in an area enclosed by a cross laminated timber 2 hour fire-resistance-rated walls protected with two layers of 5/8 inch type X gypsum board or equivalent on the room side of all walls adjacent to the enclosure.
4. Wall and ceiling assemblies with multiple layers of gypsum board shall be permitted to be furred with noncombustible or fire retardant treated wood furring provided the cavity is filled with securely attached mineral wool insulation and at least one layer of gypsum board is directly attached to the heavy timber structure. Multiple layers of gypsum board shall be permitted to be secured to furring as required in Section 722.5.1.2.1 or Figure 722.5.1(3) for columns and in Section 722.3.2.5 for walls. Attachment of multi layer gypsum wallboard to ceilings shall be permitted to be as required for single assemblies attached to resilient channels in Table 721.1(3) and the base layer or layers shall be permitted to be attached directly to the Type IV structure as required by item 21 of Table 721.1(3). Other attachment shall be permitted to be used if specified by the manufacturer and approved.
5. Buildings of Type IV construction shall be permitted to be located over a building with multiple occupancy groups meeting the provisions of Section 510.2.

Reason: Reason: Mass timber products such as cross-laminated timber (CLT) provide the structural and fire resistance capabilities necessary for taller buildings. This proposal closely follows the special occupancy for Type IIA structures in 510.6 as a model. Existing section 510.6 allows 1 fire resistance rated light frame steel buildings to be up to 9 stories and 100 feet tall when surrounded by 50 feet. This proposal goes to the same height and number of stories but requires additional fire resistance (2 hours instead of 1 hour throughout). The CLT is provided with minimum

protection throughout the inside with 5/8" type X gypsum (one layer at all interior walls and two layers at all ceilings) and the overall assembly must meet the 2 hour E119 fire resistance test. In addition to the mass timber protected with type X gypsum board, the building is provided with an NFPA 13 sprinkler system throughout and is surrounded by yards of 50 feet. The entire fire and life safety "package" is at least equivalent to what is currently specified in 510.6.

The current section 510.6 applying to one hour type II construction requires stairways to be segregated into areas separated by a two hour fire wall. Although the existing language for 510.6 is somewhat unclear, this can be accomplished in the current 510.6 with a two hour fire wall separating the one hour type II building into two fire areas, each with stairways or with separate fire walls at each exit enclosure.

A fire wall is not necessary with this proposal since the entire building is two hour fire resistance rated construction. Stairways are provided with additional protection with a second layer of 5/8" type x gypsum board on the fire side of rooms adjacent to the stairways. Provisions are included to allow the installation of resilient channels and spaces filled with insulation for sound attenuation. Additionally it is noted this building may incorporate a 3 hour separation below if additional occupancies are to be housed in a podium below.

This code change helps address concerns about climate change by allowing a taller building to utilize cross laminated timber which sequesters carbon and has low embodied energy. There is much focus on the future utilization of this building system. The following link gives examples of CLT buildings throughout the world.

<http://www.rethinkwood.com/tall-wood-survey>

In addition the following link provides access to any additional information regarding this or other code changes proposed by American Wood Council.

<http://www.awc.org/Code-Officials/2015-IBC-Code-Changes/>

Cost Impact: Will not increase the cost of construction

This new code section provides a new option for construction that is not currently available.

**G165-15 : 510.12 (New)-
RICHARDSON4889**

Public Hearing Results

Committee Action:

Disapproved

Committee Reason: The committee was uncomfortable that the proposal would allow a more than doubling of the height (Number of stories) allowed in buildings of Type IV construction which would result in an overall increase in fuel load.. The committee recognized the hard work that went into the proposal and that it included provisions intended to assure that a 9 story wood frame building was a safe one.

The committee felt that the text requiring 50 foot separation was unclear whether it applied to one side, or all sides, of the building. While testimony was clear that the proposal required 2 hour construction, and such construction would need to comply with the tested assemblies, the committee was unclear regarding the testing of these assemblies and hoped the language would be stronger regarding such. The Chapter 7 references appear to be to specific attachments to steel and concrete framing and not to wood as would occur in these buildings. There was discomfort that such a building could be the upper building of a podium structure under Section 510.2. Finally, it was suggested that the exit separations be allowed to be of other materials in addition to the CLT as currently listed in the proposal.

Assembly Motion:

As Modified

Online Vote Results:

Failed

Support: 12.11% (43) Oppose: 87.89% (312)

Online Floor Modification:

510.12 Group R-1 and R-2 buildings of Type IV HT construction. The height and story limitations for buildings of Type IV HT construction in Groups R-1 and R-2 shall be increased to nine stories and 100 feet (30 480 mm) provided all of the following are met:

1. The ~~heavy timber~~load bearing construction shall be of solid heavy timber elements not less than 2 hour fire resistance rated and protected with a minimum of one layer of 5/8 inch type X gypsum board on all interior wall surfaces and a minimum of two layers of 5/8 inch type X gypsum board on the ceiling side of all horizontal assemblies.
2. The building has a fire separation distance of not less than 50 feet (15 240 mm).
3. The exits are segregated in an area enclosed by a cross laminated timber 2 hour fire-resistance-rated walls protected with two layers of 5/8 inch type X gypsum board or equivalent on the room side of all walls adjacent to the enclosure.
4. Wall and ceiling assemblies with multiple layers of gypsum board shall be permitted to be furred with noncombustible or fire retardant treated wood furring provided the cavity is filled with securely attached mineral wool insulation and at least one layer of gypsum board is directly attached to the heavy timber structure. Only the layers of gypsum board applied directly to the heavy timber in accordance with the applicable E119 or UL 263 test report shall be utilized to meet the 2 hour required fire resistance rating. Multiple layers of gypsum board shall be permitted to be secured to furring as required in Section 722.5.1.2.1 or Figure 722.5.1(3) for columns and in Section 722.3.2.5 for walls. Attachment of multi layer gypsum wallboard to ceilings shall be permitted to be as required for single assemblies attached to resilient channels in Table 721.1(3) and the base layer or layers shall be permitted to be attached directly to the Type IV structure as required by item 21 of Table 721.1(3). Other attachment shall be permitted to be used if specified by the manufacturer

and approved.

5. Buildings of Type IV construction shall be permitted to be located over a building with multiple occupancy groups meeting the provisions of Section 510.2.

Individual Consideration Agenda

Public Comment 1:

Proponent : Stephen DiGiovanni, representing myself (sdigiovanni@clarkcountynv.gov) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Building Code

510.12 Group R-1 and R-2 buildings of Type IV HT construction.

The height and story limitations for buildings of Type IV HT construction in Groups R-1 and R-2 shall be increased to nine stories and 100 feet (30 480 mm) provided all of the following are met:

1. The heavy timber construction shall be not less than 2 hour fire resistance rated, as tested without any gypsum board attached, and further protected with a minimum of one layer of 5/8 inch type X gypsum board on all interior wall surfaces and a minimum of two layers of 5/8 inch type X gypsum board on the ceiling side of all horizontal assemblies.
2. The building has a fire separation distance of not less than 50 feet (15 240 mm).
3. The exits are segregated in an area enclosed by a cross laminated timber 2 hour fire-resistance-rated walls protected with two layers of 5/8 inch type X gypsum board or equivalent on the room side of all walls adjacent to the enclosure.
4. Wall and ceiling assemblies with multiple layers of gypsum board shall be permitted to be furred with noncombustible or fire retardant treated wood furring provided the cavity is filled with securely attached mineral wool insulation and at least one layer of gypsum board is directly attached to the heavy timber structure. Multiple layers of gypsum board shall be permitted to be secured to furring as required in Section 722.5.1.2.1 or Figure 722.5.1(3) for columns and in Section 722.3.2.5 for walls. Attachment of multi layer gypsum wallboard to ceilings shall be permitted to be as required for single assemblies attached to resilient channels in Table 721.1(3) and the base layer or layers shall be permitted to be attached directly to the Type IV structure as required by item 21 of Table 721.1(3). Other attachment shall be permitted to be used if specified by the manufacturer and approved.
5. Buildings of Type IV construction shall be permitted to be located

over a building with multiple occupancy groups meeting the provisions of Section 510.2.

Commenter's Reason: It is not clear from the original language whether the heavy timber achieves the two-hour rating test result with or without the gypsum attached. This comment seeks to clarify that the heavy timber assembly must achieve a two hour rating without the benefit of the gypsum during the test, resulting in added protection when the gypsum is added for construction.

Public Comment 2:

Proponent : Dennis Richardson, American Wood Council, representing American Wood Council (drichardson@awc.org) requests Approve as Modified by this Public Comment.

Replace Proposal as Follows:

2015 International Building Code

510.12 Group R-1 and R-2 buildings of two-hour Type IV

construction The height limitation for buildings of Type IV construction containing Groups R-1 and R-2 occupancies shall be increased to nine stories and 100 feet (30 480 mm) where the building is separated by not less than 50 feet (15 240 mm) from any other building on the lot and from adjacent lot lines or lot lines on the opposite sides of public ways, provided all of the following are met:

1. All load bearing structural elements shall be heavy timber complying with Sections 602.4 and 2304.11; and have a fire resistance rating of not less than 2 hours in accordance with Section 703.2.
2. The interior surfaces of all heavy timber walls and ceilings shall be covered by two layers of 5/8" Type X gypsum board, with all edges of the face layer offset 18 inches from those of the base layer. The base layer shall be attached with 1.75 inch #6 Type S drywall screws at 12 inches on center in both directions and the face layer shall be attached with 2.25 inch #6 Type S drywall screws at 12 inches on center in both directions offset from the screws in the base layer by 6 inches in both directions. One layer of 5/8 inch Type X gypsum sheathing shall be attached to the outside of the exterior heavy timber walls with minimum 1 3/4 inch galvanized roofing nails 12 inches on center each way and 6 inches on center at all joints or ends. All panel edges shall be attached with drywall screws or roofing nails located at least 1.5 inches but not more than 2 inches from the panel edge.

Commenter's Reason: This code change proposal would create a special provision option for 2-hour Fire Resistance-rated heavy timber construction that is similar to section 510.6 for Group R-1 and R-2 buildings of Type IIA construction. Due to the positive environmental characteristics, including low embodied energy and carbon sequestration, there is a strong desire to utilize mass timber, including Cross Laminated Timber (CLT), for multistory residential construction. The American Wood Council (AWC) is committed to finding technical solutions to make the desired use of mass timber a realistic option, for taller and larger buildings, that is both safe and environmentally-friendly.

This proposal requires all load bearing elements to have a 2-hr fire resistance rating which is more conservative than Section 510.6 which permits light frame steel

construction with a 1-hr fire resistance rating at the same height and number of stories. This proposal adds two layers of 5/8" type X gypsum board on the inside surfaces of heavy timber ceiling and wall elements and one layer of 5/8" type X gypsum sheathing on outside surfaces of exterior heavy timber walls.

Both existing Section 510.6 and proposed Section 510.12 require NFPA 13 sprinklers throughout (by virtue of being Group R occupancies over 4 stories) and all of the applicable high-rise provisions come into play when a floor is located 75 feet above fire department access.

In order to place 9 stories in 100 feet, both existing Section 510.6 and proposed Section 510.12 rely on a level of compartmentalization formed by the rated walls and floors between units to provide a high level of safety. In this proposal compartmentalization is provided by 2-hr fire resistance rated floors/ceiling assemblies and all bearing walls.

The following Q and A addresses specific questions that came up on the initial proposal that have been addressed in this public comment proposal:

Q1 Why is this proposed in special provisions instead of coming up with a new type of construction?

A By the 2021 code cycle, at least one or two new types of construction that deal with heavy timber elements having a specific fire resistance rating in addition to meeting the required prescriptive size and detailing requirements will be proposed. In the mean time, it is entirely consistent with many of the special provisions found in Section 510 to take an existing type of construction and then add additional fire resistance or detailing. Even Section 510.6, which this change is modeled after, has a first floor construction with a 90 minute rating instead of the one hour rating required for Type IIA.

Q2 There were concerns the 50 foot yard requirement in the original proposal applied only on one side.

A This was never the intent but we can see how some people arrived at that interpretation of the language. The language in this public comment proposal is expanded to make sure it is clear 50 feet minimum is required between the building and other structures, property lines and even the other buildings across the street.

Q3 There were concerns that 2-hr light frame walls using fire retardant-treated wood (FRTW) could be used for exterior bearing walls in the original proposal.

A This public comment proposal has been changed to be clear the bearing elements are required to be 2 hour fire resistance rated heavy timber.

Q4 There were concerns that fire could spread from floor to floor because exterior walls were not required to have gypsum board or sheathing.

A This public comment specifies a minimum 5/8" Type X layer of gypsum sheathing on the outside of exterior walls that are built out of heavy timber. Nonbearing walls could be FRTW lumber or noncombustible in addition to heavy timber.

Q5 There were concerns about non-standard time and temperature curves from residential furnishings that could be a problem for the CLT because of the early onset of high temperatures at the time of flashover.

A Research by Carleton University has looked at various combinations of CLT walls covered with gypsum board. Links to the AWC webpage with links to test results is at the end of this reason statement. The American Wood Council is preparing full scale tests to be completed prior to the Long Beach hearings. Use the following link to view this and other information on our website: <http://www.awc.org/Code-Officials/2015-IBC-Code-Changes/>

The two hour construction in this public comment proposal is much more robust from a fire standpoint than the one hour rated steel in Section 510.6.

Q6 Do 2 hour stair and shaft enclosures have to be constructed out of CLT?

A No, 2 hour assemblies constructed of other materials may be used. When stairs enclosures are constructed of CLT this proposal calls for a minimum of two layers of 5/8" type X gypsum on both sides. This is highly conservative.

Q7 How are ratings established?

A Like any other structural fire resistance rating found in table 601, the fire resistance rating is established through the various options found in Section 703.2.

Q8 Why is there a minimum amount of gypsum board or gypsum sheathing specified?

A Exposed timber can be calculated up to two hours structural fire resistance without any gypsum board. With the thickness of panels required for a multistory building it is likely many of the walls and floor/ceilings may be able to meet 2 hour fire resistance on their own. The fire service has expressed concerns about the potential contribution of the building structural elements to the fire fuel load. While the maximum height is only 15 feet taller than would be allowed with regular Type IV heavy timber construction, to be conservative a minimum amount of gypsum is specified on all heavy timber interior and exterior walls, and for ceilings. The attachment of this gypsum wall and sheathing board must be per the listing if it is part of a tested assembly, but is also specified in the code text for the minimum layers of gypsum that are required in the case when they are not part of the listing (in the case where the listing for 2-hours does not contain the minimum gypsum specified by this code text).

Q9 How are penetrations handled?

A Penetrations are required to pass the same requirements and tests as all walls of any material in any building when walls serve as a fire walls, fire barriers, fire partitions, or other separations required by the code.

Q10 Is there loading during fire tests?

A There have been a number of fire tests of heavy timber sized elements designed for the required fire resistance rating. Recent tests of SCL beams and CLT walls have also been conducted under various load ratios to validate fire models permitted in the IBC 722.1 through reference to the National Design Specification (NDS). In 2013, AWC funded the test of a 10' CLT wall that was loaded with 87,000 pounds. This is comparable to the typical design load for these walls. With the exceptional structural capacity of these immense panels, in most cases, it is impossible in most cases to load tests to maximum capacity, just like large walls constructed of other heavy materials. More important is verifying that the test load is within the range of design (actual) load to be experienced by the building element.

Q How can I find out more about CLT and this code change?

A Paste this web address in your browser to reach a page on the American Wood Council website listing the latest information on testing and references for this and other AWC code change proposals:

<http://www.awc.org/Code-Officials/2015-IBC-Code-Changes/>

Information pertaining to this code change G 165-15 includes the following web links or information:

1. 1. AWC CLT Test Report: WP-1950
2. Other CLT tests
3. ARUP report on Fire Safety of Tall Wood Buildings
4. NIST draft white paper: Fire Resistance of Timber Structures, March 31, 2014
5. Carleton University CLT research papers

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