IBC — General

2018 GROUP A PUBLIC COMMENT AGENDA

OCTOBER 24 - 31, 2018
GREATER RICHMOND CONVENTION CENTER
RICHMOND, VA

INTERNATIONAL CODE COUNCIL®

2018 Public Comment Agenda

First Printing

Publication Date: August 2018

PRINTED IN THE USA

G1-18

IBC: 202, 202

Proposed Change as Submitted

Proponent: Stephen Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter ICC (sthomas@coloradocode.net)

2018 International Building Code

SECTION 202 DEFINITIONS

Revise as follows

~~**[BG]**~~ **ATRIUM.** An opening connecting two or more stories other than ~~enclosed stairways~~interior exit stairways or ramps, exit access stairways or ramps, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with Section 505.

Reason: The terms "interior exit stairways or ramps" and "exit access stairway or ramps" referenced in Chapter 10 were added in the 2012 and 2015 IBC. However, they were not referenced in the Atrium definition. This change is only intended to clean up the language and provide consistency within the code. It may be considered to be editorial.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The change is editorial in nature. Therefore, there is no cost implication.

G1-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: While the testimony of the proponents was clear, the proposal results in confusion. It is better to leave the definition we have and not add confusion based on regulations and exemptions in Chapter 10. (Vote 9-5)

Assembly Action: **None**

G1-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen Thomas, Colorado Code Consulting, LLC, (sthomas@coloradocode.net) representing Colorado Chapter ICC ; Sarah Rice, representing The American Institute of Architects (srice@preview-group.com) ; David Collins, representing The American Institute of Architects (dcollins@preview-group.com) ; Wayne Jewell (wayne.jewell@greenoaktwp.com)requests As Modified by This Public Comment.

Replace as follows:

2018 International Building Code

[BG] ATRIUM. ~~An opening~~ A vertical space which is closed at the top connecting two or more stories ~~other than enclosed *stairways*, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. *Stories*, as used in this definition, do not include balconies within assembly groups or *mezzanines* that comply with Section 505~~in Groups I-2 and I-3 Occupancies or three stories in all other occupancies.

712.1.7 Atriums. Atriums complying with Section 404 that connect two or more stories in Groups I-2 or I-3 Occupancies or three stories in other occupancies shall be permitted.

Exceptions:

1. Atriums shall not be permitted within Group H Occupancies.
2. Balconies or stories within Groups A-1, A-4 and A-5, and mezzanines that comply with Section 505 shall not be considered a story as it applies to this section

~~In other than Group H occupancies, atriums complying with Section 404 shall be permitted~~

.

Commenter's Reason: The original intent of the proposal was to just add language that agreed with the current code language. However, the discussion at the Committee Hearing moved to the fact that the entire definition needed to be revised. I agreed to work with others who were interested and come up with a revised definition that did not have a laundry list and clarified what an atrium is. We also removed technical requirements from the definition. The definition in this public comment is much more simple than the previous one and defines what an atrium is.
In addition, a change was made to the language in Section 712.1.7 to bring some of the language from the previous definition into the actual code requirement and revise the language to be easier to understand. There is no intent to change any technical requirements in this public comment.

There is a lot of confusion around a two story atrium since the definition starts out saying "An opening connecting two or more stories". Many people confuse this requirement with openings between two stories in Section 712.1.9. The two-story language has been removed from the definition. We then clarified the intent in Section 712.1.7 by saying that two-story atriums in Groups I-2 and I-3 Occupancies and three-story atriums in all other occupancies must comply with Section 404. So, if you have an opening just between two stories in other than Groups 1-2 or I-3, Section 712.1.9 would apply. If the opening connects three or more stories, it would then be an atrium and need to comply with Section 404. We also revised the language from "In other than Group H Occupancies". to an exception stating that the atrium provisions do not apply to Group H Occupancies.

The definition also had an exception within it for balconies and similar areas in assembly occupancies. This exception was relocated into an exception in Section 712.1.7 to maintain that allowance of balconies and mezzanines in Assembly uses.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is just a clarification of language.

G1-18

G15-18 Part I

PART I - IBC: 303.4, 309.1

PART II - IBC: TABLE 1004.5, (IFC[BE] TABLE 1004.5)

Proposed Change as Submitted

Proponent: Micah Chappell, representing City of Seattle (micah.chappell@seattle.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE GENERAL CODE DEVELOPMENT COMMITTEE. PART II WILL BE HEARD BY THE MEANS OF EGRESS COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows

303.4 Assembly Group A-3. Group A-3 occupancy includes assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:

Amusement arcades
Art galleries <u>more than 3,000 square feet</u>
Bowling alleys
Community halls
Courtrooms
Dance halls (not including food or drink consumption)
Exhibition halls
Funeral parlors
Greenhouses for the conservation and exhibition of plants that provide public access.
Gymnasiums (without spectator seating)
Indoor *swimming pools* (without spectator seating)
Indoor tennis courts (without spectator seating)
Lecture halls
Libraries
Museums
Places of religious worship
Pool and billiard parlors
Waiting areas in transportation terminals

309.1 Mercantile Group M. Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. Mercantile occupancies shall include, but not be limited to, the following:

<u>Art galleries 3,000 square feet or less</u>
Department stores
Drug stores
Markets
Greenhouses for display and sale of plants that provide public access.
Motor fuel-dispensing facilities
Retail or wholesale stores
Sales rooms

Reason: Provides limited sized art gallery space occupancy classification and the corresponding occupant load factor alignment in the code with the common business practices of selling artistic wares and goods.
This change will allow small commercial storefronts for retail sales of unique and limited-edition items to patrons browsing displayed works, interacting with sales people and making purchases, to be classified as Mercantile Occupancies. This change is similar in concept to the current small space allowances for an Assembly Occupancy to have a classification as a Business Occupancy.

This change maintains the required standards for hazards associated with the current occupancy classification of A-3 for Art Gallery spaces greater than 3,000 square feet and large Mercantile occupancies.

Cost Impact: The code change proposal will decrease the cost of construction

This code revision has an anticipated cost benefit to the AHJ and building owners/tenants by a reduction in overall expenditures throughout the entire process of permitting, construction, inspection, and operation of retail type businesses in small spaces where an occupancy classification change is currently required. This revision may also provide a cost benefit to the AHJ by increasing business opportunities for individuals and organizations by reducing or eliminating the cost barriers of substantial alterations in these smaller spaces that are often associated with a change in occupancy classification.

G15-18 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Section 303.1.1 allows smaller assembly spaces to be classified as Group B. The committee felt that this section addressed the issue adequately. The committee also noted that the size of the space may not be the best threshold, but how the space is being used may warrant a classification other that A-3 for galleries. (Vote 12-1)

Assembly Action: **None**

G15-18 Part I

Individual Consideration Agenda

Public Comment 1:

Proponent: Micah Chappell, representing Seattle Department of Construction and Inspection (micah.chappell@seattle.gov)requests As Submitted.

Commenter's Reason: G15-18 Part 1 & 2 provide for a use of small assembly spaces for art galleries that are not covered by 303.1.1 and 303.1.2 by allowing a space less than 3000sf and 100 occupants to be classified as an M Occupancy. This change aligns small art gallery space classification with the actual use.
Technical justification for the size and occupant load limitations:

> 30 gross occupant load factor creates a limited occupant load of 100 occupants on the 3000sf allowable space for the M occupancy Art Gallery.
> 30 gross occupant load factor is similar to the current assembly art gallery occupant load factor of 30 net but calculating on gross area eliminates the possibility of a spaces labeled as accessory areas or corridors (definition of floor area, net) to be used as a way to increase occupant loads without increasing safety standards.
> Allowing small A-3 art galleries to have a classification of M occupancies will provide a code path for small spaces in existing non-sprinklered buildings, that may be on a floor other than the level of exit discharge (IBC Section 902.1.3) to be utilized without having to trigger substantial alterations required by an occupancy classification change.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This code revision has an anticipated cost benefit to the AHJ and building owners/tenants by a reduction in overall expenditures throughout the entire process of permitting, construction, inspection, and operation of retail type businesses in small spaces where an occupancy classification change is currently required. This revision may also provide a cost benefit to the AHJ by increasing business opportunities for individuals and organizations by reducing or eliminating the cost barriers of substantial alterations in these smaller spaces that are often associated with a change in occupancy classification.

G15-18 Part I

G15-18 Part II

IBC: TABLE 1004.5 (IFC[BE] TABLE 1004.5)

Proposed Change as Submitted

Proponent: Micah Chappell, representing City of Seattle (micah.chappell@seattle.gov)

2018 International Building Code

Revise as follows

TABLE 1004.5
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR[a]
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal Baggage claim Baggage handling Concourse Waiting areas	20 gross 300 gross 100 gross15 gross
AssemblyGaming floors (keno, slots, etc.)Exhibit gallery and museum	11 gross30 net
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seatsConcentrated(chairs only—not fixed)Standing space Unconcentrated (tables and chairs)	7 net5 net 15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas Concentrated business use areas	150 grossSee Section 1004.8
Courtrooms—other than fixed seating areas	40 net
Day care	35 net
Dormitories	50 gross
EducationalClassroom area Shops and other vocational room areas	20 net50 net
Exercise rooms	50 gross
Group H-5 fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areasInpatient treatment areas Outpatient areasSleeping areas	240 gross100 gross 120 gross
Kitchens, commercial	200 gross
LibraryReading rooms Stack area	50 net100 gross
Locker rooms	50 gross
Mall buildings—covered and open	See Section 402.8.2
Mercantile <u>Art gallery</u> Storage stock, shipping areas	60 gross <u>30 gross</u> 300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming poolsRink and pool Decks	50 gross15 gross
Stages and platforms	15 net
Warehouses	500 gross

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Floor area in square feet per occupant.

Reason:

Cost Impact: The code change proposal will decrease the cost of construction

G15-18 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproval of this proposal will match the action of the General Code Development Committee for Part 1. There was no technical justification for the 30 square foot gross. If the art gallery is a mercantile space, the current occupant load factor is 60 sq.ft. - what is different for an art gallery? How is an art gallery different from an exhibition space? What type of space this is intended to address needs to be clarified. (Vote: 13-0)

Assembly Action: **None**

G15-18 Part II

Individual Consideration Agenda

Public Comment 1:

Proponent: Micah Chappell, representing Seattle Department of Construction and Inspection (micah.chappell@seattle.gov)requests As Submitted.

Commenter's Reason: G15-18 Part 1 & 2 provide for a use of small assembly spaces for art galleries that are not covered by 303.1.1 and 303.1.2 by allowing a space less than 3000sf and 100 occupants to be classified as an M Occupancy. This change aligns small art gallery space classification with the actual use.
Technical justification for the size and occupant load limitations:

> 30 gross occupant load factor creates a limited occupant load of 100 occupants on the 3000sf allowable space for the M occupancy Art Gallery.
> 30 gross occupant load factor is similar to the current assembly art gallery occupant load factor of 30 net but calculating on gross area eliminates the possibility of a spaces labeled as accessory areas or corridors (definition of floor area, net) to be used as a way to increase occupant loads without increasing safety standards.
> Allowing small A-3 art galleries to have a classification of M occupancies will provide a code path for small spaces in existing non-sprinklered buildings, that may be on a floor other than the level of exit discharge (IBC Section 902.1.3) to be utilized without having to trigger substantial alterations required by an occupancy classification change.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This code revision has an anticipated cost benefit to the AHJ and building owners/tenants by a reduction in overall expenditures throughout the entire process of permitting, construction, inspection, and operation of retail type businesses in small spaces where an occupancy classification change is currently required. This revision may also provide a cost benefit to the AHJ by increasing business opportunities for individuals and organizations by reducing or eliminating the cost barriers of substantial alterations in these smaller spaces that are often associated with a change in occupancy classification.

G15-18 Part II

G21-18

IBC: 310.2

Proposed Change as Submitted

Proponent: Daniel Willham, County of Fairfax, Virginia, representing Virginia Building and Code Officials Association (VBCOA) (daniel.willham@fairfaxcounty.gov)

2018 International Building Code

Revise as follows

310.2 Residential Group R-1. Residential Group R-1 occupancies containing *sleeping units* <u>or more than two dwelling units</u> where the occupants are primarily *transient* in nature, including:

Boarding houses (*transient*) with more than 10 occupants
Congregate living facilities (*transient*) with more than 10 occupants
Hotels (*transient*)
Motels (*transient*)

Reason: There appears to be a gap in the code for hotels (*transient*) that provide *dwelling units*. As currently written, neither the R-1 nor the R-2 descriptions provide clear direction on the classification of hotels (*transient*) that provide *dwelling units*. The commentary clarifies that R-1 occupancies can contain either *sleeping units*, *dwelling units*, or both, but the code as written does not explicitly address *transient* residential occupancies that contain (more than two) *dwelling units*. The key characteristic of group R-1 occupancies is the transient nature of the occupants and not the absence of *dwelling units.* This proposal simply adds language for dwelling units that mirrors that used in the description of R-2 non-transient occupancies. With this clarification, the difference between R-1 and R-2 occupancies will be clearly defined to depend only on the transient or non-transient nature of the occupants, respectively. For reference, an excerpt from the IBC commentary (pg3-37) follows this change proposal.

living facilities are also classified as Group R. Specifically, these facilities are classified as Group R-4. Mainstreaming people who are recovering from alcohol or drug addiction and people who are developmentally disabled is reported to have therapeutic and social benefits. A residential environment often fosters this mainstreaming.

A building or part of a building is considered to be a residential occupancy if it is intended to be used for sleeping accommodations (including assisted living facilities) and is not an institutional occupancy. Institutional occupancies are similar to residential occupancies in many ways. However, they differ from each other in that institutional occupants are in a supervised environment, and, in the case of Groups I-2 and I-3 occupancies, are under some form of restraint or physical limitation that makes them incapable of complete self-preservation. The number of these occupants who are under supervision or are incapable of self-preservation is one distinguishing factor for being classified as an institutional or residential occupancy.

The term Group R refers collectively to the four individual residential occupancy classifications: Groups R-1, R-2, R-3 and R-4. These classifications are differentiated in the code based on the following criteria: 1. Whether the occupants are transient or nontransient in nature; 2. The type and number of dwelling units or sleeping units contained in a single building; and 3. The number of occupants in the facility.

310.2 Definitions. The following terms are defined in Chapter 2:

BOARDING HOUSE.

CONGREGATE LIVING FACILITIES.

DORMITORY.

GROUP HOME.

GUEST ROOM.

LODGING HOUSE.

PERSONAL CARE SERVICE.

TRANSIENT.

❖ This section lists terms that are specifically associated with the subject matter of this section. It is important to emphasize that these terms are not exclusively related to this section but may or may not also be applicable where the term is used elsewhere in the code.

Definitions of terms can help in the understanding and application of the code requirements. The purpose for including a list within this chapter is to provide more convenient access to terms which may have a specific or limited application within this chapter. For the complete definition and associated commentary, refer back to Chapter 2. Terms that are italicized provide a visual identification throughout the code that a definition exists for that term. The use and application of all defined terms are set forth in Section 201.

310.3 Residential Group R-1. Residential Group R-1 occupancies containing *sleeping units* where the occupants are primarily *transient* in nature, including:

Boarding houses (*transient*) with more than 10 occupants
Congregate living facilities (*transient*) with more than 10 occupants
Hotels (*transient*)
Motels (*transient*)

❖ The key characteristic of Group R-1 that differentiates it from other Group R occupancies is that the occupants are considered transient in nature (i.e., those whose length of stay is not more than 30 days). There is an expectation that the occupants are not as familiar with the building as those residents in nontransient facilities such as apartment buildings and single-family dwellings. If occupants are unfamiliar with their surroundings, they may not recognize potential hazards or be able to use the means of egress effectively.

The most common building types classified in Group R-1 are hotels, motels and boarding houses. Facilities classified as Group R-1 occupancies may include dwelling units, sleeping units, or a combination of both. Group R-1 occupancies do not typically have cooking facilities in the unit. When a unit is not equipped with cooking facilities, it does not meet the definition of a "dwelling unit" in Section 202. When this occurs, such units are treated as sleeping units for the application of code provisions (see Commentary Figure 310.3). A recent trend in development is the construction of "extended-stay hotels." While these units may have all of the characteristics of a typical dwelling unit (i.e., cooking, living, sleeping, eating, sanitation), the length of stay is still typically not more than 30 days. As such, these buildings would still be classified as Group R-1. If the length of stay is more than 30 days, these buildings would be classified as Group R-2. If a hotel offers rooms for short-term housing (i.e., more than 30 days), the facility must comply with the provisions for both Groups R-1 and R-2 (see Section 302.1).

Other occupancies are often found in buildings classified in Group R-1. These occupancies include nightclubs (Group A-2), restaurants (Group A-2), gift shops (Group M), business offices (Group B), health clubs (Group A-3) and storage facilities (Group S-1). When this occurs, the building is a mixed occupancy and is subject to the provisions of Section 508.

Transient congregate living facilities and boarding houses with 10 or fewer occupants can be constructed to the standards of Group R-3 occupancies rather than the general category of Group R-1. The primary intent of this provision is to permit bed-and-breakfast-type facilities to be established in existing single-family (one-family) structures. In comparison to the provision under Group R-2 which permits congregate living facilities with fewer than 16 nontransient

Bibliography: 2015 IBC Code and Commentary, Volume 1, International Code Council, 2015, pg. 3-37.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a clarification which will not affect construction cost.

G21-18

Public Hearing Results

Errata: The image in the reason statement was improved.

Committee Action: **As Submitted**

Committee Reason: Clarifies that dwelling units used as transient lodging such as short term rentals through systems such as Air B & B should also be classified as Group R-1.. (Vote: 10-4)

Assembly Action: **None**

G21-18

Individual Consideration Agenda

Public Comment 1:

Proponent: David Collins, representing The American Institute of Architects (dcollins@preview-group.com)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

310.2 Residential Group R-1. ~~Residential Group~~ **Units not used primarily as permanent residences.** R-1 occupancies ~~containing~~ typically will include sleeping units but also include dwelling units when those units are not used primarily as permanent residences. ~~or more than two dwelling units where the occupants are primarily *transient* in nature, including:~~

- ~~*Boarding houses* (*transient*) with more than 10 occupants~~
- ~~*Congregate living facilities* (*transient*) with more than 10 occupants~~
- ~~Hotels (*transient*)~~
- ~~*Motels (transient)*~~

310.2.1 **Vacation Rental (Cabin, Cottage, Bungalow, Chalet) (Transient).** Group R-1 vacation rentals shall be permitted to comply with the construction requirements of the International Residential Code where:

1. The building is composed of a single dwelling unit;
2. The building is occupied by a family or no more than 10 unrelated adults;
3. The building has two exits directly to the exterior at the level of exit discharge; and,
4. The building is located to maintain a minimum fire separation distance of thirty feet.

Commenter's Reason: The Ohio Board of Building Standards has been struggling with the question of various types of facilities that are not clearly identified in the IBC. To better classify the R-1 group, the recommended language was inserted into the IBC to address dwelling units that are not "primarily a permanent residence." A new section for vacation rental units which are transient was also added and criteria put in place that allow them to be constructed per the residential code if it is a single dwelling unit, the occupant load is limited, there are two exits on the level of exit discharge, and the minimum fire separation distance of 30 feet is maintained.
This should clafify how many properties that are rented out on a regular basis, having all the standard features of a home would be regulated under the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Many questions arise regarding how these specific facilities are to be treated. By this change the code will be clearer and more easily applied.

Public Comment 2:

Proponent: Andrew Klein, representing Lyric, Apartment Jet, National Multifamily Housing Council, Vacation Rental Management Association, Vacasa, Stay Alfred, The Guild, & WhyHotel (andrew@asklein.com)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

310.2 Residential Group R-1. Residential Group R-1 occupancies containing *sleeping units* or ~~more than two~~ dwelling units where the occupants are primarily *transient* in nature, including:

Apartment houses where 50% or more of the units house occupants who are primarily transient in nature
Boarding houses (*transient*) with more than 10 occupants
Congregate living facilities (*transient*) with more than 10 occupants
Hotels (*transient*)
Motels (*transient*)

310.3 Residential Group R-2. Residential Group R-2 occupancies containing *sleeping units* or more than two *dwelling units* where the occupants are primarily permanent in nature, including:

Apartment houses where fewer than 50% of the units house occupants who are primarily transient in nature
Congregate living facilities (nontransient) with more than 16 occupants

Boarding houses (*nontransient*)
Convents
Dormitories
Fraternities and sororities
Monasteries

Hotels (nontransient)
Live/work units
Motels (nontransient)
Vacation timeshare properties

Commenter's Reason: This original Proposal, as well as this Public Comment, aim to codify the occupancy classification of multifamily apartment and condominium buildings where some units are made available for rent on a short-term basis through companies like Airbnb, VRBO, HomeAway, WhyHotel, Lyric and others. The original proposal was unenforceable and strayed from the intent of the Code.
The distinction between Group R-1 and R-2 occupancies deals with the level of risk associated with an occupant s level of familiarity with a building. Users of Airbnb type companies expect an at-home environment and are therefore accustomed to the features of the building in which they are renting a unit.

Residential condominiums are treated by the Code the same as multifamily apartments (Group R-2). Individual dwelling units in a Group R-2 occupancy could either be rented by tenants or owned by the occupants--the Code does not make a distinction between either type of tenancy. Furthermore, Section 310.4 also specifically lists vacation timeshare properties as a Group R-2 occupancy with no distinction based on actual rental time. The reason for this is that dwelling units in such buildings are intended to be a place of abode. Fair housing regulations do not include a 30-day criteria for transient/nontransient, similar to what has been traditionally used by the building codes (see the commentary to the definition of INTENDED TO BE OCCUPIED AS A RESIDENCE in the IBC); therefore, beach homes, timeshares and extended stay hotels are classified as R-2.

A building which essentially looks and functions as a multifamily Group R-2 occupancy does not warrant a change of occupancy to a Group R-1 if fewer than 50% of the dwelling units are made available on a short-term basis. This Public Comment adds much needed clarity to the Code so that the Code Official can determine at what point a change of occupancy is warranted for apartment buildings and condominiums where units are made available for rent on short-term bases.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The language codified by this Public Comment is consistent with most code interpretations.

G21-18

G28-18

IBC: [F] 403.3.2; IFC: 914.3.1.2

Proposed Change as Submitted

Proponent: Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB) (TWB@iccsafe.org)

THIS CODE CHANGE PROPOSAL WILL BE HEARD BY THE IFC COMMITTEE. PLEASE CONSULT THE AGENDA FOR THE IFC COMMITTEE.

2018 International Building Code

Revise as follows

~~[F]~~ 403.3.2 Water supply to required fire pumps. In all buildings that are more than 420 feet (128 m) in *building height*, and buildings of Type IVA and IVB construction that are more than 120 feet in building height, required fire pumps shall be supplied by connections to not fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

> **Exception:** Two connections to the same main shall be permitted provided that the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through not fewer than one of the connections.

2018 International Fire Code

914.3.1.2 Water supply to required fire pumps. In all buildings that are more than 420 feet (128 m) in building height, and buildings of Type IVA and IVB construction that are more than 120 feet in building height, required fire pumps shall be supplied by connections to not fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

> **Exception:** Two connections to the same main shall be permitted provided that the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through not fewer than one of the connections.

Reason: The Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board to explore the science of tall wood buildings and take action on developing code changes for tall wood buildings. The TWB has created several code change proposals with respect to the concept of tall buildings of mass timber and the background information is at the end of this Statement. Within the statement are important links to information, including documents and videos, used in the deliberations which resulted in these proposals.
The Ad Hoc Committee has discussed a number of proposals to potentially increase the permitted height and area for Type IV structures, specifically mass timber buildings adding additional Types IVA, IVB & IVC. One of the basic requirements incorporated into these proposed increased heights and areas is the added active and passive protection features to these structures.

The Code Technology Committee, in response to the events of September 11, 2001, submitted proposals for water supply to super high-rise buildings of 420' and higher. This requirement was adopted 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 11th.

This code change proposal brings this same concept to Type IV structures of 120' and higher. This added protection feature would be unique to Type IVA and IVB construction (as proposed in a related code change – see table below) due to the potential contribution of the mass timber to the fuel load in the event of a fire. Due to the limitations of fire service aerial apparatus' ability to apply water to elevated floors the Ad Hoc Committee felt 120' was an appropriate height to initiate the requirement. Another consideration is that currently the code permits structures up to 85' so the committee identified the next level within the codes for additional requirements. Considerations were also given to the difficulty of fire service companies accessing elevated floors under fire conditions.

The Ad Hoc Committee has proposed greater permitted heights and areas of mass timber construction than those contained in the 2018 IBC. The Ad Hoc believes this code change proposal is an important component to these proposed increased heights and areas. If the permitted heights and areas of mass timber construction are raised it is imperative we adopt related code change proposals to insure the reliable performance of active and passive protection features to insure the safety of occupants and responding fire fighters.

Background information: The ICC Board approved the establishment of an ad hoc committee for tall wood buildings in December of 2015. The purpose of the ad hoc committee is to explore the science of tall wood buildings and to investigate the feasibility and take action on developing code changes for tall wood buildings. The committee is comprised of a balance of stakeholders with additional opportunities for interested parties to participate in the four Work Groups established by the ad hoc committee, namely: Code; Fire; Standards/Definitions; and Structural. For more information, be sure to visit the ICC website https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/ (link active and up to date as of 12/27/17). As seen in the "Meeting Minutes and Documents" and "Resource Documents" sections of the committee web page, the ad hoc committee reviewed a substantial amount of information in order to provide technical justification for code proposals.

The ad hoc committee developed proposals for the followings code sections. The committee believes this package of code changes will result in regulations that adequately address the fire and life safety issues of tall mass timber buildings.

IBC Code Section	Description
403.3.2	Water supply requirements for fire pumps in high rise buildings of Type IVA and IVB construction.
504.3	Allowable building height (feet) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT construction.
504.4	Allowable building height (stories) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
506.2	Allowable building area for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
508.4.4.1 509.4.1.1 (new)	Requirements for mass timber building elements serving as fire barriers or horizontal assemblies in buildings of Type IVB of IVC construction.
602.4	Type of Construction requirements for new proposed types of construction: Types IVA, IVB and IVC. No changes to Type IV HT construction. Includes definitions for new terms: Mass timber and Noncombustible protection (mass timber). **THIS IS THE KEY CODE CHANGE PROPOSAL WHICH OUTLINES THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED NEW TYPE OF MASS TIMBER BUILDINGS. THE PROPOSAL ALSO ADDRESSES CONCEALED SPACES, ADHESIVE PERFORMANCE AND EXTERIOR WALL PROTECTION.**
703.8 (new)	The performance method to determine the increase to the fire resistance rating provided by noncombustible protection applied to the mass timber building element.
703.9 (new)	Requirements for sealants and adhesives to be placed at abutting edges and intersections of mass timber building elements. The reason statement references a Group B proposal to Chapter 17 for special inspection requirements of sealants and adhesives.
718.2.1	Requirements on the use of mass timber building elements used for Fireblocking.
722.7 (new)	Requirements for the fire resistance rating of mass timber elements, including minimum required protection and gypsum board attachment requirements.
3102	Requirements for membrane structures using Type IV HT construction.
3314.7 (new)	New special precautions during construction of buildings of Types IVA, IVB and IVC construction: Standpipes; Water supply for fire department connections; Noncombustible protection required for mass timber elements as construction height increases.
Appendix	Requirements for walls, floors and roofs of Type IV HT construction in buildings located in Fire Districts.
IFC Code Section	**Description**
701.6	Requirements which stipulate the owner's responsibility to maintain inventory of all required fire resistance rated construction in buildings of Types IVA and IVB construction. This includes an annual inspection and proper repair where necessary.
Proposed changes to be submitted in 2019 Group B	
IBC Chapter 17	Required special inspections of mass timber construction • Structural • Sealants and adhesives (see IBC 703.8)
IBC Chapter 23	An update to referenced standard APA PRG 320 Standard for Performance –rated Cross-laminated Timber which is currently undergoing revision to ensure the adequacy of the adhesives under fire conditions.

In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the tests, and many members witnessed the test in person or online. The results of the series of 5 fire tests provide additional support for these proposals, and validate the fire performance for each of the types of construction proposed by the committee. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of through-penetration fire stops, and to evaluate conditions for responding fire personnel.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3 ½ minutes, please visit:

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

G28-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approval is based upon the proponent’s published reason. (Vote: 14-0)

Assembly Action: **None**

G28-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Dan Nichols, representing ICC Code Correlation Committee (ccc@iccsafe.org).

Commenter's Reason: The Code Correlation Committee (CCC) is not taking a position on this code change. The CCC submitted this public comment in order to bring a correlation issue to the attention of the full voting membership for the Public Comment Hearings and the Online Governmental Consensus Vote to allow the voting membership to coordinate actions on a package of code changes submitted dealing with tall wood buildings of mass timber construction. This package includes the parent proposal G108-18; if disapproved, the related proposals G28-18, G75-18, G80-18, G84-18, G89-18, FS5-18, FS6-18, FS73-18, FS81-18 and F266-18, will not be correlated with any existing code text if they are approved.
The Code Correlation Committee is a standing committee of the International Code Council whose objectives, procedures and organization are set forth in Council Policy CP#44-13. The objective of the Code Correlation Committee is to maintain technical and editorial consistency among the International Codes and to assist staff in the evaluation and processing of code change proposals and comments that are exclusively editorial.

G28-18

G32-18

IBC: 404.5

Proposed Change as Submitted

Proponent: Sarah Rice, representing Myself (srice@preview-group.com)

2018 International Building Code

Revise as follows

404.5 Smoke control. A smoke control system shall be installed in accordance with Section 909.

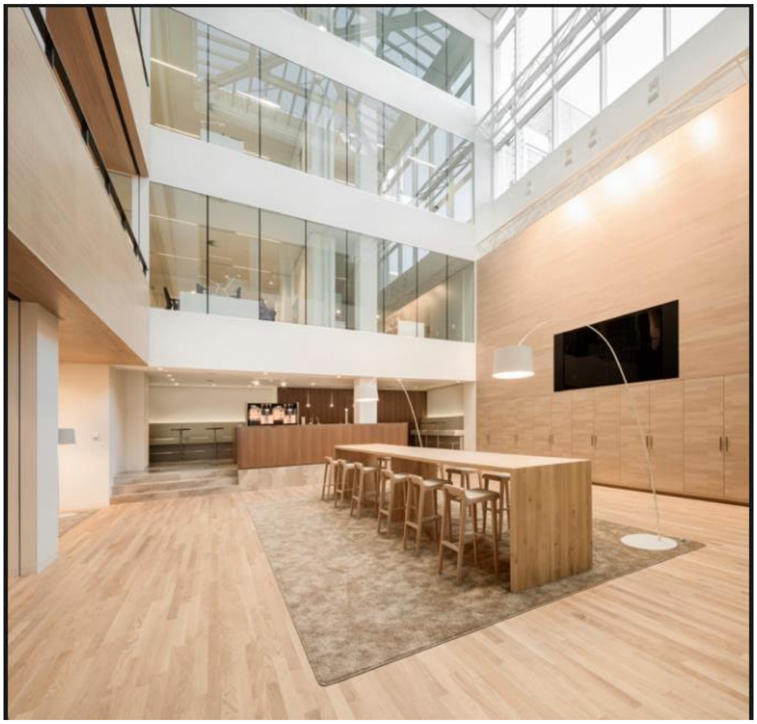
~~Exception~~ Exceptions:

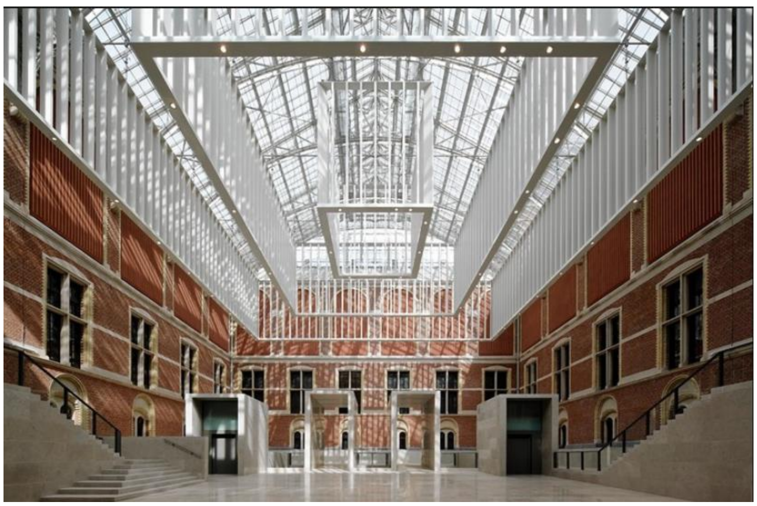
1. In other than Group I-2, and Group I-1, Condition 2, smoke control is not required for *atriums* that connect only two stories.
2. A smoke control system is not required for atriums connecting more than two stories when all of the following are met:
   - 2.1. Only the 2 lowest stories shall be permitted to be open to the atrium.
   - 2.2. All stories above the lowest 2 stories shall be separated from the atrium in accordance with Section 404.6.

Reason: As stated in Section 909, the purpose of a smoke control systems is to provide a tenable environment for the evacuation or relocation of occupants. A smoke control system is NOT intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems that are required and regulated by the IBC serve a different purpose than the smoke- and heat-venting provisions found in Section 910 and they are not considered exhaust systems under Chapter 5 of the International Mechanical Code.
In an atrium that connects more than 2 stories, the smoke control systems is intended to maintained the height of the lowest horizontal surface of the smoke layer interface to at least 6 feet above any walking surface that forms a portion of a required egress system within the smoke zone for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is less.

But what if the only walking surfaces in the atrium are on the 2 lowest stories of the atrium? What if all the walls above the 2 lowest stories are solid without operable openings? What purpose does the smoke control system then serve? We contend none. And if the smoke control system has no real value, then why install it? See Figures 1 - 3 for examples of these spaces.

This proposed change seeks to exempt atriums that connect more than 2 stories from having to have a smoke control system when 1) there are no walking surfaces in the atrium above the 2 lowest stories and 2) there are no operable windows or doors above the 2 lowest stories in the atrium and 3) the walls of the atrium on the upper levels are constructed per Section 404.6 - atrium enclosures..





Cost Impact: The code change proposal will decrease the cost of construction
The cost savings of not providing smoke control system in a building with an atrium will decrease the cost of construction.

G32-18

Public Hearing Results

Committee Action: **As Modified**

Committee Modification: Modify proposal as follows:
404.5 Smoke control.

A smoke control system shall be installed in accordance with Section 909.

Exceptions:

1. In other than Group I-2, and Group I-1, Condition 2, smoke control is not required for atriums that connect only two stories.
2. A smoke control system is not required for atriums connecting more than two stories when all of the following are met:
   2.1. Only the 2 lowest stories shall be permitted to be open to the atrium.
   2.2. All stories above the lowest 2 stories shall be separated from the atrium in accordance with ~~Section 404.6~~ the provision for a shaft in Section 713.4.

Committee Reason: Clarifies that the code allows a combination of an atrium with a shaft enclosure. The exception provides an alternative where a natural smoke sink is provided. The modification clarifies that the extension of the atrium needs to meet shaft construction requirements. The proposal doesn't redefine atrium, but replaces smoke control with a natural sink. The proponent may wish to consider via a public comment addressing a hatch or similar means to vent smoke at the top of the shaft. (Vote: 12-2)

Assembly Action: **None**

G32-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Dustin Wakefield, representing Bureau of Capital Outlay Management (dustin.wakefield@dgs.virginia.gov)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

404.5 Smoke control. A smoke control system shall be installed in accordance with Section 909.

Exceptions:

1. In other than Group I-2, and Group I-1, Condition 2, smoke control is not required for *atriums* that connect only two stories.
2. A smoke control system is not required for atriums connecting more than two stories when all of the following are met:
   2.1. Only the 2 lowest stories shall be permitted to be open to the atrium.
   2.2. All stories above the lowest 2 stories shall be separated from the atrium in accordance with ~~the provision~~ the provisions for a shaft in Section ~~713.4.~~713. The rating of such shaft construction shall be equal to the rating of the floor assembly as required in Table 601 or the provisions of 713.4, whichever is greater. Openings and penetrations in the shaft construction shall be limited to those necessary for the purpose of the shaft.

Commenter's Reason: This modification is necessary to clarify that the intent of this provision is to effectively "turn up" the rated floor assemblies beginning at the floor above the bottom two interconnected levels, thereby creating a "high bay" space with no interconnection of stories above this point. As such, the revised text indicates that the minimum hourly rating of the shaft enclosure is either the rating of the floor, or the provisions of 713.4 for fire-resistance rating of shafts (depending on the number of stories connected).

With the originally proposed modification, there could be cases where 2-hour floors are required, such as in Type I construction, and only two or three additional floors are interconnected above the bottom two levels. This would result in a 1-hour separation for the shaft, which is insufficient based on the intent described above.

Furthermore, this modification brings into play the other shaft provisions of 713, including prohibited openings and penetrations. It is important that these are limited to those items that are necessary for the purpose of the shaft. In this case, this would account for egress doors into the atrium from the upper floor levels as well as penetrations for conduits, sprinklers, etc. that serve the atrium.

Bibliography: There are no applicable external references for this proposed modification.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Any cost increase associated with this proposed modification is anticipated to be minimal. The increase would be due to the increase from 1-hour shaft construction to 2-hour shaft construction in certain scenarios in Type 1 construction or where floors are required to be rated for 2 hours for other reasons, such as occupancy separation. There could also be ancillary cost increases due to re-routing of various MEP infrastructure that are not permitted to penetrate into the shaft enclosure.

The alternative is always to provide a smoke control system, which would typically overshadow any of the miscellanous increases in shaft wall construction cost or utility coordination.

G32-18

G34-18

IBC: 202, (New), 404.6, 716.4 (New), 716.4.1 (New), 716.4.2 (New), 716.4.3 (New), Chapter 35

Proposed Change as Submitted

Proponent: Tessa Quinones, The Hickman Group, representing Smoke Guard (admin@thehickmangroup.com)

THIS CODE CHANGE WILL BE HEARD BY THE IBC FIRE SAFETY COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE

2018 International Building Code

SECTION 202 DEFINITIONS

FIRE PROTECTIVE CURTAIN ASSEMBLY. An assembly consisting of a fabric curtain, bottom bar, guides, coil, operating, and closing system.

404.6 Enclosure of atriums. *Atrium* spaces shall be separated from adjacent spaces by a 1-hour *fire barrier* constructed in accordance with Section 707 or a *horizontal assembly* constructed in accordance with Section 711, or both.

Exceptions:

1. A *fire barrier* is not required where a glass wall forming a smoke partition or a 20-minute fire protective curtain assembly is provided. The glass wall or fire protective curtain assembly shall comply with all of the following:
   - 1.1. Automatic sprinklers are provided along both sides of the separation wall, fire protective curtain assembly and doors, or on the room side only if there is not a walkway on the *atrium* side. The sprinklers shall be located between 4 inches and 12 inches (102 mm and 305 mm) away from the glass and at intervals along the glass or fire protective curtain assembly not greater than 6 feet (1829 mm). The sprinkler system shall be designed so that the entire surface of the glass or fire protective curtain assembly is wet upon activation of the sprinkler system without obstruction;
   - 1.2. The glass wall shall be installed in a gasketed frame in a manner that the framing system deflects without breaking (loading) the glass before the sprinkler system operates; and
   - 1.3. The fire protective curtain assembly shall be installed in accordance with Section 716.4 and shall be actuated in conjunction with the atrium smoke control system, and
   - ~~1.3.~~1.4. Where glass doors are provided in the glass wall, they shall be either *self-closing* or automatic-closing.
2. A *fire barrier* is not required where a glass-block wall assembly complying with Section 2110 and having a $^{3}/_{4}$-hour *fire protection rating* is provided.
3. A *fire barrier* is not required between the *atrium* and the adjoining spaces of up to three floors of the *atrium* provided that such spaces are accounted for in the design of the smoke control system.
4. A fire barrier is not required between the atrium and the adjoining spaces where the atrium is not required to be provided with a smoke control system.

Add new text as follows

716.4 Fire protective curtain assembly. Approved fire protective curtain assemblies shall be constructed of any materials or assembly of component materials tested without hose stream in accordance with UL 10D, and shall comply with the Sections 716.4.1 through 716.4.3

716.4.1 Label. Fire protective curtain assemblies used as opening protectives in fire rated walls and smoke partitions shall be labeled in accordance with Section 716.2.9.

716.4.2 Smoke and draft control. Fire protective curtain assemblies used to protect openings where smoke and draft control assemblies are required shall comply with Section 716.2.1.4.

716.4.3 Installation. Fire protective curtain assemblies shall be installed in accordance with NFPA 80.

Add new standard(s) follows

UL

UL LLC
333 Pfingsten Road
Northbrook IL 60062-2096

10D-14:

Standard for Fire Tests of Fire Protective Curtain Assemblies

Reason: During the last cycle, FS 102-15 was disapproved at least in part on the proposed use of fabric fire protective curtain assemblies as an opening protective having a one-hour fire protection rating and to replace one hour fire barriers. This proposal allows the use of a 20-minute fire protective curtain assembly as an alternative to a non-rated glass wall when protected with sprinklers for the enclosure of an atrium. In addition, the proposal allows fire protective curtain assemblies as an opening protective as permitted by other sections of the IBC.
Both of these applications are consistent with the scope of UL 10D which reads:

These requirements cover the evaluation of fire protective curtain assemblies intended to provide supplemental passive fire protection as part of an engineered fire protection system. Fire protective curtain assemblies provide nonstructural separation only, and are not intended to be substituted for structural hourly rated partitions or opening protectives that have been tested for fire endurance and hose stream performance.

The proposed definition and uses are consistent with NFPA 80-2016 and UL 10D. Some products can also pass UL 1784 for an "S" label.

The proposed requirement that the assembly be "approved" in addition to "listed" allows the Code Official to specifically approve the proposed application.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The use of the fire protective curtain assembly is an option and as such, atria enclosures can continue to be constructed as currently permitted.

Analysis: A review of the standard proposed for inclusion in the code, UL 10D-14, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

G34-18

Public Hearing Results

Committee Action: As Modified

Committee Modification: 404.6 Enclosure of atriums.
Atrium spaces shall be separated from adjacent spaces by a 1-hour fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both.

Exceptions:

1. A fire barrier is not required where a glass wall forming a smoke partition ~~or a 20-minute fire protective curtain assembly~~ is provided. The glass wall ~~or fire protective curtain assembly~~ shall comply with all of the following:
    1.1. Automatic sprinklers are provided along both sides of the separation wall, ~~fire protective curtain assembly~~ and doors, or on the room side only if there is not a walkway on the atrium side. The sprinklers shall be located between 4 inches and 12 inches (102 mm and 305 mm) away from the glass and at intervals along the glass ~~or fire protective curtain assembly~~ not greater than 6 feet (1829 mm). The sprinkler system shall be designed so that the entire surface of the glass ~~or fire protective curtain assembly~~ is wet upon activation of the sprinkler system without obstruction;
    1.2. The glass wall shall be installed in a gasketed frame in a manner that the framing system deflects without breaking (loading) the glass before the sprinkler system operates; and
    ~~1.3. The fire protective curtain assembly shall be installed in accordance with Section 716.4 and shall be actuated in conjunction with the atrium smoke control system, and~~
    ~~1.4.~~ 1.3 Where glass doors are provided in the glass wall, they shall be either self-closing or automatic-closing.
2. A fire barrier is not required where a glass-block wall assembly complying with Section 2110 and having a $^{3}/_{4}$-hour fire protection rating is provided.
3. A fire barrier is not required between the atrium and the adjoining spaces of up to three floors of the atrium provided that such spaces are accounted for in the design of the smoke control system.
4. A fire barrier is not required between the atrium and the adjoining spaces where the atrium is not required to be provided with a smoke control system.

Chapter 35- UL

10D ~~14~~ 17:

Standard for Fire Tests of Fire Protective Curtain Assemblies

Committee Reason: The proposal is a simplified version (after the modification) of the original. The products have been used for years through the alternative methods process, they should be recognized in the code. (Vote: 8-6)

Assembly Action: None

G34-18

Individual Consideration Agenda

Public Comment 1:

Proponent: David Dodge, representing McKeon Door Company (ddodge@mckeondoor.com)requests Disapprove.

Commenter's Reason: In the committee action hearings this code change was approved as modified. However, the modification didnot adequately address all concerns from both the committee and the assembly. The final committee votewas a marginal AM, 8 6. While it may be considered helpful to have something in the code regarding fireand smoke rated fabric assemblies, this code change is not yet ready for final approval and publication due tothe follow reasons:
One of the most common architectural design uses of this new technology, fire and smoke rated fabrics, istoseparate vertical spaces horizontally into two-story spaces taking advantage of the exception in 404.5eliminating the need for smoke evacuation systems in the atrium when the vertical space is limited to twofloors only. UL10D, Fire Tests of Fire-Protective Curtain Assemblies was submitted as part of this codechange. A representative from UL testified that UL10D is nothing more than UL10C without the hose-stream requirement, see G34-18 CAH video segment: http://hearingvideos.iccsafe.org/videos/g34-18/

1. Our current code addresses horizontal applications either as fixed structural floor assemblies or opening protectives within fixed structural floor assemblies as floor fire door assemblies that comply with NFPA 288. The scope of UL10D limits Fire-Protective Curtains to rated applications no greater than 20 minutes. The code change, as currently written could be misinterpreted to allow UL10D asjustification for acceptance of NFPA 288 criteria.

2. The new 716.4 language and the new 202 definition language contradict each other.

3. The new language as submitted, 716.4.2, suggests these opening protectives can be used in any firerated wall.

By disapproving this code change, the proponents can come back in the next cycle with a clean-up of theseissues and eliminate the possibility of mis-applications of this new technology in the future.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

G34-18

G35-18

IBC: 404.10.1

Proposed Change as Submitted

Proponent: David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

THIS CODE CHANGE WILL BE HEARD BY THE MEANS OF EGRESS COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Building Code

Add new text as follows

404.10.1 Exit stairs in an atrium. Where an atrium contains an interior exit stairway all the following shall be met:

1. The exit stair shall have access from a minimum of two directions.
2. The distance between an exit stair in an atrium, and a minimum of one exit stair enclosed in accordance with Section 1023.2 shall comply with Section 1007.1.1.
3. Exit access travel distance within the atrium shall be measured to the nosing of the landing at the top of the stair on each level served.
4. At least one exit shall not be located in the same atrium.

Reason: An exit stair is currently permitted to be in an atrium enclosure by IBC Sections 2023.1 and 1023.2, which allows enclosure per Section 404.6. These new provisions for the conditions for use of an atrium for an exit stair adds four specific criteria for their use as an exit.
Provision 1 - Accessed from two directions

This means that the exit stair in the atrium must have two paths of travel to allow the occupants to pass by the stair.

Provision 2 - Separation distance

To make it clear that the exit stair in the atrium must be separated from at least one other eixt stair meeting IBC Section 1023.2 by the minimum separation disance prescribed in Section 1007.1.1.

Provision 3 - Travel distance

The travel distance with the atrium to the exit stair in the atrium is to be measured to the nosing at the level the stair is serving.

Provision 4 - At least one exit is not in the atrium.

Requires that at least one exit is not permitted to be in the same atrium. The current provisions of Section 404.10 prohibit more than 50% of exit stairs from egresing through the atrium at the level of exit discharge.

Cost Impact: The code change proposal will decrease the cost of construction
This change will facilitate design decisions, reduce the number of required exit enclosures in buildings with an atrium and help with review and approval, reducing the cost of construction.

G35-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This proposal was approved because current Section 1023.2 already allows for a stairway within an atrium to be considered an exit stairway. This language in Items 2 and 3 would clarify that the exit access travel distance and exit separation requirements is measured to the top of the stairway. While the language in Item 1 for two directions could be subject to interpretation, Items 1 and 4 do further limit where a stairway in an atrium can serve as an exit, so this would improve safety. (Vote: 8-7)

Assembly Action: **None**

G35-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

404.9 Exit access travel distance. *Exit access* travel distance for areas open to an *atrium* shall comply with the requirements of this section.

404.10~~.1~~ Exit ~~stairs~~ <u>stairways</u> in an atrium. Where an atrium contains an interior exit stairway all the following shall be met:

1. The ~~exit stair~~ <u>entry to the exit stairway is the edge of the closest riser of the exit stairway.</u>
<u>2.</u> <u>The entry of the exit stairway</u> shall have access from a minimum of two directions.
<u>3</u>. The distance between <u>the entry to</u> an exit ~~stair~~ <u>stairway</u> in an atrium, and <u>the entrance to</u> a minimum of one exit ~~stair~~ <u>stairway</u> enclosed in accordance with Section 1023.2 shall comply with <u>the separation in</u> Section 1007.1.1.
<u>4</u>. <u>Exit</u> access travel distance ~~within the atrium~~ shall be measured to the ~~nosing~~ <u>closest riser</u> of the ~~landing at the top of the stair on each level served~~ <u>exit stairway</u>.
<u>5.</u> ~~At least one exit shall not~~ <u>Not more than 50 percent of the exit stairways shall</u> be located in the same atrium.

404.~~10~~<u>11</u> Interior exit stairways <u>discharge</u>. Not greater than 50 percent of *interior exit stairways* are permitted to egress through an atrium on the *level of exit discharge* in accordance with Section 1028.

Commenter's Reason: Open stairways in an atrium are permitted to be exit stairways per Section 1023.2 Exception 2. This proposal added additional criteria for that exit stairway. This modification does not change that allowance.
This section is not placed correctly. Current Section 404.10 is for exit discharge – thus the suggested title change for clarification. This new section deals with an exit stairway. Therefore, this should not be a subset of exit discharge through the lobby. This new section should be between exit access and exit discharge sections. The renumbering fixes this.

The correct term is exit stairway, not exit stair – this is revised in the title and the Items.

It is important to clarify that dispersion, separation and travel distance is to the entry/closest riser of the open stairway in the atrium and the entrance to the exit stairway, not the stairway itself or the enclosure. This is the reason for the added Item 1 and revisions to Items 2, 3 and 4.

In Item 4, the language for measurement of the travel distance in Item 4 should match use the same terminology for other open exit stairways in the exception in Section 1017.3. The phrase "on each level served" is redundant.

In Item 5, the proposed language is consistent with exit discharge allowances in Section 1028 – the current language would allow more than 50%.

This public comment is submitted by the ICC BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions there of. In 2017 and 2018 the BCAC has held 5 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes and public comments. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-action-committee-bcac

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The modification is a clarification of the approved text and will have no changes in construction requirements. The original proposal provided guidance on how an exit stairway within an atrium should comply with exit access travel distance and separation. The new item 5 is consistent with the exit discharge allowances. Since there was already an allowance for no enclosure in Section 1023.2 Exception 2, the original proposal is not a decrease in cost of construction.

G35-18

G37-18

IBC: Table TABLE 406.5.4

Proposed Change as Submitted

Proponent: Stephen Skalko, Stephen V. Skalko, P.E. & Associates, LLC, representing Stephen V. Skalko, P.E. & Associates, LLC (svskalko@svskalko-pe.com); Jason Krohn, representing Precast/Prestressed Concrete Institute (jkrohn@pci.org); William Hall, Portland Cement Association, representing Alliance For Concrete Codes and Standards (jhall@cement.org)

2018 International Building Code

Revise as follows

TABLE 406.5.4
OPEN PARKING GARAGES AREA AND HEIGHT

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
		Ramp access	Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	~~50,000~~ 75,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m^2.

Reason: When the International Building Code (IBC) the drafting committees were developing the IBC, they commonly used the least stringent fire safety provisions from one of the legacy codes (i.e BOCA National Building Code, Standard Building Code, Uniform Building Code) in establishing the requirements. However, for open parking garages the least stringent values in the Standard Building Code (SBC) were not used. The SBC permitted open parking structures of non-combustible construction with less fire resistance (i.e. SBC Type IV construction, IBC Type II construction) to be built up to 400,000 sqft in area per tier. This area value, which was placed in the SBC in the early 1980's, was based on the use of noncombustible materials for construction of the open parking structure, the open sided features for the parking structure which reduced the risk of adverse impact from vehicle fires and the documented low fire risk vehicles pose to the stability of open parking structures[1],[2].
Additional studies of fire experience in open parking structures in the United States since those earlier ones still supports the conclusion that vehicle fires pose a low risk of fire damage to the parking structure. The more recent analysis of parking garage structure fires (i.e NFPA[3], Parking Market Research Company [4]) by the Fire Safety Committee of the Parking Consultants Council concluded that in about 98.7% of the fires no structural damage occurred due to the parking structure fires studied[5]. This suggests that the present values in Table 406.5.4 for Open Parking Garages of IBC Type II construction are more stringent than necessary based on the low risk of fire damage to the structural elements from vehicle fires and should be permitted to increase.

During the 2015 Group A cycle for code changes to the 2012 IBC, a similar code change was submitted by PCI for consideration (G101-15). The IBC General Code Committee recommended disapproval of the proposal at the code development hearing, suggesting there was merit to allow bigger open parking garages when constructed using buildings of fire resistive construction, however the table values proposed in G101-15 were considered too large. Based on that feedback PCI has modified the original proposal to reduce the area per tier permitted for Type IIA construction as reflected in this code change.

The area per tier proposed is based on a common open parking garage design utilizing a footprint of 240-feet X 315-feet (4 bays @ 60-ft/bay X 35 parking spaces @ 9-ft each), which totals 75,600 sf. The table value was rounded to 75,000 sf. This area per tier, based on 10 tiers, results in an aggregate parking area consistent with the aggregate allowable floor area for an enclosed sprinklered S-2 parking garage, per Tables 504.4 and 506.2.

Based on the low risk of vehicle fires and resulting damage, and the open sided features of these garages, this proposal will permit open parking garages of Type IIA construction to be built to areas like those permitted for sprinklered enclosed parking garages.

Cost Impact: The code change proposal will decrease the cost of construction
Permitting larger open parking garages of Type IIA construction will result in a reduction in cost without any compromise in fire safety through savings in material and construction methods required for open parking structures that would otherwise have to meet Type IB construction.

G37-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee was not convinced there was evidence which warranted this increase in size. Testimony of recent fire loss in an open parking garage prompts concern. Another change has been proposed to the fire code to sprinkler these open parking garages. It was suggested if the sprinkler requirement passes, then a public comment for approval of this item for the Richmond hearing may be appropriate. More information is needed to approve this increase at this time. (Vote: 10-4)

Assembly Action: **None**

G37-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen Skalko, Stephen V. Skalko, P.E. & Associates, LLC, representing Precast/Prestressed Concrete Institute (svskalko@svskalko-pe.com); Jason Krohn, Precast/Prestressed Concrete Institute, representing Precast/Prestressed Concrete Institute (jkrohn@pci.org); William Hall, Alliance for Concrete Codes and Standards, representing Alliance for Concrete Codes and Standards (jhall@cement.org)requests As Submitted.

Commenter's Reason: G37-18 should be Approved As Submitted since the technical information in the original reason statement supporting this proposal was not refuted during testimony at the Code Action Hearing (CAH). This proposal will allow an open parking garage of Type IIA construction, which has structural fire resistance of one-hour, to be built larger than an open parking garage constructed of Type IIB, which has no structural fire resistance. It appears the General Committee was reluctant to approve the proposal based on the evidence submitted after opposing testimony regarding a recent loss in an open parking garage raised concerns.

The recent fire loss in an open parking garage that the General Committee refers to in their reason for disapproval involves a fire incident that occurred in the UK at the first of 2018. All the details of this incident were not known at the time of the CAH. However, upon review of the final report by the Merseyside Fire and Rescue Service (MFRS), the parking garage in question, referred to as a car park in the UK, had design features less robust to the effects of fire and fire spread than the designs commonly followed in the United States [Merseyside Fire Rescue Service, *Kings Dock Car Park Fire Protection Report,* April 2018, Merseyside, UK].

The following are two of the most notable differences of these design features contributing to the spread of fire in the UK car park incident:

- - The car park had a light gauge aluminum floor drainage tray attached to the underside of, and in line with, the joints of the precast floor system. The trays lead to plastic vertical piping to transfer liquids to the building storm water drainage system. The design called for a 1/2-inch gap between floor panels to allow drainage into the aluminum tray below. This gap in the floor joints allowed burning fuel spills from vehicle gas tanks to flow directly to floors below allowing the fire to spread to vehicles on other floors.

In the United States the floor joints are not left open. They are typically sealed by a combination backer rod and sealant or covered by the placement of a concrete topping with tooled and sealed joints. This not only minimizes spread of fire to floors below by leaking fuels, but also inhibits the spread of flames from the incident floor to vehicles on floors above.

- - The building code requirements in the UK permitted only a 15-minutes structural fire resistance of the precast concrete floors for the Kings Dock car park. The fire exposure from the initial vehicle (and subsequent vehicles) damaged the underside of the floor panels above sufficient enough to permit the fire to extend upward to vehicles on the next parking level.

In the US the typical precast floor systems in open parking garages meets at least a minimum of a 1-hour fire resistance, which increases significantly the ability to prevent fire spread between floors.

A study of car park fires in the UK showed a total 3,096 fire incidences over a twelve-year period [BD2552 *Fire Spread in Car Parks,* Building Research Establishment for Department for Communities and Local Government, December 2010]. The average number of car park fires per year for that period was 258/year. This represents a very low number of incidences per year and thus low risk for fires in car parks. The experience with fire incidences in the US is also very low risk for this building occupancy type.

- ◦ The US Fire Administration statistics show an average of over 1.7 million fires [FA-311, *Fire in the United States 1994-2004,* 14th edition, August 2007] for the period from 1999 to 2002. When compared to the average total parking garage fires described in the NFPA study cited in the original reason statement (1760 incidents), parking garage fires represent less than 0.1% of the fire incidences.

- ◦ The Parking Market Research Company (PMRC) study referenced in the reason statement reached a similar conclusion on such low risk. That study looked at over 4,400 fire incidences for general vehicle parking including garages and surface lots with only 25% of these incidences in parking garages. During that same 3-year period approximately 7 million total fire incidences were reported. The parking garage fires for that 3-year period represent about 0.016% of the total fires.

- ◦ The PMRC study also found that structural damage had not occurred in about 98.7% of open parking garage fires studied, which can be attributed to the excellent performance of open parking garages exposed to fire in the US.

Thus, except for that one unusual open parking garage fire incident in the UK, which had other mitigating circumstances contributing to fire spread, the data shows open parking garages to have a very low risk from vehicle fires. In addition, the design practices and features of open parking structures in the US, which minimize fire spread between floors and reasonably withstand the structural impact from fire effects, support allowing Type IIA garages to be built larger than those of Type IIB.

Recommend APPROVAL AS SUBMITTED for G37-18

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction Permitting larger open parking garages of Type IIA construction will result in a reduction in cost without any compromise in fire safety through savings in material and construction methods required for open parking structures that would otherwise have to meet Type IIB construction.

G37-18

G39-18

IBC: 202(New), 406.6.4(New), 406.6.4.1(New), 406.6.4.2(New), 406.6.4.3(New), 406.6.4.4(New), 406.6.4.5(New), TABLE 508.4; 903.2.10.2(New), TABLE 902.3.11.6 (IFC 202(New), 903.2.10.2(New), TABLE 902.3.11.6)

Proposed Change as Submitted

Proponent: James Carver, El Segundo Fire Department, representing El Segundo Fire Department (JCarver@elsegundo.org)

2018 International Building Code

SECTION 202 DEFINITIONS

Add new definition as follows

202 MECHANICAL-ACCESS ENCLOSED PARKING GARAGE An enclosed parking garage other than single car stacking systems which employs parking machines, lifts, elevators or other mechanical devices for vehicle moving from and to street level and in which public occupancy in the garage is prohibited in all areas except the vehicle access bay.

Add new text as follows

406.6.4 Mechanical-access garages. Mechanical-access enclosed parking garages shall be in accordance with Sections 406.6.4.1 through 406.6.4.5.

406.6.4.1 Separation. Mechanical-access enclosed parking garages shall be separated from other occupancies and accessory uses by not less than 2-hour fire barriers constructed in accordance with Section 707 or by not less than 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

406.6.4.2 Smoke removal. A mechanical smoke removal system, in accordance with Section 910.4, shall be provided for all areas containing an enclosed mechanical-access parking garage.

406.6.4.3 Fire control equipment. The fire control equipment, consisting of the fire alarm control unit, mechanical ventilation controls and emergency shut down shall be provided in a room with exterior access. The room size and location shall be approved by the fire code official.

406.6.4.4 Firefighter access. Access doors shall be provided at the ground level for firefighter access as approved by the fire code official.

406.6.4.5 Emergency shutdown switch. A manually activated emergency shutdown switch shall be provided for use by emergency personnel.

Revise as follows

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)f

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M,S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1[d]	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

N = No separation requirement.

NP = Not Permitted.

a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section ~~406.3.2.~~ 406.3.2 and 406.6.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.
f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

2018 International Fire Code

SECTION 202 GENERAL DEFINITIONS

Add new definition as follows

202 MECHANICAL-ACCESS ENCLOSED PARKING GARAGE An enclosed parking garage, other than single car stacking system, which employs parking machines, lifts, elevators or other mechanical devices for vehicle moving from and to street level and in which public occupancy in the garage is prohibited in all areas except the vehicle access bay.

Add new text as follows

903.2.10.2 Mechanical-access enclosed parking garages. An approved automatic sprinkler system shall be provided throughout buildings used for the storage of motor vehicles in a mechanical-access enclosed parking garage. The portion of the building that contains the mechanical-access enclosed parking garage shall be protected with a performance-based design specially engineered sprinkler system.

Revise as follows

TABLE 903.2.11.6
ADDITIONAL REQUIRED FIRE SUPPRESSION SYSTEMS

SECTION	SUBJECT

903.2.10.2	Mechanical-access enclosed parking garages
914.2.1	Covered and open mall buildings
914.3.1	High-rise buildings
914.4.1	Atriums
914.5.1	Underground structures
914.6.1	Stages
914.7.1	Special amusement buildings
914.8.2	Airport traffic control towers
914.8.3, 914.8.6	Aircraft hangars
914.9	Flammable finishes
914.10	Drying rooms
914.11.1	Ambulatory care facilities
1029.6.2.3	Smoke-protected assembly seating
1103.5.1	Existing Group A occupancies
1103.5.2	Pyroxylin plastic storage in existing buildings
1103.5.3	Existing Group I-2 occupancies
1103.5.4	Existing Group I-2, Condition 2 occupancies
1103.5.4	Pyroxylin plastics
2108.2	Dry cleaning plants
2108.3	Dry cleaning machines
2309.3.2.6.2	Hydrogen motor fuel-dispensing area canopies
2404.2	Spray finishing in Group A, E, I or R
2404.4	Spray booths and spray rooms
2405.2	Dip-tank rooms in Group A, I or R
2405.4.1	Dip tanks
2405.9.4	Hardening and tempering tanks
2703.10	HPM facilities
2703.10.1.1	HPM work station exhaust
2703.10.2	HPM gas cabinets and exhausted enclosures
2703.10.3	HPM exit access corridor
2703.10.4	HPM exhaust ducts
2703.10.4.1	HPM noncombustible ducts
2703.10.4.2	HPM combustible ducts
2807.3	Lumber production conveyor enclosures
2808.7	Recycling facility conveyor enclosures
3006.1	Class A and B ovens
3006.2	Class C and D ovens
Table 3206.2	Storage fire protection
3206.4	Storage
3704.5	Storage of more than 1,000 cubic feet of loose combustible fibers
5003.8.4.1	Gas rooms
5003.8.5.3	Exhausted enclosures
5004.5	Indoor storage of hazardous materials
5005.1.8	Indoor dispensing of hazardous materials
5104.4.1	Aerosol product warehouses
5106.3.2	Aerosol display and merchandising areas
5306.2.1	Exterior medical gas storage room
5306.2.2	Interior medical gas storage room

5306.2.3	Medical gas storage cabinet
5606.5.2.1	Storage of smokeless propellant
5606.5.2.3	Storage of small arms primers
5704.3.7.5.1	Flammable and combustible liquid storage rooms
5704.3.8.4	Flammable and combustible liquid storage warehouses
5705.3.7.3	Flammable and combustible liquid Group H-2 or H-3 areas
6004.1.2	Gas cabinets for highly toxic and toxic gas
6004.1.3	Exhausted enclosures for highly toxic and toxic gas
6004.2.2.6	Gas rooms for highly toxic and toxic gas
6004.3.3	Outdoor storage for highly toxic and toxic gas
6504.1.1	Pyroxylin plastic storage cabinets
6504.1.3	Pyroxylin plastic storage vaults
6504.2	Pyroxylin plastic storage and manufacturing

For SI: 1 cubic foot = 0.023 m^3.

Reason: Enclosed mechanical-access parking garages are being constructed in the United States on an increasing basis, yet there is no prescriptive code requirements for these occupancies. These occupancies are unique from the traditional open mechanical-access parking garage in that there are no openings, the entire structure is enclosed. These occupancies are more similar to automated high rack storage systems, they have no floors, no stairwells and no above ground level access, except maintenance walkways and ladders. With these being a silent occupancy type, the Code does not provide the code official with prescriptive requirements. There are fires involving parked vehicles with the vehicle parked and the ignition system off. If a fire were to occur in an enclosed mechanical-access parking garage, unless the local code authority required additional fire protection during construction, they do not have a point-setter to code requirements. Where these systems have been installed, there is not a consistent fire protection methodology to protecting these structures from a fire.
An enclosed mechanical-access parking garage offers many firefighting challenges; most are constructed in a building shell, without a floor system. The vehicles are parked in a cage/rack system, with no safe elevated access to the interior of the structure. With firefighter safety in mind and to have the ability to use fixed fire suppression to extinguish and\or control these fires, the code proposal is presented.

IFC Section 202 adds a definition for these occupancies. Open mechanical-access parking garages are defined in the Code, but do not pose the firefighting challenge as an enclosed mechanical access parking garage. An open parking garage has floors, stairwells, standpipe connections and natural ventilation. An enclosed garage is in a box, no stairwells or floors or standpipes for elevated firefighting, and no ventilation to remove the products of combustion, heat and super-heated gases.

IBC Section 406 6.1.3 is added to require a minimum 2-hour fire separation between these occupancies and other uses. If a fire were to occur in the occupancy, partitioning is needed to protect adjoining occupancies and other uses until the fire can be contained by the sprinkler system and mechanical ventilation.

IFC Section 320 is added to provide basic prescriptive requirements to provide for firefighter safety and to assist in the extinguishment of these fires, providing ground level access doors for firefighting operations, a room to consolidate the required fire control equipment, mechanical smoke removal and an emergency shut down switch. These occupancies are similar to high-piled automated storage systems. The general requirements are similar to high piled rack and automated storage requirements in Chapter 32.

IFC Section 903.2.10.2 is added to prescriptively require a performance-based designed sprinkler system. With the projected fire load in these occupancies and the inability to get water to the seat of the fire, a prescriptively designed sprinkler system is not anticipated to provide the required water for fire suppression.

Footnote c in IBC Table 508.4 is added to include the new section, 406.6.1.3.

Section 320 is being added to IFC Table 903.2.11.6 to the list of occupancies requiring additional fire suppression systems.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is to provide prescriptive language for enclosed mechanical-access parking garages. These code requirements are being currently enforced as part of a performance-based design when approved and constructed. As the designed and builder will have prescriptive requirements, they will not be required to obtain an Alternative Materials and Methods approval for each project.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee sees the need to improve the code in this topic, but found the current proposal needs substantial work. They pointed out the following areas needing improvement: sprinkler design criteria; smoke control; the fire control equipment control room and to what extend it needs to parallel other control rooms, definition complexity and the impact this could have on low income housing. The proponent was urged to work with the BCAC to develop improved criteria. (Vote: 14-0)

Assembly Action: **None**

G39-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Crystal Sujeski, representing Crystal Sujeski (crystal.sujeski@fire.ca.gov)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

SECTION 202 DEFINITIONS

202 MECHANICAL-ACCESS ENCLOSED PARKING GARAGE An enclosed parking garage ~~other than single car stacking systems ,~~ which employs parking machines, lifts, elevators or other mechanical devices for vehicle moving from and to street level and in which public occupancy in the garage is prohibited in all areas except the vehicle access bay.

406.6.4 Mechanical-access garages. Mechanical-access enclosed parking garages shall be in accordance with Sections 406.6.4.1 through 406.6.4.5.

406.6.4.1 Separation. Mechanical-access enclosed parking garages shall be separated from other occupancies and accessory uses by not less than 2-hour fire barriers constructed in accordance with Section 707 or by not less than 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

406.6.4.2 Smoke removal. A mechanical smoke removal system, in accordance with Section 910.4, shall be provided for all areas containing an ~~enclosed~~ mechanical-access ~~parking~~ enclosed parking garage.

406.6.4.3 Fire control equipment room. The fire control equipment, consisting of the fire alarm control unit, mechanical ventilation controls and emergency shut down switch shall be provided in a room ~~with exterior access~~located where the equipment is able to be accessed by the fire service from a secured exterior door of the building. The room shall be a minimum of 50 square feet in size and ~~location~~ shall be in a location that is approved by the fire code official.

406.6.4.4 ~~Firefighter~~ Fire department access doors. Access doors shall be provided ~~at the ground level for firefighter access as approved by the fire code official~~in accordance with Section 3206.7.

406.6.4.~~5~~ 3.1 Emergency shutdown switch. ~~A~~ The mechanical parking system shall be provided with a manually activated emergency shutdown switch ~~shall be provided~~ for use by emergency personnel. The switch shall be clearly identified and shall be in a location approved by the fire code official.

2018 International Fire Code

SECTION 202 GENERAL DEFINITIONS

202 MECHANICAL-ACCESS ENCLOSED PARKING GARAGE An enclosed parking garage, ~~other than single car stacking system,~~ which employs parking machines, lifts, elevators or other mechanical devices for vehicle moving from and to street level and in which public occupancy in the garage is prohibited in all areas except the vehicle access bay.

903.2.10.2 Mechanical-access enclosed parking garages. An approved automatic sprinkler system shall be provided throughout buildings used for the storage of motor vehicles in a mechanical-access enclosed parking garage. The portion of the building that contains the mechanical-access enclosed parking garage shall be protected with a ~~performance-based design~~ specially engineered automatic sprinkler system.

Commenter's Reason: G39-18 has been modified to address the comments and feedback received at the committee action hearings held in Columbus, Ohio in April 2018. The modifications were derived by a task group of industry professionals, code consultants, fire officials, and building officials.
The definition has been modified to correlate with the NFPA 88A Standard for Parking Structures document and include all automatic parking systems.

406.6.4.2 The modification was editorial to move the word enclosed after the term mechanical-access to stay consistent within the section.

406.6.4.3 The word "room" was added to the section heading to clarify that the equipment is intended to be housed within a defined space. To address a committee comment on the size of the room, the task group concluded that the appropriate size would be a minimum of 50 square feet. This dimension was derived by comparing the language and use of an emergency response area used in the California Building Code for L occupancy for supplies and equipment. The room is not intended to be used for fire suppression command and control use. The room is designed to only operate fire protection systems.

406.6.4.3.1 The emergency shut down switch has been clarified to what the function is intended to achieve. The section number was moved to become a subsection of the fire control equipment room for code user ease.

406.4.4.4 Fire Department access is a critical component of firefighting operations. The modification gives the minimum access for fire department response. With the similarities between mechanical-access enclosed parking garages and high-pile rack storage systems, the demand for fire fighter access requirements are comparable. To achieve consistency within the code for fire fighter access the reference to section 3206.7 has been added.

903.2.10.2 To address the committee comment about the term performance based design. We modified the proposal to correlate with the high-pile storage language in section 3208.5.1. The intent to require a "specially engineered automatic sprinkler system" is to identify the varied fuel loads, configurations, scope and size of these projects. In this way, the designer and code official will be assured that the hazard is adequately accounted for within the fire protection design.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The public comment modification will continue to achieve the same goals of the original intent of the proposal. The cost of construction will decrease as designers and code officials will have a minimum, consistent bases for design without having to create alternate means agreements with each jurisdiction the designer, developer intends to submit a project.

G39-18

G43-18

IBC: 407.4.4.1, 407.4.4.3

Proposed Change as Submitted

Proponent: John Williams, Chair, representing Healthcare Committee (AHC@iccsafe.org)

THIS CODE CHANGE WILL BE HEARD BY THE MEANS OF EGRESS COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

2018 International Building Code

Revise as follows

407.4.4 Group I-2 care suites. *Care suites* in Group I-2 shall comply with Sections 407.4.4.1 through 407.4.4.4 and either Section 407.4.4.5 or 407.4.4.6.

407.4.4.1 Exit access through care suites. *Exit* access from all other portions of a building not classified as a *care suite* shall not pass through a *care suite*. ~~In a *care suite* required to have more than one *exit*, one *exit access* is permitted to pass through an adjacent *care suite* provided that all of the other requirements of Sections 407.4 and 1016.2 are satisfied.~~

407.4.4.2 Separation. *Care suites* shall be separated from other portions of the building, including other care suites, by a smoke partition complying with Section 710.

407.4.4.3 Access to corridor. Every care suite shall have a door leading directly to an exit access corridor or horizontal exit. Movement from habitable rooms within the care suite shall not require ~~passage through~~ more than ~~three doors and~~ 100 feet (30 480 mm) ~~distance of travel within the~~ of travel within the care suite to a door leading to the exit access corridor or horizontal exit. Where a care suite is required to have more than one exit access door by Section 407.4.4.5.2 or 407.4.4.6.2, the additional door shall lead directly to an exit access corridor, horizontal exit or an adjacent suite.

~~Exception~~ Exceptions:

1. The distance of travel shall be permitted to be increased to 125 feet (38 100 mm) where an automatic smoke detection system is provided throughout the *care suite* and installed in accordance with NFPA 72.
2. Where two or more exit access doors are required by Section 407.4.4.5.2 or 407.4.4.6.2, not more than one of the doors shall be permitted to be an exit door leading to an exit stairway, exit ramp, exit passageway, or an exterior exit door.

Reason: Since this section was heavily edited in the 2012 version of the code, the federal rules have changed. This change reflects those changes and provides additional clarity relating to the exit access options out of a suite. The federal regulations stopped counting number of intervening rooms, instead relying on overall travel (K256 and K257). This proposal is submitted by the ICC Committee on Healthcare (CHC). The CHC was established by the ICC Board to evaluate and assess contemporary code issues relating to healthcare facilities. This is a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. In 2017 the CHC held 2 open meetings and numerous conference calls, *which included members of the committees as well as any interested parties, to discuss and debate the proposed changes*. Information on the CHC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CHC effort can be downloaded from the CHC website at: https://www.iccsafe.org/codes-tech-support/cs/icc-committee-on-healthcare/.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal allows for one door out of a suite to be an exit door. This allows for additional design flexibility without adding any additional requirements.

G43-18

Public Hearing Results

Errata: Editorial modifications:

407.4.4.3 Access to corridor. Every care suite shall have a door leading directly to an exit access corridor or horizontal exit. Movement from habitable rooms within the care suite shall not require more than 100 feet (30 480 mm) of travel within the care suite to a door leading to the exit access corridor or horizontal exit. Where a care suite is required to have more than one exit access door by Section 407.4.4.5.2 or 407.4.4.6.2, the additional door shall lead directly to an exit access corridor, horizontal exit or an adjacent suite.

Exceptions:

The distance of travel shall be permitted to be increased to 125 feet (38 100 mm) where an automatic smoke detection system is provided throughout the care suite and installed in accordance with NFPA 72.
Where two or more exit access doors are required by Section 407.4.4.5.2 or 407.4.4.6.2, not more than one of the doors shall be permitted to be an exit door leading to an exit stairway, exit ramp, exit passageway, or an exterior exit door.

Committee Action: As Submitted

Committee Reason: The committee modified Section 407.4.4.3 to consistently use the defined term "care suite" instead of just "suite". The addition of “of” in the main text and “an” in Exception 2 was for better grammar. This was viewed as editorial only, so the committee did not vote on a modification.
The proposal was approved as appropriate for a facility that used a defend-in-place strategy for occupant safety during a fire event. This will coordinate the IBC with CMS requirements, thus reducing potential conflicts for hospitals and nursing homes. The committee suggested that Exception 2 is really a requirement, and should be moved up into the main text. (Vote: 14-0)

Assembly Action: None

G43-18

Individual Consideration Agenda

Public Comment 1:

Proponent: John Williams, representing Healthcare Committee (ahc@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

407.4.4.3 Access to corridor. Every care suite shall have a door leading directly to an exit access corridor or horizontal exit. Movement from habitable rooms within the care suite shall not require more than 100 feet (30 480 mm) of travel within the care suite to a door leading to the exit access corridor or horizontal exit. Where a care suite is required to have more than one exit access door by Section 407.4.4.5.2 or 407.4.4.6.2, the additional door shall lead directly to an exit access corridor, ~~horizontal~~ exit or an adjacent suite.

~~Exceptions~~Exception:

1. The distance of travel shall be permitted to be increased to 125 feet (38 100 mm) where an automatic smoke detection system is provided throughout the *care suite* and installed in accordance with NFPA 72.
2. ~~Where two or more exit access doors are required by Section 407.4.4.5.2 or 407.4.4.6.2, not more than one of the doors shall be permitted to be an exit door leading to an exit stairway, exit ramp, exit passageway, or an exterior exit door.~~

Commenter's Reason: This proposal in in response to a recommendation by the Means of Egress Code Development committee that Exception 2 was really a requirement and not an exception. Rather than lists the types of exits, the last sentence is now all inclusive.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposal allows for one door out of a suite to be an exit door. This allows for additional design flexibility without adding any additional requirements.

G43-18

G54-18

IBC: 420.2, 705.3

Proposed Change as Submitted

Proponent: Micah Chappell, representing City of Seattle (micah.chappell@seattle.gov)

2018 International Building Code

Revise as follows

420.2 Separation walls. Walls separating *dwelling units* in the same building, walls separating *sleeping units* in the same building and walls separating *dwelling* or *sleeping units* from other occupancies contiguous to them in the same building shall be constructed as *fire partitions* in accordance with Section 708. <u>Exterior walls separating units shall comply with Section 705.3.</u>

Exceptions:

1. Where sleeping units include private bathrooms, walls between bedrooms and the associated private bathrooms are not required to be constructed as fire partitions.
2. Where sleeping units are constructed as suites, walls between bedrooms within the sleeping unit and the walls between the bedrooms and associated living spaces are not required to be constructed as fire partitions.
3. In Group R-3 and R-4 facilities, walls within the dwelling units or sleeping units are not required to be constructed as fire partitions.

705.3 Buildings on the same lot. For the purposes of determining the required wall and opening protection, projections and roof-covering requirements, buildings on the same lot <u>and portions of the same building requiring dwelling or sleeping unit separation</u> shall be assumed to have an imaginary line between them. <u>Section 705.3 Exception 1 shall not be used where dwelling or sleeping unit separation is required.</u>
Where a new building is to be erected on the same lot as an existing building, the location of the assumed imaginary line with relation to the existing building shall be such that the *exterior wall* and opening protection of the existing building meet the criteria as set forth in Sections 705.5 and 705.8.

Exceptions:

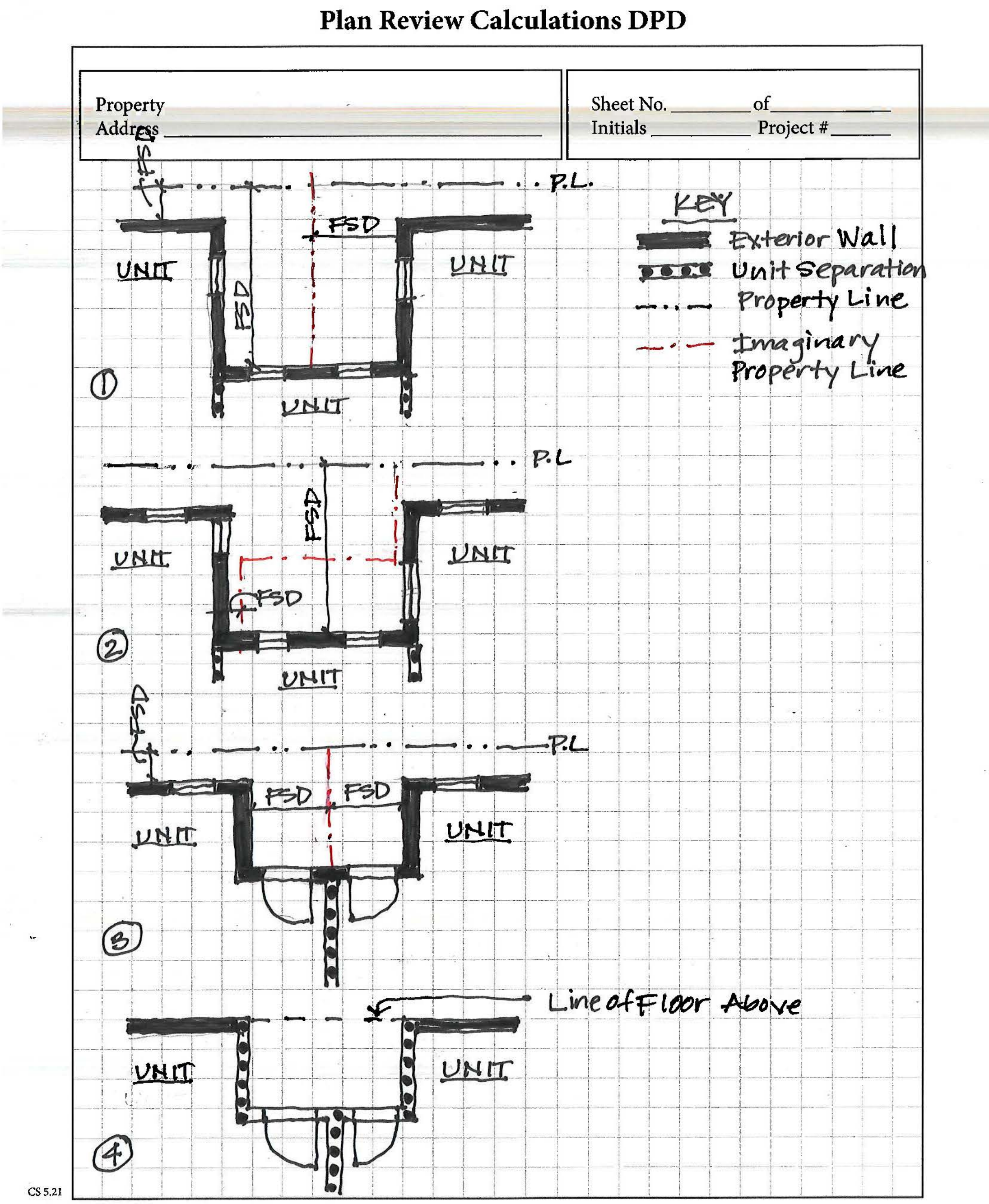
1. Two or more buildings on the same lot shall be either regulated as separate buildings or shall be considered as portions of one building if the aggregate area of such buildings is within the limits specified in Chapter 5 for a single building. Where the buildings contain different occupancy groups or are of different types of construction, the area shall be that allowed for the most restrictive occupancy or construction.
2. Where an S-2 parking garage of Construction Type I or IIA is erected on the same lot as a Group R-2 building, and there is no *fire separation distance* between these buildings, then the adjoining *exterior walls* between the buildings are permitted to have occupant use openings in accordance with Section 706.8. However, opening protectives in such openings shall only be required in the exterior wall of the S-2 parking garage, not in the exterior wall openings in the R-2 building, and these opening protectives in the exterior wall of the S-2 parking garage shall be not less than $1^1/_2$-hour *fire protection rating*.

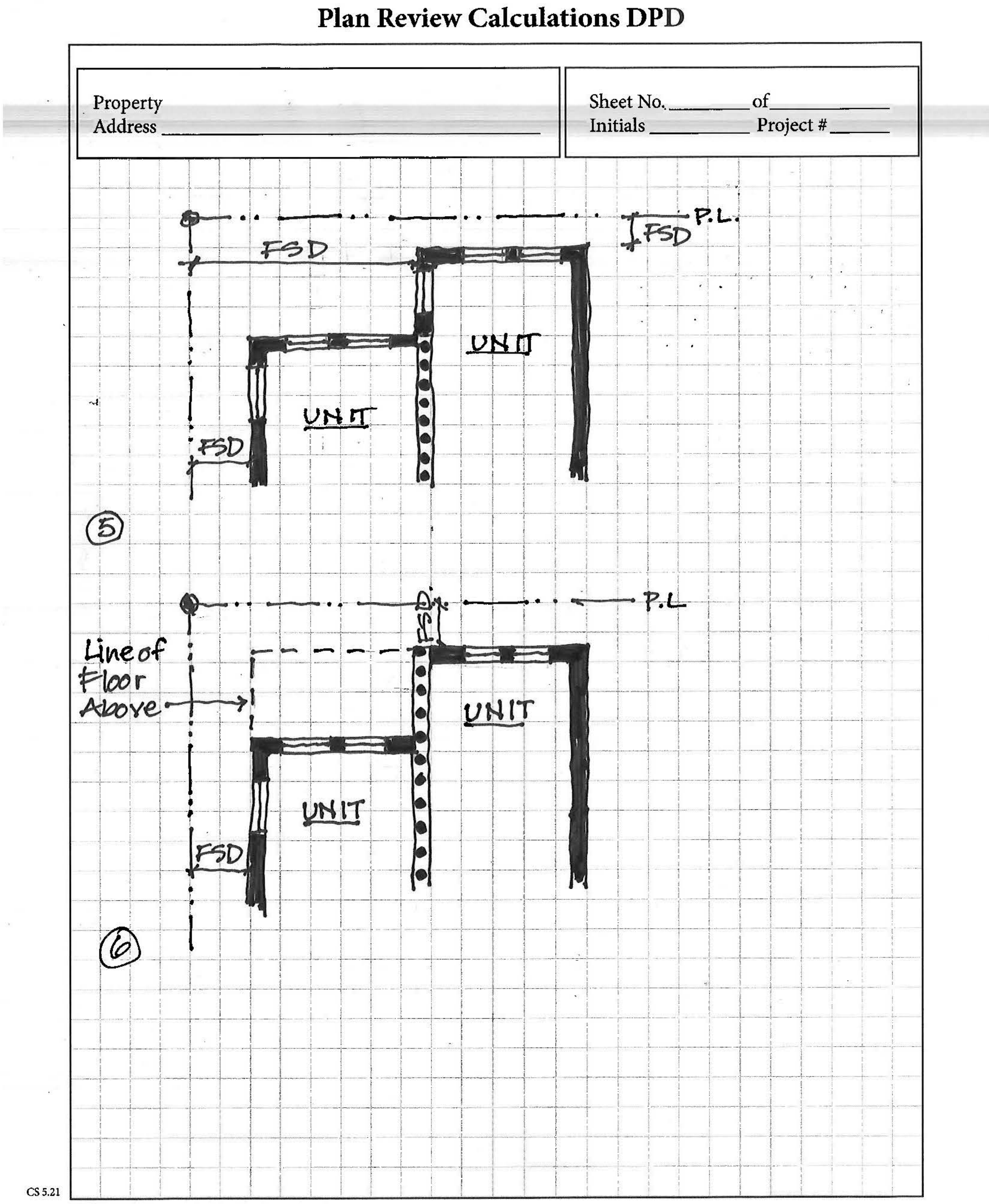
Reason: The code requires fire-rated construction between dwelling units, but does not specifically address the situation where the separating wall is exterior. The provisions of 705.3 establish a means to determine the required fire rating and allowable openings for exterior walls of two buildings on the same lot. The same principles should be applied to the requirements for dwelling unit separation.
Dwelling unit separation is intended to prevent a fire in one unit from spreading to other units in a building. If adjacent units have unprotected openings in close proximity, fire can more readily spread between units, and to exterior balconies, cladding and roof.

With increasing demand for greater density housing, architects are designing more multifamily residential buildings with smaller units, often with windows on opposite sides of courts.

The provisions of Section 1206 control the minimum sizes of courts, but are silent on the fire-rating requirements, as this section is focused on light and ventilation.

This revision will provide greater clarity for designers and increased safety and privacy for building residents.





Cost Impact: The code change proposal will not increase or decrease the cost of construction
Minimal cost implications for construction. Potential property damage and life savings as fires are more likely to be limited to the unit of origin.

G54-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal would attempt to required buildings with stepped facades to be analyzed as if the steps represent different buildings on the same property. The committee found the proposal to be vague and unenforceable. It is not adequately supported with data that the building designs which it would prohibit are in fact, providing dangerous design conditions. . A case to require a building to be protected from itself was not made. The committee felt that the cost of construction was significantly understated. (Vote: 13-1)

Assembly Action: **None**

G54-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Micah Chappell, representing Seattle Department of Construction and Inspection (micah.chappell@seattle.gov)requests As Submitted.

Commenter's Reason: The code change proposal is not to protect the building from itself, but to provide unit separation for the condition when adjacent unit exterior walls are in close proximity. We see the condition shown on the previously submitted sketches quite often in Seattle where the exterior wall of a building undulates to accommodate windows or unit entry doors. Another example is two window openings from adjacent units directly facing each other across a light well. The light well depth could be small as three feet to provide light or ventilation in a yard or court per IBC Section 1205.2 & 1205.3. If the light well were infilled with floor area then the unit separation would require a rated wall between the units and protected openings. Removing the floor area and treating those walls as exterior walls does not remove the hazard from adjacent units.
The philosophy of providing fire protection due to adjacent exterior hazards within the same building is a common approach in the current building code and can be found in the following building code locations:

1023.7: Protect adjacent exterior walls at an angle less than 180 degrees of a nonrated exit stair exterior wall or unprotected opening.

1023.3, 1024.4, 1028.1: Exit stairs/passageways that extend to an exit discharge are required to extend to the exterior edge of the building p. For inset exit doors, protection to be extended to building edge.

This code change proposal extends this protection to unit separation.

This code change proposal will increase construction costs.

I believe the original code proposal should be approved as proposed. This code change will provide clear guidance in how to address the hazard of adjacent units.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Cost increase as indicated in original proposal.

G54-18

G72-18

IBC: 202, 308.1.1(New), 429 (New), Chapter 35

Proposed Change as Submitted

Proponent: Dave Frable, U.S. General Services Administration, representing U.S. General Services Administration

2018 International Building Code

SECTION 202 DEFINITIONS

Add new definition as follows

LOCK-UP An area located within a building or structure having a predominant occupancy classification other than Group I-3, and where the occupants for penal or correctional purposes are detained for less than 24 hours by the use of security measures not under the occupants' control.

Add new text as follows

308.1.1 Lock-ups. Lock-ups located within a building or structure having a predominant occupancy classification other than Group I-3, where the area has capacity for not more than 50 detainees, and where no individual is detained for 24 hours or more, shall comply with the requirements of the predominant occupancy of the building or structure in which the lock-up is located and with the requirements of Section 429. Lock-ups having a capacity for more than 50 detainees or where any individual is detained for 24 hours or more shall be classified as Group I-3 occupancy and shall comply with the other applicable requirements in this code.

429 LOCK-UPS

429.1 General. Lock-ups located within a building or structure having a predominant occupancy classification other than Group I-3, where the area has capacity for not more than 50 detainees, and where no individual is detained for 24 hours or more, shall comply with the provisions in Sections 429.1 through 429.5 and other applicable provisions of this code.

429.2 Automatic Sprinkler System. Buildings and structures where lock-ups are located shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

429.3 Fire Alarm System. Buildings and structures where lock-ups are located shall be equipped with a fire alarm system that initiates the occupant notification signal installed in accordance with Section 907.6.

429.4 Lock-up Criteria. The lock-up shall comply with the requirements for the predominant occupancy of the building in which the lockup is located, and the following criteria:

1. Doors and other physical restraints to free egress by detainees can be readily released by staff within 2-minutes of the onset of a fire or similar emergency.
2. Staff is in sufficient proximity to the lock-up so as to be able to cause the 2-minute release required by Item1 whenever detainees occupy the lockup.

   Exception: Where staff is not in sufficient proximity to the lock-up so as to be able to cause the 2-minute release required by Item 2, an automatic smoke detection system shall be installed throughout the lock-up area installed in accordance with the requirements in NFPA 72.

3. Staff is authorized to cause the release required by Item 1.
4. Staff is trained and practiced in effecting the release required by Item1.
5. Where the release required by Item1 is caused by means of remote release, detainees are not to be restrained from evacuating without the assistance of others.
6. Where security operations necessitate the locking of required means of egress, the following shall apply:

   6.1. Detention-grade hardware complying with ASTM F 1577 shall be provided on swinging doors within the required means of egress.

   6.2. Sliding doors within the required means of egress shall be designed and engineered for detention and correctional use, and lock cylinders shall meet the cylinder test requirements of ASTM F 1577.

429.5 **Fire department notification.** The building owner/manager shall notify the fire department with responsibility to respond to the building or structure of the presence of the lockup.

Add new standard(s) follows

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box
C700
West Conshohocken PA 19428-2959
US

F1577-05 (2012):

Standard Test Methods for Detention locks for Swinging Doors

Analysis: A review of the standard proposed for inclusion in the code, [INSERT STANDARD], with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

Reason: The intent of this code change proposal is to address the subject matter of 'lock-ups" where the occupants for penal or correctional purposes are detained for less than 24 hours by the use of security measures not under the occupants' control. A lock-up is basically a holding area in which persons are detained with some degree of security imposed on them that are commonly located in different types of occupancies. For example, lockups are typically located in U.S. Customs and Border Protection facilities at border crossings, airports and seaports; prisoner holding facilities at courthouses; local police departments; security offices at sports stadia; security offices at shopping mall complexes; etc. Currently, the requirements within the IBC require "lock-ups" to meet the rigorous defend in place requirements applicable to Institutional Group I-3 occupancies. This code change proposal provides requirements specifically for lock-ups located in building and structures having a predominant occupancy classification other than Institutional Group I-3 occupancy and provides a reasonable set of safe guards applicable to the predominant occupancy of the building in which the lock-up is located. The subject provisions for lock-ups are meant to apply to holding areas having a capacity of not more than 50 detainees, in which no individual is detained for 24 hours or more. The threshold for the holding area to limit the capacity to not more than 50 detainees is based on the requirements in NFPA 101, Life Safety Code, and seems reasonable for processing/holding areas for facilities at border crossings, airports and seaports and prisoner holding facilities at courthouses.
Section 202 has been revised to include a new definition for a lock-up. Section 308 has also been revised to include a new sub-section 308.1 on lock-ups

A new Section 429, Lock-Ups has been created to provide a reasonable set of safe guards applicable for when a predominant occupancy of the building or structure has an occupancy classification other than Institutional Group I-3 occupancy in which the lock-up is located. For example, safe guards include, but are not limited to: an automatic sprinkler system throughout the building or structure, a fire alarm system, a 2-minute timeframe for trained staff to release the detainees or an option for the installation of a smoke detection system within the lock-up area if the 2-minute timeframe for trained staff to release the detainees cannot be met, detention-grade door hardware to improve reliability, and building owner/manager notification of the local responding fire department of the presence of the lock-up.

Please note that the subject code change proposal is based on the requirements for lock-ups in the National Fire Protection Association 101, Life Safety Code (2018 edition).

The intent of this proposal is to reference ASTM Standard F 1577-05 (2012), Standard Test Methods for Detention Locks for Swinging Doors to improve the reliability of detention-grade hardware for lock-ups.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
We believe the subject code change proposal to include lock-ups will not affect the cost of construction either way.

Requiring lock cylinders of detention door hardware to meet the cylinder test requirements of ASTM F 1577 may increase construction costs.

Analysis: A review of the standard proposed for inclusion in the code, ASTM F1577-05 (2012), with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

G72-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This issue needs to be addressed especially to address facilities where 5 or fewer persons are 'locked' up and not free to egress in malls, small court houses. The committee spoke to areas where the proposal needs further development: 1. Clarity of locking arrangements, specifically unlocking during emergency situations. 2. Consider limiting the number of doors in the path of egress. 3. Relying on the 'owner' to call the fire department in case of emergencies. 4. Cost of compliance for very small jurisdictions that may have only 1 or 2 persons in lock up at any time. 5. Reconsider the maximum threshold. 6. Consider separating those needed for health care and those needed for law enforcement. (Vote 9-5)

Assembly Action: **None**

G72-18

Individual Consideration Agenda

Public Comment 1:

Proponent: David Collins, representing The American Institute of Architects (dcollins@preview-group.com)requests As Submitted.

Commenter's Reason: Holding facilities have an extremely important role in various types of facilities. Secuirty needs for retail operations, medical facilities and even governmental facilities often have to deal with persons that are violent or disturbed, have mental health issues that require that the operators of these facilities detain them for a period before the local authorities can retrieve the individual and take them to be dealt with. Without guidance from the IBC, many designers and owners are having to creatively identify the necessary features of such an area for temporarily holding such individuals.
We believe this proposal offers clear and concise requirements for designers, owners and building officials to use in creating appropriate facilities for detention without classifying the space as an I-3 occupancy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As stated in the original proposal.

G72-18

G75-18

IBC: Table TABLE 504.3

Proposed Change as Submitted

Proponent: Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB) (TWB@iccsafe.org)

2018 International Building Code

Revise as follows

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANEa

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION											TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									
I-4	NS[d, g]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	270	180	85	85	70	60

For SI: 1 foot = 304.8 mm.

UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Reason: The Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board to explore the science of tall wood buildings and take action on developing code changes for tall wood buildings. The TWB has created several code change proposals with respect to the concept of tall buildings of mass timber and the background information is at the end of this Statement. Within the statement are important links to information, including documents and videos, used in the deliberations which resulted in these proposals.
The TWB and it various WGs held meetings, studied issues and sought input from various expert sources around the world. The TWB has posted those documents and input on its website for interested parties to follow its progress and to allow those parties to, in turn, provide input to the TWB.

At its first meeting, the TWB discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings:

1. No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.
2. No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios.
3. No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios.
4. No unusual fire department access issues.
5. Egress systems designed to protect building occupants during the design escape time, plus a factor of safety.
6. Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

The comprehensive package of proposals from the TWB meet these performance objectives. The TWB also determined that fire testing was necessary to validate these concepts. At its first meeting, members discussed the nature and intention of fire testing so as to ensure meaningful results for the TWB and, more specifically, for the fire service. Subsequently a test plan was developed. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of joints, and to evaluate conditions for responding fire personnel. The Fire WG then refined the test plan, which was implemented with a series of five, full-scale, multiple-story building tests at the Alcohol, Tobacco and Firearms (ATF) laboratories in Beltsville, MD. The results of those tests, as well as testing conducted by others, helped form the basis upon which the Codes WG developed its code change proposals. This code change proposal is one of those developed by the Codes WG and approved by the TWB.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3-1/2 minutes each, please visit: http://bit.ly/ATF-firetestvideos.

Both of these links were confirmed active on 12/27/17

Allowable Height

This proposal addresses the allowable building height, in terms of feet, for the three new construction types proposed by the TWB. As set forth in the proposal to Section 602.4, the three new types of construction are Types IV-A, IV-B, and IV-C. The Committee examined each proposed type of construction for its safety and efficacy with regard to each occupancy type.

The following approach was used to develop proposed allowable heights of the new construction types, based on the conclusions of the Committee:

1. Based upon TWB review of fire safety and structural integrity performance, Type IV-B is equated to Type I-B for height (in feet). A noteworthy item to remember is that, per Section 403.2.1.1 of the IBC, Type IB construction is permitted to be reduced to 1-hour Fire Resistance rating; however, the TWB does not propose to allow the same reduction for Type IV-B. As a result, the comparison is between 2-hr mass timber construction that is partially exposed, versus 1-hr Type IB construction, and the Committee believes that 2-hr mass timber construction that is partially exposed per the limits of proposed Section 602.4 warrants the same heights as allowed for 1-hr Type I-B construction. It should be noted that the unprotected mass timber also needs to meet the 2 hour FRR, thus the protected area will likely be conservatively higher FRR than actually required;

2. Type IV-A should be somewhat larger than IV-B, as Type IV-A construction is entirely protected (no exposed mass timber permitted) and the required rating of the structure is equivalent to those required of Type I-A construction (3-hr rating for structural frame). However, the Committee did not find it acceptable to allow the unlimited heights of Type I-A to be applied to Type IV-A. Instead, the Committee applied a multiplier of 1.5 to the heights proposed for Type IV-B construction, in order to propose reasonable height allowances for IV-A construction;

3. The Committee viewed Type IV-C as similar to existing HT construction with the exception that IV-C has a 2 hour FRR where HT is acceptably fire resistant based on the large sizes of the members. As such, the height in feet is proposed to be equal to the height in feet of Type IV-HT. In terms of stories, however, the Committee proposed an additional number of stories for IV-C in recognition of its greater FRR.

4. While the base code seems to allow significant heights for buildings without sprinklers (e.g., Table 504.3 currently allows a height of 160 feet for NS Type I-B construction for many occupancy classifications), the Committee believes that no additional heights over what is already permitted for Type IV-HT would be proposed for the NS (non sprinklered) rows. As such, where separate rows are provided for heights for the NS situation, the proposed heights for Types IV-A, IV-B, and IV-C are the same as those heights already permitted for Type IV for the NS condition.

This methodology explains the majority of the recommendations here. Specifically, for occupancy groups A, B, E, F, I-4, M, R, S, U, the methodology described above accurately reflects how the height proposals were developed.

After undergoing this methodology to develop initial height recommendations, the Committee then applied professional judgment (from both a fire safety and a structural perspective), to develop a working draft table, cell by cell, for all occupancy types.

The exercise for establishing the allowable number of stories for the three new types of construction started with setting Type I-B allowances equivalent to Type IV-B. The tabular fire resistance ratings of building elements for these two types of construction is identical (not including the reduction permitted by 403.2.1.1), so the identical number of stories was deemed a reasonable starting point. From this point, the TWB Committee reviewed each occupancy classification to see if the Type I-B story allowance required adjustment.

Following is a summary of how allowable number of stories for sprinklered I-B were adjusted for IV-B:

- A-1, A-2, A-3, A-4, A-5, B, E, H-1, H-5, I-1(1), I-1(2), I-2, I-3, I-4, R-1, R-2, R-3, R-4, U: no adjustment, same number of allowable stories as Type I-B.
- F-1 and S-1: reduced from 12 to 7 (2 story increase from Type IV-HT)
- F-2, M, S-2: reduced from 12 to 8 (2 story increase from Type IV-HT)
- H-2: reduced from 3 to 2 (same as Type IV-HT)
- H-3: reduced from 6 to 4 (same as IV-Type HT)
- H-4: reduced from 8 to 7 (1 story increase from Type IV-HT)

Similarly, to establish the height in feet for Type IV-B:

- A-1, A-2, A-3, A-4, A-5, B, E, F-1, F-2, I-4, M, R-1, R-2, R-3, R-4, S-1, S-2, U: same allowable height as I-B.
- H-1, H-2, H-3: reduced from 180’ to 90’
- H-4: reduced from 180’ to 100’
- H-5: reduced from 160’ to 90’
- I-1(1): reduced from 180’ to 120’
- I-1(2): reduced from 180’ to 65’
- I-2: reduced from 180’ to 65’
- I-3: reduced from 180’ to 120’

Adjusting IV-B up to IV-A for allowable number of stories:

- A-1, A-2, A-3, A-4, A-5, B, E, F-2, I-4, M, R-1, R-2, R-3, R-4, S-1, S-2, U – 1.5 x IV-B number of stories
- F-1, S-1 increase by 3 stories
- H-1, H-3 same as IV-HT
- H-2, H-4, H-5 increase by 1 story
- I-1(1), I-1(2), I-2, I-3 increase by 2 stories
- H-3 reduced from 6 to 4 (same as IV-HT)
- H-4 reduced from 8 to 7 (1 story increase from IV-HT)
- I-I(1), I-1(2), I-2, I-3, same as IV-HT

Adjusting IV-B to IV-A for building height:

- A-1, A-2, A-3, A-4, A-5, B, E, F-1, F-2, H-1, H-5, I-1(1), I-3, I-4, M, R-1, R-2, R-3, R-4, S-1, S-2, U: multiply 1.5 x Type IV-B (180 ft.)
- H-1, H-2 H-3, H-5: increase by 30 ft.
- H-4: increase by 40 ft.
- I-1(2), I-2: same as Type IV-HT

For instance, for Groups H-1, H-2, H-3, and H-5, while the table allows 160 feet for Type I-B construction, the Committee proposed a height of 90 feet for Type IV-B construction, and is using a multiplier of 1.33 to propose a height for Type IV-A construction of 120 feet height, intentionally made equal to the existing Heavy Timber heights.

For H-4, corrosives represent a health hazard (but not necessarily a fire hazard) to building occupants and first responders, the Committee believed that reduced heights were warranted. These are slightly greater than discussed above for the H-occupancy groups (140 feet versus 120 feet for IV-A construction, and 100 feet versus 90 feet for IV-B construction), but these still are far below what is permitted for Type I-B construction (180 feet permitted for the sprinklered condition), and is in recognition of the particular type of Hazardous occupancy covered by the H-4 occupancy group.

For Group I occupancies, there are two rows in the table, one being a row that includes I-1 Condition 1 and I-3 occupants (more capable of self-preservation) and the other being a row that includes I-1 Condition 2 and I-2 occupants (less capable of self-preservation). For I-1 Condition 1 and I-3 occupants, the Committee proposed a height of 120 feet for Type IV-B (versus 180 feet from the general methodology summarized above) and a height of 180 feet for Type IV-A (versus 270 feet from the general methodology summarized above). For those I-1 Condition 2 and I-2 occupants, the Committee took a very conservative approach and will only allow the heights that are already permitted by code for traditional Type IV construction.

Background information: The ICC Board approved the establishment of an ad hoc committee for tall wood buildings in December of 2015. The purpose of the ad hoc committee is to explore the science of tall wood buildings and to investigate the feasibility and take action on developing code changes for tall wood buildings. The committee is comprised of a balance of stakeholders with additional opportunities for interested parties to participate in the four Work Groups established by the ad hoc committee, namely: Code; Fire; Standards/Definitions; and Structural. For more information, be sure to visit the ICC website https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/ (link active and up to date as of 12/27/17). As seen in the “Meeting Minutes and Documents” and “Resource Documents” sections of the committee web page, the ad hoc committee reviewed a substantial amount of information in order to provide technical justification for code proposals.

The ad hoc committee developed proposals for the followings code sections. The committee believes this package of code changes will result in regulations that adequately address the fire and life safety issues of tall mass timber buildings.

IBC Code Section	Description
403.3.2	Water supply requirements for fire pumps in high rise buildings of Type IVA and IVB construction.
504.3	Allowable building height (feet) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT construction.
504.4	Allowable building height (stories) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
506.2	Allowable building area for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
508.4.4.1 509.4.1.1 (new)	Requirements for mass timber building elements serving as fire barriers or horizontal assemblies in buildings of Type IVB of IVC construction.
602.4	Type of Construction requirements for new proposed types of construction: Types IVA, IVB and IVC. No changes to Type IV HT construction. Includes definitions for new terms: Mass timber and Noncombustible protection (mass timber). **THIS IS THE KEY CODE CHANGE PROPOSAL WHICH OUTLINES THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED NEW TYPE OF MASS TIMBER BUILDINGS. THE PROPOSAL ALSO ADDRESSES CONCEALED SPACES, ADHESIVE PERFORMANCE AND EXTERIOR WALL PROTECTION.**
703.8 (new)	The performance method to determine the increase to the fire resistance rating provided by noncombustible protection applied to the mass timber building element.
703.9 (new)	Requirements for sealants and adhesives to be placed at abutting edges and intersections of mass timber building elements. The reason statement references a Group B proposal to Chapter 17 for special inspection requirements of sealants and adhesives.
718.2.1	Requirements on the use of mass timber building elements used for Fireblocking.
722.7 (new)	Requirements for the fire resistance rating of mass timber elements, including minimum required protection and gypsum board attachment requirements.
3102	Requirements for membrane structures using Type IV HT construction.
3314.7 (new)	New special precautions during construction of buildings of Types IVA, IVB and IVC construction: Standpipes; Water supply for fire department connections; Noncombustible protection required for mass timber elements as construction height increases.
Appendix	Requirements for walls, floors and roofs of Type IV HT construction in buildings located in Fire Districts.
IFC Code Section	**Description**
701.6	Requirements which stipulate the owner's responsibility to maintain inventory of all required fire resistance rated construction in buildings of Types IVA and IVB construction. This includes an annual inspection and proper repair where necessary.
Proposed changes to be submitted in 2019 Group B	
IBC Chapter 17	Required special inspections of mass timber construction • Structural • Sealants and adhesives (see IBC 703.8)
IBC Chapter 23	An update to referenced standard APA PRG 320 Standard for Performance –rated Cross-laminated Timber which is currently undergoing revision to ensure the adequacy of the adhesives under fire conditions.

In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the tests, and many members witnessed the test in person or online. The results of the series of 5 fire tests provide additional support for these proposals, and validate the fire performance for each of the types of construction proposed by the committee. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of through-penetration fire stops, and to evaluate conditions for responding fire personnel.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3 ½ minutes, please visit:

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

G75-18

Public Hearing Results

Committee Action: As Modified

Committee Modification: In Table 503.4, the value under Type IV A construction is to be 180 instead of 270 and the value under Type IV B construction is to be 120 instead of 180. All other portions of the proposal are not modified.

Committee Reason: The modification proposed makes this proposal work. The proposal was excessive without it. Otherwise, many of the reasons cited by the committee for proposal G80-18 apply. (Vote: 12-2)

Assembly Action: None

G75-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)requests As Modified by This Public Comment.

Further modify as follows:

2018 International Building Code

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION											TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A	~~B~~	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	~~65~~	65	65	50	40
	S	UL	180	85	75	85	75	270	~~180~~	85	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	120	~~90~~	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	~~65~~	65	65	50	40
	S	UL	180	85	75	85	75	140	~~100~~	85	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	~~65~~	65	65	50	40
	S	UL	180	85	75	85	75	180	~~120~~	85	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	~~65~~	65	65	50	40
	S	UL	180	85									
I-4	NS[d, g]	UL	160	65	55	65	55	65	~~65~~	65	65	50	40
	S	UL	180	85	75	85	75	270	~~180~~	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	~~65~~	65	65	50	40
	S13D	60	60	60	60	60	60	60	~~60~~	60	60	50	40
	S13R	60	60	60	60	60	60	60	~~60~~	60	60	60	60
	S	UL	180	85	75	85	75	270	~~180~~	85	85	70	60

For SI:
1 foot = 304.8 mm.

UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Commenter's Reason: We recommend that the Type IV-B mass timber designation be deleted from the tall wood building proposals.
The origins of the development of the types of construction were originally developed to “account for the response or participation that a building’s structure will have in a fire condition originating within the building as a result of the occupancy or the fuel load” (Example source from BOCA National Building Code 1993 Commentary). The modern day types of construction are parsed out into three primary categories of construction; noncombustible (Types I and II), noncombustible/combustible (Types III and IV) and combustible (Type V). Subcategories were created to identify the protection; Type A for protected and Type B for unprotected.

What we have within proposals G75-18, G80-18, G84-18, G89-18, and G108-18 is the addition of a new construction category that has been proposed based on the need to satisfy aesthetics based on the combination of Types IV-A and IV-C, which is a departure from the black and white construction categories based on construction that is either non-combustible or combustible. We feel this inappropriate for the codes to begin to designate designer type construction categories.

In the past such mixing and matching of construction types into building or structure is more suited to the IBC Section 104.11 (Alternative materials, design and methods of construction and equipment), or through use of the ICC International Performance Code or performance analysis. We feel that these are the most appropriate options for the mixing-and-matching of construction types in building design.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This will not increase or decrease the cost of construction as this code change proposal and public comment address information that was not previously contained in the code, therefore there is no cost impact when compared to present requirements.

Public Comment 2:

Proponent: Brian M. McGraw, P.E., Virginia Department of Fire Programs, State Fire Marshal's Office, representing Virginia State Fire Marshal's Office, Virginia Fire Services Board (brian.mcgraw@vdfp.virginia.gov)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANEa

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION											TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~270~~ 85	~~180~~ 85	85	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	~~120~~ 65	~~90~~ 65	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~140~~ 85	~~100~~ 85	85	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~180~~ 85	~~120~~ 85	85	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									
I-4	NS[d, g]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~270~~ 85	~~180~~ 85	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	~~270~~ 85	~~180~~ 85	85	85	70	60

For SI: 1 foot = 304.8 mm.

UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building ~~Code.~~Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Commenter's Reason: The Virginia Fire Services Board opposes Proposal G75-18 as originally submitted. We propose that the allowable heights in this proposal be reduced to those currently allowed for Type IV-HT construction until additional testing can be performed to validate the assumptions on which the currently proposed heights are based. While we do not oppose the concept of utilizing renewable resources, such as timber, in the construction of buildings, we are not convinced that 270 foot tall wood buildings provide an acceptable level of safety to occupants or responding firefighters.

The reason statement for this proposal indicates that the Ad-Hoc Committee on Tall Wood Buildings (TWB) discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings including:

- Egress systems designed to protect building occupants during the design escape time, plus a safety factor.
- Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

There is no reference in the stated performance objectives related to protecting firefighters and other emergency responders during the time required to access and extinguish a fire. The Report on High-Rise Fireground Field Experiments , NIST Technical Note 1797, published in April 2013, indicates times between 21 and 23 minutes from fire ignition for fire crews to reach the 11^{th} floor of a high-rise building, depending on crew size. These times are based on studies involving major metropolitan fire departments. There are many variables that could significantly increase these times, including time for notification of the fire department, turnout time, response time and vertical travel time to reach higher floors.

There were 14 proposals submitted by the TWB. Only one, G28-18, addresses the reliability of fire suppression systems. It requires the water supply to required fire pumps be supplied by connections to not fewer than two water mains located in different streets for tall wood buildings that are more than 120 feet in building height. This proposal does nothing to increase the reliability of fire suppression system in buildings less than 120 feet tall. In addition, it does nothing to increase the reliability of the suppression systems within the building itself. There is no requirement to demonstrate the reliability of the fire suppression system as compared to the evacuation time and risk of collapse. It should also be noted that this proposal allows the construction of tall wood buildings to a height of 65 feet with no requirements for fire suppression systems.

We acknowledge that fire tests have been conducted; however, we do not believe that the results of the fire tests provide sufficient justification to allow tall wood building to be constructed to heights of 270 feet. The original proposal cites engineering judgment as the basis for a comparative analysis between Type I and Type IV buildings and the extrapolation of two-story fire tests to 270 foot tall structures. There has been no testing to demonstrate the performance of these structures after aging for a period of years or decades.

Bibliography: Report on High-Rise Fireground Field Experiments. NIST Technical Note 1797. Butler, Kathryn M. (editor). April 2013. https://cpse.org/wp-content/uploads/2018/02/NIST.TN_.1797-min.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal does not alter the method of construction; rather it limits the allowable height for this type of construction.

Public Comment 3:

Proponent: Michael O'Brian, International Assocation of Fire Chiefs, representing Riverside County Fire Department, representing California Fire Chiefs Association (mobrian@brightonareafire.com); Kevin Reinertson (kevin.reinertson@fire.ca.gov)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANEa

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION											TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~270~~ 180	~~180~~ 120	85	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	~~120~~ 85	~~90~~ 65	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~140~~ 100	~~100~~ 85	85	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~180~~ 125	~~120~~ 85	85	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									
I-4	NS[d, g]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	~~270~~ 180	~~180~~ 120	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	~~270~~ 180	~~180~~ 120	85	85	70	60

For SI: 1 foot = 304.8 mm.

UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Commenter's Reason: This is a series of comments to modify the proposed height, stories, and allowable area of the new Type IV-A, Type IV-B, and Type IV-C proposed construction classifications as proposed by the Ad-Hoc Committee on Tall Wood Buildings.
There is concern the formulas utilized are not fully supported by technical substantiation and are missing the needed technical support to allow the construction type to such heights. This change takes a moderate approach and reduces the allowable heights, area, and stories by a factor of 30%.

This proposed public comment doesn't dismiss the concept out of hand, we do feel the current proposals go too far, to fast in an area of significant and long-lasting importance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change in cost of construction as these heights have not been permitted before with this construction classification.

Public Comment 4:

Proponent: Gary Bridgens, representing Mass Timber Code Coalition (info@buildtallbuildsafe.com)requests As Modified by Committee.

Commenter's Reason: PUBLIC COMMENT

SUBMITTED BY GARY BRIDGENS

ON BEHALF OF THE MASS TIMBER CODE COALITION

The Mass Timber Code Coalition has been organized to provide information on the code proposals drafted by the Ad Hoc Committee on Tall Wood Buildings

Mass timber is not new to the *International Building Code* (IBC). Currently listed as Type IV Heavy Timber, this construction type is a proven option that fully complies with the structural and fire resistive requirements of the IBC. The code recognizes that mass timber is a fundamentally different material than dimension lumber used in more familiar "stick built" wood construction. The code also recognizes the inherent fire resistance of mass timber, where charring in a fire event provides protection of inner structures, as well as a consistent and predictable rate of charring.

With the expansion of the mass timber supply chain, panels of cross-laminated timber (CLT), nail-laminated timber (NLT) and glue-laminated timber (Glulam), requests for approvals of tall mass timber buildings (TMTB) by local authorities have become more common. Estimates by industry sources have identified 35 current proposals for tall mass timber buildings, ranging from 7 to 24 stories, in 21 different jurisdictions.

Importantly, this interest in tall mass timber construction has been reliant on various local codes and approval processes. The IBC does not currently account for these tall wood buildings, beyond the current Type IV Heavy Timber height and area limitations.

The Ad Hoc Committee on Tall Wood Buildings (AHC-TWB)

To ensure the IBC keeps pace with the changing construction marketplace, the Board of Directors of the International Code Council (ICC) appointed the Ad Hoc Committee on Tall Wood Buildings (AHC-TWB) in 2015. The AHC-TWB included members from the code official, regulatory, construction, engineering, architectural, fire services and materials communities.

The AHC-TWB was specifically charged with investigating the science of mass timber construction, undertaking any necessary new research and recommending any code changes needed to ensure safety in TMTB. The AHC-TWB set performance criteria of its own: any code change developed was required to achieve the following.

> No collapse under scenarios of complete burn-out of fuel without automatic sprinkler protection;
> No high radiation exposure from the subject building to adjoining properties that risk ignition under severe fire scenarios;
> No unusual response from radiation exposure from adjacent properties that risk ignition of the subject building under severe fire scenarios;
> No unusual fire department access issues;
> Egress systems to protect occupants during design escape times plus a margin of safety;
> Enhanced and redundant fire protection systems to ensure performance during various fire scenarios.

Code Change Proposals

After two years of work, the AHC-TWB has produced 14 code change proposals. All 14 of these proposals were recommended for approval by various ICC committees at the recent ICC 2018 Group A Committee Action Hearing.

The key change, G108-18, defines three new categories of Type -IV Mass Timber construction:

Type IV-A: 1 to 18 stories based on Occupancy Classification. 3-hour fire resistance rating with non-combustible protection throughout;

Type IV-B: 1 to 12 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection on most mass timber surfaces;

Type IV-C: 1 to 9 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection for critical areas; exit enclosures, etc.

Each new construction type defined by the AHC-TWB (Type IV-A, B and C) has fire resistance requirements as robust or more robust than those required for comparable non-combustible (concrete and steel) buildings.

Other provisions provide standards for mass timber manufacturing, height/area restrictions, active and passive fire protection systems, fire safety during construction, enhanced water supply requirements, and standards for sealants and adhesives.

Fire Resistance of Mass Timber

Citing fire and market concerns, both the Portland Cement Association and the National Ready Mix Concrete Association have criticized the AHC-TWB code change proposals as "untested" and "unsound." However, these criticisms fail to consider that:

> The purpose of the International Building Code is to provide building officials with the tools they need to ensure public and first-responder safety. It is not to choose winners and losers in the market, nor is it to defend any single industry's position;
> Tall mass timber buildings already built are performing well;
> Mass timber (and heavy timber before it) has undergone extensive fire resistance testing in multiple fire scenarios by Underwriters Laboratories, the Southwest Research Institute, the National Research Council of Canada and the U.S. Government's ATF Fire Research Laboratory, the world's largest indoor fire investigation lab.

Numerous mass timber floor/ceiling and wall assemblies have been tested at national laboratories using ASTM E119 standards. This testing history shows that mass timber has repeatedly achieved the hourly fire resistance requirements of the code. This is in part because of charring properties that provide a steady and predictable measurement of fire resistance. Additionally, detailed code requirements for non-combustible protection applied to the mass timber greatly enhance the hourly rating. Further, fire protection systems (active and passive) also ensure safety in mass timber structures.

The AHC-TWB benefitted from recent tests in 2017 at the U.S. ATF Fire Research Laboratory on full-scale mass timber buildings. Most tests assumed an unlikely failure of sprinkler systems:

> Mass timber apartment with full fuel load. Fully protected by Type X gypsum wall board. Fire self-extinguished after 3 hours with no significant charring on mass timber surfaces;
> Mass timber apartment with full fuel load. 20% exposed CLT ceiling. Test concluded at 4-hour mark after fuel burnout. CLT self-extinguished after charring;
> Mass timber apartment with full fuel load. 2 CLT walls fully exposed. Fuel burnout at 4-hours. CLT walls self-extinguished after charring;
> Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire quickly extinguished;
> Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire allowed to grow to flashover (23 minutes) then quickly extinguished.

In fact, proposed Type IVA, B and C fire resistance requirements are the same or more robust than comparable steel and concrete construction. Further detail can be obtained at buildtallbuildsafe.com.

Benefits of Mass Timber Construction

In addition to the obvious environmental attributes of using a renewable resource in construction and the boost for the economies in timber-producing regions, builders and communities cite several distinctive benefits that make mass timber buildings an attractive option:

Builders report several benefits, including:

> **Job site safety.** Mass timber panels are easy to install and can be delivered to a work site as needed, rather than stockpiled. Moreover, worker training is easier as is exposure to job site risk;
> **Job site efficiency.** Persistent labor shortages are eased as more workers are qualified to work with mass timber panels. Jobs are built more quickly and materials are delivered as needed, thereby reducing costs;
> **Design.** The favorable strength-to-weight ratio of CLT and the characteristics of wood offer more design options and more attractive built environments, improving business performance.

Local communities embrace mass timber construction:

> **Faster and quieter.** The dislocation experienced by neighboring communities is reduced in mass timber projects. In addition to lower fire risks, things occur more quickly and panels are installed more simply than comparable steel and concrete sites;
> **Greener.** Forestry officials cite the carbon sequestration properties of wood, but also the benefits to forest management of using wood products more efficiently and effectively, thereby further reducing decay and fire risk;
> **Energy efficient.** Manufacturing mass timber is less energy intensive then other building materials. More importantly, the superior insulation characteristics of wood far outperform steel and concrete structures.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

Public Comment 5:

Proponent: Sam Francis, representing American Wood Council (sfrancis@awc.org)requests As Modified by Committee.

Commenter's Reason: AWC was appointed to be a member of the ICC Tall Wood Building Ad Hoc Committee (TWB), the single wood industry representative on the TWB. AWC is not speaking for TWB on this issue. It simply is relaying information regarding the development of the proposals. Other members of the 16-member TWB included representation from architects, engineers, fire protection engineers, fire marshals, testing laboratories, and fire fighters, as well as the major materials industries. After two years of study, listening to testimony, reviewing documents, reviewing public input, conducting an extensive test program, and reviewing test results from tests around the world, the TWB made this proposal to ICC for the membership s consideration.
Early in the process, the TWB heard proposals from four different commentors suggesting maximum stories of 20, 24, 40, and 42 stories. The TWB worked through dozens of drafts of the proposed new types of construction, dozens more pertaining to the building height in stories, nearly a dozen pertaining to building height in feet and nearly a dozen regarding maximum permitted building area per floor. These documents were all posted to the TWB page of the ICC website. Comments were solicited for all drafts.

The first aspect of height and area taken up by the TWB was height in stories. That seemed to be the easiest to get at with the information gleaned from the testimony and documentation presented to the TWB. A public comment by AWC to G80 outlines how experts from around the world presented a case to the TWB that mass timber was equivalent to types I-A and I-B in every way other than the combustibility of the base material. They outlined various strategies for overcoming that combustibility issue. The TWB relied upon this concept of equivalent performance to determine its maximum permitted height in stories. The Reason Statement provided by the TWB Chairman, Steve DiGiovanni, clearly lays out the background for, and the process of, the deliberation on Height in Stories. That is a must read to understand this process and its outcomes.

Next, based upon comments submitted, TWB tried to assign height in feet to its chosen maximum stories. In its first drafts, the maximum number of stories for proposed type IV-A was 24 for a few occupancy groups. Similarly, IV-B was proposed to be limited to 12 stories based on the equivalency mentioned above. Thus, IV-B was assigned the same maximum height in feet as type I-B, 180 feet. In regards to the fire service s ability to address fires in mass timber buildings at these heights, the following rationale was used:

AWC was appointed to be a member of the ICC Tall Wood Building Ad Hoc Committee (TWB), the single wood industry representative on the TWB. AWC is not speaking for TWB on this issue. It simply is relaying information regarding the development of the proposals. Other members of the 16-member TWB included representation from architects, engineers, fire protection engineers, fire marshals, testing laboratories, and fire fighters, as well as the major materials industries. After two years of study, listening to testimony, reviewing documents, reviewing public input, conducting an extensive test program, and reviewing test results from tests around the world, the TWB made this proposal to ICC for the membership s consideration.

Early in the process, the TWB heard proposals from four different commentors suggesting maximum stories of 20, 24, 40, and 42 stories. The TWB worked through dozens of drafts of the proposed new types of construction, dozens more pertaining to the building height in stories, nearly a dozen pertaining to building height in feet and nearly a dozen regarding maximum permitted building area per floor. These documents were all posted to the TWB page of the ICC website. Comments were solicited for all drafts.

The first aspect of height and area taken up by the TWB was height in stories. That seemed to be the easiest to get at with the information gleaned from the testimony and documentation presented to the TWB. A public comment by AWC to G80 outlines how experts from around the world presented a case to the TWB that mass timber was equivalent to types

I-A and I-B in every way other than the combustibility of the base material. They outlined various strategies for overcoming that combustibility issue. The TWB relied upon this concept of equivalent performance to determine its maximum permitted height in stories. The Reason Statement provided by the TWB Chairman, Steve DiGiovanni, clearly lays out the background for, and the process of, the deliberation on Height in Stories. That is a must read to understand this process and its outcomes.

Next, based upon comments submitted, TWB tried to assign height in feet to its chosen maximum stories. In its first drafts, the maximum number of stories for proposed type IV-A was 24 for a few occupancy groups. Similarly, IV-B was proposed to be limited to 12 stories based on the equivalency mentioned above. Thus, IV-B was assigned the same maximum height in feet as type I-B, 180 feet. In regards to the fire service s ability to address fires in mass timber buildings at these heights, the following rationale was used:

The height limit, in feet, proposed for Type IV-B is even more conservative when considering that Type IV-B requires a greater degree of fire resistance than that of I-B when the *fire-resistance rating* of the building elements in Type IB construction are reduced to only the *fire-resistance ratings* required for Type IIA as permitted by Section 403.2.1 of the IBC. In effect, the proposed 2 hour fire resistance ratings required for Type IV-B will be twice that allowed by the IBC, since its inception, for those buildings under 420 feet whose building elements are permitted to be of only 1 hour fire resistance in accordance with the high rise provisions of Chapter 4, which will not apply to the proposed mass timber construction types.

Type I-A is, in most cases unlimited in height. The TWB agreed that the performance of IV-A was equivalent, but its conservative approach meant that they chose not to permit IV-A to enjoy the unlimited height that I-A does. In fact, the approach was so conservative that it considered only increasing the height in feet by 50% over type IV-B. So a modest increase of 50% was chosen. This is infinitely less than the unlimited height in feet permitted in type I-A for nearly every use group.

The reason statement offered by the TWB for this proposal clearly explains that the allowable height in feet was determined by assessing the overall performance of the new types of construction and equating them to existing types of construction. It also clearly defines the acceptable performance which it found to be equivalent to the higher types. From the beginning, the TWB has been committed to criteria which result in acceptable performance.

The fire test program, drafted by the Fire Work Group of the TWB may be seen as videos of each of the five tests. They can be found at this link or on the ICC TWB web page.

https://www.youtube.com/playlist?list=PL_sDiz8JiMIwby77vfpPSPucEhBuEK22P

This proposal is thoroughly conservative. The following points address claims made by opponents:

<u>Concerns about exterior fire testing:</u>

The TWB proposals significantly reduce the risk of exterior building surface flame propagation by prohibiting all combustibles on the exterior side of exterior walls (except for the required water resistive barrier). Continuous insulation on the exterior, where provided, will be non-combustible. In addition, protection with at least 40 minutes of noncombustible material (typically a layer of 5/8-inch type X gypsum wallboard) is required on the outside of mass timber exterior walls. What is proposed therefore is more conservative than any other construction type, including Types I and II, virtually eliminating the possibility of fire spread on exterior walls due to combustible materials.

<u>Concerns about the testing's relevance to tall wood buildings:</u>

The testing was designed by fire service representation on the TWB committee to directly address potential tall wood buildings, regardless of height. Rather than rely on standardized testing of building assemblies alone, with fire service input the TWB committee chose to undertake full-scale, multistory compartment testing, with high residential fuel loads for which no standardized test exists. Furthermore, in four of the five tests, the normal operation of the required automatic fire suppression system (sprinklers) was not allowed. The fires in tests applicable to the proposed 18 and 12 story limits (Types IV-A and IV-B respectively) were allowed to continue throughout the decay phase and well past burn-out,

Type I-A is, in most cases unlimited in height. The TWB agreed that the performance of IV-A was equivalent, but its conservative approach meant that they chose not to permit IV-A to enjoy the unlimited height that I-A does. In fact, the approach was so conservative that it considered only increasing the height in feet by 50% over type IV-B. So a modest increase of 50% was chosen. This is infinitely less than the unlimited height in feet permitted in type I-A for nearly every use group.

The reason statement offered by the TWB for this proposal clearly explains that the allowable height in feet was determined by assessing the overall performance of the new types of construction and equating them to existing types of construction. It also clearly defines the acceptable performance which it found to be equivalent to the higher types.

From the beginning, the TWB has been committed to criteria which result in acceptable performance.

The fire test program, drafted by the Fire Work Group of the TWB may be seen as videos of each of the five tests. They can be found at this link or on the ICC TWB web page.

https://www.youtube.com/playlist?list=PL_sDiz8JiMlwby77vfpPSPucEhBuEK22P

This proposal is thoroughly conservative. The following points address claims made by opponents:

Concerns about exterior fire testing:

The TWB proposals significantly reduce the risk of exterior building surface flame propagation by prohibiting all combustibles on the exterior side of exterior walls (except for the required water resistive barrier). Continuous insulation on the exterior, where provided, will be non-combustible. In addition, protection with at least 40 minutes of noncombustible material (typically a layer of 5/8-inch type X gypsum wallboard) is required on the outside of mass timber exterior walls. What is proposed therefore is more conservative than any other construction type, including Types I and II, virtually eliminating the possibility of fire spread on exterior walls due to combustible materials.

Concerns about the testing's relevance to tall wood buildings:

The testing was designed by fire service representation on the TWB committee to directly address potential tall wood buildings, regardless of height. Rather than rely on standardized testing of building assemblies alone, with fire service input the TWB committee chose to undertake full-scale, multistory compartment testing, with high residential fuel loads for which no standardized test exists. Furthermore, in four of the five tests, the normal operation of the required automatic fire suppression system (sprinklers) was not allowed. The fires in tests applicable to the proposed 18 and 12 story limits (Types IV-A and IV-B respectively) were allowed to continue throughout the decay phase and well past burn-out,

The committee action is incorrectly reported in the CAH report. As shown above in the committee action, it fails to include the Occupancy Group to which the modified height should apply. the text of the modification submited by Mr. DiGiovanni, is

G75

Table 504.3

Change the following two entries in the table:

Occupancy Classification: I-4 (sprinklered)

Type IVA ~~270~~ 180

Type IVB ~~180~~ 120

SO this should apply to group I-4 only, not all the groups as it appears in the report above

Bibliography:

Modification DiGiovanni - 1

G75

Table 504.3

Change the following two entries in the table:

Occupancy Classification: I-4 (sprinklered)

Type IVA ~~270~~ 180

Type IVB ~~180~~ 120

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This is a heretofore unknown type of construction. Adding alternatives in the code generally means creating more choice which should result in lower costs.

The impact of the incorrect modification is to add cost. The impact of this modification is the same as the impact in the original proposal because it only fixes the editorial problem

Public Comment 6:

Proponent: Patrick Ford, representing selfrequests Disapprove.

Commenter's Reason: Reason: These code changes would allow for structurally unsafe conditions to be inherently designed into tall buildings. As proposed, they would introduce new categories of Type IV construction into the code and expand the number of storeys, allowable areas, and maximum heights of buildings framed with combustible materials. I believe that for several reasons, this would greatly increase the risk to firefighters and building occupants, as well as neighboring buildings. Several of the major decisions that went into the creation of this proposal were based on “engineering judgment” and significant extrapolation of test data from a two storey test building to buildings with dozens more storeys.
Aside from the potentially dangerous and unproven provisions in general, there are several specifics relative to structural connections in these new building types and sizes. I do not believe that these were addressed or at the very least not adequately addressed.

The new building types and increased limits allowed for in these proposals should not be allowed, and the proposals should be disapproved for the following reasons:

> The AHC-TWB report that was instrumental in many of the provisions indicates that connections were tested, but in fact, no exposed connections were ever tested in any of the assemblies.
> The compartment tests did not test any connections, nor did any of the standard ASTM tests, including the E84, E119, E814, nor the NFPA 285 tests.
> The full scale test did not have any exposed connections, yet the code explicitly notes exposed steel and metal caps or brackets allowed in type IV construction within the wood chapter. The exposed metal connectors and their fasteners penetrate well beneath the typical char layer of the structural member, significantly reducing the strength of the member at and near the connection itself. This can create many hot spots and potential critical structural failure locations throughout a tall building. No other tests addressed this issue either.
> Adhesive based splice connections remain unproven, the overall adhesive requirements being based on a testing protocol derived after a failed test.
> The Small Scale Adhesive Qualification Test Protocol (CSA 077 SSA.2) could conceivably be directed toward such connections or splices, but it is a test that lasts only 5 minutes per side of the tested specimen.
> As an additional note, the full scale test was run on only a two storey structure, leaving any critical structural connections that may have been needed to support only a single storey above. With code proposals allowing for many times this, these concerns should be much more carefully vetted before approval.

It should also always be remembered that in no other type of tall building allowed by the code, is the structure itself also fuel for the fire.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There would be no cost increase associated with my comment because if the code proposal were defeated, there would be no change in the building allowable from the current code.

Public Comment 7:

Proponent: Robert Grupe, representing Grupe Gypsum Consulting, LLC (rcgconsult@outlook.com)requests Disapprove.

Commenter's Reason: Overall building performance is predicated on the individual systems that comprise the structure. Further these systems are a series of individual building materials that are integrated based on their performance attributes, and compatibility with adjacent building materials. The proposed Tall Wood-frame construction is based primarily on the use of Cross Laminated Timber, CLT. However the proposal does not address potential compatibility issues, and in some cases lacks critical data to support required performance. Therefore, the CLT, system is not ready for use in wholesale high-rise construction. There are at least two critical system design areas that require additional testing and verification. These two examples are offered here to provide areas of specific concern. These examples are expressed in specific published white papers on the use of Cross-Laminated Timber.
The first example is on acoustics, specifically that of sound transmission through floor-assemblies. The current International Building Code has established minimum requirements for floor-to-floor transmission. In a published white paper entitled ***Mass Timber High-Rise Design Research: Museum Tower in Los Angeles Reimagined in Mass Timber*** (2015) the following statement is made regarding acoustics:

Testing is required to determine the ability of this assembly to obtain the code-required acoustic performance.

The paper covered the design of a timber-framed high-rise building. The acoustical design of the structure was centered around two floor-ceiling systems proposed for this project, both of which did not have any acoustic testing to substantiate compliance. The above comment followed a written description of each proposed floor/ceiling assembly.

Another issue of concern relating to additional required research is the proper design of connections that can accommodate the naturally occurring shrinking and swelling of CLT members primarily due to seasonal changes. The issue is the compatibility and serviceability of sealants and membranes that are incorporated into the CLT system. The following is taken from the ***CLT Handbook*** (2013):

Differential movement between CLT and other wood-based products or materials (in case of mixed materials and systems) need to be taken into account at the design and detailing stages due to potential shrinkage-induced stress that could undermine the connection capacity in CLT. More information and guidelines related to detailing will be provided in future versions of this document as additional studies need to be performed.

The point to be made here is that these are critical components in system and ultimately building design that require additional testing and research. It is obvious from the above mentioned white paper and handbook that the composite action of the independent building materials that make up the building systems have yet to be fully researched, tested, and detailed for use in general construction.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 8:

Proponent: Patrick Hainault, representing Self (path@matsenford.com)requests Disapprove.

Commenter's Reason: “Tower of Fire destroys LA apartment complex under construction.” This headline in the December 8, 2014 LA Times barely scratches the surface in describing the dangers from fires in buildings under construction when those buildings are framed with wood and wood-based materials. This fire not only destroyed at least 239 of the rental units and 2/3rds of the complex at the Da Vinci Apartments but caused significant damage to neighboring buildings and infrastructure, and greatly burdened the surrounding community in general. Yet, this proposal will dramatically raise the allowable heights and areas of buildings made from combustible materials.
It is not rationale to increase the allowable height of buildings as in this proposal when significant problems in much smaller buildings still present a well-documented risk to life and property. The assembly should overturn the committee decision to effectively prohibit the type of proposed construction until and if it can be proven safe during and after construction. The following paragraphs expand on the issues the assembly should consider in evaluating this proposal.

How do we even begin to come to grips with the risk to adjacent properties and occupied buildings during the construction phase when an 18- story wood structure allowed by this proposal is burning in a suburban or urban area? Without safeguards well beyond those currently in the code (or proposed as part of a series of related proposals) to protect adjacent properties and infrastructure, the impacts will be devastating. For example, the Da Vinci fire caused:

- Damage to adjacent buildings. At least four nearby buildings were damaged. The building at 221 N. Figueroa St., where the computers and cubicles melted, had significant damage on its 15 floors, with 300 windows blown out. Three floors were also damaged in the Los Angeles County Department of Health Services building at 313 N. Figueroa. LA Department of Water and Power staff identified at least 160 damaged windows. A Los Angeles Department of Building and Safety spokesman reported windows blew out in the north tower of its department headquarters, and the heat and smoke triggered sprinklers that soaked carpets and desks. Overall, the Da Vinci Apartments fire caused an estimated $111.5 million in damages, including $80 million in damage to city properties from the fire and the water used to extinguish it and $20-$30 million to the apartment complex.

- Damage to Infrastructure. A Caltrans spokesman estimated the fire caused $1.5-million damage to the freeway. Roads were closed around the area including a major commuter route during rush hour. Caltrans officials reported an exit sign over the 110 Freeway melted and would have to be replaced, forcing another freeway closure later the same week.
- Extensive impacts on the community. The attached study of the economic risk to taxpayers and the community posed by mid-rise apartments produced by assistant adjunct professor Urvashi Kaul at Columbia University captures the total cost impacts from fires like the Da Vinci apartments and smaller incidents. This study finds that:
  - In Los Angeles County, alone, fires in mid-rise residential buildings with combustible frames could have a negative impact of $22.6B over 15 years, including $17.14B in direct losses from property damage.
  - On average, fire in a mid-rise residential building constructed using combustible framing material costs the Los Angeles County a total of $141.81 per square foot in potential economic impact and $2.38 per square foot in lost tax revenues.
  - Potential impact the County may face in a single year could be $1.7 billion, including $1.3 billion in direct property damage.

The assembly is also urged to reconsider the argument that cladding requirements proposed to address fires in buildings under construction will resolve these issues. As demonstrated in a large fire from 2015 in a wood-framed apartment building in Edgewater, NJ, cladding will not stop a fire from spreading once the framing in part of the building ignites. It doesn’t create a barrier between unexposed framing and exposed framing, but only provides some resistance to ignition from within or outside of the building. The Edgewater fire spread rapidly throughout the buildings once framing behind a wall was ignited during repairs to the occupied and fully-clad building.

The Da Vinci and Edgewater fires are not uncommon incidents. Dozens of similar fires have occurred (see more at http://buildwithstrength.com/america-is-burning/) in buildings under construction since the market began broadly taking advantage of relatively recent changes to the IBC that allowed taller and larger wood-framed buildings. In a similar fire in Houston, the life of a construction worker literally hung in the balance as he was rescued from a burning wood framed building just seconds before the stories above came crashing down. The assembly can prevent these types of risks from greatly expanding by disapproving this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 9:

Proponent: William Hall, representing Alliance for Concrete Codes and Standards (jhall@cement.org)requests Disapprove.

Commenter's Reason: At the recent ICC Committee hearings in Columbus, OH, your committee **Failed you.** The general committee charged with looking at proposals and weighing justification **FAILED** to do their job when it came to Tall Wood Buildings. Despite overwhelming testimony that fire tests were inadequate, the committee simply ignored the fact that the TWB ADHOC committee only considered a two story residential structure during testing, and then used **'Engineering Judgment"** to determine that those results will be sufficient for 18 stories.
WHERE is the testing for all the other occupancy groups? 100% increases in story height are proposed for other use groups **without any justification.**

The ICC TWB ADHOC Committee has taken it upon themselves to develop a prescriptive TWB approach that **exceeds** the allowable heights of every country in the world. The United States just recently began looking at Mass Timber for taller buildings and yet, if this proposal goes through, we will allow mass timber 6 stories higher than any other country.

Not only will the U.S. allow the tallest buildings, we will also allow 12 story Mercantile, Storage and Factory to be built **without** gypsum covering on 40% of the CLT surface.

While mass timber may be an acceptable building material, it has not gone through the rigors of that are needed for high rise buildings**. Do not let the U.S. be the testing ground for these Tall Wood Buildings.**

Vote Dissapproval

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No effect

Public Comment 10:

Proponent: James Narva, National Assoc. of State Fire Marshals, representing National Assoc. of State Fire Marshals (jnarva@narvaassociates.com)requests Disapprove.

Commenter's Reason: The National Association of State Fire Marshals (NASFM) opposes the committee action to approve G75-18, G80-18, and G84-18 as submitted.
The proponent(s) of these proposals (TWB) are attempting to validate, and codify, various changes to the tables regarding height, area, and stories based, in part, on professional judgment of the committee. This concern is exacerbated by the understanding that the historic basis for the underlying table values were themselves somewhat arbitrary. Continued consideration of the TWB concept deserves a continuation of testing, evaluation, an abundance of caution, and always a default to the side of safety.

While NASFM doesn t dismiss the concept out of hand, we do feel the current proposals go too far, to fast, in an area of significant and long-lasting importance. The NASFM Model Codes Committee has observed the process and had members present at various meetings and TWB test burns.

In support of our opposition, we ask ICC members to consider the following aspects of these proposals:

- There is no scientific basis for increasing height and area limits beyond what is currently allowable in code for heavy timber buildings.
- There has been no live fire testing at or near the limits being proposed for these buildings.
- There has been no wind aided fire testing conducted.
- There is incomplete data regarding the fire loading of test burn buildings.
- There was no quantitative or qualitative analysis performed in the testing to measure smoke production from the materials
- There was no testing performed to evaluate the effects of exterior fires or how CLT materials are tested to NFPA 285 for compliance
- Professional Judgement is insufficient justification for a change of this magnitude.
- No indication that any seismic testing has been performed or evaluated which goes to the issue of resiliency and sustainability.
- To allow a proliferation of larger, taller wood buildings without proper testing and justification is premature and would impact the fire suppression environment significantly.

In the Reason section of each of the three proposals it states the performance objectives for TWB are:

- No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.
- No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios.
- No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios.
- No unusual fire department access issues.
- Egress systems designed to protect building occupants during the design escape time, plus a factor of safety.
- Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios.
- The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

Since no full-scale live fire testing has been conducted in buildings constructed to the limits being proposed, and the limited application of external influences to fire behavior, it is extremely difficult to accept that these proposals meet the committees own stated objectives. We are left with professional judgment as the only quantifiable substantiation presented for their passage. In addition, the reason statement places an over reliance on the presence of fire sprinklers. NASFM steadfastly supports the use of fire sprinklers. However, we are cognizant of the fact that sprinklers can never be 100% effective given the impact of human behavior in the areas of design, installation, maintenance, and intentional disabling.

NFPA *Sprinklers in Reported U.S. Fires during 2010 to 2014 Fact Sheet,* July 2017, states, "Sprinklers operated effectively in 88% of the fires large enough to activate them and reported sprinkler failures (660 per year) were twice as common as reported fires in which sprinklers were ineffective and did not control the fire."

- 40% of the combined sprinkler problems were due to system shut-offs.
- In three of every five (59%) incidents in which sprinklers failed to operate, the system had been shut off.
- In half (51%) of the fires in which sprinklers were ineffective, the water did not reach the fire.
- The term highly reliable as used by the TWB committee is subjective at best. While it is agreed that sprinklers provide a valuable life-saving service, it is speculative to base a major part of justification on this one item.
- Code committees, fire service organizations, and fire safety advocates have rightly demanded data to support decisions related to code changes. NASFM feels the limited testing, in conjunction with a proposed commitment to conduct additional tests, is insufficient currently to warrant changes of this magnitude.

On behalf of the National Association of State Fire Marshals we urge the membership to oppose the committee recommendation to approve this code change.

Bibliography: NFPA, *Sprinklers in Reported U.S. Fires during 2010 to 2014 Fact Sheet,* July 2017

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no cost increase or decrease associated with this comment due to the fact that it is a comment for dismissal of the original proposal.

Public Comment 11:

Proponent: Tien Peng, representing National Ready Mixed Concrete Association (tpeng@nrmca.org)requests Disapprove.

Commenter's Reason: While the Ad Hoc Committee had intended to validate the fire performance of cross laminated timber in fire conditions of buildings, the AWC/ATF compartment testing was limited in scope and not a thorough predictor of fire behavior for high rise building made of a new material. The testing so far is insufficient to capture the fire response characteristics in question. No tests were done to factor in wind, exterior performance, panel connections or moisture, which impacts material performance, fire-fighting and property damage. CLT is a great innovation for the wood industry but it s not ready for prime time and it s certainly not ready for us to build safely to 270 feet and 18 stories. The ICC should not adopt code provisions that will put people at risk.
1. CLT Reliability and Predictability Issues

Cross laminated timber does not have a long enough history to demonstrate their reliability and predictability. The structural design of modern tall buildings is governed by the need to efficiently transfer loading, particularly that from wind, whilst providing increasingly complex building functionality. The use of cross laminated timber implies a highly optimized systems which means the least amount of material to enabled efficient load transfer. Thus, in the event of a fire there is an increased risk not typical in mid-rise constructions, and especially not in a two-story mock up in a lab.

The NFPA with ARUP *Fire Safety Challenges of Tall Wood Buildings*paper noted (NFPA 2013)[i]:

- In a real fire situation, the load-bearing elements in CLT are expected to load-share , or redistribute in a method that is not easily predicted in simple fire testing.
- Previous CLT fire testing has resulted in delamination and char fall-off when exposed to fire conditions.
- This has the potential to increase the fire temperature and burning rate within the compartment, and could impact the structural fire resistance at later stages in the fire duration.

The full-scale fire testing in Norway (SPFR A15101 2016)[ii] showed:

- The temperature increased fast and flashover was reached after four minutes.
- Temperatures were significantly higher than the standard time-temperature curve according to EN 1363-1
- The fire did not cool down before manual suppression was initiated when the test room collapsed 1-hour 36 minutes after ignition
- The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin.
- The charring rate varied much faster than expected

We should not be putting lives in high rises at risk with this level of material unpredictability.

2. Exposed CLT Fire / Moisture /Delamination Issues

The National Institute of Standards (NIST) tests complete previously said there were concerns that flashover occurred earlier with CLTs, heat delamination of the exposed CLT affected its fire performance and a large re-flash occurred on the exposed wall with delamination of the second ply of the CLT. (NIST 2017)[i]

While fire departments understand the risk of collapse with solid wood, there is not enough documentation or history of bonded or laminated wood structures, and they may fail sooner under fire conditions. The problem is that under fire conditions an adhesive may either thermally soften or chemically degrade causing the member to lose its strength, leading to structural collapse. Hence, we see delamination from the NIST testing as well as the very real construction failure on portions of the new College of Forestry building at Oregon State University where a large section of subflooring made of cross-laminated timber gave way between the second and third stories.

Moisture is an important issue for delamination and in many parts of the country the laminated mass timber panels will experience an environment which may exceed the testing limits. Wood will change in all three orthogonal dimensions with changes in moisture, and the changes are not even. This not only means that some species swell more because of their higher density, but also wood of non-uniform density displays non-uniform swelling. Moreover, as wood swells and shrinks, adhesives do not follow with the same volumetric expansion. RDH Building Science full-scale mock-up study (Lepage 2017) [ii]notes that, The research indicates that CLT and mass timber is susceptible to dangerously high moisture contents, particularly when exposed to liquid water in horizontal applications. and other research indicate that CLT is at risk of structural damage by decay and rotting fungi (Zabel and Morrell 1992)[iii]

Clearly, we should not be putting lives in high rises at risk with this level of material unpredictability.

3. Fire / Connections Vertical Fire Spread

All connections used in current projects are proprietary and no information is publicly available regarding their performance. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors. Typically, the floor slab provides a robust barrier inhibiting external fire spread so long as it remains firmly supported by the structure. However, the AWC/ATF compartment fire testing had not adequately accounted for the connections in the CLT technologies to meet this crucial objective. The deformation of the connections when exposed to fire can expose gaps and flammable materials which can lead to spread both upwards through flaming, and downwards through dripping molten materials. Once fire starts spreading away from the floor of origin the safety of the occupants is compromised. Examples of vertical fire spread include:

- Las Vegas Hilton, USA: 22 Stories in approximately 25 minutes
- Caracas Tower, Venezuela: 17 floors in a 24-hour period
- Windsor Tower, Spain: 19 floors, ~7 hours for spread, 24 hours total fire duration
- TVCC Tower, China: 44 floors, around 15 minutes

4. Fire / Stack Effect

A similar concerning pattern emerges when discussing wind and air movement fire performance. One problem common to high-rises but not found in low-rise buildings is the stack effect movement of air inside the building.This air movement is critical to understand what happens during a fire event, as it can intensify a fire or allow flames and combustion gases to move beyond the room of origin. Fire personnel responding to a high-rise fire event need to understand where smoke and toxic gases may be going. Yet, shrinkage, moisture and creep, common in wood products including CLT, will create unpredictable opportunities for air movement within a building.

Air pressure and thermal differential with the use of CLT panels can shift the neutral pressure plane of the building. In cold weather (positive stack effect), the velocity of air channeling into the core from the lower floors is a very real concern to the occupants when they have to defend in place as well as fire service if the fire egress is compromised with smoke. In warm weather (reverse stack effect), where typically the staging floor is two floors below the fire floor, there can be concern of contamination, if there is unpredictability of where the fire path may be taking.

5. Fire / Wind

We typically associate wind with brush and wildland fires but it s just as important in structural fires.

- In 2009 a Texas probationary fire fighter and captain die as a result of rapid fire progression in a wind driven residential fire. Sustained winds from east/south-east at 17 mph with gusts up to 26 mph.
- Virginia Firefighters Battle Three-Alarm Townhouse Fire in 2011. In assessing the high winds and the fire conditions Battalion Barnes says fire crews tried to attack the flames inside two townhouses, but were forced back by intense heat and falling ceilings.

- In 2012 Prince George s County (Maryland), firefighters arrive on scene to a structure fire with winds impacting the rear of the structure. Shortly after forcing the front door open, they saw a dramatic change in fire behavior. As they made entry, they quickly experienced high velocity and high temperature gases, injuring seven firefighters, two critically.

The American Wood Council compartment fire tests did not account for wind loads.

Wind can add to the hazard to a low-rise fire, but it is most concerning around the upper floors of tall buildings. And high-rise fires create unique safety challenges for occupants and firefighters, even without the influence of wind. Wind can change the FLOW PATH of a fire and in some cases create a blowtorch effect and untenable conditions. When a window in the fire apartment fails, the influx of wind can create significant and rapid increases in the heat production of a fire. Smoke and heat spreading through corridors and stairwells, for instance, can inhibit occupants ability to escape and can limit firefighters ability to rescue them. Conditions in a corridor are of critical importance because it is the route that firefighters use to approach a fire and that occupants use to exit a building.

During the course of any structure fire, the wind may also influence exterior conditions and firefighter safety. Accelerated winds near high rises are caused by the downdraft effect , where the air hits a building and, with nowhere else to go, is pushed up, down and around the sides. The air forced downwards increases wind speed at street level. Tests conducted by National Institute of Standards and Technology (NIST 2012), the Fire Fighting Technology Group, FFTG, on positive pressure ventilation determined that an external wind speed of as low as 10 mph could cause a vented room within a structure to quickly spread from an apartment unit to a vent point, represented by a stairwell door. The spreading had floor-to-ceiling and wall-to-wall fire involvement with blowtorch effects. Moreover, if several towers stand near each other, the channeling effect, a wind acceleration created by air having to be squeezed through a narrow space. This Venturi effect will endanger the adjacent buildings.

6. Fire on Exterior

The AWC/ATF compartment fire tests did not account for exterior fire conditions and the proposed exterior proposal does not meet the required testing of CLT assemblies.

An important aspect of fire behavior in the affected building involves the burning behavior of materials on the exterior. While the AWC/ATF test demonstrated an understanding of CLT in an interior fire situation, the circumstances contributing to ignition scenarios of the exterior can be equally complex and equally important. In the past few years we have seen a number of deadly high-rise fires that propagated on the exterior of the structure.

- 2018 Almas Tower in Dubai, UAE
- 2017 Marco Polo apartment complex in Hawaii
- 2018 *Grenfell* Tower *fire* in West *London*

Simply testing the interior fire scenario does not capture potentially important parameters affecting CLT elements in tall wood buildings. If a fire in a heavy-timber building is not extinguished by the initial attack, a tremendous conflagration with flames coming out of the windows will spread fire to adjoining buildings by radiated heat. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors.

Notably missing from the proposals is how the mass timber exterior assembly in buildings over 40 feet in heightwould comply with NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components*.

- *Section 1403.5*: For combustible water-resistive barriers in buildings over 40 feet in height of Type I, II, III, or IV construction.
- *Section 1407.10.4*: For metal composite materials (MCM) used on buildings of Type I, II, III, and **IV** construction.
- *Section 1409.10.4*: For high-pressure decorative exterior-grade compact laminates (HPL) exterior wall coverings used on buildings of Type I, II, III, and **IV** construction.
- *Section 1509.6.2*: Combustible mechanical equipment screens used on buildings of Type I, II, III, and **IV** buildings.
- *Section 2603.5.5*: Exterior walls of buildings of Type I, II, III, and **IV** construction of any height incorporating foam plastic insulation, except for one-story sprinklered buildings.

This is a requirement yet there is no reference to NFPA 285 testing of exterior CLT assemblies. One test by Nordic Engineered Wood published under the Canadian ULC S134 is not enough of a sample size to validate the tall wood proposals. Again, there is not enough historical fires with cross laminated timber to provide information that can be used in an 85-ft building, much less one at 270 feet.

7. Limits of Redundancy

The ICC TW-AHC claimed the added safety factor of active sprinkler systems adds to the safety of the proposals. Without a doubt, the inclusion of fire sprinkler systems in our buildings since the late 1980 s has been effective at increasing the chances of survival in a fire. But when systems don t operate as intended (such as in a freeze failure with water damage) or fail in a high-rise fire condition, the impact can be large, not just in monetary terms, but also in the lives of the occupants and fire fighters.

The full-scale fire testing completed in Norway showed the The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin. (SPFR A15101 2016).[iv] Moreover, according to NFPA s report *U.S. Experience with Sprinklers*, sprinklers were effective at controlling the fire in 96% of fires in which they operated, but sprinklers were only effective in 88% of the fires large enough to activate them. The reported sprinkler failures (660 per year) were twice as common as reported fires in which sprinklers were ineffective and did not control the fire. A National Institute of Standards and Technology (NIST) study, *Estimates of Operational Reliability of Fire Protection Systems*, also demonstrates this over-reliance on fire sprinklers is misguided.

8. Untested Reference Standard

State and local governments that adopt and enforce model building codes which references a number of standards. Yet, the proposals regularly cite the newly referenced standard, *ANSI/APA PRG 320-2018: Standard for Performance-Rated Cross-Laminated Timber*, an untested document. The reference to ANSI/APA PRG 320-2018 resolves nothing and takes no legal responsibility for performance failure. APA PRG 320 has no real history of use or validation as a reliable document and no jurisdiction refers to this document. It is premature to utilize a standard that is rarely referenced and start building to 18 stories from it.

Bibliography: [i] https://www.nist.gov/el/fire-research-division-73300/national-fire-research-laboratory-73306/fire-safety-challenges-0
[ii] https://buildingsciencelabs.com/wp-content/uploads/2017/11/CCBST-2017-Moisture-Uptake-Testing-for-CLT-Floor-Panels.pdf

[iii] Zabel RA, Morrell JJ (2012) Wood microbiology: decay and its prevention. Academic press.

[iv] http://www.mypaper.se/html5/customer/355/11143/?page=21

[v] https://sustainable-fire-engineering.sustainable-design.ie/wp-content/uploads/2015/08/NFPA-FPRF_Tall-Wood-Buildings-Fire-Safety-Challenges_2013.pdf

[vi] http://www.mypaper.se/html5/customer/355/11143/?page=21

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed public comment would **reduce cost of construction**. Substantiation and references below.

1. Research:

A recent feasibility study [[i]] reveals that CLT construction is significantly more costly than other well-established construction methods such as concrete. Renowned structural engineers, Cary Kopczynski & Company found that the cost of the CLT structural system for a typical 10 story apartment building would cost $48 to $56 per square foot compared to $42 to $46 per square foot for concrete, translating nearly **20% premium** for Cross Laminated Timber.

2. Brock Commons, British Columbia

Per "University of British Columbia: Report to The Board of Governors, Tall Wood Student Residence, Brock Commons Phase 1" Report [[ii]], dated September 30, 2014,

- "The capital cost for the project is estimated at $44 million ($40m standard construction, plus $4m wood premium)."
- "The $4m estimated premium for advanced wood design and construction is to be funded from external sources including $3.45m secured to date from the Canada Wood Council (CWC) and Forest Innovation Investment."

This is a **10% premium** for Cross Laminated Timber at the 18-Story Brock Commons.

3. Framework Oregon:

Per the January 5, 2018 *Portland Oregonian* article "Wheeler Defends Decision to Invest In Pricey Complex" of the Portland Oregonian[[iii]],

- "While each unit is expected to cost an average $480,000 to build, the city's contribution will amount to $100,000 per apartment."
- Despite a pledge from Mayor Ted Wheeler to bring down the cost of affordable housing in Portland, the Portland Housing Bureau had nonetheless awarded the building $6 million toward the $29 million total. (A **21% subsidy** by the taxpayers for the 12- Story Framework project).

By the July 16, 2018 *Willamette Week* (*WW*) article "Plans for Record-Setting Timber Tower in Downtown Portland Fall Through" [[iv]] reported,

- The building, which was slated to include 60 *affordable* apartments, was projected to cost $651.43 per square foot, *WW* reported in December. (The 660-square foot two bedroom apartments were projected to cost $567,389 to build.)

4. Lumber Pricing:

And this doesn't consider the recent price increases of softwood lumber that have risen wildly from $424 per board foot a year ago to $536 in the second quarter of 2018. That's a **26% increase** in just one year. At the same time, concrete prices rose at a stable rate of 5%.

[i] http://buildingstudies.org/pdf/related_studies/Cross_Laminated_Timber_Feasibility_Study_Feb-2018.pdf
[ii] http://bog2.sites.olt.ubc.ca/files/2014/09/3.2_2014.09_Tall-Wood-Building.pdf
[iii] https://www.oregonlive.com/politics/index.ssf/2018/01/portland_mayor_ted_wheeler_def.html
[iv] http://www.wweek.com/news/city/2018/07/16/plans-for-record-setting-timber-tower-in-downtown-portland-fall-through/

Public Comment 12:

Proponent: Adam Shoemaker, representing ClarkDietrich (adam.shoemaker@clarkdietrich.com)requests Disapprove.

Commenter's Reason: IBC Section 602.2 states that 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 this code.
In table 601, Type IB and proposed Type IVB have the same Fire-Resistance Rating (FRR) requirements. I don t believe can you justify in this proposal to allow combustible AND non-combustible elements with the same FRR to have the same allowable building heights in table 504.3. It is not reasonable to extrapolate a two story fire test into a 180 foot tall building with combustible structural elements, when a structure with non-combustible elements has the same allowable height.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No cost effect.

Public Comment 13:

Proponent: Richard Swan, representing International Association of Fire Fighters (rswan@iaff.org)requests Disapprove.

Commenter's Reason: At this time the International Association of Fire Fighters is unable to support any change in the height or area of this type of construction. We believe there is still not enough research into many of the components and there is still little data on the materials and components used in the building of these products.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
If not adopted no change to the public on cost.

Public Comment 14:

Proponent: Larry Williams, representing Steel Framing Industry Associationrequests Disapprove.

Commenter's Reason: The leap in assumptions that fire tests on a two-story mock up can be extrapolated to fire performance of an 18-story building is an unreasonable extension in the allowance for use of "professional judgement." Proponents of G108-18 and related proposals state that the expected fire performance of mass timber buildings was “validated by a series of full scale multiple-story fire tests.” However, the actual model tested was only two storeys in height, and from this test users are expected to have confidence that a 180-foot tall building construction with cross-laminated timber will exhibit identical performance.

The fundamental problem of this assumption is that some characteristics of large fires have not been observed on small fires, either because they do not occur in small fires or because they are too small to be detected. It seems likely that a different set of controls of fire behavior may take over after a fire reaches a certain size or intensity. The difficulty of extrapolating from small to large fires is further complicated by the fact that behavior of fire is a pattern phenomenon--the behavior at one point is often dependent on the behavior at another point. The behavior of one part of a fire may change even if burning conditions at that point do not vary when the characteristics of the fire at some other point changes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with current requirements.

Public Comment 15:

Proponent: Dan Nichols, representing ICC Code Correlation Committee (ccc@iccsafe.org).

Commenter's Reason: The Code Correlation Committee (CCC) is not taking a position on this code change. The CCC submitted this public comment in order to bring a correlation issue to the attention of the full voting membership for the Public Comment Hearings and the Online Governmental Consensus Vote to allow the voting membership to coordinate actions on a package of code changes submitted dealing with tall wood buildings of mass timber construction. This package includes the parent proposal G108-18; if disapproved, the related proposals G28-18, G75-18, G80-18, G84-18,

G89-18, FS5-18, FS6-18, FS73-18, FS81-18 and F266-18, will not be correlated with any existing code text if they are approved.
The Code Correlation Committee is a standing committee of the International Code Council whose objectives, procedures and organization are set forth in Council Policy CP#44-13. The objective of the Code Correlation Committee is to maintain technical and editorial consistency among the International Codes and to assist staff in the evaluation and processing of code change proposals and comments that are exclusively editorial.

G75-18

G76-18

IBC: Table TABLE 504.3, Table TABLE 504.4

Proposed Change as Submitted

Proponent: Stephen Skalko, Stephen V. Skalko, P.E. & Associates, LLC, representing Masonry Alliance for Codes and Standards (svskalko@svskalko-pe.com); Jason Krohn, representing Precast/Prestressed Concrete Institute (jkrohn@pci.org); William Hall, Portland Cement Association, representing Alliance For Concrete Codes and Standards (jhall@cement.org)

2018 International Building Code

Revise as follows

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANEa

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION									
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A, ~~B~~, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
B	NS	UL	160	80	55	65	55	65	50	40
	S	UL	180	100	75	85	75	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S									
H-4	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85						
I-4	NS[d, g]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
R[h]	NS[d]	UL	160	~~65~~ 80	55	65	55	65	50	40
	S13D	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60
	S	UL	180	~~85~~ 100	75	85	75	85	70	60

For SI: 1 foot = 304.8 mm.

UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANEa, b

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION									
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	2	1

	S	UL	6	4	3	4	3	4	3	2
A-2	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-3	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-4	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	~~5~~ 6	3	5	3	5	3	2
	S	UL	12	~~6~~ 7	4	6	4	6	4	3
E	NS	UL	5	3	2	3	2	3	1	1
	S	UL	6	4	3	4	3	4	2	2
F-1	NS	UL	11	4	2	3	2	4	2	1
	S	UL	12	5	3	4	3	5	3	2
F-2	NS	UL	11	5	3	4	3	5	3	2
	S	UL	12	6	4	5	4	6	4	3
H-1	NS[c, d]	1	1	1	1	1	1	1	1	NP
	S									
H-2	NS[c, d]	UL	3	2	1	2	1	2	1	1
	S									
H-3	NS[c, d]	UL	6	4	2	4	2	4	2	1
	S									
H-4	NS[c, d]	UL	7	5	3	5	3	5	3	2
	S	UL	8	6	4	6	4	6	4	3
H-5	NS[c, d]	4	4	3	3	3	3	3	3	2
	S									
I-1 Condition 1	NS[d, e]	UL	9	4	3	4	3	4	3	2
	S	UL	10	5	4	5	4	5	4	3
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	4	3	2
	S	UL	10	5						
I-2	NS[d, f]	UL	4	2	1	1	NP	1	1	NP
	S	UL	5	3						
I-3	NS[d, e]	UL	4	2	1	2	1	2	2	1
	S	UL	5	3	2	3	2	3	3	2
I-4	NS[d, g]	UL	5	3	2	3	2	3	1	1
	S	UL	6	4	3	4	3	4	2	2
M	NS	UL	11	4	2	4	2	4	3	1
	S	UL	12	5	3	5	3	5	4	2
R-1 [h]	NS[d]	UL	11	4	4	4	4	4	3	2
	S13R	4	4						4	3
	S	UL	12	~~5~~ 6	5	5	5	5	4	3
R-2[h]	NS[d]	UL	11	4	4	4	4	4	3	2
	S13R	4	4	4					4	3
	S	UL	12	~~5~~ 6	5	5	5	5	4	3
R-3[h]	NS[d]	UL	11	4	4	4	4	4	3	3
	S13D	4	4						3	2
	S13R	4	4						4	3
	S	UL	12	~~5~~ 6	5	5	5	5	4	4

R-4[h]	NS[d]	UL	11	4	4	4	4	4	3	2
	S13D	4	4						3	2
	S13R	4	4						4	3
	S	UL	12	~~5~~ 6	5	5	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	3	1
	S	UL	12	5	3	4	3	5	4	2
S-2	NS	UL	11	5	3	4	3	4	4	2
	S	UL	12	6	4	5	4	5	5	3
U	NS	UL	5	4	2	3	2	4	2	1
	S	UL	6	5	3	4	3	5	3	2

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and 1103.5 of the International Fire Code.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Reason: Since development of the early building codes, and even with the International Building Code today, building size has typically been determined based on a combination of factors; (a) the occupancy type for the building; (b) the materials used to construct the building; and (c), the presence of automatic sprinkler protection. Regarding occupancy types, the fire loads associated with contents found in a particular occupancy group and the relative risk of danger to the occupants from fire because of the occupancy characteristics are considered. For the materials used to construct the building the presence of combustible materials used in the construction of the building structure itself are key. As the quantity of combustible materials decreases the relative risk of fire size, spread of fire to adjacent properties, and danger to the fire service are less such that the building sizes are allowed to increase. Another factor considered from a building materials aspect is the degree of fire resistance provided. When structural fire resistance is provided to the load carrying structural members the risk of damage to the structure or potential for collapse is also considered reduced. Finally, sprinkler protection has been utilized as a factor in allowing increases in the size of buildings. A good discussion of these concepts can be found in the report "*Fire-Resistance Classifications of Building Construction*", Report BMS92, National Bureau of Standards, October 7, 1942.

One thing of importance in the report is that buildings constructed of noncombustible materials and provided with at least 1-hour of fire resistance (classified as Fireproof construction in the report) were considered to be a much lower risk to the safety of the occupants and fire service, and to the spread of fire, than buildings constructed of noncombustible materials with little or no fire resistance (classified as Incombustible construction in the report). The same was said for buildings constructed with a combination of noncombustible exterior walls and interior combustible structural materials (classified as Exterior-Protected construction in the report). Hence the report advised that these noncombustible buildings with at least 1-hour fire resistance could be built to taller heights due to the lack of combustible materials in the structural systems combined with some level of fire resistance.

Unfortunately, when you look at Tables 504.3 and 504.4 in the 2018 International Building Code, building occupancies with low internal fire loads such as Group B, Business and Group R, Residential, when constructed of one-hour fire rated noncombustible construction (i.e. Type IIA), are not given due credit for the enhanced fire risk attributes when compared to buildings of one-hour fire resistance construction using a combination of noncombustible exterior walls and interior combustible structural materials (i.e. Types IIIA and Type IV). This is especially apparent when comparing these Group B and R occupancies to Group F, Factory and Group S, Storage Occupancies in Table 504.4.

Recognizing the lower fire risk of Type IIA construction compared to Type IIIA and Type IV construction, this code change proposes permitting Group B and Group R buildings of Type IIA construction to be built one story and 15-feet higher. These increases are attributed to elimination of the fire load present in the structural components, combined with the 1-hour fire resistance for these noncombustible structural elements, consistent with the fire safety premises for building construction types in BMS92. The new story heights are increased in proportion to the story heights/number of stories for existing buildings of Type IIA Group B and Group R, with rounding to be consistent with other values in Table 504.3.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Presently Group B and R occupancy buildings of noncombustible construction with 1-hour fire resistance (i.e. Type IIA) are only allowed to be built to the same story height as buildings of Group B and R occupancy with a combination combustible/noncombustible construction and a 1-hour fire resistance (i.e. Type IIIA and IV). However, to build Group B or R occupancy buildings of noncombustible construction taller, the fire resistance of the structural elements (i.e. columns and floors) are required to be increased to 2-hours (i.e. Type IB construction).

This proposal recognizes the improved fire safety of Group B and R occupancy buildings of Type IIA construction, compared to Types IIIA and IV construction of the same occupancy groups, since Type IIA buildings have a reduced fire load associated with the reduced use of combustible structural components. Allowing one additional story height of Group B and R occupancy buildings without having to increase the fire resistance of columns and floors will reduce the cost of construction of these noncombustible buildings Group B and R occupancies.

G76-18

Public Hearing Results

Errata: Missing table cells have been restored.

Committee Action: **Disapproved**

Committee Reason: The committee felt that a newer study and analysis is needed before making this change in the current code. In addition, the proposal conflicts with Section 510.6. (Vote: 13-1)

Assembly Action: **None**

G76-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen Skalko, representing Precast/Prestressed Concrete Institute (svskalko@svskalko-pe.com); Jason Krohn, Precast/Prestressed Concrete Institute, representing Precast/Prestressed Concrete Institute (jkrohn@pci.org); William Hall, Alliance for Concrete Codes and Standards, representing Alliance for Concrete Codes and Standards (jhall@cement.org)requests As Submitted.

Commenter's Reason: REASON: G76-18 is recommended for Approval As Submitted based on an additional technical study to answer the General Committee concerns.
Previously in the support statement for G76-18 it was identified that buildings constructed of noncombustible materials and provided with at least 1-hour of fire resistance (classified as Fireproof construction in the report) were considered to be a much lower risk to the safety of the occupants and fire service, and to the spread of fire, than buildings constructed of noncombustible materials with little or no fire resistance (classified as Incombustible construction in the report). The same was said for buildings constructed with a combination of noncombustible exterior walls and interior combustible structural materials (classified as Exterior-Protected construction in the report). These conclusions were cited from the report *Fire-Resistance Classifications of Building Construction* , Report BMS 92, National Bureau of Standards, October 7, 1942.

In their reason for Disapproval the General Committee stated *a newer study and analysis is needed before making this change in the current code* . Responding to this reason for disapproval an additional analysis has been performed to show that a building constructed of noncombustible materials poses a far less risk to the occupants and fire service than one constructed wholly or partly of combustible materials. This analysis was done by comparing the fire load density (FLD) of the occupied floor for an example Group R, Residential constructed of Type IIA construction and the same building constructed of Type IIIA construction.

The FLD can be defined as the fire load per unit floor area of a building and is well documented to reflect the total fire load in a building consisting of: (1) *combustible materials generally comprising furniture, equipment and stored objects goods*; and (2), *combustible components of the structural elements (permanent fire load) which can burn during a fire*. [p 1131, Chapter 35, SFPE Handbook of Fire Protection Engineering, Vol. 1, 2016.]. In comparing buildings of Type IIA construction with Type IIIA construction, the fire load portion of the FLD attributable to furniture, equipment, etc. can be treated as equal since it can be assumed the residents of a dwelling will have the same general fire load regardless of the building construction type. Thus, the main difference in the FLD of the building which can pose additional risk to occupants and fire service will be reflected by the permanent fire load of the structural components which can burn during a fire (e.g. the structural wood components).

The example building used in the analysis is a fully sprinklered, 5-story apartment building that is 23,056 square feet in footprint area. The typical floor plan and dimensions are shown in Figure 1.

Building structural features are approximately as follows:

- Exterior walls (bearing) - 2X6 fire retardant treated studs @ 16-in o.c. Total length 766 feet
- Interior walls between dwelling units (bearing) DBL 2X4 wood studs @ 16-in o.c. Total length 480 feet
- Interior corridor walls (bearing) - 2X4 wood studs @ 16-in o.c. Total length 580 feet
- Floor system 18-inch wood floor trusses, 3/4-inch gypcrete on 3/4-structural wood floor panel, 5/8-in Type X GWB on resilient channels.
- Roof system pre-engineered wood trusses (4:12 slope), 5/8-in structural wood sheathing, asphalt shingle roof

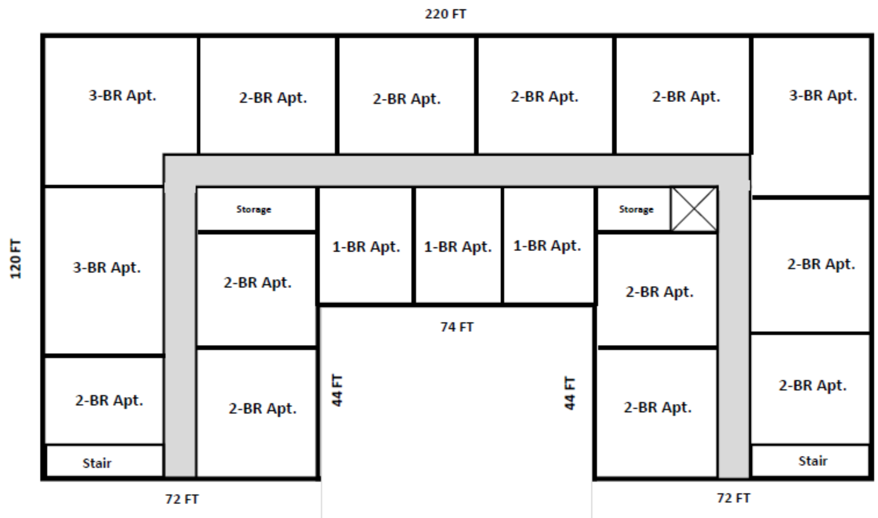


FIGURE 1

Typical Floor for 5-story Apartment Building

The permanent fire load of the structural components of a Type IIA building can generally be considered insignificant since the components are required to be of non-combustible materials according to the IBC. For the Type IIIA building the analysis examined the structural fire load contributed by the framing members of the exterior walls, the interior dwelling unit separation walls, the interior corridor walls and the structural wood floor panels. The additional contribution to the fire load density by the combustible interior non-bearing walls within each apartment and the floor trusses were not included. These were not considered for simplicity of the calculations but their inclusion would significantly increase the fire load density for each floor of the building so the conclusions reported are conservative.

In Section 7.3.2 of NFPA 557, *Standard for Determination of Fire Loads for Use in Structural Fire Protection Design, 2016,* the heat of combustion value for materials derived entirely of wood can be accepted as the value of 15MJ/kg. Further, in recognition of the fire retarding properties of some wood products, Section 7.3.4.6 of NFPA 557 permits the heat of combustion value to be taken as 10 MJ/kg. These values, converted to IP units, were used in this analysis. The IP units used are 6448 BTU/LB and 4,299 BTU/LB, respectively.

The wood species used in buildings of Type IIIA construction can vary depending on location and structural design parameters however, conservatively, the wood density was assumed to be 33-LB/FT^3. This value is consistent with the mid-range density for several wood species commonly used for light wood frame buildings. Taking into consideration a combination of wood studs, and top and bottom plates, the fire load contribution of wood for the three wall systems based on the heat of combustion of the wood can be summarized as follows [Ceiling height of the example apartment was specified at 8-ft 11-in]:

- 766 feet of 2X6 fire retardant wood studs for the exterior walls contributes approximately 61 million BTUs to the fire load per floor.
- 480 feet of DBL 2X4 wood studs for the tenant walls contributes approximately 68 million BTUs to the fire load per floor.
- 580 feet of 2X4 wood studs for the corridor walls contributes approximately 42 million BTUs to the fire load per floor.

In addition to the walls noted, consideration was also given to include the quantity of wood floor sheathing contributing to the fire load for the typical floor. Based on nominal 3/4-thick structural wood panels and excluding the floor openings for the two stairs and elevator shaft, the contribution is estimated to be 276 million BTUs per story for the 23,056 ft^2 example building floor area.

Thus, the fire load attributable to much of the wood framing on each story of the example building is over 400 million BTUs of fire load. Divided by the building area this results in an FLD attributable to the main light framed wood walls and floor deck of about 17,350 BTU/ft^2. This value makes it apparent why the BMS 92 Study referenced above concluded that noncombustible buildings with one-hour fire resistance (i.e. Type IIA) were considered a much lower risk to the safety of the occupants and the fire service, and to the spread of fire than buildings classified as Exterior-Protected construction (i.e. Type III) in the report.

To further illustrate this point, Figures 2 and 3 show two buildings under construction. Figure 2 is a 6-story building of noncombustible framing (i.e. like Type II). Figure 3 is a 5-story building of combustible framing (i.e. like Type III). These pictures illustrate the difference in the amount of combustible materials present based on construction type reflected by the analysis above.

Figure 2

Noncombustible Framing

Figure 3

Combustible Framing

Recognizing the lower fire risk of Type IIA construction compared to Type IIIA and Type IV construction, this code change proposes permitting Group B and Groups R buildings of Type IIA construction to be built one story and 15-feet higher. These increases are attributed to elimination of the fire load present in the structural components, combined with the 1-hour fire resistance for these noncombustible structural elements, consistent with the fire safety premises for building construction types in BMS92. The new story heights are increased in proportion to the story heights/number of stories for existing buildings of Type IIA Group B and Groups R, with rounding to be consistent with other values in Table 504.3. This proposal is also consistent with story increase allowed for Group F and S occupancy buildings, which contain much larger FLD due to contents, when changing from Type IIIA construction to Type IIA construction in Table 504.4.

The other item the General Committee noted in their reason statement was that the proposal conflicts with IBC Section 510.6. Upon examination of Section 510.6 this conclusion is not correct. In Section 510.1 the code identifies that the following provisions in this section (i.e. 510), including 510.6, are for the purpose of exempting from, or modify, the specific requirements of Chapter 5, such as allowable heights and areas based on the occupancy classification and type of construction. Thus, Section 510.6 specifically allows a height increase for Type IIA buildings in Groups R-1 and R-2 up to nine stories and 100-feet in height provided the other requirements in the section are followed. Nothing would prohibit the code user from applying Section 510.6 if they wanted to build a Group R-1 or R-2 building of Type IIA construction up to nine stories and 100-feet provided that section is followed.

By the same token, the code does not require any of the provisions in Section 510 be met provided the normal height and area requirements in Chapter 5 are met. Approval of G76-18 will allow Group R-1 R-2 buildings of Type IIA construction up to 6-stories in recognition that the fire risk to occupants and the fire service is significantly reduced when combustible structural components permitted in 5-story Type IIIA construction buildings are removed when Type IIA construction is chosen.

Recommend APPROVAL AS SUBMITTED for G76-18.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction Presently Group B and R occupancy buildings of noncombustible construction with 1-hour fire resistance (i.e. Type IIA) are only allowed to be built to the same story height as buildings of Group B and R occupancy with a combination combustible/noncombustible construction and a 1-hour fire resistance (i.e. Type IIIA and IV). However, to build Group B or R occupancy buildings of noncombustible construction taller, the fire resistance of the structural elements (i.e. columns and floors) are required to be increased to 2-hours (i.e. Type IB construction).

This proposal recognizes the improved fire safety of Group B and R occupancy buildings of Type IIA construction, compared to Types IIIA and IV construction of the same occupancy groups, since Type IIA buildings have a reduced fire load associated with the reduced use of combustible structural components. Allowing one additional story height of Group B and R occupancy buildings without having to increase the fire resistance of columns and floors will reduce the cost of construction of these noncombustible buildings Group B and R occupancies.

G76-18

G80-18

IBC: Table TABLE 504.4

Proposed Change as Submitted

Proponent:

Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB) (TWB@iccsafe.org)

2018 International Building Code

Revise as follows

TABLE 504.4

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANEa, b

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION					
	TYPE IV			TYPE IV	TYPE V	
	A	B	C	HT	A	B
A-1	3	3	3	3	2	1
	9	6	4	4	3	2
A-2	3	3	3	3	2	1
	18	12	6	4	3	2
A-3	3	3	3	3	2	1
	18	12	6	4	3	2
A-4	3	3	3	3	2	1
	18	12	6	4	3	2
A-5	1	1	1	UL	UL	UL
	UL	UL	UL	UL	UL	UL
B	5	5	5	5	3	2
	18	12	9	6	4	3
E	3	3	3	3	1	1
	9	6	4	4	2	2
F-1	3	3	3		2	1
	10	7	5	5	3	2
F-2	5	5	5	5	3	2
	12	8	6	6	4	3
H-1	NP	NP	NP	1	1	NP
	1	1	1			

H-2		1	1	1	2	1	1
		2	2	2			
H-3		3	3	3	4	2	1
		4	4	4			
H-4		5	5	5	5	3	2
		8	7	6	6	4	3
H-5		2	2	2	3	3	2
		3	3	3			
I-1 Condition 1		4	4	4	4	3	2
		10	7	5	5	4	3
I-1 Condition 2		3	3	3	4	3	2
		10	6	4			
I-2		NP	NP	NP	1	1	NP
		7	5	1			
I-3		2	2	2	2	2	1
		7	5	3	3	3	2
I-4		3	3	3	3	1	1
		9	6	4	4	2	2
M		4	4	4	4	3	1
		12	8	6	5	4	2
R-1[h]		4	4	4	4	3	2
						4	3
		18	12	8	5	4	3
R-2[h]		4	4	4	4	3	2
						4	3
		18	12	8	5	4	3
R-3[h]		4	4	4	4	3	3
						3	3
						4	4
		18	12	5	5	4	4
R-4[h]		4	4	4	4	3	2
						3	2
						4	3
		18	12	5	5	4	3
S-1		4	4	4	4	3	1
		10	7	5	5	4	2
S-2		4	4	4	4	4	2
		12	8	5	5	5	3
U		4	4	4	4	2	1
		9	6	5	5	3	2

PORTIONS OF TABLE NOT SHOWN REMAIN UNCHANGED

~~UL~~ TUL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and 1103.5 of the International Fire Code.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Reason:

The Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board to explore the science of tall wood buildings and take action on developing code changes for tall wood buildings. The TWB has created several code change proposals with respect to the concept of tall buildings of mass timber and the background information is at the end of this Statement. Within the statement are important links to information, including documents and videos, used in the deliberations which resulted in these proposals.

The TWB and it various WGs held meetings, studied issues and sought input from various expert sources around the world. The TWB has posted those documents and input on its website for interested parties to follow its progress and to allow those parties to, in turn, provide input to the TWB.

At its first meeting, the TWB discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings:

1. No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.
2. No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios.
3. No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios.
4. No unusual fire department access issues.
5. Egress systems designed to protect building occupants during the design escape time, plus a factor of safety.

6. Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

The comprehensive package of proposals from the TWB meet these performance objectives.

The TWB also determined that fire testing was necessary to validate these concepts. At its first meeting, members discussed the nature and intention of fire testing so as to ensure meaningful results for the TWB and, more specifically, for the fire service. Subsequently a test plan was developed. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of joints, and to evaluate conditions for responding fire personnel. The Fire WG then refined the test plan, which was implemented with a series of five, full-scale, multiple-story building tests at the Alcohol, Tobacco and Firearms (ATF) laboratories in Beltsville, MD. The results of those tests, as well as testing conducted by others, helped form the basis upon which the Codes WG developed its code change proposals. This code change proposal is one of those developed by the Codes WG and approved by the TWB.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3-1/2 minutes each, please visit: http://bit.ly/ATF-firetestvideos.

Both of these links were confirmed active on 12/27/17.

Number of Stories

This proposal addresses the building height, in terms of the number of stories, for the three new construction types proposed by the TWB. As set forth in the proposal to Section 602.4, the three new types of construction are Types IV-A, IV-B, and IV-C. The Committee examined each proposed type of construction for its safety and efficacy with regard to each occupancy.

The following approach was considered appropriate for the heights of the new construction types, based on the conclusions of the Committee:

1. Based upon TWB review of fire safety and structural integrity performance, Type IV-B is equated to Type I-B for height (in number of stories). A noteworthy item is that, per Section 403.2.1.1 of the IBC, Type I-B construction is permitted to be reduced to 1-hour Fire Resistance Rating (FRR); however, the TWB does not propose to allow the same reduction for Type IV-B. As a result, the comparison is between 2-hr mass timber construction that is permitted to be partially unprotected, versus 1-hr Type IB construction, and the Committee believes that 2-hr mass timber construction that is partially exposed per the limits of proposed Section 602.4 warrants the same heights as allowed for 1-hr Type I-B construction;

2. Type IV-A should be somewhat larger than IV-B, as Type IV-A construction is entirely protected (no exposed mass timber permitted) and the required rating of the structure is equivalent to those required of Type I-A construction (3-hr rating for structural frame). However, the Committee did not find it acceptable to allow the scale of heights

(many of which are unlimited) of Type I-A to be applied to Type IV-A. Instead, the Committee applied a multiplier of 1.5 to the heights proposed for Type IV-B construction (rounded up or down based on judgment) in order to propose reasonable height allowances for IV-A construction;

3. The Committee viewed Type IV-C as sufficiently similar to existing HT construction, especially in terms of the percentage of exposed wood (it is permitted to be entirely unprotected), and the resulting contribution to fire. While the height in feet for Type IV-C is proposed to be equal to the height in feet of Type IV-HT, the Committee felt that additional stories was warranted in some cases. Therefore, in terms of stories, the Committee proposes additional number of stories for Type IV-C construction when compared to traditional Type IV heavy timber construction. The Committee feels that some recognition is warranted for the fire resistance rating requirements (Type IV-C has 2-hour rating on structural elements, whereas traditional Type IV Heavy Timber used dimensional wood, which is understood to yield an approximate fire resistance rating equivalent to about 1-hour construction) and provided that flexibility when developing height, in terms of stories, for Type IV-C construction. A multiplier of 1.5 was applied from the Type IV-HT heights to develop reasonable numbers of stories for Type IV-C construction.

4. While the base code seems to allow significant heights for buildings without sprinklers (e.g., Table 504.4 currently allows 11 stories for NS Type I-B construction for many occupancy classifications), the Committee believes that no additional heights over what is already permitted for Type IV should be proposed for the NS (non sprinklered) rows. As such, where separate rows are provided for heights for the NS condition, the proposed heights for Types IV-A, IV-B, and IV-C are the same as those heights already permitted for Type IV for the NS condition.

This methodology explains the majority of the recommendations included in this proposal. Specifically, for occupancy groups A, B, E, R, and U, the methodology described above accurately reflects how the height proposals were developed.

The Committee applied professional judgment (from both a fire safety and a structural perspective) to develop a draft table, cell by cell, for all occupancy types. After further examination, reduced heights were proposed for F, H, I, M, and S occupancy classifications.

For F-1 occupancies, the Committee proposed a height of 7 stories for Type IV-B construction (versus the 12 stories currently permitted for I-B construction). A multiplier of 1.5 was used to propose a height of 10 stories for Type IV-A construction (when rounded down). No additional height was proposed for Type IV-C construction (Type IV-C proposed at 5 stories, and 5 stories is already permitted by code for Type IV-HT).

For F-2 occupancies, again the Committee is proposing a reduced number of stories, with 8 stories for Type IV-B construction (versus 12 stories that would be derived from the methodology). Again, a multiplier of 1.5 was used to propose a height of 12 stories for Type IV-A construction. No additional height is proposed for Type IV-C construction (Type IV-C proposed at 6 stories, and 6 stories is already permitted by code for Type IV-HT).

A conservative approach also explains the proposed heights for Group H occupancies. For Group H-1, only 1 story buildings are permitted by Table 504.4 for all construction types, so the proposal was adjusted to also limit all of the new Type IV construction types to 1 story as well.

For Groups H-2, H-3, and H-5, heights were intentionally made equal to the existing Heavy Timber heights. In other words, there is no proposal to any increased heights over what is already allowed by code for these use groups.

Group H-4, being corrosives which represents a health hazard (but not necessarily a fire hazard) to occupants and first responders, was also reduced, slightly. The TWB proposes 7 stories for Type IV-B construction (equivalency to Type I-B would have yielded 8 stories). The proposal allows only 8 stories for Type IV-A construction. No additional height is proposed for Type IV-C construction (Type IV-C proposed at 6 stories, and 6 stories is already permitted by code for Type IV-HT).

For Group I, the Committee took a more conservative approach and proposed an equivalent number of stories for Type IV-A construction, as is provided for Type I-B construction (10 stories for both construction types and occupancy types). The allowable heights for Type IV-B construction were selected to fall between the 10 stories for Type IV-A and the number of stories for Type IV-C construction. The Committee proposed a height of 7 stories for I-1, and 6 stories for I-2. No additional height was proposed for Type IV-C construction (IV-C construction heights in floors is equal to the number of floors already allowed for Type IV-HT, 5 stories for I-1, 4 stories for I-2).

For Group M occupancies, the Committee again took a conservative approach, and proposed an equivalent number of stories for Type IV-A construction, as is provided for Type I-B construction (12 stories for both construction types). The proposal for Type IV-B construction is 8 stories which is based on the use of the multiplier of 1.5 with respect to the Type IV-A proposal. A modest increase (from 5 to 6 stories) is proposed for Type IV-C construction due to the higher requirement for structural fire-resistance.

For Group S, while the base code does not differentiate between S-1 and S-2 in Type I-B construction (both 12 stories), the Committee recognized that the base code does provide a difference for Group F (10 stories for F-1, 12 stories for F-2). As explained above, this led the Committee to propose lower heights for F-1, than for F-2. The Committee felt this was appropriate with respect to the hazard differences between F-1 and F-2. Rather than basing our proposal for S occupancies on the same starting point of 12 stories, the Committee decided to simply copy the proposed heights for Group F into the rows for Group S for both IV-A and IV-B construction types. No additional height is proposed for IV-C construction (IV-C proposed at 5 stories for both S-1 and S-2, same as existing Type IV-HT heights).

Background information: The ICC Board approved the establishment of an ad hoc committee for tall wood buildings in December of 2015. The purpose of the ad hoc committee is to explore the science of tall wood buildings and to investigate the feasibility and take action on developing code changes for tall wood buildings. The committee is comprised of a balance of stakeholders with additional opportunities for interested parties to participate in the four Work Groups established by the ad hoc committee, namely: Code; Fire; Standards/Definitions; and Structural. For more information, be sure to visit the ICC website https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/ (link active and up to date as of 12/27/17). As seen in the "Meeting Minutes and Documents" and "Resource Documents" sections of the committee web page, the ad hoc committee reviewed a substantial amount of information in order to provide technical justification for code proposals.

The ad hoc committee developed proposals for the followings code sections. The committee believes this package of code changes will result in regulations that adequately address the fire and life safety issues of tall mass timber buildings

IBC Code Section	**Description**
403.3.2	Water supply requirements for fire pumps in high rise buildings of Type IVA and IVB construction.
504.3	Allowable building height (feet) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT construction.
504.4	Allowable building height (stories) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
506.2	Allowable building area for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
508.4.4.1 509.4.1.1 (new)	Requirements for mass timber building elements serving as fire barriers or horizontal assemblies in buildings of Type IVB of IVC construction.
602.4	Type of Construction requirements for new proposed types of construction: Types IVA, IVB and IVC. No changes to Type IV HT construction. Includes definitions for new terms: Mass timber and Noncombustible protection (mass timber). **THIS IS THE KEY CODE CHANGE PROPOSAL WHICH OUTLINES THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED NEW TYPE OF MASS TIMBER BUILDINGS. THE PROPOSAL ALSO ADDRESSES CONCEALED SPACES, ADHESIVE PERFORMANCE AND EXTERIOR WALL PROTECTION.**
703.8 (new)	The performance method to determine the increase to the fire resistance rating provided by noncombustible protection applied to the mass timber building element.
703.9 (new)	Requirements for sealants and adhesives to be placed at abutting edges and intersections of mass timber building elements. The reason statement references a Group B proposal to Chapter 17 for special inspection requirements of sealants and adhesives.
718.2.1	Requirements on the use of mass timber building elements used for Fireblocking.
722.7 (new)	Requirements for the fire resistance rating of mass timber elements, including minimum required protection and gypsum board attachment requirements.
3102	Requirements for membrane structures using Type IV HT construction.
3314.7 (new)	New special precautions during construction of buildings of Types IVA, IVB and IVC construction: Standpipes; Water supply for fire department connections; Noncombustible protection required for mass timber elements as construction height increases.
Appendix	Requirements for walls, floors and roofs of Type IV HT construction in buildings located in Fire Districts.
IFC Code Section	**Description**
701.6	Requirements which stipulate the owner's responsibility to maintain inventory of all required fire resistance rated construction in buildings of Types IVA and IVB construction. This includes an annual inspection and proper repair where necessary.
Proposed changes to be submitted in 2019 Group B	
IBC Chapter 17	Required special inspections of mass timber construction • Structural • Sealants and adhesives (see IBC 703.8)
IBC Chapter 23	An update to referenced standard APA PRG 320 Standard for Performance –rated Cross-laminated Timber which is currently undergoing revision to ensure the adequacy of the adhesives under fire conditions.

In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the tests, and many members witnessed the test in person or online. The results of the series of 5 fire tests provide additional support for these proposals, and validate the fire performance for each of the types of construction proposed by the committee. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of through-penetration fire stops, and to evaluate conditions for responding fire personnel.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3 ½ minutes, please visit:

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

G80-18

Public Hearing Results

Errata:

The complete table is now shown

Committee Action: As Submitted

Committee Reason:

We need to have increased heights for these new construction types based on all the work that has been done. Tweaks can be made and debated in the public comment process for other story heights. However, Canada has already set presidents for tall wood structures. We may already have overkill in fire protection features to address the additional stories. The information supporting this proposal is online on the ICC website for those that have concerns. (Vote: 12-2)

Assembly Action: None

G80-18

Individual Consideration Agenda

Public Comment 1:

Proponent:

Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org) requests As Modified by This Public Comment

Modify as follows:

2018 International Building Code

TABLE 504.4

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANEa, b

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION										TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	~~TYPE IV~~	TYPE IV	TYPE IV	TYPE V	
		A	B	A	B	A	B	A	~~B~~	C	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	~~3~~	3	3	2	1
	S	UL	6	4	3	4	3	9	~~6~~	4	4	3	2
A-2	NS	UL	11	3	2	3	2	3	~~3~~	3	3	2	1
	S	UL	12	4	3	4	3	18	~~12~~	6	4	3	2
A-3	NS	UL	11	3	2	3	2	3	~~3~~	3	3	2	1
	S	UL	12	4	3	4	3	18	~~12~~	6	4	3	2
A-4	NS	UL	11	3	2	3	2	3	~~3~~	3	3	2	1
	S	UL	12	4	3	4	3	18	~~12~~	6	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	1	~~1~~	1	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	~~UL~~	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	~~5~~	5	5	3	2
	S	UL	12	6	4	6	4	18	~~12~~	9	6	4	3
E	NS	UL	5	3	2	3	2	3	~~3~~	3	3	1	1

	S	UL	6	4	3	4	3	9	~~6~~	4	4	2	2
F-1	NS	UL	11	4	2	3	2		~~3~~	3	3		2
	S	UL	12	5	3	4	3	10	~~7~~	5	5	3	2
F-2	NS	UL	11	5	3	4	3	5	~~5~~	5	5	3	2
	S	UL	12	6	4	5	4	12	~~8~~	6	6	4	3
H-1	NS[c, d]	1	1	1	1	1	1	NP	~~NP~~	NP	1	1	NP
	S							1	~~1~~	1			
H-2	NS[c, d]	UL	3	2	1	2	1	1	~~1~~	1	2	1	1
	S							2	~~2~~	2			
H-3	NS[c, d]	UL	6	4	2	4	2	3	~~3~~	3	4	2	1
	S							4	~~4~~	4			
H-4	NS[c, d]	UL	7	5	3	5	3	5	~~5~~	5	5	3	2
	S	UL	8	6	4	6	4	8	~~7~~	6	6	4	3
H-5	NS[c, d]	4	4	3	3	3	3	2	~~2~~	2	3	3	2
	S							3	~~3~~	3			
I-1 Condition 1	NS[d, e]	UL	9	4	3	4	3	4	~~4~~	4	4	3	2
	S	UL	10	5	4	5	4	10	~~7~~	5	5	4	3
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	3	~~3~~	3	4	3	2
	S	UL	10	5				10	~~6~~	4			
I-2	NS[d, f]	UL	4	2	1	1	NP	NP	~~NP~~	NP	1	1	NP
	S	UL	5	3				7	~~5~~	1			
I-3	NS[d, e]	UL	4	2	1	2	1	2	~~2~~	2	2	2	1
	S	UL	5	3	2	3	2	7	~~5~~	3	3	3	2
I-4	NS[d, g]	UL	5	3	2	3	2	3	~~3~~	3	3	1	1
	S	UL	6	4	3	4	3	9	~~6~~	4	4	2	2
M	NS	UL	11	4	2	4	2	4	~~4~~	4	4	3	1
	S	UL	12	5	3	5	3	12	~~8~~	6	5	4	2
R-1 [h]	NS[d]	UL	11	4	4	4	4	4	~~4~~	4	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	18	~~12~~	8	5	4	3

R-2[h]	NS[d]	UL	11	4	4	4	4	4	~~4~~	4	4		3	2
	S13R	4	4	4									4	3
	S	UL	12	5	5	5	5	18	~~12~~	8	5		4	3
R-3[h]	NS[d]	UL	11	4	4	4	4	4	~~4~~	4	4		3	3
	S13D	4	4										3	3
	S13R	4	4										4	4
	S	UL	12	5	5	5	5	18	~~12~~	5	5		4	4
R-4[h]	NS[d]	UL	11	4	4	4	4	4	~~4~~	4	4		3	2
	S13D	4	4										3	2
	S13R	4	4										4	3
	S	UL	12	5	5	5	5	18	~~12~~	5	5		4	3
S-1	NS	UL	11	4	2	3	2	4	~~4~~	4	4		3	1
	S	UL	12	5	3	4	3	10	~~7~~	5	5		4	2
S-2	NS	UL	11	5	3	4	3	4	~~4~~	4	4		4	2
	S	UL	12	6	4	5	4	12	~~8~~	5	5		5	3
U	NS	UL	5	4	2	3	2	4	~~4~~	4	4		2	1
	S	UL	6	5	3	4	3	9	~~6~~	5	5		3	2

TUL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and 1103.5 of the International Fire Code.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.

h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Commenter's Reason:

We recommend that the Type IV-B mass timber designation be deleted from the tall wood building proposals.

The origins of the development of the types of construction were originally developed to “account for the response or participation that a building’s structure will have in a fire condition originating within the building as a result of the occupancy or the fuel load” (Example source from BOCA National Building Code 1993 Commentary). The modern day types of construction are parsed out into three primary categories of construction; noncombustible (Types I and II), noncombustible/combustible (Types III and IV) and combustible (Type V). Subcategories were created to identify the protection; Type A for protected and Type B for unprotected.

What we have within proposals G75-18, G80-18, G84-18, G89-18, and G108-18 is the addition of a new construction category that has been proposed based on the need to satisfy aesthetics based on the combination of Types IV-A and IV-C, which is a departure from the black and white construction categories based on construction that is either non-combustible or combustible. We feel this inappropriate for the codes to begin to designate designer type construction categories.

In the past such mixing and matching of construction types into building or structure is more suited to the IBC Section 104.11 (Alternative materials, design and methods of construction and equipment), or through use of the ICC International Performance Code or performance analysis. We feel that these are the most appropriate options for the mixing-and-matching of construction types in building design.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This will not increase or decrease the cost of construction as this code change proposal and public comment address information that was not previously contained in the code, therefore there is no cost impact when compared to present requirements.

Public Comment 2:

Proponent:

Brian M. McGraw, P.E., State Fire Marshal, Virginia Deopartment of Fire Programs, State Fire Marshal's Office, representing Virginia State Fire Marshal's Office, Virginia Fire Services Board (brian.mcgraw@vdfp.virginia.gov) requests As Modified by This Public Comment

.

Modify as follows:

2018 International Building Code

TABLE 504.4

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANEa, b

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION										TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE IV	TYPE IV	TYPE IV	TYPE V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1
	S	UL	6	4	3	4	3	~~9~~ 4	~~6~~ 4	4	4	3	2
A-2	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	~~18~~ 4	~~12~~ 4	~~6~~ 4	4	3	2
A-3	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	~~18~~ 4	~~12~~ 4	~~6~~ 4	4	3	2
A-4	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	~~18~~ 4	~~12~~ 4	~~6~~ 4	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	1	1	1	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	~~18~~ 6	~~12~~ 6	~~9~~ 6	6	4	3
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	~~9~~ 4	~~6~~ 4	4	4	2	2
F-1	NS	UL	11	4	2	3	2		3	3	3		2
	S	UL	12	5	3	4	3	10	~~7~~ 3	~~5~~ 3	~~5~~ 3	3	2
F-2	NS	UL	11	5	3	4	3	5	5	5	5	3	2
	S	UL	12	6	4	5	4	~~12~~ 6	~~8~~ 6	6	6	4	3
H-1	NS[c, d]	1	1	1	1	1	1	NP	NP	NP	1	1	NP
	S							1	1	1			
H-2	NS[c, d]	UL	3	2	1	2	1	1	1	1	2	1	1
	S							2	2	2			
H-3	NS[c, d]	UL	6	4	2	4	2	3	3	3	4	2	1
	S							4	4	4			
H-4	NS[c, d]	UL	7	5	3	5	3	5	5	5	5	3	2

	S	UL	8	6	4	6	4	~~8~~ 6	~~7~~ 6	6	6	4	3
H-5	NS[c, d]	4	4	3	3	3	3	2	2	2	3	3	2
	S							3	3	3			
I-1 Condition 1	NS[d, e]	UL	9	4	3	4	3	4	4	4	4	3	2
	S	UL	10	5	4	5	4	~~10~~ 5	~~7~~ 5	5	5	4	3
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	3	3	3	4	3	2
	S	UL	10	5				~~10~~ 4	~~6~~ 4	4			
I-2	NS[d, f]	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S	UL	5	3				~~7~~ 1	~~5~~ 1	1			
I-3	NS[d, e]	UL	4	2	1	2	1	2	2	2	2	2	1
	S	UL	5	3	2	3	2	~~7~~ 3	~~5~~ 3	3	3	3	2
I-4	NS[d, g]	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	~~9~~ 4	~~6~~ 4	4	4	2	2
M	NS	UL	11	4	2	4	2	4	4	4	4	3	1
	S	UL	12	5	3	5	3	~~12~~ 5	~~8~~ 5	~~6~~ 5	5	4	2
R-1[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	~~18~~ 5	~~12~~ 5	~~8~~ 5	5	4	3
R-2[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4	4								4	3
	S	UL	12	5	5	5	5	~~18~~ 5	~~12~~ 5	~~8~~ 5	5	4	3
R-3[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	3
	S13D	4	4									3	3
	S13R	4	4									4	4
	S	UL	12	5	5	5	5	~~18~~ 5	~~12~~ 5	5	5	4	4
R-4[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13D	4	4									3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	~~18~~ 5	~~12~~ 5	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	4	4	4	3	1

	S	UL	12	5	3	4	3	~~10~~ 5	~~7~~ 5	5	5	4	2
S-2	NS	UL	11	5	3	4	3	4	4	4	4	4	2
	S	UL	12	6	4	5	4	~~12~~ 5	~~8~~ 5	5	5	5	3
U	NS	UL	5	4	2	3	2	4	4	4	4	2	1
	S	UL	6	5	3	4	3	~~9~~ 5	~~6~~ 5	5	5	3	2

TUL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and 1103.5 of the International Fire Code.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Commenter's Reason:

The Virginia Fire Services Board opposes Proposal G80-18 as originally submitted. We propose that the allowable heights in this be proposal be reduced to those currently allowed for Type IV-HT construction until additional testing can be performed to validate the assumptions on which the currently proposed heights are based. While we do not oppose the concept of utilizing renewable resources, such as timber, in the construction of buildings, we are not convinced that 18-story “tall wood buildings” provide an acceptable level of safety to occupants or responding firefighters.

The reason statement for this proposal indicates that the Ad-Hoc Committee on Tall Wood Buildings (TWB) “discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings” including:

- Egress systems designed to protect building occupants during the design escape time, plus a safety factor.

- Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

There is no reference in the stated performance objectives related to protecting firefighters and other emergency responders during the time required to access and extinguish a fire. The Report on High-Rise Fireground Field Experiments, NIST Technical Note 1797, published in April 2013, indicates times between 21 and 23 minutes from fire ignition for fire crews to reach the 11th floor of a high-rise building, depending on crew size. These times are based on studies involving major metropolitan fire departments. There are many variables that could significantly increase these times, including time for notification of the fire department, turnout time, response time and vertical travel time to reach higher floors.

There were 14 proposals submitted by the TWB. Only one, G28-18, addresses the reliability of fire suppression systems. It requires the water supply to required fire pumps be supplied by connections to not fewer than two water mains located in different streets for tall wood buildings that are more than 120 feet in building height. This proposal does nothing to increase the reliability of fire suppression system in buildings less than 120 feet tall. In addition, it does nothing to increase the reliability of the suppression systems within the building itself. There is no requirement to demonstrate the reliability of the fire suppression system as compared to the evacuation time and risk of collapse. It should also be noted that this proposal allows the construction of tall wood buildings to a height of 65 feet with no requirements for fire suppression systems.

We acknowledge that fire tests have been conducted; however, we do not believe that the results of the fire tests provide sufficient justification to allow tall wood building to be constructed to heights of 18 stories. The original proposal cites "engineering judgment" as the basis for a comparative analysis between Type I and Type IV buildings and the extrapolation of two-story fire tests to 18 story structures. There has been no testing to demonstrate the performance of these structures after aging for a period of years or decades.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposal does not change the method of construction; rather it limits the height to which the type of construction can be built.

Public Comment 3:

Proponent:

Michael O'Brian, International Assocation of Fire Chiefs, representing Riverside County Fire Department, representing California Fire Chiefs Association (mobrian@brightonareafire.com); Kevin Reinertson (kevin.reinertson@fire.ca.gov) requests As Modified by This Public Comment

.

Further modify as follows:

2018 International Building Code

TABLE 504.4

ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION										TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	SEE FOOTNOTES	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE IV	TYPE IV	TYPE IV	TYPE V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1
	S	UL	6	4	3	4	3	~~9~~6	~~6~~5	4	4	3	2
A-2	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	~~18~~12	~~12~~8	~~6~~4	4	3	2
A-3	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	~~18~~12	~~12~~8	~~6~~4	4	3	2
A-4	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	~~18~~12	~~12~~8	~~6~~4	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	1	1	1	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	~~18~~12	~~12~~8	~~9~~6	6	4	3
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	~~9~~6	~~6~~5	4	4	2	2
F-1	NS	UL	11	4	2	3	2		3	3	3		2
	S	UL	12	5	3	4	3	10	7	5	5	3	2
F-2	NS	UL	11	5	3	4	3	5	5	5	5	3	2
	S	UL	12	6	4	5	4	~~12~~7	~~8~~6	6	6	4	3
H-1	NS[c, d]	1	1	1	1	1	1	NP	NP	NP	1	1	NP
	S							1	1	1			
H-2	NS[c, d]	UL	3	2	1	2	1	1	1	1	2	1	1
	S							2	2	2			

H-3	NS[c, d]	UL	6	4	2	4	2	3	3	3	4	2	1
	S							4	4	4			
H-4	NS[c, d]	UL	7	5	3	5	3	5	5	5	5	3	2
	S	UL	8	6	4	6	4	8	7	6	6	4	3
H-5	NS[c, d]	4	4	3	3	3	3	2	2	2	3	3	2
	S							3	3	3			
I-1 Condition 1	NS[d, e]	UL	9	4	3	4	3	4	4	4	4	3	2
	S	UL	10	5	4	5	4	~~10~~7	~~7~~6	5	5	4	3
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	3	3	3	4	3	2
	S	UL	10	5				~~10~~7	~~6~~5	4			
I-2	NS[d, f]	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S	UL	5	3				~~7~~5	~~5~~3	1			
I-3	NS[d, e]	UL	4	2	1	2	1	2	2	2	2	2	1
	S	UL	5	3	2	3	2	~~7~~5	~~5~~4	3	3	3	2
I-4	NS[d, g]	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	~~9~~6	~~6~~5	4	4	2	2
M	NS	UL	11	4	2	4	2	4	4	4	4	3	1
	S	UL	12	5	3	5	3	~~12~~8	~~8~~5	6	5	4	2
R-1 [h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	~~18~~12	~~12~~8	8	5	4	3
R-2[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4	4								4	3
	S	UL	12	5	5	5	5	~~18~~12	~~12~~8	8	5	4	3
R-3[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	3
	S13D	4	4									3	3
	S13R	4	4									4	4
	S	UL	12	5	5	5	5	~~18~~12	~~12~~8	5	5	4	4
R-4[h]	NS[d]	UL	11	4	4	4	4	4	4	4	4	3	2
	S13D	4	4									3	2
	S13R	4	4									4	3

	S	UL	12	5	5	5	5	~~18~~12	~~12~~8	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	4	4	4	3	1
	S	UL	12	5	3	4	3	~~10~~7	~~7~~6	5	5	4	2
S-2	NS	UL	11	5	3	4	3	4	4	4	4	4	2
	S	UL	12	6	4	5	4	~~12~~8	~~8~~7	5	5	5	3
U	NS	UL	5	4	2	3	2	4	4	4	4	2	1
	S	UL	6	5	3	4	3	~~9~~7	6	5	5	3	2

TUL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and 1103.5 of the International Fire Code.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Commenter's Reason:

This is a series of comments to modify the proposed height, stories, and allowable area of the new Type IV-A, Type IV-B, and Type IV-C proposed construction classifications as proposed by the Ad-Hoc Committee on Tall Wood Buildings.

There is concern on the formulas utilized are not fully supported by technical substantiation and are missing the needed technical support to allow the construction type to such heights. This change takes a moderate approach and reduces the allowable heights, area, and stories by a factor of 30%.

This proposed public comment doesn’t dismiss the concept out of hand, we do feel the current proposals go too far, to fast in an area of significant and long-lasting importance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This change will modify the allowable heights and will not increase or decrease as the allowable heights are new to the code

Public Comment 4:

Proponent:

Gary Bridgens, representing Mass Timber Code Coalition (info@buildtallbuildsafe.com) requests As Submitted

.

Commenter's Reason:

PUBLIC COMMENT

SUBMITTED BY GARY BRIDGENS

ON BEHALF OF THE MASS TIMBER CODE COALITION

The Mass Timber Code Coalition has been organized to provide information on the code proposals drafted by the Ad Hoc Committee on Tall Wood Buildings

Mass timber is not new to the *International Building Code* (IBC). Currently listed as Type IV Heavy Timber, this construction type is a proven option that fully complies with the structural and fire resistive requirements of the IBC. The code recognizes that mass timber is a fundamentally different material than dimension lumber used in more familiar stick built wood construction. The code also recognizes the inherent fire resistance of mass timber, where charring in a fire event provides protection of inner structures, as well as a consistent and predictable rate of charring.

With the expansion of the mass timber supply chain, panels of cross-laminated timber (CLT), nail-laminated timber (NLT) and glue-laminated timber (Glulam), requests for approvals of tall mass timber buildings (TMTB) by local authorities have become more common. Estimates by industry sources have identified 35 current proposals for tall mass timber buildings, ranging from 7 to 24 stories, in 21 different jurisdictions.

Importantly, this interest in tall mass timber construction has been reliant on various local codes and approval processes. The IBC does not currently account for these tall wood buildings, beyond the current Type IV Heavy Timber height and area limitations.

The Ad Hoc Committee on Tall Wood Buildings (AHC-TWB)

To ensure the IBC keeps pace with the changing construction marketplace, the Board of Directors of the International Code Council (ICC) appointed the Ad Hoc Committee on Tall Wood Buildings (AHC-TWB) in 2015. The AHC-TWB included members from the code official, regulatory, construction, engineering, architectural, fire services and materials communities.

The AHC-TWB was specifically charged with investigating the science of mass timber construction, undertaking any necessary new research and recommending any code changes needed to ensure safety in TMTB. The AHC-TWB set performance criteria of its own: any code change developed was required to achieve the following.

1. No collapse under scenarios of complete burn-out of fuel without automatic sprinkler protection;
2. No high radiation exposure from the subject building to adjoining properties that risk ignition under severe fire scenarios;
3. No unusual response from radiation exposure from adjacent properties that risk ignition of the subject building under severe fire scenarios;
4. No unusual fire department access issues;
5. Egress systems to protect occupants during design escape times plus a margin of safety;
6. Enhanced and redundant fire protection systems to ensure performance during various fire scenarios.

Code Change Proposals

After two years of work, the AHC-TWB has produced 14 code change proposals. All 14 of these proposals were recommended for approval by various ICC committees at the recent ICC 2018 Group A Committee Action Hearing.

The key change, G108-18, defines three new categories of Type -IV Mass Timber construction:

Type IV-A: 1 to 18 stories based on Occupancy Classification. 3-hour fire resistance rating with non-combustible protection throughout;

Type IV-B: 1 to 12 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection on most mass timber surfaces;

Type IV-C: 1 to 9 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection for critical areas; exit enclosures, etc.

Each new construction type defined by the AHC-TWB (Type IV-A, B and C) has fire resistance requirements as robust or more robust than those required for comparable non-combustible (concrete and steel) buildings.

Other provisions provide standards for mass timber manufacturing, height/area restrictions, active and passive fire protection systems, fire safety during construction, enhanced water supply requirements, and standards for sealants and adhesives.

Fire Resistance of Mass Timber

Citing fire and market concerns, both the Portland Cement Association and the National Ready Mix Concrete Association have criticized the AHC-TWB code change proposals as untested and unsound. However, these criticisms fail to consider that:

1. The purpose of the International Building Code is to provide building officials with the tools they need to ensure public and first-responder safety. It is not to choose winners and losers in the market, nor is it to defend any single industry s position;

2. Tall mass timber buildings already built are performing well;
3. Mass timber (and heavy timber before it) has undergone extensive fire resistance testing in multiple fire scenarios by Underwriters Laboratories, the Southwest Research Institute, the National Research Council of Canada and the U.S. Government s ATF Fire Research Laboratory, the world s largest indoor fire investigation lab.

Numerous mass timber floor/ceiling and wall assemblies have been tested at national laboratories using ASTM E119 standards. This testing history shows that mass timber has repeatedly achieved the hourly fire resistance requirements of the code. This is in part because of charring properties that provide a steady and predictable measurement of fire resistance. Additionally, detailed code requirements for non-combustible protection applied to the mass timber greatly enhance the hourly rating. Further, fire protection systems (active and passive) also ensure safety in mass timber structures.

The AHC-TWB benefitted from recent tests in 2017 at the U.S. ATF Fire Research Laboratory on full-scale mass timber buildings. Most tests assumed an unlikely failure of sprinkler systems:

1. Mass timber apartment with full fuel load. Fully protected by Type X gypsum wall board. Fire self-extinguished after 3 hours with no significant charring on mass timber surfaces;
2. Mass timber apartment with full fuel load. 20% exposed CLT ceiling. Test concluded at 4-hour mark after fuel burnout. CLT self-extinguished after charring;
3. Mass timber apartment with full fuel load. 2 CLT walls fully exposed. Fuel burnout at 4-hours. CLT walls self-extinguished after charring;
4. Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire quickly extinguished;
5. Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire allowed to grow to flashover (23 minutes) then quickly extinguished.

In fact, proposed Type IVA, B and C fire resistance requirements are the same or more robust than comparable steel and concrete construction. Further detail can be obtained at buildtallbuildsafe.com.

Benefits of Mass Timber Construction

In addition to the obvious environmental attributes of using a renewable resource in construction and the boost for the economies in timber-producing regions, builders and communities cite several distinctive benefits that make mass timber buildings an attractive option:

Builders report several benefits, including:

1. **Job site safety.** Mass timber panels are easy to install and can be delivered to a work site as needed, rather than stockpiled. Moreover, worker training is easier as is exposure to job site risk;
2. **Job site efficiency.** Persistent labor shortages are eased as more workers are qualified to work with mass timber panels. Jobs are built more quickly and materials are delivered as needed, thereby reducing costs;
3. **Design.** The favorable strength-to-weight ratio of CLT and the characteristics of wood offer more design options and more attractive built environments, improving business performance.

Local communities embrace mass timber construction:

1. **Faster and quieter.** The dislocation experienced by neighboring communities is reduced in mass timber projects. In addition to lower fire risks, things occur more quickly and panels are installed more simply than comparable steel and concrete sites;
2. **Greener.** Forestry officials cite the carbon sequestration properties of wood, but also the benefits to forest management of using wood products more efficiently and effectively, thereby further reducing decay and fire risk;
3. **Energy efficient.** Manufacturing mass timber is less energy intensive then other building materials. More importantly, the superior insulation characteristics of wood far outperform steel and concrete structures.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

Public Comment 5:

Proponent:

Sam Francis, representing American Wood Council (sfrancis@awc.org) requests As Submitted

.

Commenter's Reason:

AWC was appointed to be a member of the ICC Tall Wood Building Ad Hoc Committee (TWB), the single wood industry representative on the TWB. AWC is not speaking for TWB on this issue. It simply is relaying information regarding the development of the proposals. Other members of the 16-member TWB included representation from architects, engineers, fire protection engineers, fire marshals, testing laboratories, and fire fighters, as well as the major materials industries. After two years of study, listening to testimony, reviewing documents, reviewing public input, conducting an extensive test program, and reviewing test results from tests around the world, the TWB made this proposal to ICC for the membership s consideration.

Early in the process, the TWB heard proposals from four different commenters suggesting maximum stories of 20, 24, 40, and 42 stories. The TWB worked through dozens of drafts of the proposed new types of construction, dozens more pertaining to the building height in stories, nearly a dozen pertaining to building height in feet and nearly a dozen regarding maximum permitted building area per floor. These documents were all posted to the TWB page of the ICC website. Comments were solicited for all drafts.

The first draft of Table 504.4 (allowable stories) was based on the discussions by the TWB at its November, 2016 meeting and considered by the Codes Work Group (Codes WG) in February, 2017. In March, 2017, comments to the February draft were considered by the Codes WG. In May, 2017, the Codes WG reported to the TWB its recommendations for a maximum number of stories for Type IV-A of 24 for many use groups, including B and R.

In June the TWB considered reducing the recommended number of stories for several occupancies, including B and R, due to reported opposition to the higher limits. Thus, as a result, the maximum number of stories was reduced from 24 to 18 for many occupancies including R, and from 24 to 20 for Group B because of the lower fuel load and increased occupant awareness in Group B. These drafts were also posted by the TWB on the ICC website. No one publicly commented on the original recommendations nor on the TWB reductions in maximum stories to accommodate what was believed to be opposition to its position.

Finally, the TWB held its last meeting (by video conference) December 27, 2017 to finalize all proposals before the January 6, 2018 submittal deadline. In that meeting it was suggested that continuing to allow Group B to be 20 stories seemed to be an outlier and, for that reason alone, the TWB again reduced Group B to the current 18 story limit.

The reason statement offered by the TWB for this proposal clearly explains that the allowable stories was determined by assessing the overall performance of the new types of construction and equating them to existing types of construction. From the beginning of this process, the TWB considered the body of data and fire protection engineering principles, deliberated the issue and concluded that because of the complete package of extensive features such as the required fire resistance ratings, the extensive noncombustible protection required on the surface of the mass timber elements, the prohibition of light frame wood assemblies altogether, and many other restrictive features, the performance of IV-B was indeed equivalent to I-B in every way. This concept was presented by several researchers who had been invited to present to the TWB at its initial face-to-face meeting. Similarly, due to the even more extensive required features in Type IV-A, including redundant water supply, they concluded that the performance of Type IV-A was equivalent to I-A. The TWB agreed that the performance was equivalent, but its conservative approach meant that they chose not to permit IV-A to enjoy the unlimited number of stories that I-A does. In fact, it was so conservative that it initially considered only doubling of the number of stories, which is infinitely less than the unlimited number of stories permitted in type I-A for nearly every use group. They ultimately proposed even fewer stories than that.

Moreover, the number of stories proposed for Type IV-B are even more conservative when considering that Type IV-B requires a greater degree of fire resistance than that of I-B when the *fire-resistance rating* of the building elements in Type IB construction are reduced to only the *fire-resistance ratings* required for Type IIA as permitted by Section 403.2.1 of the IBC. In effect, the proposed 2 hour fire resistance ratings required for Type IV-B will be twice that allowed by the IBC, since its inception, for those buildings under 420 feet whose building elements are permitted to be of only 1 hour fire resistance in accordance with the highrise provisions of Chapter 4, which will not apply to the proposed mass timber construction types.

From the beginning, the TWB has been committed to criteria which result in acceptable performance. Critics of the proposed allowable number of stories have been heard to comment that 18 stories will not be the end of increased story limits, but, indeed, 18 stories was not the beginning of it, either! Rather, 18 stories is a conservative limit that was reduced, by concession, not evidence, from 24 stories, to 20 stories, and finally to 18 stories.

Finally, much has been said about the proposed heights, but it s important to consider this: unlike noncombustible construction types I-A and I-B, which for most use groups are unlimited in allowable area per story no matter how tall, these proposed mass timber construction types will be increasingly limited in allowable area per floor as the building gets higher. This is because Equations 5-2 and 5-3 in the IBC limit the total allowable area of the building to no more than three times the allowable area of a single story. (Story areas for most use groups in Types I-A and I-B are never limited no matter how tall because their single-story areas are unlimited.) As a result, in the proposed mass timber construction types the compartmentalization of building areas between fire resistance rated and protected assemblies is vastly increased, and the allowable area between fire resistance rated and protected elements is vastly reduced, compared to Types I-A and I-B construction. See Tables 1 and 2 below for a comparison.

This proposal is thoroughly conservative. The following points address claims made by opponents:

Concerns about exterior fire testing:

The TWB proposals significantly reduce the risk of exterior building surface flame propagation by prohibiting all combustibles on the exterior side of exterior walls (except for the required water resistive barrier). Continuous insulation on the exterior, where provided, will be non-combustible. In addition, protection with at least 40 minutes of noncombustible material (typically a layer of 5/8-inch type X gypsum wallboard) is required on the outside of mass timber exterior walls. What is proposed therefore is more conservative than any other construction type, including Types I and II, virtually eliminating the possibility of fire spread on exterior walls due to combustible materials.

Concerns about the testing s relevance to tall wood buildings:

The testing was designed by fire service representation on the TWB committee to directly address potential tall wood buildings, regardless of height. Rather than rely on standardized testing of building assemblies alone, with fire service input the TWB committee chose to undertake full-scale, multistory compartment testing, with high residential fuel loads for which no standardized test exists. Furthermore, in four of the five tests, the normal operation of the required automatic fire suppression system (sprinklers) was not allowed. The fires in tests applicable to the proposed 18 and 12 story limits (Types IV-A and IV-B respectively) were allowed to continue throughout the decay phase and well past burn-out, the most conservative approach possible. In other words, because the fire tests were specifically designed to address tall wood buildings of any height, the absolute worst circumstances were assumed: sprinklers not working, no active suppression of any kind, and the fire allowed to burn until self-extinguishment after the burning room contents are consumed (a tiny percentage of all possible fire scenarios). This parallels expectations for Type I buildings.

Concerns that wind has not been addressed in the testing:

There are no current test standards for exterior exposure that includes wind as a component. This means that even Types I and II buildings--which may have combustible materials on the exterior of the exterior walls, such as foam plastic insulation--are not tested to specific wind criteria. The new construction types proposed for tall wood building do not permit combustible materials on the exterior of exterior walls (as opposed to all other construction types), and in addition all mass timber building elements in exterior walls are required to be protected on the exterior side by noncombustible material equaling at least 40 minutes of fire resistance (typically 5/8-inch Type X gypsum wallboard). This very conservative criteria is intended to take the possibility of exterior fire spread completely out of the question.

In regard to wind reaching the interior of the building, since the extensive noncombustible protection of the interior in building over 12 stories is designed to allow complete burn-out of contents in the case of sprinkler malfunction, if wind were to cause contents to burn faster, there is no negative impact on fire performance of the protected building elements themselves. Fire scientists believe that protected mass timber will respond favorably to a more severe fire that is flamed by wind, since burn-out of contents may be achieved sooner. In regard to Type IV-C which permits totally exposed mass timber throughout, the allowable height in feet from grade is not increased from what is allowed for current Type IV heavy timber construction, and 2-hour fire resistance ratings of building elements are required throughout (as opposed to heavy timber dimensions only in current Type IV). Finally, combustible light frame walls are not permitted in the proposed new construction types, only mass timber elements

Concerns that loads from upper stories were not considered in the fire testing:

Structural loads will in large part govern the size of mass timber members, as it does concrete and steel members. As the loads from upper stories increase, the structural design requires loadbearing mass timber walls and columns to get bigger or more numerous. In buildings over 12 stories, these mass timber elements are required to be protected by at least three layers of 5/8 type X gypsum, as part of the 3-hour rating. This is an extremely conservative approach for all buildings ranging from 12 to 18 stories. The intent is to prevent the mass timber building elements from becoming involved in the fire even in the extremely small percentage of fire that are not controlled by the sprinkler system or eventually put out by the fire department.

Concerns that increased hazards from storage and mercantile occupancies, and their effect on firefighting, were not considered:

The TWB committee specifically addressed mercantile (M) and storage occupancies (typically S-1) and the hazards associated with their higher fuel loads. They did this by placing stricter limits on their height. M and S-1 occupancies groups are not allowed over 12 and 10 stories respectively even in Type IV-A, which has 3-hour walls and columns and 2-hour floors, and is required incorporate noncombustible protection equal to 2/3 of the required rating (three layers of 5/8 Type X gypsum wall board on loadbearing walls and columns). By comparison, Groups M and S-1 in Type I-A construction with the same ratings are unlimited in height. Type I-B allows both Groups M and S-1 up to 12 stories with only 2-hour walls and columns, whereas Type IV-B with equal ratings and required noncombustible protection is limited to eight stories (M) and seven stories (S-1).

Concerns about fire sealants and connections during the testing:

Researchers noted inconsistencies in some installations during the testing at ATF, but this has no bearing on the efficacy of the tests, which were successful in spite of these irregularities. Even so, to address this and undesirable results at the FPRF tests at NIST, a proposed requirement for all splices and intersections to have adhesive sealant followed by a proposed modification requiring special inspection of sealant installation was proposed by the TWB committee at the Committee Action Hearing. The sealant requirement was approved but the modification for its special inspection was ruled beyond the scope of the original proposal, but has been reconstituted as a Public Comment which can be put forward at the public comment hearings this fall.

Concerns that there is only limited information available about how CLT performs or can be used with other materials:

There is extensive information available about CLT construction from many sources, including the increasing number of manufacturers of CLT. For example, a CLT Handbook, addressing structural design, lateral design, connections, fire performance, sound performance, building envelope design, environmental performance, and handling during construction has been available for free for several years. The American Wood Council s National Design Specification for Wood Construction, an ANSI accredited standard, has been updated to incorporate structural and fire design provisions for CLT. There are other guidelines for structural and fire resistance issues published by AWC and other organizations, including information on hybrid systems with steel and concrete.

Among the other advantages of CLT are that it does not distort, loose its strength, or explosively spall when exposed to high temperatures. It has inherently high fire resistance due to its mass, and when protected with gypsum wallboard protection performs improves. Early testing of a highly loaded CLT exterior wall by AWC yielded a 3-hour rating with only one layer of 5/8 Type X gypsum wallboard. Also, in general, CLT responds well to flame impingement by remaining strong and stable when the gypsum is cracked or losing integrity. It is much less heat sensitive than certain noncombustible materials.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This is about new types of construction. Adding new types of construction means more choices in construction. More alternatives means lower cost in many cases.

Public Comment 6:

Proponent:

Patrick Ford, representing self (pat@matsenford.com) requests Disapprove

.

Commenter's Reason:

Reason: These code changes would allow for structurally unsafe conditions to be inherently designed into tall buildings. As proposed, they would introduce new categories of Type IV construction into the code and expand the number of storeys, allowable areas, and maximum heights of buildings framed with combustible materials. I believe that for several reasons, this would greatly increase the risk to firefighters and building occupants, as well as neighboring buildings. Several of the major decisions that went into the creation of this proposal were based on "engineering judgment" and significant extrapolation of test data from a two storey test building to buildings with dozens more storeys.

Aside from the potentially dangerous and unproven provisions in general, there are several specifics relative to structural connections in these new building types and sizes. I do not believe that these were addressed or at the very least not adequately addressed.

The new building types and increased limits allowed for in these proposals should not be allowed, and the proposals should be disapproved for the following reasons:

1. The AHC-TWB report that was instrumental in many of the provisions indicates that connections were tested, but in fact, no exposed connections were ever tested in any of the assemblies.
2. The compartment tests did not test any connections, nor did any of the standard ASTM tests, including the E84, E119, E814, nor the NFPA 285 tests.
3. The full scale test did not have any exposed connections, yet the code explicitly notes exposed steel and metal caps or brackets allowed in type IV construction within the wood chapter. The exposed metal connectors and their fasteners penetrate well beneath the typical char layer of the structural member, significantly reducing the strength of the member at and near the connection itself. This can

create many hot spots and potential critical structural failure locations throughout a tall building. No other tests addressed this issue either.

4. Adhesive based splice connections remain unproven, the overall adhesive requirements being based on a testing protocol derived after a failed test.
5. The Small Scale Adhesive Qualification Test Protocol (CSA 077 SSA.2) could conceivably be directed toward such connections or splices, but it is a test that lasts only 5 minutes per side of the tested specimen.
6. As an additional note, the full scale test was run on only a two storey structure, leaving any critical structural connections that may have been needed to support only a single storey above. With code proposals allowing for many times this, these concerns should be much more carefully vetted before approval.

It should also always be remembered that in no other type of tall building allowed by the code, is the structure itself also fuel for the fire.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

There would be no cost increase associated with my comment because if the code proposal were defeated, there would be no change in the building allowable from the current code.

Public Comment 7:

Proponent:

Robert Grupe, representing Grupe Gypsum Consulting, LLC (rcgconsult@outlook.com) requests Disapprove

.

Commenter's Reason:

Overall building performance is predicated on the individual systems that comprise the structure. Further these systems are a series of individual building materials that are integrated based on their performance attributes, and compatibility with adjacent building materials. The proposed Tall Wood-frame construction is based primarily on the use of Cross Laminated Timber, CLT. However the proposal does not address potential compatibility issues, and in some cases lacks critical data to support required performance. Therefore, the CLT, system is not ready for use in wholesale high-rise construction. There are at least two critical system design areas that require additional testing and verification. These two examples are offered here to provide areas of specific concern. These examples are expressed in specific published white papers on the use of Cross-Laminated Timber.

The first example is on acoustics, specifically that of sound transmission through floor-assemblies. The current International Building Code has established minimum requirements for floor-to-floor transmission. In a published white paper entitled ***Mass Timber High-Rise Design Research: Museum Tower in Los Angeles Reimagined in Mass Timber*** (2015) the following statement is made regarding acoustics:

"Testing is required to determine the ability of this assembly to obtain the code-required acoustic performance."

The paper covered the design of a timber-framed high-rise building. The acoustical design of the structure was centered around two floor-ceiling systems proposed for this project, both of which did not have any acoustic testing to substantiate compliance. The above comment followed a written description of each proposed floor/ceiling assembly.

Another issue of concern relating to additional required research is the proper design of connections that can accommodate the naturally occurring shrinking and swelling of CLT members primarily due to seasonal changes. The issue is the compatibility and serviceability of sealants and membranes that are incorporated into the CLT system. The following is taken from the ***CLT Handbook*** (2013):

"Differential movement between CLT and other wood-based products or materials (in case of mixed materials and systems) need to be taken into account at the design and detailing stages due to potential shrinkage-induced stress that could undermine the connection capacity in CLT. More information and guidelines related to detailing will be provided in future versions of this document as additional studies need to be performed."

The point to be made here is that these are critical components in system and ultimately building design that require additional testing and research. It is obvious from the above mentioned white paper and handbook that the composite action of the independent building materials that make up the building systems have yet to be fully researched, tested, and detailed for use in general construction.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements

Public Comment 8:

Proponent:

Patrick Hainault, representing Self (path@matsenford.com) requests Disapprove

.

Commenter's Reason:

"Tower of Fire destroys LA apartment complex under construction." This headline in the December 8, 2014 LA Times barely scratches the surface in describing the dangers from fires in buildings under construction when those buildings are framed with wood and wood-based materials. This fire not only destroyed at least 239 of the rental units and 2/3rds of the complex at the Da Vinci Apartments but caused significant damage to neighboring buildings and infrastructure, and greatly burdened the surrounding community in general. Yet, this proposal will dramatically raise the allowable heights and areas of buildings made from combustible materials.

It is not rationale to increase the allowable height of buildings as in this proposal when significant problems in much smaller buildings still present a well-documented risk to life and property. The assembly should overturn the committee decision to effectively prohibit the type of proposed construction until and if it can be proven safe during and after construction. The following paragraphs expand on the issues the assembly should consider in evaluating this proposal.

How do we even begin to come to grips with the risk to adjacent properties and occupied buildings during the construction phase when an 18- story wood structure allowed by this proposal is burning in a suburban or urban area? Without safeguards well beyond those currently in the code (or proposed as part of a series of related proposals) to protect adjacent properties and infrastructure, the impacts will be devastating. For example, the Da Vinci fire caused:

- Damage to adjacent buildings. At least four nearby buildings were damaged. The building at 221 N. Figueroa St., where the computers and cubicles melted, had significant damage on its 15 floors, with 300 windows blown out. Three floors were also damaged in the Los Angeles County Department of Health Services building at 313 N. Figueroa. LA Department of Water and Power staff identified at least 160 damaged windows. A Los Angeles Department of Building and Safety spokesman reported windows blew out in the north tower of its department headquarters, and the heat and smoke triggered sprinklers that soaked carpets and desks. Overall, the Da Vinci Apartments fire caused an estimated $111.5 million in damages, including $80 million in damage to city properties from the fire and the water used to extinguish it and $20-$30 million to the apartment complex.

- Damage to Infrastructure. A Caltrans spokesman estimated the fire caused $1.5-million damage to the freeway. Roads were closed around the area including a major commuter route during rush hour. Caltrans officials reported an exit sign over the 110 Freeway melted and would have to be replaced, forcing another freeway closure later the same week.
- Extensive impacts on the community. The attached study of the economic risk to taxpayers and the community posed by mid-rise apartments produced by assistant adjunct professor Urvashi Kaul at Columbia University captures the total cost impacts from fires like the Da Vinci apartments and smaller incidents. This study finds that:
  - In Los Angeles County, alone, fires in mid-rise residential buildings with combustible frames could have a negative impact of $22.6B over 15 years, including $17.14B in direct losses from property damage.
  - On average, fire in a mid-rise residential building constructed using combustible framing material costs the Los Angeles County a total of $141.81 per square foot in potential economic impact and $2.38 per square foot in lost tax revenues.
  - Potential impact the County may face in a single year could be $1.7 billion, including $1.3 billion in direct property damage.

The assembly is also urged to reconsider the argument that cladding requirements proposed to address fires in buildings under construction will resolve these issues. As demonstrated in a large fire from 2015 in a wood-framed apartment building in Edgewater, NJ, cladding will not stop a fire from spreading once the framing in part of the building ignites. It doesn't create a barrier between unexposed framing and exposed framing, but only provides some resistance to ignition from within or outside of the building. The Edgewater fire spread rapidly throughout the buildings once framing behind a wall was ignited during repairs to the occupied and fully-clad building.

The Da Vinci and Edgewater fires are not uncommon incidents. Dozens of similar fires have occurred (see more at http://buildwithstrength.com/america-is-burning/) in buildings under construction since the market began broadly taking advantage of relatively recent changes to the IBC that allowed taller and larger wood-framed buildings. In a similar fire in Houston, the life of a construction worker literally hung in the balance as he was rescued from a burning wood framed building just seconds before the stories above came crashing down. The assembly can prevent these types of risks from greatly expanding by disapproving this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 9:

Proponent:

William Hall, Portland Cement Association, representing Alliance for Concrete Codes and Standards (jhall@cement.org) requests Disapprove

.

Commenter's Reason:

At the recent ICC Committee hearings in Columbus, OH, your committee **Failed you.** The general committee charged with looking at proposals and weighing justification **FAILED** to do their job when it came to Tall Wood Buildings. Despite overwhelming testimony that fire tests were inadequate, the committee simply ignored the fact that the TWB ADHOC committee only considered a two story residential structure during testing, and then used **'Engineering Judgment"** to determine that those results will be sufficient for 18 stories.

WHERE is the testing for all the other occupancy groups? 100% increases in story height are proposed for other use groups **without any justification.**

The ICC TWB ADHOC Committee has taken it upon themselves to develop a prescriptive TWB approach that **exceeds** the allowable heights of every country in the world. The United States just recently began looking at Mass Timber for taller buildings and yet, if this proposal goes through, we will allow mass timber 6 stories higher than any other country.

Not only will the U.S. allow the tallest buildings, we will also allow 12 story Mercantile, Storage and Factory to be built **without** gypsum covering on 40% of the CLT surface.

While mass timber may be an acceptable building material, it has not gone through the rigors of that are needed for high rise buildings**. Do not let the U.S. be the testing ground for these Tall Wood Buildings.**

Vote Dissapproval

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No effect

Public Comment 10:

Proponent:

Marc Nard, Portland Cement Association, representing Portland Cement Association (mnard@cement.org) requests Disapprove

.

Commenter's Reason:

Mass Timber is a new and incompletely tested building method. There has been insufficient / inadequate testing of the complete system to date. As code officials prescriptive limits are strictly adhered to. You would not allow even a single story increase in the currently allowed construction height of 6 stories. If a contractor asked to be allowed to build to 7 stories he would be told NO that would exceed the height code allows. Now not only is the wood industry seeking to simply exceed the height limitation of 6 stories by one story the desire is to extend the height beyond 6 stories and in fact, without proper testing, NO wind testing or proper justification randomly raise the height allowance three times the current limit allowed to 18 stories. for Mass Timber structures.

18 Story structures far exceeds the level of fire department access. I have 12 years experience as a firefighter in the States of Indiana and Michigan and would urge DISAPPROVAL. Not being able to reach the fire in a combustible building is a recipe for disaster. Common sense and the experience learned from high rise fires dictates that to be safe we use NONCOMBUSTIBLE materials, Type 1 and Type II construction not just open the door for untested systems to be built as high rises. Having combustible construction above the level of fire department access puts occupants, fire fighters and emergency services persons at unnecessary risks.

Wood structures will burn and this affects them and adjacent structures as well. It simply does not provide the Resiliency, Safety and Piece of Mind that Concrete and Steel offer. Fire testing to date has been done on two story structures. We need testing on an 18 story structure both with and without sprinkler protection (they can fail or be inoperative on occasion) and we need testing with wind and water pooling to see how the system reacts to the additional deteriorating factors.

Cross Laminated Timber / Mass Timber burns and chars in a fire. Wood is a combustible product. Given enough heat and oxygen it acts as a fuel and will burn. Note: if the char rate is 1 per hour in a typical fire then after a 2 hour fire exposure a 6 inch wall assembly is now missing 4 inches of structural material. There is no repair method offered so that if there is a kitchen fire and the material is damaged no one as decided it would be an advantage to develop and disseminate the repair procedures prior to building and occupying these structures. This is a major mistake.

To date no standard, including NFPA 285, has a wind component that has been part of the testing of Mass Timber. The recent loss of life in the London high rise fire shows clearly that wind is an accelerating factor in a high rise fire. Support DISAPPROVAL do not experiment with structures people live in and use. Do the testing on full size structures prior to putting these extended height allowances into the code and be certain we test for wind effect.

In the case of a fire event there are two major overriding issues beyond the combustibility of wood products. First, where does the water go after a sprinkler head is activated either by fire or by accidental event (kids throwing a ball in an apartment and hitting a sprinkler head). Second, if the fire department does have to fight an active fire the additional volume of water from attack lines adds to the already added load of sprinkler head water. The connectors have not been tested. There is no provision for a drainage system. What effect will this have on adhesives holding these systems together. What about weather that causes windows to blow out and rain or wind blown debris to enter and pool in the structure. Mold and mildew are a serious concern that have not been addressed. The behavior of Mass Timber / CLT in high rise structures is completely dependent on proper connections. All connections being used to date are considered proprietary meaning that there is no information available to the public on their design capacities and failure rate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The proponent has submitted a Cost Impact statement that declares that this will not increase the cost of construction. CLT / Mass Timber is a brand new technology which is bound to have a cost increase on the cost of construction using current code compliant non-combustible construction materials.

Disapproving this code change proposal will not increase or increase the cost of construction.

The proposed text provides information that was not previously in the code and thus there is no comparative data. This only underlines the necessity for approximate cost of construction materials and does not alleviate the need for comparison cost of construction values. Perspective building owners and designers have to have some gauge to go by as they determine materials cost in construction.

Public Comment 11:

Proponent:

Lawrence Novak, representing Portland Cement Assocation (lnovak@cement.org) requests Disapprove

.

Commenter's Reason:

-
  - Wood absorbs water, and the resulting rot and mold can seriously impair a wood structures' overall anticipated performance. Note: non-combustible materials such as concrete, masonry and structural steel do not rot.
  -
  - The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?
  -
  - Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
  -
  - Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
  -
  - It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a

sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues.

-
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
-
- To date, there has been no full scale CLT fire tests done to ASTM standards.
-
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Charring wood will add fuel to the fire and increase the heat and smoke output relative to noncombustible materials. Note: if the char rate is 1" per hour in a fire, then after 2 hours in a fire, a 6" thick CLT wood load bearing wall will only have 2" of structural material left. This is not acceptable and is not addressed in the code change proposals.
-
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete, masonry and steel.
-
- Allowing wood framed structures to be built above the level of fire department access is a serious mistake. The vast majority of municipal ladder trucks cannot reach above the 7^{th} floor.
-
- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

- Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 12:

Proponent:

Tien Peng, representing National Ready Mixed Concrete Association (tpeng@nrmca.org) requests Disapprove

.

Commenter's Reason:

While the Ad Hoc Committee had intended to validate the fire performance of cross laminated timber in fire conditions of buildings, the AWC/ATF compartment testing was limited in scope and not a thorough predictor of fire behavior for high rise building made of a new material. The testing so far is insufficient to capture the fire response characteristics in question. No tests were done to factor in wind, exterior performance, panel connections or moisture, which impacts material performance, fire-fighting and property damage. CLT is a great innovation for the wood industry but it’s not ready for prime time and it’s certainly not ready for us to build safely to 270 feet and 18 stories. The ICC should not adopt code provisions that will put people at risk.

1. CLT Reliability and Predictability Issues

Cross laminated timber does not have a long enough history to demonstrate their reliability and predictability. The structural design of modern tall buildings is governed by the need to efficiently transfer loading, particularly that from wind, whilst providing increasingly complex building functionality. The use of cross laminated timber implies a highly optimized systems which means the least amount of material to enabled efficient load transfer. Thus, in the event of a fire there is an increased risk not typical in mid-rise constructions, and especially not in a two-story mock up in a lab.

The NFPA with ARUP *Fire Safety Challenges of Tall Wood Buildings*paper noted (NFPA 2013)[i]:

- In a real fire situation, the load-bearing elements in CLT are expected to load-share , or redistribute in a method that is not easily predicted in simple fire testing.
- Previous CLT fire testing has resulted in delamination and char fall-off when exposed to fire conditions.
- This has the potential to increase the fire temperature and burning rate within the compartment, and could impact the structural fire resistance at later stages in the fire duration.

The full-scale fire testing in Norway (SPFR A15101 2016)[ii] showed:

- The temperature increased fast and flashover was reached after four minutes.
- Temperatures were significantly higher than the standard time-temperature curve according to EN 1363-1
- The fire did not cool down before manual suppression was initiated when the test room collapsed 1-hour 36 minutes after ignition
- The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin.
- The charring rate varied much faster than expected

We should not be putting lives in high rises at risk with this level of material unpredictability.

2. Exposed CLT Fire / Moisture /Delamination Issues

The National Institute of Standards (NIST) tests complete previously said there were concerns that flashover occurred earlier with CLTs, heat delamination of the exposed CLT affected its fire performance and a large re-flash occurred on the exposed wall with delamination of the second ply of the CLT. (NIST 2017)[i]

While fire departments understand the risk of collapse with solid wood, there is not enough documentation or history of bonded or laminated wood structures, and they may fail sooner under fire conditions. The problem is that under fire conditions an adhesive may either thermally soften or chemically degrade causing the member to lose its strength, leading to structural collapse. Hence, we see delamination from the NIST testing as well as the very real construction failure on portions of the new College of Forestry building at Oregon State University where a large section of subflooring made of cross-laminated timber gave way between the second and third stories.

Moisture is an important issue for delamination and in many parts of the country the laminated mass timber panels will experience an environment which may exceed the testing limits. Wood will change in all three orthogonal dimensions with changes in moisture, and the changes are not even. This not only means that some species swell more because of their higher density, but also wood of non-uniform density displays non-uniform swelling. Moreover, as wood swells and shrinks, adhesives do not follow with the same volumetric expansion. RDH Building Science full-scale mock-up study (Lepage 2017)[ii]notes that, The research indicates that CLT and mass timber is susceptible to dangerously high moisture contents, particularly when exposed to liquid water in horizontal applications. and other research indicate that CLT is at risk of structural damage by decay and rotting fungi (Zabel and Morrell 1992)[iii]

Clearly, we should not be putting lives in high rises at risk with this level of material unpredictability.

3. Fire / Connections Vertical Fire Spread

All connections used in current projects are proprietary and no information is publicly available regarding their performance. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors. Typically, the floor slab provides a robust barrier inhibiting external fire spread so long as it remains firmly supported by the structure. However, the AWC/ATF compartment fire testing had not adequately accounted for the connections in the CLT technologies to meet this crucial objective. The deformation of the connections when exposed to fire can expose gaps and flammable materials which can lead to spread both upwards through flaming, and downwards through dripping molten materials. Once fire starts spreading away from the floor of origin the safety of the occupants is compromised. Examples of vertical fire spread include:

- Las Vegas Hilton, USA: 22 Stories in approximately 25 minutes
- Caracas Tower, Venezuela: 17 floors in a 24-hour period
- Windsor Tower, Spain: 19 floors, ~7 hours for spread, 24 hours total fire duration
- TVCC Tower, China: 44 floors, around 15 minutes

4. Fire / Stack Effect

A similar concerning pattern emerges when discussing wind and air movement fire performance. One problem common to high-rises but not found in low-rise buildings is the stack effect movement of air inside the building.This air movement is critical to understand what happens during a fire event, as it can intensify a fire or allow flames and combustion gases to move beyond the room of origin. Fire personnel responding to a high-rise fire event need to understand where smoke and toxic gases may be going. Yet, shrinkage, moisture and creep, common in wood products including CLT, will create unpredictable opportunities for air movement within a building.

Air pressure and thermal differential with the use of CLT panels can shift the neutral pressure plane of the building. In cold weather (positive stack effect), the velocity of air channeling into the core from the lower floors is a very real concern to the occupants when they have to defend in place as well as fire service if the fire egress is compromised with smoke. In warm weather (reverse stack effect), where typically the staging floor is two floors below the fire floor, there can be concern of contamination, if there is unpredictability of where the fire path may be taking.

5. Fire / Wind

We typically associate wind with brush and wildland fires but it s just as important in structural fires.

- In 2009 a Texas probationary fire fighter and captain die as a result of rapid fire progression in a wind driven residential fire. Sustained winds from east/south-east at 17 mph with gusts up to 26 mph.

- Virginia Firefighters Battle Three-Alarm Townhouse Fire in 2011. In assessing the high winds and the fire conditions Battalion Barnes says fire crews tried to attack the flames inside two townhouses, but were forced back by intense heat and falling ceilings.

- In 2012 Prince George s County (Maryland), firefighters arrive on scene to a structure fire with winds impacting the rear of the structure. Shortly after forcing the front door open, they saw a dramatic change in fire behavior. As they made entry, they quickly experienced high velocity and high temperature gases, injuring seven firefighters, two critically.

The American Wood Council compartment fire tests did not account for wind loads.

Wind can add to the hazard to a low-rise fire, but it is most concerning around the upper floors of tall buildings. And high-rise fires create unique safety challenges for occupants and firefighters, even without the influence of wind. Wind can change the FLOW PATH of a fire and in some cases create a blowtorch effect and untenable conditions. When a window in the fire apartment fails, the influx of wind can create significant and rapid increases in the heat production of a fire. Smoke and heat spreading through corridors and stairwells, for instance, can inhibit occupants ability to escape and can limit firefighters ability to rescue them. Conditions in a corridor are of critical importance because it is the route that firefighters use to approach a fire and that occupants use to exit a building.

During the course of any structure fire, the wind may also influence exterior conditions and firefighter safety. Accelerated winds near high rises are caused by the downdraft effect , where the air hits a building and, with nowhere else to go, is pushed up, down and around the sides. The air forced downwards increases wind speed at street level. Tests conducted by National Institute of Standards and Technology (NIST 2012), the Fire Fighting Technology Group, FFTG, on positive pressure ventilation determined that an external wind speed of as low as 10 mph could cause a vented room within a structure to quickly spread from an apartment unit to a vent point, represented by a stairwell door. The spreading had floor-to-ceiling and wall-to-wall fire involvement with blowtorch effects. Moreover, if several towers stand near each other, the channeling effect, a wind acceleration created by air having to be squeezed through a narrow space. This Venturi effect will endanger the adjacent buildings.

6. Fire on Exterior

The AWC/ATF compartment fire tests did not account for exterior fire conditions and the proposed exterior proposal does not meet the required testing of CLT assemblies.

An important aspect of fire behavior in the affected building involves the burning behavior of materials on the exterior. While the AWC/ATF test demonstrated an understanding of CLT in an interior fire situation, the circumstances contributing to ignition scenarios of the exterior can be equally complex and equally important. In the past few years we have seen a number of deadly high-rise fires that propagated on the exterior of the structure.

- 2018 Almas Tower in Dubai, UAE
- 2017 Marco Polo apartment complex in Hawaii
- 2018 *Grenfell*Tower *fire* in West *London*

Simply testing the interior fire scenario does not capture potentially important parameters affecting CLT elements in tall wood buildings. If a fire in a heavy-timber building is not extinguished by the initial attack, a tremendous conflagration with flames coming out of the windows will spread fire to adjoining buildings by radiated heat. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors.

Notably missing from the proposals is how the mass timber exterior assembly in buildings over 40 feet in heightwould comply with NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components*.

- *Section 1403.5*: For combustible water-resistive barriers in buildings over 40 feet in height of Type I, II, III, or IV construction.
- *Section 1407.10.4*: For metal composite materials (MCM) used on buildings of Type I, II, III, and **IV** construction.
- *Section 1409.10.4*: For high-pressure decorative exterior-grade compact laminates (HPL) exterior wall coverings used on buildings of Type I, II, III, and **IV** construction.
- *Section 1509.6.2*: Combustible mechanical equipment screens used on buildings of Type I, II, III, and **IV** buildings.
- *Section 2603.5.5*: Exterior walls of buildings of Type I, II, III, and **IV** construction of any height incorporating foam plastic insulation, except for one-story sprinklered buildings.

This is a requirement yet there is no reference to NFPA 285 testing of exterior CLT assemblies. One test by Nordic Engineered Wood published under the Canadian ULC S134 is not enough of a sample size to validate the tall wood proposals. Again, there is not enough historical fires with cross laminated timber to provide information that can be used in an 85-ft building, much less one at 270 feet.

7. Limits of Redundancy

The ICC TW-AHC claimed the added safety factor of active sprinkler systems adds to the safety of the proposals. Without a doubt, the inclusion of fire sprinkler systems in our buildings since the late 1980 s has been effective at increasing the chances of survival in a fire. But when systems don t operate as intended (such as in a freeze failure with water damage) or fail in a high-rise fire condition, the impact can be large, not just in monetary terms, but also in the lives of the occupants and fire fighters.

The full-scale fire testing completed in Norway showed the The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin. (SPFR A15101 2016).[iv] Moreover, according to NFPA s report *U.S. Experience with Sprinklers*, sprinklers were effective at controlling the fire in 96% of fires in which they operated, but sprinklers were only effective in 88% of the fires large enough to activate them. The reported sprinkler failures (660 per year) were twice as common as reported fires in which sprinklers were ineffective and did not control the fire. A National Institute of Standards and Technology (NIST) study, *Estimates of Operational Reliability of Fire Protection Systems*, also demonstrates this over-reliance on fire sprinklers is misguided.

8. Untested Reference Standard

State and local governments that adopt and enforce model building codes which references a number of standards. Yet, the proposals regularly cite the newly referenced standard, *ANSI/APA PRG 320-2018: Standard for Performance-Rated Cross-Laminated Timber*, an untested document. The reference to ANSI/APA PRG 320-2018 resolves nothing and takes no legal responsibility for performance failure. APA PRG 320 has no real history of use or validation as a reliable document and no jurisdiction refers to this document. It is premature to utilize a standard that is rarely referenced and start building to 18 stories from it.

Bibliography:

[i] https://www.nist.gov/el/fire-research-division-73300/national-fire-research-laboratory-73306/fire-safety-challenges-0

[ii] https://buildingsciencelabs.com/wp-content/uploads/2017/11/CCBST-2017-Moisture-Uptake-Testing-for-CLT-Floor-Panels.pdf

[iii] Zabel RA, Morrell JJ (2012) Wood microbiology: decay and its prevention. Academic press.

[iv] http://www.mypaper.se/html5/customer/355/11143/?page=21

[v] https://sustainable-fire-engineering.sustainable-design.ie/wp-content/uploads/2015/08/NFPA-FPRF_Tall-Wood-Buildings-Fire-Safety-Challenges_2013.pdf

[vi] http://www.mypaper.se/html5/customer/355/11143/?page=21

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The proposed public comment would **reduce cost of construction**. Substantiation and references below.

1. Research:

A recent feasibility study [[i]] reveals that CLT construction is significantly more costly than other well-established construction methods such as concrete. Renowned structural engineers, Cary Kopczynski & Company found that the cost of the CLT structural system for a typical 10 story apartment building would cost $48 to $56 per square foot compared to $42 to $46 per square foot for concrete, translating nearly **20% premium** for Cross Laminated Timber.

2. Brock Commons, British Columbia

Per "University of British Columbia: Report to The Board of Governors, Tall Wood Student Residence, Brock Commons Phase 1" Report [[ii]], dated September 30, 2014,

- "The capital cost for the project is estimated at $44 million ($40m standard construction, plus $4m wood premium)."
- "The $4m estimated premium for advanced wood design and construction is to be funded from external sources including $3.45m secured to date from the Canada Wood Council (CWC) and Forest Innovation Investment."

This is a **10% premium** for Cross Laminated Timber at the 18-Story Brock Commons.

3. Framework Oregon:

Per the January 5, 2018 *Portland Oregonian* article "Wheeler Defends Decision to Invest In Pricey Complex" of the Portland Oregonian[[iii]],

- “While each unit is expected to cost an average $480,000 to build, the city’s contribution will amount to $100,000 per apartment.”
- Despite a pledge from Mayor Ted Wheeler to bring down the cost of affordable housing in Portland, the Portland Housing Bureau had nonetheless awarded the building $6 million toward the $29 million total. (A **21% subsidy** by the taxpayers for the 12- Story Framework project).

By the July 16, 2018 *Willamette Week* (*WW*) article “Plans for Record-Setting Timber Tower in Downtown Portland Fall Through” [[iv]] reported,

- The building, which was slated to include 60 *affordable* apartments, was projected to cost $651.43 per square foot, *WW* reported in December. (The 660-square foot two bedroom apartments were projected to cost $567,389 to build.)

4. Lumber Pricing:

And this doesn’t consider the recent price increases of softwood lumber that have risen wildly from $424 per board foot a year ago to $536 in the second quarter of 2018. That’s a **26% increase** in just one year. At the same time, concrete prices rose at a stable rate of 5%.

[i] http://buildingstudies.org/pdf/related_studies/Cross_Laminated_Timber_Feasibility_Study_Feb-2018.pdf

[ii] http://bog2.sites.olt.ubc.ca/files/2014/09/3.2_2014.09_Tall-Wood-Building.pdf

[iii] https://www.oregonlive.com/politics/index.ssf/2018/01/portland_mayor_ted_wheeler_def.html

[iv] http://www.wweek.com/news/city/2018/07/16/plans-for-record-setting-timber-tower-in-downtown-portland-fall-through/

Public Comment 13:

Proponent:

Greg Ralph, representing ClarkDietrich Engineering Services requests Disapprove

.

Commenter's Reason:

Proponents of G80 -18 claim the combustible CLT products have been validated by full scale multiple-story fire tests. In reality, the tests were only two stories. The low-rise tests have been severely extrapolated to the proposed 18 stories.

There is significant concern of the wisdom to extrapolate to these extremes. The characteristics of a fire event of this magnitude are unknown. The impact of the fuel load of these combustible materials is of significant concern. The proposed extrapolation from two stories to 18 is unreasonable.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared to the present requirements.

Public Comment 14:

Proponent:

Adam Shoemaker, representing ClarkDietrich (adam.shoemaker@clarkdietrich.com) requests Disapprove

.

Commenter's Reason:

In IBC Section 602.2 it states that 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 this code.

In table 601, Type IB and proposed Type IVB have the same Fire-Resistance Rating (FRR) requirements. I don t believe you can justify in this proposal to allow combustible AND non-combustible elements with the same FRR to have the same allowable number of stories above plane grade table 504.4. It is not reasonable to extrapolate the data from a two story fire test on combustible structural elements as an equal to Type IB non-combustible structural elements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No cost impact.

Public Comment 15:

Proponent:

Paul Tennis, representing Portland Cement Association (pdtennis@comporium.net) requests Disapprove

.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.

- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 16:

Proponent:

Larry Williams, representing Steel Framing Industry Association (williams@steelframingassociation.org) requests Disapprove

.

Commenter's Reason:

The leap in assumptions that fire tests on a two-storey mock up can be extrapolated to fire performance of an 18-story building is an unreasonable extension in the allowance for use of "professional judgement."

Proponents of G108-18 and related proposals state that the expected fire performance of mass timber buildings was “validated by a series of full scale multiple-story fire tests.” However, the actual model tested was only two storeys in height, and from this test users are expected to have confidence that a 180-foot tall building construction with cross-laminated timber will exhibit identical performance.

The fundamental problem of this assumption is that some characteristics of large fires have not been observed on small fires, either because they do not occur in small fires or because they are too small to be detected. It seems likely that a different set of controls of fire behavior may take over after a fire reaches a certain size or intensity. The difficulty of extrapolating from small to large fires is further complicated by the fact that behavior of fire is a pattern phenomenon--the behavior at one point is often dependent on the behavior at another point. The behavior of one part of a fire may change even if burning conditions at that point do not vary when the characteristics of the fire at some other point changes.

The structural and fire resistance performance of cross-laminated timber is fundamentally determined by the performance of the adhesive used to hold the layers of the product together. Delamination as a result of exposure of CLT to heat and flame have been identified as an issue of concern through both independent research and tests conducted under the supervision of members of the Ad Hoc Tall Wood Committee.

The solution to this concern was the addition of language in the proposal to reference PRG 320-18 which had not been published at the time of the submission of the proposed G108-18. Since the proposal was submitted, the PRG 320-18 has been published with an Appendix B that is intended to provide a test procedure to be used in evaluating the elevated temperature performance of adhesives.

This Appendix B has been public for less than 5 months, and consequently has no history of use that would validate assumptions that we are being asked to make. In addition, it clearly states that not all factors needed for a risk assessment are incorporated into the development of the Appendix. Further, the task of verifying that any of the methods discussed in the Appendix is left to the user.

Given the important role that adhesives play in the structural performance and safety of a bonded system, too little is known or provided that would ensure that 180-foot tall structures would be safe in the event of a fire or exposure to heat.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with current requirements.

Public Comment 17:

Proponent:

Dan Nichols, representing ICC Code Correlation Committee (ccc@iccsafe.org)

.

Commenter's Reason:

The Code Correlation Committee (CCC) is not taking a position on this code change. The CCC submitted this public comment in order to bring a correlation issue to the attention of the full voting membership for the Public Comment Hearings and the Online Governmental Consensus Vote to allow the voting membership to coordinate actions on a package of code changes submitted dealing with tall wood buildings of mass timber construction. This package includes the parent proposal G108-18; if disapproved, the related proposals G28-18, G75-18, G80-18, G84-18, G89-18, FS5-18, FS6-18, FS73-18, FS81-18 and F266-18, will not be correlated with any existing code text if they are approved.

The Code Correlation Committee is a standing committee of the International Code Council whose objectives, procedures and organization are set forth in Council Policy CP#44-13. The objective of the Code Correlation Committee is to maintain technical and editorial consistency among the International Codes and to assist staff in the evaluation and processing of code change proposals and comments that are exclusively editorial.

G80-18

G84-18

IBC: Table TABLE 506.2

Proposed Change as Submitted

Proponent:

Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB) (TWB@iccsafe.org)

2018 International Building Code

Revise as follows

TABLE 506.2

OCCUPANCY CLASSIFICATION					TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	TYPE IV				TYPE V		
		A	B	C	HT	A	B
A-1		45,000	30,000	18,750	15,000	11,500	5,500
		180,000	120,000	75,000	60,000	46,000	22,000
		135,000	90,000	56,250	45,000	34,500	16,500
A-2		45,000	30,000	18,750	15,000	11,500	6,000
		180,000	120,000	75,000	60,000	46,000	24,000
		135,000	90,000	56,250	45,000	34,500	18,000
A-3		45,000	30,000	18,750	15,000	11,500	6,000
		180,000	120,000	75,000	60,000	46,000	24,000
		135,000	90,000	56,250	45,000	34,500	18,000
A-4		45,000	30,000	18,750	15,000	11,500	6,000
		180,000	120,000	75,000	60,000	46,000	24,000
		135,000	90,000	56,250	45,000	34,500	18,000
A-5		UL	UL	UL	UL	UL	UL

		108,000	72,000	45,000	36,000	18,000	9,000
B		432,000	288,000	180,000	144,000	72,000	36,000
		324,000	216,000	135,000	108,000	54,000	27,000
		76,500	51,000	31,875	25,500	18,500	9,500
E		306,000	204,000	127,500	102,000	74,000	38,000
		229,500	153,000	95,625	76,500	55,500	28,500
		100,500	67,000	41,875	33,500	14,000	8,500
F-1		402,000	268,000	167,500	134,000	56,000	34,000
		301,500	201,000	125,625	100,500	42,000	25,500
		151,500	101,000	63,125	50,500	21,000	13,000
F-2		606,000	404,000	252,500	202,000	84,000	52,000
		454,500	303,000	189,375	151,500	63,000	39,000
H-1		10,500	10,500	10,500	10,500	7,500	NP
H-2		10,500	10,500	10,500	10,500	7,500	3,000
H-3		25,500	25,500	25,500	25,500	10,000	5,000
		72,000	54,000	40,500	36,000	18,000	6,500
H-4		288,000	216,000	162,000	144,000	72,000	26,000
		216,000	162,000	121,500	108,000	54,000	19,500
		72,000	54,000	40,500	36,000	18,000	9,000
H-5		288,000	216,000	162,000	144,000	72,000	36,000
		216,000	162,000	121,500	108000	54,000	27,000
		54,000	36,000	18,000	18,000	10,500	4,500
I-1		216,000	144,000	72,000	72,000	42,000	18,000
		162,000	108,000	54,000	54,000	31,500	13,500
I-2		36,000	24,000	12,000	12,000	9,500	NP

		144,000	96,000	48,000	48,000	38,000	NP
		108,000	72,000	36,000	36,000	28,500	NP
I-3		36,000	24,000	12,000	12,000	7,500	5,000
		144,000	96,000	48,000	48,000	30,000	20,000
		108,000	72,000	36,000	36,000	22,500	15,000
I-4		76,500	51,000	25,500	25,500	18,500	9,000
		306,000	204,000	102,000	102,000	74,000	36,000
		229,500	153,000	76,500	76,500	55,500	27,000
M		61,500	41,000	25,625	20,500	14,000	9,000
		246,000	164,000	102,500	82,000	56,000	36,000
		184,500	123,000	76,875	61,500	42,000	27,000
R-1h		61,500	41,000	25,625	20,500	12,000	7,000
		246,000	164,000	102,500	82,000	48,000	28,000
		184,500	123,000	76,875	61,500	36,000	21,000
R-2h		61,500	41,000	25,625	20,500	12,000	7,000
		246,000	164,000	102,500	82,000	48,000	28,000
		184,500	123,000	76,875	61,500	36,000	21,000
R-3h		UL	UL	UL	UL	UL	UL
R-4h		61,500	41,000	25,625	20,500	12,000	7,000
		246,000	164,000	102,500	82,000	48,000	28,000
		184,500	123,000	76,875	61,500	36,000	21,000

		76,500	51,000	31,875	25,500	14,000	9,000
S-1		306,000	204,000	127,500	102,000	56,000	36,000
		229,500	153,000	95,625	76,500	42,000	27,000
		115,500	77,000	48,125	38,500	21,000	13,500
S-2		462,000	308,000	192,500	154,000	84,000	54,000
		346,500	231,000	144,375	115,500	63,000	40,500
		54,000	36,000	22,500	18,000	9,000	5,500
U		216,000	144,000	90,000	72,000	36,000	22,000
		162,000	108,000	67,500	54,000	27,000	16,500

PORTIONS OF TABLE REMOVED REMAIN UNCHANGED

For SI: 1 square foot = 0.0929 m^2.

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building area in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the International Fire Code.
g. New Group I-4 occupancies see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.

Reason:

The Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board to explore the science of tall wood buildings and take action on developing code changes for tall wood buildings. The TWB has created several code change proposals with respect to the concept of tall buildings of mass timber and the background information is at the end of this Statement. Within the statement are important links to information, including documents and videos, used in the deliberations which resulted in these proposals.

The TWB and it various WGs held meetings, studied issues and sought input from various expert sources around the world. The TWB has posted those documents and input on its website for interested parties to follow its progress and to allow those parties to, in turn, provide input to the TWB.

At its first meeting, the TWB discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings:

1. No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.
2. No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios.
3. No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios.
4. No unusual fire department access issues.
5. Egress systems designed to protect building occupants during the design escape time, plus a factor of safety.
6. Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

The comprehensive package of proposals from the TWB meet these performance objectives.

Allowable Area

In addressing this topic, it was necessary to develop height and area criteria to address each new type of construction being proposed. Relying upon each new type of construction proposed for tall wood buildings (Types IV-A, IV-B and IV-C), the committee examined each type of construction for its safety and efficacy with regard to each occupancy type. This proposal on allowable areas should be considered as a companion proposal to the height proposals. The three proposals were developed with regard to one another as well as with regard to the new types of construction.

The TWB also determined that fire testing was necessary to validate these concepts. At its first meeting, members discussed the nature and intention of fire testing so as to ensure meaningful results for the TWB and, more specifically, for the fire service. Subsequently a test plan was developed. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stairway. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of joints, and to evaluate conditions for responding fire personnel. The Fire WG then refined the test plan, which was implemented with a series of five full-scale, multiple-story building tests at the Alcohol, Tobacco and Firearms (ATF) laboratories in Beltsville, MD. The results of those tests, as well as testing conducted by others, helped the Committee form the basis upon which the Codes WG developed its code change proposals. This code change proposal is one of those developed by the Codes WG and adopted by the TWB.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3-1/2 minutes each, please visit: http://bit.ly/ATF-firetestvideos.

Both of these links were confirmed active on 12/27/17.

Each proposed new type of construction was examined for its fire safety characteristics and compared to the existing, long-standing type of construction known as Heavy Timber. The committee found that it was reasonable to develop a multiplier which could be applied to the traditional HT areas. This was done for each new type of construction. Thus, the proposed new Type IV-C was 1.25 times the HT allowable area, IV-B was 2.00 times the HT allowable area and IV-A was 3.00 times the HT allowable area.

These multipliers were examined in terms of relative performance compared to traditional HT. They were reexamined on a case-by-case basis based upon relative hazard and occupancy classification. Some hazards were perceived to be greater and, thus, areas were adjusted downward to reflect the hazard. Other situations were similarly considered. For example, Hazardous and Institutional occupancies do not fully follow the multiplier method, as most areas for those occupancies were reduced from what the multiplier method would suggest.

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.

Background information: The ICC Board approved the establishment of an ad hoc committee for tall wood buildings in December of 2015. The purpose of the ad hoc committee is to explore the science of tall wood buildings and to investigate the feasibility and take action on developing code changes for tall wood buildings. The committee is comprised of a balance of stakeholders with additional opportunities for interested parties to participate in the four Work Groups established by the ad hoc committee, namely: Code; Fire; Standards/Definitions; and Structural. For more information, be sure to visit the ICC website https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/ (link active and up to date as of 12/27/17). As seen in the "Meeting Minutes and Documents" and "Resource Documents" sections of the committee web page, the ad hoc committee reviewed a substantial amount of information in order to provide technical justification for code proposals.

The ad hoc committee developed proposals for the followings code sections. The committee believes this package of code changes will result in regulations that adequately address the fire and life safety issues of tall mass timber buildings.

IBC Code Section	Description
403.3.2	Water supply requirements for fire pumps in high rise buildings of Type IVA and IVB construction.
504.3	Allowable building height (feet) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT construction.
504.4	Allowable building height (stories) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
506.2	Allowable building area for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
508.4.4.1 509.4.1.1 (new)	Requirements for mass timber building elements serving as fire barriers or horizontal assemblies in buildings of Type IVB of IVC construction.
602.4	Type of Construction requirements for new proposed types of construction: Types IVA, IVB and IVC. No changes to Type IV HT construction. Includes definitions for new terms: Mass timber and Noncombustible protection (mass timber). **THIS IS THE KEY CODE CHANGE PROPOSAL WHICH OUTLINES THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED NEW TYPE OF MASS TIMBER BUILDINGS. THE PROPOSAL ALSO ADDRESSES CONCEALED SPACES, ADHESIVE PERFORMANCE AND EXTERIOR WALL PROTECTION.**
703.8 (new)	The performance method to determine the increase to the fire resistance rating provided by noncombustible protection applied to the mass timber building element.
703.9 (new)	Requirements for sealants and adhesives to be placed at abutting edges and intersections of mass timber building elements. The reason statement references a Group B proposal to Chapter 17 for special inspection requirements of sealants and adhesives.
718.2.1	Requirements on the use of mass timber building elements used for Fireblocking.
722.7 (new)	Requirements for the fire resistance rating of mass timber elements, including minimum required protection and gypsum board attachment requirements.
3102	Requirements for membrane structures using Type IV HT construction.
3314.7 (new)	New special precautions during construction of buildings of Types IVA, IVB and IVC construction: Standpipes; Water supply for fire department connections; Noncombustible protection required for mass timber elements as construction height increases.
Appendix	Requirements for walls, floors and roofs of Type IV HT construction in buildings located in Fire Districts.
IFC Code Section	**Description**
701.6	Requirements which stipulate the owner's responsibility to maintain inventory of all required fire resistance rated construction in buildings of Types IVA and IVB construction. This includes an annual inspection and proper repair where necessary.
Proposed changes to be submitted in 2019 Group B	
IBC Chapter 17	Required special inspections of mass timber construction • Structural • Sealants and adhesives (see IBC 703.8)
IBC Chapter 23	An update to referenced standard APA PRG 320 Standard for Performance –rated Cross-laminated Timber which is currently undergoing revision to ensure the adequacy of the adhesives under fire conditions.

In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the tests, and many members witnessed the test in person or online. The results of the series of 5 fire tests provide additional support for these proposals, and validate the fire performance for each of the types of construction proposed by the committee. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of through-penetration fire stops, and to evaluate conditions for responding fire personnel.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3 ½ minutes, please visit:

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

G84-18

Public Hearing Results

Errata:

The balance of the table's columns are now shown.

Committee Action: As Submitted

Committee Reason:

The committee approved the proposal based on their previous testimony as recorded in the committee reason statements to proposals G27, G75, G80, G89, G108, G146, G152, FS5, FS6, F73 and FS81. (Vote: 14-0)

Assembly Action: None

G84-18

Individual Consideration Agenda

Public Comment 1:

Proponent:

Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org) requests As Modified by This Public Comment

Modify as follows:

2018 International Building Code

TABLE 506.2

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET [a, b]

OCCUPANCY CLASSIFICATION							**TYPE OF CONSTRUCTION**	**TYPE OF CONSTRUCTION**	**TYPE OF CONSTRUCTION**
		TYPE III		**TYPE IV**				**TYPE V**	
		A	**B**	**A**	~~**B**~~	**C**	**HT**	**A**	**B**
A-1		14,000	8,500	45,000	~~30,000~~	18,750	15,000	11,500	5,500
		56,000	34,000	180,000	~~120,000~~	75,000	60,000	46,000	22,000
		42,000	25,500	135,000	~~90,000~~	56,250	45,000	34,500	16,500
A-2		14,000	9,500	45,000	~~30,000~~	18,750	15,000	11,500	6,000
		56,000	38,000	180,000	~~120,000~~	75,000	60,000	46,000	24,000
		42,000	28,500	135,000	~~90,000~~	56,250	45,000	34,500	18,000
A-3		14,000	9,500	45,000	~~30,000~~	18,750	15,000	11,500	6,000
		56,000	38,000	180,000	~~120,000~~	75,000	60,000	46,000	24,000
		42,000	28,500	135,000	~~90,000~~	56,250	45,000	34,500	18,000
A-4		14,000	9,500	45,000	~~30,000~~	18,750	15,000	11,500	6,000
		56,000	38,000	180,000	~~120,000~~	75,000	60,000	46,000	24,000
		42,000	28,500	135,000	~~90,000~~	56,250	45,000	34,500	18,000
A-5		UL	UL	UL	~~UL~~	UL	UL	UL	UL
B		28,500	19,000	108,000	~~72,000~~	45,000	36,000	18,000	9,000
		114,000	76,000	432,000	~~288,000~~	180,000	144,000	72,000	36,000
		85,500	57,000	324,000	~~216,000~~	135,000	108,000	54,000	27,000
E		23,500	14,500	76,500	~~51,000~~	31,875	25,500	18,500	9,500

		94,000	58,000	306,000	~~204,000~~	127,500	102,000	74,000	38,000
		70,500	43,500	229,500	~~153,000~~	95,625	76,500	55,500	28,500
F-1		19,000	12,000	100,500	~~67,000~~	41,875	33,500	14,000	8,500
		76,000	48,000	402,000	~~268,000~~	167,500	134,000	56,000	34,000
		57,000	36,000	301,500	~~201,000~~	125,625	100,500	42,000	25,500
F-2		28,500	18,000	151,500	~~101,000~~	63,125	50,500	21,000	13,000
		114,000	72,000	606,000	~~404,000~~	252,500	202,000	84,000	52,000
		85,500	54,000	454,500	~~303,000~~	189,375	151,500	63,000	39,000
H-1		9,500	7,000	10,500	~~10,500~~	10,500	10,500	7,500	NP
H-2		9,500	7,000	10,500	~~10,500~~	10,500	10,500	7,500	3,000
H-3		17,500	13,000	25,500	~~25,500~~	25,500	25,500	10,000	5,000
H-4		28,500	17,500	72,000	~~54,000~~	40,500	36,000	18,000	6,500
		114,000	70,000	288,000	~~216,000~~	162,000	144,000	72,000	26,000
		85,500	52,500	216,000	~~162,000~~	121,500	108,000	54,000	19,500
H-5		28,500	19,000	72,000	~~54,000~~	40,500	36,000	18,000	9,000
		114,000	76,000	288,000	~~216,000~~	162,000	144,000	72,000	36,000
		85,500	57,000	216,000	~~162,000~~	121,500	108000	54,000	27,000
I-1		16,500	10,000	54,000	~~36,000~~	18,000	18,000	10,500	4,500
		66,000	40,000	216,000	~~144,000~~	72,000	72,000	42,000	18,000
		49,500	30,000	162,000	~~108,000~~	54,000	54,000	31,500	13,500
I-2		12,000	NP	36,000	~~24,000~~	12,000	12,000	9,500	NP
		48,000	NP	144,000	~~96,000~~	48,000	48,000	38,000	NP
		36,000	NP	108,000	~~72,000~~	36,000	36,000	28,500	NP
I-3		10,500	7,500	36,000	~~24,000~~	12,000	12,000	7,500	5,000
		42,000	30,000	144,000	~~96,000~~	48,000	48,000	30,000	20,000
		31,500	22,500	108,000	~~72,000~~	36,000	36,000	22,500	15,000
I-4		23,500	13,000	76,500	~~51,000~~	25,500	25,500	18,500	9,000
		94,000	52,000	306,000	~~204,000~~	102,000	102,000	74,000	36,000
		70,500	39,000	229,500	~~153,000~~	76,500	76,500	55,500	27,000
M		18,500	12,500	61,500	~~41,000~~	25,625	20,500	14,000	9,000
		74,000	50,000	246,000	~~164,000~~	102,500	82,000	56,000	36,000
		55,500	37,500	184,500	~~123,000~~	76,875	61,500	42,000	27,000
R-1h		24,000	16,000	61,500	~~41,000~~	25,625	20,500	12,000	7,000

		96,000	64,000	246,000	~~164,000~~	102,500	82,000	48,000	28,000
		72,000	48,000	184,500	~~123,000~~	76,875	61,500	36,000	21,000
R-2h		24,000	16,000	61,500	~~41,000~~	25,625	20,500	12,000	7,000
		96,000	64,000	246,000	~~164,000~~	102,500	82,000	48,000	28,000
		72,000	48,000	184,500	~~123,000~~	76,875	61,500	36,000	21,000
R-3h		UL	UL	UL	~~UL~~	UL	UL	UL	UL
R-4h		24,000	16,000	61,500	~~41,000~~	25,625	20,500	12,000	7,000
		96,000	64,000	246,000	~~164,000~~	102,500	82,000	48,000	28,000
		72,000	48,000	184,500	~~123,000~~	76,875	61,500	36,000	21,000
S-1		26,000	17,500	76,500	~~51,000~~	31,875	25,500	14,000	9,000
		104,000	70,000	306,000	~~204,000~~	127,500	102,000	56,000	36,000
		78,000	52,500	229,500	~~153,000~~	95,625	76,500	42,000	27,000
S-2		39,000	26,000	115,500	~~77,000~~	48,125	38,500	21,000	13,500
		156,000	104,000	462,000	~~308,000~~	192,500	154,000	84,000	54,000
		117,000	78,000	346,500	~~231,000~~	144,375	115,500	63,000	40,500
U		14,000	8,500	54,000	~~36,000~~	22,500	18,000	9,000	5,500
		56,000	34,000	216,000	~~144,000~~	90,000	72,000	36,000	22,000
		42,000	25,500	162,000	~~108,000~~	67,500	54,000	27,000	16,500

For SI: 1 square foot = 0.0929 m^2.

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.

d. The NS value is only for use in evaluation of existing building area in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the International Fire Code.
g. New Group I-4 occupancies see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.

Commenter's Reason:

We recommend that the Type IV-B mass timber designation be deleted from the tall wood building proposals.

The origins of the development of the types of construction were originally developed to “account for the response or participation that a building’s structure will have in a fire condition originating within the building as a result of the occupancy or the fuel load” (Example source from BOCA National Building Code 1993 Commentary). The modern day types of construction are parsed out into three primary categories of construction; noncombustible (Types I and II), noncombustible/combustible (Types III and IV) and combustible (Type V). Subcategories were created to identify the protection; Type A for protected and Type B for unprotected.

What we have within proposals G75-18, G80-18, G84-18, G89-18, and G108-18 is the addition of a new construction category that has been proposed based on the need to satisfy aesthetics based on the combination of Types IV-A and IV-C, which is a departure from the black and white construction categories based on construction that is non-combustible or combustible. We feel this inappropriate for the codes to begin to designate designer type construction categories.

In the past such mixing and matching of construction types into building or structure is more suited to the IBC Section 104.11 (Alternative materials, design and methods of construction and equipment), or through use of the ICC International Performance Code or performance analysis. We feel that these are the most appropriate options for the mixing-and-matching of construction types in building design.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This will not increase or decrease the cost of construction as this code change proposal and public comment address information that was not previously contained in the code, therefore there is no cost impact when compared to present requirements.

Public Comment 2:

Proponent:

Brian M. McGraw, P.E., Virginia Department of Fire Programs, State Fire Marshal's Office, representing Virginia State Fire Marshal's Office, Virginia Fire Services Board (brian.mcgraw@vdfp.virginia.gov) requests As Modified by This Public Comment

Modify as follows:

2018 International Building Code

TABLE 506.2

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET [a, b]

OCCUPANCY CLASSIFICATION				TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION	TYPE OF CONSTRUCTION
	TYPE IV				TYPE V	
	A	~~B~~	C	HT	A	B
A-1	~~45,000~~ 15,000	~~30,000~~ 15,000	~~18,750~~ 15,000	15,000	11,500	5,500
	~~180,000~~ 60,000	~~120,000~~ 60,000	~~75,000~~ 60,000	60,000	46,000	22,000
	135,000	90,000	56,250	45,000	34,500	16,500
A-2	~~45,000~~ 15,000	~~30,000~~ 15,000	~~18,750~~ 15,000	15,000	11,500	6,000
	~~180,000~~ 60,000	~~120,000~~ 60,000	~~75,000~~ 60,000	60,000	46,000	24,000
	135,000	90,000	56,250	45,000	34,500	18,000
A-3	~~45,000~~ 15,000	~~30,000~~ 15,000	~~18,750~~ 15,000	15,000	11,500	6,000
	~~180,000~~ 60,000	~~120,000~~ 60,000	~~75,000~~ 60,000	60,000	46,000	24,000
	135,000	90,000	56,250	45,000	34,500	18,000
A-4	~~45,000~~ 15,000	~~30,000~~ 15,000	~~18,750~~ 15,000	15,000	11,500	6,000
	~~180,000~~ 60,000	~~120,000~~ 60,000	~~75,000~~ 60,000	60,000	46,000	24,000
	135,000	90,000	56,250	45,000	34,500	18,000
A-5	UL	UL	UL	UL	UL	UL
B	~~108,000~~ 36,000	~~72,000~~ 36,000	~~45,000~~ 36,000	36,000	18,000	9,000
	432,000	288,000	180,000	144,000	72,000	36,000
	324,000	~~216,000~~ 54,000	~~135,000~~ 54,000	~~108,000~~ 54,000	54,000	27,000

E		~~76,500~~ 25,500	~~51,000~~ 25,500	~~31,875~~ 25,500	25,500	18,500	9,500
		306,000	204,000	127,500	102,000	74,000	38,000
		229,500	~~153,000~~ 55,000	~~95,625~~ 55,000	~~76,500~~ 55,000	55,500	28,500
F-1		~~100,500~~ 33,500	~~67,000~~ 33,500	~~41,875~~ 33,500	33,500	14,000	8,500
		402,000	268,000	167,500	134,000	56,000	34,000
		301,500	~~201,000~~ 42,000	~~125,625~~ 42,000	~~100,500~~ 42,000	42,000	25,500
F-2		~~151,500~~ 50,500	~~101,000~~ 50,500	~~63,125~~ 50,500	50,500	21,000	13,000
		~~606,000~~ 202,000	~~404,000~~ 202,000	~~252,500~~ 202,000	202,000	84,000	52,000
		~~454,500~~ 151,500	~~303,000~~ 151,500	~~189,375~~ 151,500	151,500	63,000	39,000
H-1		10,500	10,500	10,500	10,500	7,500	NP
H-2		10,500	10,500	10,500	10,500	7,500	3,000
H-3		~~25,500~~ 10,000	~~25,500~~ 10,000	~~25,500~~ 10,000	25,500	10,000	5,000
H-4		~~72,000~~ 36,000	~~54,000~~ 36,000	~~40,500~~ 36,000	36,000	18,000	6,500
		~~288,000~~ 144,000	~~216,000~~ 144,000	~~162,000~~ 144,000	144,000	72,000	26,000
		216,000	162,000	121,500	108,000	54,000	19,500
H-5		~~72,000~~ 36,000	~~54,000~~ 36,000	~~40,500~~ 36,000	36,000	18,000	9,000
		~~288,000~~ 144,000	~~216,000~~ 144,000	~~162,000~~ 144,000	144,000	72,000	36,000
		216,000	162,000	121,500	108000	54,000	27,000
I-1		~~54,000~~ 18,000	~~36,000~~ 18,000	18,000	18,000	10,500	4,500

		216,000	144,000	72,000	72,000	42,000	18,000
		162,000	~~108,000~~ 31,500	~~54,000~~ 31,500	~~54,000~~ 31,500	31,500	13,500
		~~36,000~~ 12,000	~~24,000~~ 12,000	12,000	12,000	9,500	NP
I-2		144,000	96,000	48,000	48,000	38,000	NP
		108,000	~~72,000~~ 28,500	~~36,000~~ 28,500	~~36,000~~ 28,500	28,500	NP
		~~36,000~~ 12,000	~~24,000~~ 12,000	12,000	12,000	7,500	5,000
I-3		~~144,000~~ 48,000	~~96,000~~ 48,000	48,000	48,000	30,000	20,000
		~~108,000~~ 36,000	~~72,000~~ 36,000	36,000	36,000	22,500	15,000
		~~76,500~~ 25,500	~~51,000~~ 25,500	25,500	25,500	18,500	9,000
I-4		~~306,000~~ 102,000	~~204,000~~ 102,000	102,000	102,000	74,000	36,000
		~~229,500~~ 76,500	~~153,000~~ 76,500	76,500	76,500	55,500	27,000
		~~61,500~~ 20,500	~~41,000~~ 20,500	~~25,625~~ 20,500	20,500	14,000	9,000
M		246,000	164,000	102,500	82,000	56,000	36,000
		184,500	~~123,000~~ 42,000	~~76,875~~ 42,000	~~61,500~~ 42,000	42,000	27,000
		~~61,500~~ 20,500	~~41,000~~ 20,500	~~25,625~~ 20,500	20,500	12,000	7,000
R-1h		246,000	164,000	102,500	82,000	48,000	28,000
		184,500	~~123,000~~ 36,000	~~76,875~~ 36,000	~~61,500~~ 36,000	36,000	21,000
		~~61,500~~ 20,500	~~41,000~~ 20,500	~~25,625~~ 20,500	20,500	12,000	7,000
R-2h		246,000	164,000	102,500	82,000	48,000	28,000
		184,500	~~123,000~~ 36,000	~~76,875~~ 36,000	~~61,500~~ 36,000	36,000	21,000
R-3h		UL	UL	UL	UL	UL	UL

R-4h		61,500	41,000	25,625	20,500	12,000	7,000
		246,000	~~164,000~~ 48,000	~~102,500~~ 48,000	~~82,000~~ 48,000	48,000	28,000
		184,500	~~123,000~~ 36,000	~~76,875~~ 36,000	~~61,500~~ 36,000	36,000	21,000
S-1		76,500	51,000	31,875	25,500	14,000	9,000
		306,000	~~204,000~~ 56,000	~~127,500~~ 56,000	~~102,000~~ 56,000	56,000	36,000
		229,500	~~153,000~~ 42,000	~~95,625~~ 42,000	~~76,500~~ 42,000	42,000	27,000
S-2		115,500	77,000	48,125	38,500	21,000	13,500
		462,000	~~308,000~~ 84,000	~~192,500~~ 84,000	~~154,000~~ 84,000	84,000	54,000
		346,500	~~231,000~~ 63,000	~~144,375~~ 63,000	~~115,500~~ 63,000	63,000	40,500
U		~~54,000~~ 18,000	~~36,000~~ 18,000	~~22,500~~ 18,000	18,000	9,000	5,500
		~~216,000~~ 72,000	~~144,000~~ 72,000	~~90,000~~ 72,000	72,000	36,000	22,000
		~~162,000~~ 54,000	~~108,000~~ 54,000	~~67,500~~ 54,000	54,000	27,000	16,500

For SI: 1 square foot = 0.0929 m^2.

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building area in accordance with the International Existing Building Code.
e. 903.2.6.oup I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the International Fire Code.
g. New Group I-4 occupancies see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.

Commenter's Reason:

The Virginia Fire Services Board opposes Proposal G84-18 as originally submitted. We propose that the allowable areas in this proposal be reduced to those currently allowed for Type IV-HT construction until additional testing can be performed to validate the assumptions on which the currently proposed areas are based. While we do not oppose the concept of utilizing renewable resources, such as timber, in the construction of buildings, we are not convinced that “tall wood buildings” with floor areas of up to 432,000 square feet per floor provide an acceptable level of safety to occupants or responding firefighters.

The reason statement for this proposal indicates that the Ad-Hoc Committee on Tall Wood Buildings (TWB) “discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings” including:

- Egress systems designed to protect building occupants during the design escape time, plus a safety factor.
- Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

There is no reference in the stated performance objectives related to protecting firefighters and other emergency responders during the time required to access and extinguish a fire. The Report on High-Rise Fireground Field Experiments, NIST Technical Note 1797, published in April 2013, indicates times between 21 and 23 minutes from fire ignition for fire crews to reach the 11th floor of a high-rise building, depending on crew size. These times are based on studies involving major metropolitan fire departments. There are many variables that could significantly increase these times, including time for notification of the fire department, turnout time, response time and vertical travel time to reach higher floors.

There were 14 proposals submitted by the TWB. Only one, G28-18, addresses the reliability of fire suppression systems. It requires the water supply to required fire pumps be supplied by connections to not fewer than two water mains located in different streets for tall wood buildings that are more than 120 feet in building height. This proposal does nothing to increase the reliability of fire suppression system in buildings less than 120 feet tall. In addition, it does nothing to increase the reliability of the suppression systems within the building itself. There is no requirement to demonstrate the reliability of the fire suppression system as compared to the evacuation time and risk of collapse. It should also be noted that this proposal allows the construction of tall wood buildings to a height of 65 feet with no requirements for fire suppression systems.

We acknowledge that fire tests have been conducted; however, we do not believe that the results of the fire tests provide sufficient justification to allow tall wood building to be constructed with areas of up to 432,000 square feet per story. The original proposal cites "engineering judgment" as the basis for a comparative analysis between Type I and Type IV buildings and the extrapolation of two-story fire tests to the proposed building areas. There has been no testing to demonstrate the performance of these structures after aging for a period of years or decades.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposal does not change the method of construction; rather, it limits the allowable area for the specified type of construction.

Public Comment 3:

Proponent:

Kevin Reinertson, representing Riverside County Fire Department, representing California Fire Chiefs Association (kevin.reinertson@fire.ca.gov); Michael O'Brian (mobrian@brightonareafire.com) requests As Modified by This Public Comment

Modify as follows:

2018 International Building Code

TABLE 506.2

ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET [a, b]

OCCUPANCY CLASSIFICATION		TYPE OF CONSTRUCTION					
		TYPE IV				TYPE V	
		A	~~B~~	C	HT	A	B
A-1		~~45,000~~ 31,500	~~30,000~~ 21,000	~~18,750~~ 15,000	15,000	11,500	5,500
		~~180,000~~ 126,000	~~120,000~~ 84,000	~~75,000~~ 60,000	60,000	46,000	22,000

		~~135,000~~ 108,000	~~90,000~~ 63,000	~~56,250~~ 45,000	45,000	34,500	16,500
A-2		~~45,000~~ 31,500	~~30,000~~ 21,000	~~18,750~~ 15,000	15,000	11,500	6,000
		~~180,000~~ 126,000	~~120,000~~ 84,000	~~75,000~~ 60,000	60,000	46,000	24,000
		~~135,000~~ 108,000	~~90,000~~ 63,000	~~56,250~~ 45,000	45,000	34,500	18,000
A-3		~~45,000~~ 31,500	~~30,000~~ 21,000	~~18,750~~ 15,000	15,000	11,500	6,000
		~~180,000~~ 126,000	~~120,000~~ 84,000	~~75,000~~ 60,000	60,000	46,000	24,000
		~~135,000~~ 108,000	~~90,000~~ 63,000	~~56,250~~ 45,000	45,000	34,500	18,000
A-4		~~45,000~~ 31,500	~~30,000~~ 21,000	~~18,750~~ 15,000	15,000	11,500	6,000
		~~180,000~~ 126,000	~~120,000~~ 84,000	~~75,000~~ 60,000	60,000	46,000	24,000
		~~135,000~~ 108,000	~~90,000~~ 63,000	~~56,250~~ 45,000	45,000	34,500	18,000
A-5		UL	UL	UL	UL	UL	UL
B		~~108,000~~ 75,500	~~72,000~~ 50,500	~~45,000~~ 36,000	36,000	18,000	9,000
		~~432,000~~ 302,500	~~288,000~~ 201,500	~~180,000~~ 144,000	144,000	72,000	36,000
		~~324,000~~ 226,750	~~216,000~~ 151,500	~~135,000~~ 108,000	108,000	54,000	27,000
E		~~76,500~~ 53,500	~~51,000~~ 35,550	~~31,875~~ 25,500	25,500	18,500	9,500

		~~306,000~~ 214,000	~~204,000~~ 142,750	~~127,500~~ 102,000	102,000	74,000	38,000
		~~229,500~~ 160,500	~~153,000~~ 107,000	~~95,625~~ 76,500	76,500	55,500	28,500
F-1		~~100,500~~ 70,500	~~67,000~~ 47,000	~~41,875~~ 33,500	33,500	14,000	8,500
		~~402,000~~ 281,500	~~268,000~~ 187,500	~~167,500~~ 134,000	134,000	56,000	34,000
		~~301,500~~ 211,000	~~201,000~~ 140,750	~~125,625~~ 100,500	100,500	42,000	25,500
F-2		~~151,500~~ 106,000	~~101,000~~ 70,750	~~63,125~~ 50,500	50,500	21,000	13,000
		~~606,000~~ 424,000	~~404,000~~ 282,750	~~252,500~~ 202,000	202,000	84,000	52,000
		~~454,500~~ 318,000	~~303,000~~ 212,000	~~189,375~~ 151,500	151,500	63,000	39,000
H-1		10,500	10,500	10,500	10,500	7,500	NP
H-2		10,500	10,500	10,500	10,500	7,500	3,000
H-3		25,500	25,500	25,500	25,500	10,000	5,000
H-4		~~72,000~~ 50,400	~~54,000~~ 37,800	~~40,500~~ 36,000	36,000	18,000	6,500
		~~288,000~~ 201,600	~~216,000~~ 151,200	~~162,000~~ 144,000	144,000	72,000	26,000
		~~216,000~~ 151,200	~~162,000~~ 113,400	~~121,500~~ 108,000	108,000	54,000	19,500
H-5		~~72,000~~ 50,400	~~54,000~~ 37,800	~~40,500~~ 36,000	36,000	18,000	9,000

		~~288,000~~ 201,600	~~216,000~~ 151,200	~~162,000~~ 144,000	144,000	72,000	36,000
		~~216,000~~ 151,200	~~162,000~~ 113,400	~~121,500~~ 108,000	108000	54,000	27,000
I-1		~~54,000~~ 37,800	~~36,000~~ 25,200	18,000	18,000	10,500	4,500
		~~216,000~~ 151,200	~~144,000~~ 100,800	72,000	72,000	42,000	18,000
		~~162,000~~ 113,400	~~108,000~~ 75,600	54,000	54,000	31,500	13,500
I-2		~~36,000~~ 25,200	~~24,000~~ 16,800	12,000	12,000	9,500	NP
		~~144,000~~ 100,800	~~96,000~~ 67,200	48,000	48,000	38,000	NP
		~~108,000~~ 75,600	~~72,000~~ 50,400	36,000	36,000	28,500	NP
I-3		~~36,000~~ 25,200	~~24,000~~ 16,800	12,000	12,000	7,500	5,000
		~~144,000~~ 100,800	~~96,000~~ 67,200	48,000	48,000	30,000	20,000
		~~108,000~~ 75,600	~~72,000~~ 50,400	36,000	36,000	22,500	15,000
I-4		~~76,500~~ 53,500	~~51,000~~ 35,700	25,500	25,500	18,500	9,000
		~~306,000~~ 214,200	~~204,000~~ 142,800	102,000	102,000	74,000	36,000
		~~229,500~~ 160,650	~~153,000~~ 107,100	76,500	76,500	55,500	27,000
M		~~61,500~~ 43,050	~~41,000~~ 28,500	~~25,625~~ 20,500	20,500	14,000	9,000

		~~246,000~~ 172,200	~~164,000~~ 115,000	~~102,500~~ 82,000	82,000	56,000	36,000
		~~184,500~~ 129,150	~~123,000~~ 86,000	~~76,875~~ 61,500	61,500	42,000	27,000
R-1[h]		~~61,500~~ 43,050	~~41,000~~ 28,500	~~25,625~~ 20,500	20,500	12,000	7,000
		~~246,000~~ 172,200	~~164,000~~ 115,000	~~102,500~~ 82,000	82,000	48,000	28,000
		~~184,500~~ 129,150	~~123,000~~ 86,000	~~76,875~~ 61,500	61,500	36,000	21,000
R-2[h]		~~61,500~~ 43,050	~~41,000~~ 28,500	~~25,625~~ 20,500	20,500	12,000	7,000
		~~246,000~~ 172,200	~~164,000~~ 115,000	~~102,500~~ 82,000	82,000	48,000	28,000
		~~184,500~~ 129,150	~~123,000~~ 86,000	~~76,875~~ 61,500	61,500	36,000	21,000
R-3[h]		UL	UL	UL	UL	UL	UL
R-4[h]		~~61,500~~ 43,050	~~41,000~~ 28,500	~~25,625~~ 20,500	20,500	12,000	7,000
		~~246,000~~ 172,200	~~164,000~~ 115,000	~~102,500~~ 82,000	82,000	48,000	28,000
		~~184,500~~ 129,150	~~123,000~~ 86,000	~~76,875~~ 61,500	61,500	36,000	21,000
S-1		~~76,500~~ 53,585	~~51,000~~ 35,500	~~31,875~~ 25,500	25,500	14,000	9,000
		~~306,000~~ 214,200	~~204,000~~ 143,000	~~127,500~~ 102,000	102,000	56,000	36,000

		~~229,500~~ 160,650	~~153,000~~ 107,100	~~95,625~~ 76,500	76,500	42,000	27,000
S-2		~~115,500~~ 80,850	~~77,000~~ 53,900	~~48,125~~ 38,500	38,500	21,000	13,500
		~~462,000~~ 323,400	~~308,000~~ 215,600	~~192,500~~ 154,000	154,000	84,000	54,000
		~~346,500~~ 242,550	~~231,000~~ 161,700	~~144,375~~ 115,500	115,500	63,000	40,500
U		~~54,000~~ 37,8000	~~36,000~~ 25,200	~~22,500~~ 18,000	18,000	9,000	5,500
		~~216,000~~ 151,200	~~144,000~~ 100,800	~~90,000~~ 72,000	72,000	36,000	22,000
		~~162,000~~ 113,400	~~108,000~~ 75,600	~~67,500~~ 54,000	54,000	27,000	16,500

For SI: 1 square foot = 0.0929 m^2.

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building area in accordance with the International Existing Building Code.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies, Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the International Fire Code.
g. New Group I-4 occupancies see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.

Commenter's Reason:

This is a series of comments to modify the proposed height, stories, and allowable area of the new Type IV-A, Type IV-B, and Type IV-C proposed construction classifications as proposed by the Ad-Hoc Committee on Tall Wood Buildings.

There is concern on the formulas utilized are not fully supported by technical substantiation and are missing the needed technical support to allow the construction type to such heights. This change takes a moderate approach and reduces the allowable heights, area, and stories by a factor of 30%.

This proposed public comment doesn't dismiss the concept out of hand, we do feel the current proposals go too far, to fast in an area of significant and long-lasting importance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The area for this proposal is not allowed currently and therefore doesn't increase or decrease

Public Comment 4:

Proponent:

Gary Bridgens, representing Mass Timber Code Coalition (info@buildtallbuildsafe.com) requests As Submitted

Commenter's Reason:

PUBLIC COMMENT

SUBMITTED BY GARY BRIDGENS

ON BEHALF OF THE MASS TIMBER CODE COALITION

The Mass Timber Code Coalition has been organized to provide information on the code proposals drafted by the Ad Hoc Committee on Tall Wood Buildings

Mass timber is not new to the *International Building Code* (IBC). Currently listed as Type IV Heavy Timber, this construction type is a proven option that fully complies with the structural and fire resistive requirements of the IBC. The code recognizes that mass timber is a fundamentally different material than dimension lumber used in more familiar "stick built" wood construction. The code also recognizes the inherent fire resistance of mass timber, where charring in a fire event provides protection of inner structures, as well as a consistent and predictable rate of charring.

With the expansion of the mass timber supply chain, panels of cross-laminated timber (CLT), nail-laminated timber (NLT) and glue-laminated timber (Glulam), requests for approvals of tall mass timber buildings (TMTB) by local authorities have become more common. Estimates by industry sources have identified 35 current proposals for tall mass timber buildings, ranging from 7 to 24 stories, in 21 different jurisdictions.

Importantly, this interest in tall mass timber construction has been reliant on various local codes and approval processes. The IBC does not currently account for these tall wood buildings, beyond the current Type IV Heavy Timber height and area limitations.

The Ad Hoc Committee on Tall Wood Buildings (AHC-TWB)

To ensure the IBC keeps pace with the changing construction marketplace, the Board of Directors of the International Code Council (ICC) appointed the Ad Hoc Committee on Tall Wood Buildings (AHC-TWB) in 2015. The AHC-TWB included members from the code official, regulatory, construction, engineering, architectural, fire services and materials communities.

The AHC-TWB was specifically charged with investigating the science of mass timber construction, undertaking any necessary new research and recommending any code changes needed to ensure safety in TMTB. The AHC-TWB set performance criteria of its own: any code change developed was required to achieve the following.

1. No collapse under scenarios of complete burn-out of fuel without automatic sprinkler protection;
2. No high radiation exposure from the subject building to adjoining properties that risk ignition under severe fire scenarios;
3. No unusual response from radiation exposure from adjacent properties that risk ignition of the subject building under severe fire scenarios;
4. No unusual fire department access issues;
5. Egress systems to protect occupants during design escape times plus a margin of safety;
6. Enhanced and redundant fire protection systems to ensure performance during various fire scenarios.

Code Change Proposals

After two years of work, the AHC-TWB has produced 14 code change proposals. All 14 of these proposals were recommended for approval by various ICC committees at the recent ICC 2018 Group A Committee Action Hearing.

The key change, G108-18, defines three new categories of Type -IV Mass Timber construction:

Type IV-A: 1 to 18 stories based on Occupancy Classification. 3-hour fire resistance rating with non-combustible protection throughout;

Type IV-B: 1 to 12 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection on most mass timber surfaces;

Type IV-C: 1 to 9 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection for critical areas; exit enclosures, etc.

Each new construction type defined by the AHC-TWB (Type IV-A, B and C) has fire resistance requirements as robust or more robust than those required for comparable non-combustible (concrete and steel) buildings.

Other provisions provide standards for mass timber manufacturing, height/area restrictions, active and passive fire protection systems, fire safety during construction, enhanced water supply requirements, and standards for sealants and adhesives.

Fire Resistance of Mass Timber

Citing fire and market concerns, both the Portland Cement Association and the National Ready Mix Concrete Association have criticized the AHC-TWB code change proposals as "untested" and "unsound." However, these criticisms fail to consider that:

1. The purpose of the International Building Code is to provide building officials with the tools they need to ensure public and first-responder safety. It is not to choose winners and losers in the market, nor is it to defend any single industry's position;
2. Tall mass timber buildings already built are performing well;
3. Mass timber (and heavy timber before it) has undergone extensive fire resistance testing in multiple fire scenarios by Underwriters Laboratories, the Southwest Research Institute, the National Research Council of Canada and the U.S. Government's ATF Fire Research Laboratory, the world's largest indoor fire investigation lab.

Numerous mass timber floor/ceiling and wall assemblies have been tested at national laboratories using ASTM E119 standards. This testing history shows that mass timber has repeatedly achieved the hourly fire resistance requirements of the code. This is in part because of charring properties that provide a steady and predictable measurement of fire resistance. Additionally, detailed code requirements for non-combustible protection applied to the mass timber greatly enhance the hourly rating. Further, fire protection systems (active and passive) also ensure safety in mass timber structures.

The AHC-TWB benefitted from recent tests in 2017 at the U.S. ATF Fire Research Laboratory on full-scale mass timber buildings. Most tests assumed an unlikely failure of sprinkler systems:

1. Mass timber apartment with full fuel load. Fully protected by Type X gypsum wall board. Fire self-extinguished after 3 hours with no significant charring on mass timber surfaces;
2. Mass timber apartment with full fuel load. 20% exposed CLT ceiling. Test concluded at 4-hour mark after fuel burnout. CLT self-extinguished after charring;
3. Mass timber apartment with full fuel load. 2 CLT walls fully exposed. Fuel burnout at 4-hours. CLT walls self-extinguished after charring;
4. Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire quickly extinguished;
5. Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire allowed to grow to flashover (23 minutes) then quickly extinguished.

In fact, proposed Type IVA, B and C fire resistance requirements are the same or more robust than comparable steel and concrete construction. Further detail can be obtained at buildtallbuildsafe.com.

Benefits of Mass Timber Construction

In addition to the obvious environmental attributes of using a renewable resource in construction and the boost for the economies in timber-producing regions, builders and communities cite several distinctive benefits that make mass timber buildings an attractive option:

Builders report several benefits, including:

1. **Job site safety.** Mass timber panels are easy to install and can be delivered to a work site as needed, rather than stockpiled. Moreover, worker training is easier as is exposure to job site risk;
2. **Job site efficiency.** Persistent labor shortages are eased as more workers are qualified to work with mass timber panels. Jobs are built more quickly and materials are delivered as needed, thereby reducing costs;
3. **Design.** The favorable strength-to-weight ratio of CLT and the characteristics of wood offer more design options and more attractive built environments, improving business performance.

Local communities embrace mass timber construction:

1. **Faster and quieter.** The dislocation experienced by neighboring communities is reduced in mass timber projects. In addition to lower fire risks, things occur more quickly and panels are installed more simply than comparable steel and concrete sites;
2. **Greener.** Forestry officials cite the carbon sequestration properties of wood, but also the benefits to forest management of using wood products more efficiently and effectively, thereby further reducing decay and fire risk;
3. **Energy efficient.** Manufacturing mass timber is less energy intensive then other building materials. More importantly, the superior insulation characteristics of wood far outperform steel and concrete structures.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

Public Comment 5:

Proponent:

Sam Francis, representing American Wood Council (sfrancis@awc.org) requests As Submitted

Commenter's Reason:

AWC was appointed to be a member of the ICC Tall Wood Building Ad Hoc Committee (TWB), the single wood industry representative on the TWB. AWC is not speaking for TWB on this issue. It simply is relaying information regarding the development of the proposals. Other members of the 16-member TWB included representation from architects, engineers, fire protection engineers, fire marshals, testing laboratories, and fire fighters, as well as the major materials industries. After two years of study, listening to testimony, reviewing documents, reviewing public input, conducting an extensive test program, and reviewing test results from tests around the world, the TWB made this proposal to ICC for the membership s consideration.

Early in the process, the TWB heard proposals from four different commenters suggesting maximum stories of 20, 24, 40, and 42 stories. The TWB worked through dozens of drafts of the proposed new types of construction, dozens more pertaining to the building height in stories, nearly a dozen pertaining to building height in feet and nearly a dozen regarding maximum permitted building area per floor. These documents were all posted to the TWB page of the ICC website. Comments were solicited for all drafts.

The first aspect of height and area taken up by the TWB was height in stories. That seemed to be the easiest to get at with the information gleaned from the testimony and documentation presented to the TWB. A public comment by AWC to G80 outlines how experts from around the world presented a case to the TWB that mass timber was equivalent to types I-A and I-B in every way other than the combustibility of the base material. They outlined various strategies for overcoming that combustibility issue. The TWB relied upon this concept of equivalent performance to determine its maximum permitted height in stories. The Reason Statement provided by the TWB Chairman, Steve DiGiovanni, clearly lays out the background for, and the process of, the deliberation on Height in Stories. That is a must read to understand this process and its outcomes.

Next, based upon comments submitted, TWB tried to assign height in feet to its chosen maximum stories. In its first drafts, the maximum number of stories for proposed type IV-A was 24 for a few occupancy groups. Similarly, IV-B was proposed to be limited to 12 stories based on the equivalency mentioned above. Thus, IV-B was assigned the same maximum height in feet as type I-B, 180 feet. My Public Comment on G75 explains the TWB s rationale for assigning the stories in its proposal.

The TWB took up the allowable area issue. The Reason Statement of its proposal G84-18 describes in great detail the process by which the TWB created a draft H A table, reviewed it cell by cell for efficacy, reasonable fire safety and so on. Based on that review, the TWB modified results using professional judgment and input from commenters. Thus the H A proposal saw many cells of reduced allowable area. This is a well prepared package, well thought out, with good documentation which is all available on the ICC website, TWB page. It is the product of the performance approach the TWB chose to use in following the ICC Board of Directors instructions to study the issues. The technical support for the proposal is the criteria that these construction types meet the fire resistance required of other existing construction. The TWB then developed a fire test plan which validated the concepts.

Of equal importance here is that the TWB recognizes that mass timber is NOT wood frame, light weight construction, or stick built construction. In fact, in order to ensure that its performance objectives would be correctly interpreted and that any building constructed to these requirements would meet, and probably exceed, its performance expectations.

Some observers have the mistaken belief that the permitted areas of this proposal will allow larger areas than those permitted for concrete or steel construction. The TWB insists that since these types of construction are based on equivalent performance, they are a great decrease from I-A or I-B construction s allowable areas. See the tables attached at the end of this comment for a comparison of the allowable areas. Clearly, Unlimited area is considerably larger than the finite, limits of the TWB proposal.

The fire test program, drafted by the Fire Work Group of the TWB to validate these concepts, may be seen as videos of each of the five tests. They can be found at this link or on the ICC TWB web page.

https://www.youtube.com/playlist?list=PL_sDiz8JiMIwby77vfpPSPucEhBuEK22P

This proposal is thoroughly conservative. Mass timber buildings are completely different from conventional wood construction of studs and joists. Besides the automatic fire suppression and other life safety systems required for all high rises (including enhanced water supply), all loadbearing walls in mass timber buildings will be solid wood slabs typically between 6 and 20 inches thick, fire resistance rated, and directly protected with noncombustible protection equally at least 2/3 of the required rating. Light frame wood stud construction is prohibited. Nonbearing partitions will be solid mass timber slabs or noncombustible (steel) studs. All loadbearing horizontal assemblies will be solid mass timber slabs between 4 and 12 inches thick, fire resistance rated, protected on the underside with noncombustible protection equaling at least 2/3 of the required rating, and on the upper side with not less than one inch of noncombustible material. Light frame wood joist construction is prohibited. All construction enclosing concealed spaces will be noncombustible (steel) framing or mass timber protected with noncombustible materials. Full scale compartments fire tests for this new construction system reflecting Types IV-A and IV-B construction have shown that conservative residential fuel loads will completely burn out without the mass timber becoming involved in the fire, or will self-extinguish following burn-out, all without the sprinkler system operating.

The following points respond to misleading claims made by opponents:

Measures to prevent exterior fire propagation exceed current

tall building code requirements

Proposed code requirements to prevent exterior fire spread on tall mass timber buildings are significantly more restrictive than what is permitted for non-combustible construction. **Simply put; no combustible materials are permitted on the exterior side of exterior walls** (except for a required water-resistive barrier). What is proposed for tall mass timber buildings is more conservative than any other construction type, including non-combustible Types I and II. Exterior walls of these buildings will require:

- Continuous insulation on the exterior, where provided, must be non-combustible.
- Protection with at least 40 minutes of fire resistance from noncombustible materials.
- Additional testing to an exterior fire propagation standard

Tall wood building fire tests expand beyond standard testing

and consider severe real fire demonstrations

No other building elements have been tested in fires as severe as those used to substantiate the building code proposals. Fire testing for mass timber exposed timber building elements to extreme fires, which, in reality, will be extremely rare in sprinklered tall wood buildings. In addition to reviewing results of standardized testing of mass timber building elements, the ICC Tall Wood Building (TWB) committee, which included members of the fire service, developed and witnessed full-scale, multistory building compartment fire testing. In the tests, in addition to having typical residential furnishings as a fuel load, a number of wood cribs were added to provide additional fuel to increase the challenge on the building. **The three unsprinklered tests resulted in the fire self-extinguishing, and in the two tests that included sprinklers, the fire was easily contained immediately after sprinkler activation.**

- These real fire scenarios with high fire loads proved the integrity of a typical building constructed with cross-laminated timber (CLT).
- Tests representing fires in buildings of proposed 18- and 12-story heights (Types IV-A and IV-B, respectively) were allowed to continue to burn for hours, throughout the decay phase and well past burn-out, the most conservative approach possible.
- In the tests, the absolute worst circumstances were presented: sprinklers not working, no fire suppression of any kind, and fires burning without any intervention until self-extinguishment. This parallels the expected performance of non-combustible Type I buildings.

Wind-driven fire is not a code requirement for any building,

- ***but precautionary requirements for mass timber ensure a lower risk factor***

There are no current fire test standards for exterior building exposure or vertical flame propagation that includes wind as a test element. **Even Type I and II buildings -- which are allowed to have combustible materials on exterior walls, such as foam plastic insulation -- are not tested with added wind.**

- Even in high wind, the new tall wood construction types will require non-combustible materials on the exterior, limiting the possibility of wind-driven exterior fire spread. [SH1]
- Interiors of buildings over 12 stories will require additional layers of interior non-combustible protection, providing protection against wind penetrating the exterior.
- Non-combustible protection of mass timber elements is designed to allow complete burn-out of contents in the case of sprinkler malfunction. If wind were to cause contents to burn faster, there is no negative impact on fire performance of the protected building elements themselves.
- Mass timber buildings, as proposed, would exclude the use of traditional light frame wood walls and floors, and mass timber elements would need to be completely protected with non-combustible materials for any building greater than 12 stories in height.
-
  - ***Massive timber building elements can carry***

heavy loads for extended time periods under fire exposure

Like their concrete and steel counterparts, as loads from upper stories increase, structural design requires loadbearing mass timber walls and columns to get bigger.

- As required for steel, in buildings over 12 stories mass timber elements will be required to have at least three layers of 5/8 type X gypsum wallboard as additional protection, as part of a required 3-hour fire-resistance rating. This is an extremely conservative approach for all buildings ranging from 12 to 18 stories.
- The established objective was to ensure that mass timber building elements do not become involved in a fire, even in the extremely rare circumstance where there is no control by a sprinkler system or extinguishment by the fire service.
  - ***Greater hazards from storage and mercantile occupancies are recognized***

The ICC committee chose to specifically address mercantile (M) and storage occupancies (typically S-1), and the hazards associated with their higher fuel loads, by placing stricter limits on the height of buildings containing these occupancies.

M and S-1 occupancy groups will not be allowed over 12 and 10 stories, respectively, in building Types IV-B and IV-A, which have the greatest additional fire resistance requirements. By comparison, Groups M and S-1 in non-combustible Type I-A construction are allowed to be unlimited in height, and beams and bearing walls can be reduced to a 2 hour fire resistance rating.

The enforcement community readily understands the code

and the measures necessary to inspect tall mass timber buildings

As with any new structural system, there will be a learning curve, and the wood products industry is committed to providing education. There is already an abundance of training available, and much of it is free. Many code officials have already taken advantage of these extensive training opportunities.

Fire sealants, fasteners, and connections contribute to overall performance

In some cases during fire testing, sealants were not used at all and all fire tests were nonetheless very successful.

If seen as important, a proposed modification requiring special inspection of a sealant installation could be put forward at the public comment hearings this fall. Multiple connection configurations were incorporated into the multi-story fire test structure. Floors of CLT were supported by wood and steel ledgers that were properly protected from heat exposure. Wood columns and beams were connected with steel, which was protected from fire as would be required by the code.

Tall mass timber buildings have been successfully built in North America,

Europe, and Australia and are in use with great success

There is extensive information available about CLT construction from many sources, including the increasing number of CLT manufacturers.

The published *CLT Handbook* addresses structural and lateral design, connections, fire performance, sound performance, building envelope design, environmental performance, and handling during construction, and is available for free. The American Wood Council s *National Design Specification for Wood Construction*, an ANSI accredited standard referenced in the *International Building Code*, now includes structural and fire design provisions for CLT. There are other guidelines for mass timber structural and fire resistance published by AWC and other organizations, including information on hybrid systems with steel and concrete. Among the advantages of CLT are:

- It does not distort, twist, rapidly loose strength, or explosively spall when exposed to high temperatures from fires.
- It has inherent high fire resistance due to its mass, and when protected with gypsum wallboard performance even improves. ASTM E119 testing of a loaded CLT exterior wall by AWC resulted in a 3-hour fire resistance rating when protected with only a single layer of 5/8 Type X gypsum wallboard.
- Mass timber responds well to flame and heat impingement by remaining strong and stable, providing continuous support for gypsum wallboard, allowing it to remain in place for a longer period of time.

- Mass timber is much less sensitive than certain noncombustible materials when subject to elevated temperature.

The enforcement community readily understands the code

and the measures necessary to inspect tall mass timber buildings

As with any new structural system, there will be a learning curve, and the wood products industry is committed to providing education. There is already an abundance of training available, and much of it is free. Many code officials have already taken advantage of these extensive training opportunities.

Adhesives used in CLT have excellent performance at elevated temperatures

The adhesives used in CLT have been standardized and requirements are mandated by the ANSI/APA standard PRG 320-18, which is also proposed for adoption in the 2021 *International Building Code*.

Variations in adhesive performance in early testing conducted by the National Fire Protection Research Foundation led to important revisions of PRG 320-18 that mandate required adhesive integrity under fire exposure, eliminating the possibility of delamination, fire regrowth or secondary flashover. CLT manufactured to APA PRG 320-18 requirements must demonstrate that the adhesive has been tested to these protocols. Qualifying adhesives are required in all proposed mass timber construction types.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This proposal will offer more choices in Type of Construction. More alternatives generally means the ability to select a type which results in less cost.

Public Comment 6:

Proponent:

Patrick Ford, representing self (pat@matsenford.com) requests Disapprove

Commenter's Reason:

Reason: These code changes would allow for structurally unsafe conditions to be inherently designed into tall buildings. As proposed, they would introduce new categories of Type IV construction into the code and expand the number of storeys, allowable areas, and maximum heights of buildings framed with combustible materials. I believe that for several reasons, this would greatly increase the risk to firefighters and building occupants, as well as neighboring buildings. Several of the major decisions that went into the creation of this proposal were based on “engineering judgment” and significant extrapolation of test data from a two storey test building to buildings with dozens more storeys.

Aside from the potentially dangerous and unproven provisions in general, there are several specifics relative to structural connections in these new building types and sizes. I do not believe that these were addressed or at the very least not adequately addressed.

The new building types and increased limits allowed for in these proposals should not be allowed, and the proposals should be disapproved for the following reasons:

1. The AHC-TWB report that was instrumental in many of the provisions indicates that connections were tested, but in fact, no exposed connections were ever tested in any of the assemblies.
2. The compartment tests did not test any connections, nor did any of the standard ASTM tests, including the E84, E119, E814, nor the NFPA 285 tests.
3. The full scale test did not have any exposed connections, yet the code explicitly notes exposed steel and metal caps or brackets allowed in type IV construction within the wood chapter. The exposed metal connectors and their fasteners penetrate well beneath the typical char layer of the structural member, significantly reducing the strength of the member at and near the connection itself. This can create many hot spots and potential critical structural failure locations throughout a tall building. No other tests addressed this issue either.
4. Adhesive based splice connections remain unproven, the overall adhesive requirements being based on a testing protocol derived after a failed test.
5. The Small Scale Adhesive Qualification Test Protocol (CSA 077 SSA.2) could conceivably be directed toward such connections or splices, but it is a test that lasts only 5 minutes per side of the tested specimen.
6. As an additional note, the full scale test was run on only a two storey structure, leaving any critical structural connections that may have been needed to support only a single storey above. With code proposals allowing for many times this, these concerns should be much more carefully vetted before approval.

It should also always be remembered that in no other type of tall building allowed by the code, is the structure itself also fuel for the fire.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

There would be no cost increase associated with my comment because if the code proposal were defeated, there would be no change in the building allowable from the current code.

Public Comment 7:

Proponent:

Patrick Hainault, representing Self (path@matsenford.com) requests Disapprove

Commenter's Reason:

“Tower of Fire destroys LA apartment complex under construction.” This headline in the December 8, 2014 LA Times barely scratches the surface in describing the dangers from fires in buildings under construction when those buildings are framed with wood and wood-based materials. This fire not only destroyed at least 239 of the rental units and 2/3rds of the complex at the Da Vinci Apartments but caused significant damage to neighboring buildings and infrastructure, and greatly burdened the surrounding community in general. Yet, this proposal will dramatically raise the allowable heights and areas of buildings made from combustible materials.

It is not rationale to increase the allowable height of buildings as in this proposal when significant problems in much smaller buildings still present a well-documented risk to life and property. The assembly should overturn the committee decision to effectively prohibit the type of proposed construction until and if it can be proven safe during and after construction. The following paragraphs expand on the issues the assembly should consider in evaluating this proposal.

How do we even begin to come to grips with the risk to adjacent properties and occupied buildings during the construction phase when an 18- story wood structure allowed by this proposal is burning in a suburban or urban area? Without safeguards well beyond those currently in the code (or proposed as part of a series of related proposals) to protect adjacent properties and infrastructure, the impacts will be devastating. For example, the Da Vinci fire caused:

- Damage to adjacent buildings. At least four nearby buildings were damaged. The building at 221 N. Figueroa St., where the computers and cubicles melted, had significant damage on its 15 floors, with 300 windows blown out. Three floors were also damaged in the Los Angeles County Department of Health Services building at 313 N. Figueroa. LA Department of Water and Power staff identified at least 160 damaged windows. A Los Angeles Department of Building and Safety spokesman reported windows blew out in the north tower of its department headquarters, and the heat and smoke triggered sprinklers that soaked carpets and desks. Overall, the Da Vinci Apartments fire caused an estimated $111.5 million in damages, including $80 million in damage to city properties from the fire and the water used to extinguish it and $20-$30 million to the apartment complex.

- Damage to Infrastructure. A Caltrans spokesman estimated the fire caused $1.5-million damage to the freeway. Roads were closed around the area including a major commuter route during rush hour. Caltrans officials reported an exit sign over the 110 Freeway melted and would have to be replaced, forcing another freeway closure later the same week.
- Extensive impacts on the community. The attached study of the economic risk to taxpayers and the community posed by mid-rise apartments produced by assistant adjunct professor Urvashi Kaul at Columbia University captures the total cost impacts from fires like the Da Vinci apartments and smaller incidents. This study finds that:
    - In Los Angeles County, alone, fires in mid-rise residential buildings with combustible frames could have a negative impact of $22.6B over 15 years, including $17.14B in direct losses from property damage.
    - On average, fire in a mid-rise residential building constructed using combustible framing material costs the Los Angeles County a total of $141.81 per square foot in potential economic impact and $2.38 per square foot in lost tax revenues.
    - Potential impact the County may face in a single year could be $1.7 billion, including $1.3 billion in direct property damage.

The assembly is also urged to reconsider the argument that cladding requirements proposed to address fires in buildings under construction will resolve these issues. As demonstrated in a large fire from 2015 in a wood-framed apartment building in Edgewater, NJ, cladding will not stop a fire from spreading once the framing in part of the building ignites. It doesn't create a barrier between unexposed framing and exposed framing, but only provides some resistance to ignition from within or outside of the building. The Edgewater fire spread rapidly throughout the buildings once framing behind a wall was ignited during repairs to the occupied and fully-clad building.

The Da Vinci and Edgewater fires are not uncommon incidents. Dozens of similar fires have occurred (see more at http://buildwithstrength.com/america-is-burning/) in buildings under construction since the market began broadly taking advantage of relatively recent changes to the IBC that allowed taller and larger wood-framed buildings. In a similar fire in Houston, the life of a construction worker literally hung in the balance as he was rescued from a burning wood framed building just seconds before the stories above came crashing down. The assembly can prevent these types of risks from greatly expanding by disapproving this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 8:

Proponent:

William Hall, representing Alliance for Concrete Codes and Standards (jhall@cement.org) requests Disapprove

Commenter's Reason:

At the recent ICC Committee hearings in Columbus, OH, your committee **Failed you.** The general committee charged with looking at proposals and weighing justification **FAILED** to do their job when it came to Tall Wood Buildings. Despite overwhelming testimony that fire tests were inadequate, the committee simply ignored the fact that the TWB ADHOC committee only considered a two story residential structure during testing, and then used **'Engineering Judgment"** to determine that those results will be sufficient for 18 stories.

WHERE is the testing for all the other occupancy groups? 100% increases in story height are proposed for other use groups **without any justification.**

The ICC TWB ADHOC Committee has taken it upon themselves to develop a prescriptive TWB approach that **exceeds** the allowable heights of every country in the world. The United States just recently began looking at Mass Timber for taller buildings and yet, if this proposal goes through, we will allow mass timber 6 stories higher than any other country.

Not only will the U.S. allow the tallest buildings, we will also allow 12 story Mercantile, Storage and Factory to be built **without** gypsum covering on 40% of the CLT surface.

While mass timber may be an acceptable building material, it has not gone through the rigors of that are needed for high rise buildings**. Do not let the U.S. be the testing ground for these Tall Wood Buildings.**

Vote Dissapproval

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No effect

Public Comment 9:

Proponent:

Tien Peng, representing National Ready Mixed Concrete Association (tpeng@nrmca.org) requests Disapprove

Commenter's Reason:

While the Ad Hoc Committee had intended to validate the fire performance of cross laminated timber in fire conditions of buildings, the AWC/ATF compartment testing was limited in scope and not a thorough predictor of fire behavior for high rise building made of a new material. The testing so far is insufficient to capture the fire response characteristics in question. No tests were done to factor in wind, exterior performance, panel connections or moisture, which impacts material performance, fire-fighting and property damage. CLT is a great innovation for the wood industry but it's not ready for prime time and it's certainly not ready for us to build safely to 270 feet and 18 stories. The ICC should not adopt code provisions that will put people at risk.

1. CLT Reliability and Predictability Issues

Cross laminated timber does not have a long enough history to demonstrate their reliability and predictability. The structural design of modern tall buildings is governed by the need to efficiently transfer loading, particularly that from wind, whilst providing increasingly complex building functionality. The use of cross laminated timber implies a highly optimized systems which means the least amount of material to enabled efficient load transfer. Thus, in the event of a fire there is an increased risk not typical in mid-rise constructions, and especially not in a two-story mock up in a lab.

The NFPA with ARUP *Fire Safety Challenges of Tall Wood Buildings*paper noted (NFPA 2013)[i]:

- In a real fire situation, the load-bearing elements in CLT are expected to load-share , or redistribute in a method that is not easily predicted in simple fire testing.
- Previous CLT fire testing has resulted in delamination and char fall-off when exposed to fire conditions.
- This has the potential to increase the fire temperature and burning rate within the compartment, and could impact the structural fire resistance at later stages in the fire duration.

The full-scale fire testing in Norway (SPFR A15101 2016)[ii] showed:

- The temperature increased fast and flashover was reached after four minutes.
- Temperatures were significantly higher than the standard time-temperature curve according to EN 1363-1
- The fire did not cool down before manual suppression was initiated when the test room collapsed 1-hour 36 minutes after ignition
- The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin.
- The charring rate varied much faster than expected

We should not be putting lives in high rises at risk with this level of material unpredictability.

2. Exposed CLT Fire / Moisture /Delamination Issues

The National Institute of Standards (NIST) tests complete previously said there were concerns that flashover occurred earlier with CLTs, heat delamination of the exposed CLT affected its fire performance and a large re-flash occurred on the exposed wall with delamination of the second ply of the CLT. (NIST 2017)[i]

While fire departments understand the risk of collapse with solid wood, there is not enough documentation or history of bonded or laminated wood structures, and they may fail sooner under fire conditions. The problem is that under fire conditions an adhesive may either thermally soften or chemically degrade causing the member to lose its strength, leading to structural collapse. Hence, we see delamination from the NIST testing as well as the very real construction failure on portions of the new College of Forestry building at Oregon State University where a large section of subflooring made of cross-laminated timber gave way between the second and third stories.

Moisture is an important issue for delamination and in many parts of the country the laminated mass timber panels will experience an environment which may exceed the testing limits. Wood will change in all three orthogonal dimensions with changes in moisture, and the changes are not even. This not only means that some species swell more because of their higher density, but also wood of non-uniform density displays non-uniform swelling. Moreover, as wood swells and shrinks, adhesives do not follow with the same volumetric expansion. RDH Building Science full-scale mock-up study (Lepage 2017)[ii]notes that, The research indicates that CLT and mass timber is susceptible to dangerously high moisture contents, particularly when exposed to liquid water in horizontal applications. and other research indicate that CLT is at risk of structural damage by decay and rotting fungi (Zabel and Morrell 1992)[iii]

Clearly, we should not be putting lives in high rises at risk with this level of material unpredictability.

3. Fire / Connections Vertical Fire Spread

All connections used in current projects are proprietary and no information is publicly available regarding their performance. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors. Typically, the floor slab provides a robust barrier inhibiting external fire spread so long as it remains firmly supported by the structure. However, the AWC/ATF compartment fire testing had not adequately accounted for the connections in the CLT technologies to meet this crucial objective. The deformation of the connections when exposed to fire can expose gaps and flammable materials which can lead to spread both upwards through flaming, and downwards through dripping molten materials. Once fire starts spreading away from the floor of origin the safety of the occupants is compromised. Examples of vertical fire spread include:

- Las Vegas Hilton, USA: 22 Stories in approximately 25 minutes
- Caracas Tower, Venezuela: 17 floors in a 24-hour period
- Windsor Tower, Spain: 19 floors, ~7 hours for spread, 24 hours total fire duration
- TVCC Tower, China: 44 floors, around 15 minutes

4. Fire / Stack Effect

A similar concerning pattern emerges when discussing wind and air movement fire performance. One problem common to high-rises but not found in low-rise buildings is the stack effect movement of air inside the building.This air movement is critical to understand what happens during a fire event, as it can intensify a fire or allow flames and combustion gases to move beyond the room of origin. Fire personnel responding to a high-rise fire event need to understand where smoke and toxic gases may be going. Yet, shrinkage, moisture and creep, common in wood products including CLT, will create unpredictable opportunities for air movement within a building.

Air pressure and thermal differential with the use of CLT panels can shift the neutral pressure plane of the building. In cold weather (positive stack effect), the velocity of air channeling into the core from the lower floors is a very real concern to the occupants when they have to defend in place as well as fire service if the fire egress is compromised with smoke. In warm weather (reverse stack effect), where typically the staging floor is two floors below the fire floor, there can be concern of contamination, if there is unpredictability of where the fire path may be taking.

5. Fire / Wind

We typically associate wind with brush and wildland fires but it s just as important in structural fires.

- In 2009 a Texas probationary fire fighter and captain die as a result of rapid fire progression in a wind driven residential fire. Sustained winds from east/south-east at 17 mph with gusts up to 26 mph.
- Virginia Firefighters Battle Three-Alarm Townhouse Fire in 2011. In assessing the high winds and the fire conditions Battalion Barnes says fire crews tried to attack the flames inside two townhouses, but were forced back by intense heat and falling ceilings.
- In 2012 Prince George s County (Maryland), firefighters arrive on scene to a structure fire with winds impacting the rear of the structure. Shortly after forcing the front door open, they saw a dramatic change in fire behavior. As they made entry, they quickly experienced high velocity and high temperature gases, injuring seven firefighters, two critically.

The American Wood Council compartment fire tests did not account for wind loads.

Wind can add to the hazard to a low-rise fire, but it is most concerning around the upper floors of tall buildings. And high-rise fires create unique safety challenges for occupants and firefighters, even without the influence of wind. Wind can change the FLOW PATH of a fire and in some cases create a blowtorch effect and untenable conditions. When a window in the fire apartment fails, the influx of wind can create significant and rapid increases in the heat production of a fire. Smoke and heat spreading through corridors and stairwells, for instance, can inhibit occupants ability to escape and can limit firefighters ability to rescue them. Conditions in a corridor are of critical importance because it is the route that firefighters use to approach a fire and that occupants use to exit a building.

During the course of any structure fire, the wind may also influence exterior conditions and firefighter safety. Accelerated winds near high rises are caused by the downdraft effect , where the air hits a building and, with nowhere else to go, is pushed up, down and around the sides. The air forced downwards increases wind speed at street level. Tests conducted by National Institute of Standards and Technology (NIST 2012), the Fire Fighting Technology Group, FFTG, on positive pressure ventilation determined that an external wind speed of as low as 10 mph could cause a vented room within a structure to quickly spread from an apartment unit to a vent point, represented by a stairwell door. The spreading had floor-to-ceiling and wall-to-wall fire involvement with blowtorch effects. Moreover, if several towers stand near each other, the channeling effect, a wind acceleration created by air having to be squeezed through a narrow space. This Venturi effect will endanger the adjacent buildings.

6. Fire on Exterior

The AWC/ATF compartment fire tests did not account for exterior fire conditions and the proposed exterior proposal does not meet the required testing of CLT assemblies.

An important aspect of fire behavior in the affected building involves the burning behavior of materials on the exterior. While the AWC/ATF test demonstrated an understanding of CLT in an interior fire situation, the circumstances contributing to ignition scenarios of the exterior can be equally complex and equally important. In the past few years we have seen a number of deadly high-rise fires that propagated on the exterior of the structure.

- 2018 Almas Tower in Dubai, UAE
- 2017 Marco Polo apartment complex in Hawaii
- 2018 *Grenfell* Tower *fire* in West *London*

Simply testing the interior fire scenario does not capture potentially important parameters affecting CLT elements in tall wood buildings. If a fire in a heavy-timber building is not extinguished by the initial attack, a tremendous conflagration with flames coming out of the windows will spread fire to adjoining buildings by radiated heat. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors.

Notably missing from the proposals is how the mass timber exterior assembly in buildings over 40 feet in heightwould comply with NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components*.

- *Section 1403.5*: For combustible water-resistive barriers in buildings over 40 feet in height of Type I, II, III, or IV construction.
- *Section 1407.10.4*: For metal composite materials (MCM) used on buildings of Type I, II, III, and **IV** construction.
- *Section 1409.10.4*: For high-pressure decorative exterior-grade compact laminates (HPL) exterior wall coverings used on buildings of Type I, II, III, and **IV** construction.
- *Section 1509.6.2*: Combustible mechanical equipment screens used on buildings of Type I, II, III, and **IV** buildings.
- *Section 2603.5.5*: Exterior walls of buildings of Type I, II, III, and **IV** construction of any height incorporating foam plastic insulation, except for one-story sprinklered buildings.

This is a requirement yet there is no reference to NFPA 285 testing of exterior CLT assemblies. One test by Nordic Engineered Wood published under the Canadian ULC S134 is not enough of a sample size to validate the tall wood proposals. Again, there is not enough historical fires with cross laminated timber to provide information that can be used in an 85-ft building, much less one at 270 feet.

7. Limits of Redundancy

The ICC TW-AHC claimed the added safety factor of active sprinkler systems adds to the safety of the proposals. Without a doubt, the inclusion of fire sprinkler systems in our buildings since the late 1980 s has been effective at increasing the chances of survival in a fire. But when systems don t operate as intended (such as in a freeze failure with water damage) or fail in a high-rise fire condition, the impact can be large, not just in monetary terms, but also in the lives of the occupants and fire fighters.

The full-scale fire testing completed in Norway showed the The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin. (SPFR A15101 2016).[iv] Moreover, according to NFPA s report *U.S. Experience with Sprinklers*, sprinklers were effective at controlling the fire in 96% of fires in which they operated, but sprinklers were only effective in 88% of the fires large enough to activate them. The reported sprinkler failures (660 per year) were twice as common as reported fires in which sprinklers were ineffective and did not control the fire. A National Institute of Standards and Technology (NIST) study, *Estimates of Operational Reliability of Fire Protection Systems*, also demonstrates this over-reliance on fire sprinklers is misguided.

8. Untested Reference Standard

State and local governments that adopt and enforce model building codes which references a number of standards. Yet, the proposals regularly cite the newly referenced standard, *ANSI/APA PRG 320-2018: Standard for Performance-Rated Cross-Laminated Timber*, an untested document. The reference to ANSI/APA PRG 320-2018 resolves nothing and takes no legal responsibility for performance failure. APA PRG 320 has no real history of use or validation as a reliable document and no jurisdiction refers to this document. It is premature to utilize a standard that is rarely referenced and start building to 18 stories from it.

Bibliography:

[i] https://www.nist.gov/el/fire-research-division-73300/national-fire-research-laboratory-73306/fire-safety-challenges-0

[ii] https://buildingsciencelabs.com/wp-content/uploads/2017/11/CCBST-2017-Moisture-Uptake-Testing-for-CLT-Floor-Panels.pdf

[iii] Zabel RA, Morrell JJ (2012) Wood microbiology: decay and its prevention. Academic press.

[iv] http://www.mypaper.se/html5/customer/355/11143/?page=21

[v] https://sustainable-fire-engineering.sustainable-design.ie/wp-content/uploads/2015/08/NFPA-FPRF_Tall-Wood-Buildings-Fire-Safety-Challenges_2013.pdf

[vi] http://www.mypaper.se/html5/customer/355/11143/?page=21

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The proposed public comment would **reduce cost of construction**. Substantiation and references below.

1. Research:

A recent feasibility study [[i]] reveals that CLT construction is significantly more costly than other well-established construction methods such as concrete. Renowned structural engineers, Cary Kopczynski & Company found that the cost of the CLT structural system for a typical 10 story apartment building would cost $48 to $56 per square foot compared to $42 to $46 per square foot for concrete, translating nearly **20% premium** for Cross Laminated Timber.

2. Brock Commons, British Columbia

Per “University of British Columbia: Report to The Board of Governors, Tall Wood Student Residence, Brock Commons Phase 1” Report [[ii]], dated September 30, 2014,

- “The capital cost for the project is estimated at $44 million ($40m standard construction, plus $4m wood premium).”
- “The $4m estimated premium for advanced wood design and construction is to be funded from external sources including $3.45m secured to date from the Canada Wood Council (CWC) and Forest Innovation Investment.”

This is a **10% premium** for Cross Laminated Timber at the 18-Story Brock Commons.

3. Framework Oregon:

Per the January 5, 2018 *Portland Oregonian* article “Wheeler Defends Decision to Invest In Pricey Complex” of the Portland Oregonian[[iii]],

- “While each unit is expected to cost an average $480,000 to build, the city’s contribution will amount to $100,000 per apartment.”
- Despite a pledge from Mayor Ted Wheeler to bring down the cost of affordable housing in Portland, the Portland Housing Bureau had nonetheless awarded the building $6 million toward the $29 million total. (A **21% subsidy** by the taxpayers for the 12- Story Framework project).

By the July 16, 2018 *Willamette Week* (*WW*) article “Plans for Record-Setting Timber Tower in Downtown Portland Fall Through” [[iv]] reported,

- The building, which was slated to include 60 *affordable* apartments, was projected to cost $651.43 per square foot, *WW* reported in December. (The 660-square foot two bedroom apartments were projected to cost $567,389 to build.)

4. Lumber Pricing:

And this doesn’t consider the recent price increases of softwood lumber that have risen wildly from $424 per board foot a year ago to $536 in the second quarter of 2018. That’s a **26% increase** in just one year. At the same time, concrete prices rose at a stable rate of 5%.

[i] http://buildingstudies.org/pdf/related_studies/Cross_Laminated_Timber_Feasibility_Study_Feb-2018.pdf

[ii] http://bog2.sites.olt.ubc.ca/files/2014/09/3.2_2014.09_Tall-Wood-Building.pdf

[iii] https://www.oregonlive.com/politics/index.ssf/2018/01/portland_mayor_ted_wheeler_def.html

[iv] http://www.wweek.com/news/city/2018/07/16/plans-for-record-setting-timber-tower-in-downtown-portland-fall-through/

Public Comment 10:

Proponent:

Adam Shoemaker, representing ClarkDietrich (adam.shoemaker@clarkdietrich.com) requests Disapprove

Commenter's Reason:

In IBC Section 602.2 it states that 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 this code.

I do not believe it is a conservative or safe approach to allow for 190% and 252% increases in allowable area for Type IVA and IVB combustible elements over that of non-combustible structural elements. The testing submitted does not show side by side comparisons of these two systems. It is not reasonable to extrapolate data from a 2-story fire test of combustible materials into such huge increases in area as compared to Type IB non-combustible construction.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No cost impact.

Public Comment 11:

Proponent:

Larry Williams, representing Steel Framing Industry Association (williams@steelframingassociation.org) requests Disapprove

Commenter's Reason:

The leap in assumptions that fire tests on a two-story mock up can be extrapolated to fire performance of an 18-story building is an unreasonable extension in the allowance for use of professional judgement.

Proponents of G108-18 and related proposals state that the expected fire performance of mass timber buildings was validated by a series of full scale multiple-story fire tests. However, the actual model tested was only two storeys in height, and from this test users are expected to have confidence that a 180-foot tall building construction with cross-laminated timber will exhibit identical performance.

The fundamental problem of this assumption is that some characteristics of large fires have not been observed on small fires, either because they do not occur in small fires or because they are too small to be detected. It seems likely that a different set of controls of fire behavior may take over after a fire reaches a certain size or intensity. The difficulty of extrapolating from small to large fires is further complicated by the fact that behavior of fire is a pattern phenomenon--the behavior at one point is often dependent on the behavior at another point. The behavior of one part of a fire may change even if burning conditions at that point do not vary when the characteristics of the fire at some other point changes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with current requirements.

Public Comment 12:

Proponent:

Dan Nichols, representing ICC Code Correlation Committee (ccc@iccsafe.org).

Commenter's Reason:

The Code Correlation Committee (CCC) is not taking a position on this code change. The CCC submitted this public comment in order to bring a correlation issue to the attention of the full voting membership for the Public Comment Hearings and the Online Governmental Consensus Vote to allow the voting membership to coordinate actions on a package of code changes submitted dealing with tall wood buildings of mass timber construction. This package includes the parent proposal G108-18; if disapproved, the related proposals G28-18, G75-18, G80-18, G84-18, G89-18, FS5-18, FS6-18, FS73-18, FS81-18 and F266-18, will not be correlated with any existing code text if they are approved.

The Code Correlation Committee is a standing committee of the International Code Council whose objectives, procedures and organization are set forth in Council Policy CP#44-13. The objective of the Code Correlation Committee is to maintain technical and editorial consistency among the International Codes and to assist staff in the evaluation and processing of code change proposals and comments that are exclusively editorial.

G84-18

G86-18

IBC: 506.3.2, 506.3.3, 506.3.3 (New), Table 506.3.3 (New)

Proposed Change as Submitted

Proponent: Stephen Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter ICC (sthomas@coloradocode.net)

2018 International Building Code

Revise as follows

506.3 Frontage increase. Every building shall adjoin or have access to a *public way* to receive an area factor increase based on frontage. Area factor increase shall be determined in accordance with Sections 506.3.1 through 506.3.3.

506.3.1 Minimum percentage of perimeter. To qualify for an area factor increase based on frontage, a building shall have not less than 25 percent of its perimeter on a *public way* or open space. Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved *fire lane*.

506.3.2 Minimum frontage distance. To qualify for an area factor increase based on frontage, the *public way* or open space adjacent to the building perimeter shall have a minimum distance ~~(*W*)~~ of 20 feet (6096 mm) measured at right angles from the building face to any of the following:

1. The closest interior lot line.
2. The entire width of a street, alley or public way.
3. The exterior face of an adjacent building on the same property.

~~Where the value of *W* is greater than 30 feet (9144 mm), a value of 30 feet (9144 mm) shall be used in calculating the *building area* increase based on frontage, regardless of the actual width of the *public way* or open space. Where the value of *W* varies along the perimeter of the building, the calculation performed in accordance with Equation 5-5 shall be based on the weighted average calculated in accordance with Equation 5-4.~~

~~W = (L1×w1+L2×w2+L3×w3...)/F~~

~~(Equation 5-4)~~
~~where:~~

~~*W* (Width: weighted average) = Calculated width of *public way* or open space (feet).~~

~~L_n = Length of a portion of the exterior perimeter wall.~~

~~w_n = Width (≥ 20 feet) of a *public way* or open space associated with that portion of the exterior perimeter wall.~~

~~*F* = Building perimeter that fronts on a *public way* or open space having a width of 20 feet (6096 mm) or more.~~
~~**Exception:** Where a building meets the requirements of Section 507, as applicable, except for compliance with the minimum 60-foot (18 288 mm) *public way* or *yard* requirement, and the value of *W* is greater than 30 feet (9144 mm), the value of *W* shall not exceed 60 feet (18 288 mm).~~

The frontage increase shall be based on the smallest public way or open space that is 20 feet (6096 mm) or greater, and the percentage of building perimeter having a minimum 20 feet (6096 mm) public way or open space.

506.3.3 Amount of increase. The area factor increase based on frontage shall be determined in accordance with ~~Equation 5-5:~~

~~I_f=[F/P-0.25]W/30~~
~~(Equation 5-5)~~
~~where:~~

~~I_f = Area factor increase due to frontage.~~

~~*F* = Building perimeter that fronts on a *public way* or open space having minimum distance of 20 feet (6096 mm).~~

~~*P* = Perimeter of entire building (feet).~~

~~W = Width of *public way* or open space (feet) in accordance with Section 506.3.2.~~

Table 506.3.3.

~~I_f= [F/P - 0.25]W/30~~

Add new text as follows

Table 506.3.3
FRONTAGE INCREASE FACTOR

	Open Space			
Percentage (%) of Perimeter	0 to less than 20 Feet	20 to less than 25 Feet	25 to less than 30 Feet	30 Feet or greater
0 to less than 25	0	0	0	0
25 to less than 50	0	0.17	0.21	0.25
50 to less than 75	0	0.33	0.42	0.50
75 to 100	0	0.5	0.63	0.75

Reason: Calculating the frontage increase is a confusing process for little benefit. This proposal simplifies the process by creating a table outlining the increase based on the percentage of open space around the building and the distance of that open space. It still uses the concept of the percentage of open space around the building. The values in the table are based on the calculations using Equation 5-5. The proposal also deletes the confusing weighted average calculation that most people do not use.
For example, if you have a building that has a perimeter of open space of 63% and the smallest open space is 25 feet, the increase would be 0.42. Using the calculation in Equation 5-5, it would be 0.32. This is a 10% difference. The total increase for a Group B Occupancy of Type VB Construction would be 2,790 square feet using the equation and 3,780 using the table. This is a difference of 990 square feet. This is negligible in the overall scheme of allowable area calculations.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a simplification of an existing calculation in the code. It should not affect the cost of construction.

G86-18

Public Hearing Results

Errata:

The proposal has been corrected.

Committee Action: Disapproved

Committee Reason:

The tabular version found some favor with the committee, but it wasn't convinced that even with the modifications offered that the change was neutral. A well crafted public comment with some examples may make this acceptable. (Vote: 10-4)

Assembly Action: None

G86-18

Individual Consideration Agenda

Public Comment 1:

Proponent:

Stephen Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter ICC (sthomas@coloradocode.net) requests As Modified by This Public Comment

.

Modify as follows:

2018 International Building Code

506.3 Frontage increase.

Every building shall adjoin or have access to a *public way* to receive an area factor increase based on frontage. Area factor increase shall be determined in accordance with Sections 506.3.1 through 506.3.3.

506.3.1 Minimum percentage of perimeter.

To qualify for an area factor increase based on frontage, a building shall have not less than 25 percent of its perimeter on a *public way* or open space. Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved *fire lane*.

506.3.2 Minimum frontage distance.

To qualify for an area factor increase based on frontage, the *public way* or open space adjacent to the building perimeter shall have a minimum distance of 20 feet (6096 mm) measured at right angles from the building face to any of the following:

1. The closest interior lot line.
2. The entire width of a street, alley or public way.
3. The exterior face of an adjacent building on the same property.

The frontage increase shall be based on the smallest public way or open space that is 20 feet (6096 mm) or greater, and the percentage of building perimeter having a minimum 20 feet (6096 mm) public way or open space.

506.3.3 Amount of increase.

The area factor increase based on frontage shall be determined in accordance with

Table 506.3.3.

FRONTAGE INCREASE FACTOR

	Open Space			
Percentage (%) of Perimeter	**0 to less than 20 Feet**	**20 to less than 25 Feet**	**25 to less than 30 Feet**	**30 Feet or greater**
0 to less than 25	0	0	0	0
25 to less than 50	0	0.17	0.21	0.25
50 to less than 75	0	0.33	0.42	0.50
75 to 100	0	0.5	0.63	0.75

Interpolation is permitted.

506.3.3.1 Section 507 Buildings

Where a building meets the requirements of Section 507, as applicable, except for compliance with the minimum 60-foot (18 288 mm) public way or yard requirement, the The area factor increase based on frontage shall be determined in accordance with Table 506.3.3.1.

Table 506.3.3.1

SECTION 507 BUILDINGS

	Open Space					
% perimeter	30 to less than 35 feet	35 to less than 40 feet	40 feet to less than 45 feet	45 feet to less than 50 feet	50 feet to less than 55 feet	55 feet to less than 60 feet
0 to less than 25	0	0	0	0	0	0
25 to less than 50	0.29	0.33	0.38	0.42	0.46	0.5
50 to less than 75	0.58	0.67	0.75	0.83	0.92	1.00
75 to 100	0.88	1.00	1.13	1.25	1.38	1.5

Interpolation is permitted.

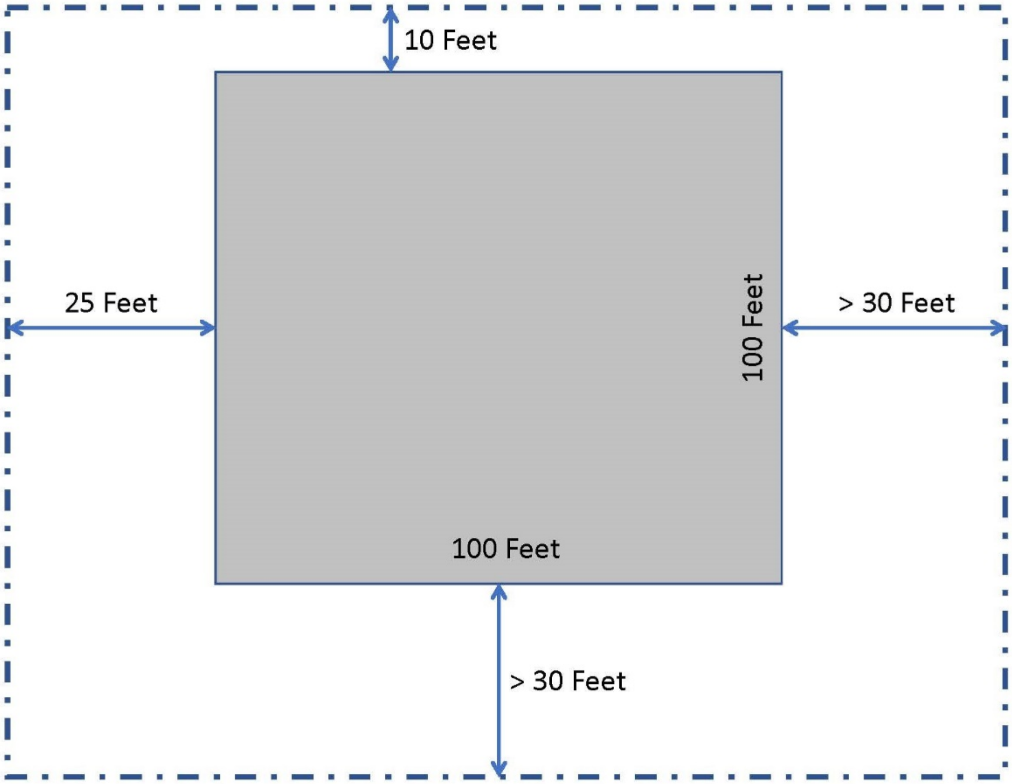
Commenter's Reason:

This proposal makes the frontage increase much easier to calculate. It takes the existing equation and puts into a table format. When we changed the equation in the 2015 IBC, many people are using the wrong value from the table and the calculation is wrong. The user of the code is supposed to use the NS number from Table 506.2 to determine the frontage increase. However, many people are incorrectly using the S1 or SM value from the table. These new tables will eliminate that confusion and potential error by putting the frontage increases into a table.

The committee was in support of the concept, but felt that some improvements could be made to the table. They suggested that language be added to allow the user to interpolate the values within the table. That language was added to this public comment. They also had concerns that the provisions of the exception to Section 506.3.2 was not included in the proposal. This exception permits a larger increase for those buildings listed in Section 507. An additional table has been added to this public comment to address that exception and provides those values. It is based on the same calculation but with higher values.

To use the table, you need to figure the percentage of the building perimeter that has at least a 20 foot open space. Then you determine the dimension of the smallest open space over 20 feet. You then take those two values and go into the table to determine the frontage increase. For example, if you have a building on a site as shown in Figure 1, you can see that three of the four perimeter walls have at least a 20 foot yard and the building is 100 X 100. Therefore, 300/400 = 75% perimeter with at least a 20 foot yard. The smallest yard is 25 feet on the left side. Therefore, you go into the table and enter the bottom row at "75% to 100%" and go across to the "25 to less than 30 feet" column and find that you would get a 63% frontage increase based on this layout. You could interpolate within the table if you would like.

The intent of the proposal is to simplify the allowable area calculation and reduce the number of mistakes that we now see.



Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

There is no change to the underlying code requirements

G86-18

G87-18

IBC: 508.3.1.2

Proposed Change as Submitted

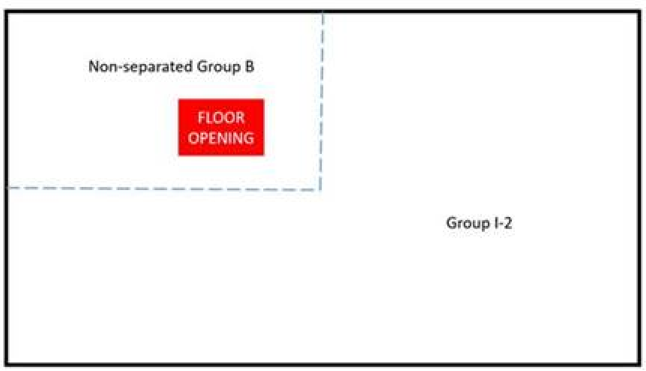
Proponent: John Williams, Chair, representing Healthcare Committee (AHC@iccsafe.org)

2018 International Building Code

Revise as follows

508.3.1.2 Group I-2, Condition 2 occupancies. Where one of the nonseparated occupancies is Group I-2, Condition 2, the ~~most restrictive~~ requirements of Sections 407, 509 and 712 shall apply throughout the fire area containing the Group I-2 occupancy. The ~~most restrictive~~ requirements of Chapter 10 for Group I-2, Condition 2 shall apply to the path of egress from the Group I-2, Condition 2 occupancy up to and including the exit discharge.

Reason: This section relates to the use of non-separated mixed uses in hospitals. Historically a hospital building has broadly been considered as an I-2 occupancy. However, designs are increasingly using this non-separated option to create situations that adversely impact the I-2 occupancy. This language was added in the previous cycle to with the intent to require certain non-separated facility designs to follow some of the basic requirements for Group I-2, Condition 2 hospitals. The goal was to point designers and code officials to four key components to consider when designing non-separated uses: Section 407 which contains specific healthcare requirements, Section 509 for incidental uses, Section 712 for vertical openings and Chapter 10 for egress. Failure to follow these could have adverse impacts on patients and staff. For example, unprotected floor openings allowed by 712 are prohibited in Group I-2, they are not prohibited in Group B. Without this section, a design would be allowed to punch a hole in the floor that adversely affects the I-2 patients on that floor.



An unintended consequence of the language is that by referencing the “most restrictive” requirements, the section prohibits the use of any exception permissible for Group I-2. It also doesn’t clearly identify which requirements should be considered. For example, we did not intend to apply Group H restrictions on these conditions just because they are more restrictive. There are several exceptions that should be maintained for these parts of the building, especially in Chapter 10. This change clarifies that all of the I-2 specific requirements apply, whether they are more or less restrictive.

This proposal is submitted by the ICC Committee on Healthcare (CHC). The CHC was established by the ICC Board to evaluate and assess contemporary code issues relating to healthcare facilities. This is a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. In 2017 the CHC held 2 open meetings and numerous conference calls, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Information on the CHC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CHC effort can be downloaded from the CHC website at: https://www.iccsafe.org/codes-tech-support/cs/icc-committee-on-healthcare/.

Cost Impact: The code change proposal will decrease the cost of construction
This clarification would remove requirements for more restrictive provisions where hospital provisions apply.

G87-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proponent asked for disapproval as they were unsure whether the proposal as submitted conflicts with the federal standards. (Vote: 14-0)

Assembly Action: **None**

G87-18

Individual Consideration Agenda

Public Comment 1:

Proponent: John Williams, representing Healthcare Committee (ahc@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

508.3.1.2 Group I-2, Condition 2 occupancies. ~~Where one of the nonseparated occupancies is~~ The requirements for Group I-2, Condition 2 ~~, the requirements of~~ in Sections 407, 509 and 712 shall apply throughout the fire area containing the Group I-2 occupancy. The requirements of Chapter 10 for Group I-2, Condition 2 shall apply to the path of egress from the Group I-2, Condition 2 occupancy up to and including the exit discharge.

Commenter's Reason: The revised language is a clarification of requirements. The provisions for hospitals should be applied on a component by component basis such as fire areas. This should not apply to everything in the building, however, the concentration should be on the fire area within the building. The last sentence applies when the means of egress from a hospital goes through a business area.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction This clarification would remove requirements for more restrictive provisions where hospital provisions apply.

G87-18

G88-18

IBC: Table TABLE 508.4

Proposed Change as Submitted

Proponent: Ed Kulik, Chair, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Building Code

Revise as follows

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[f]

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M,S-1		H-1		H-2		H-3, H-4		H-5	
	S	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	1	2	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	2	NP	2	NP	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	1	2	N	N	2	NP	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	N	1	1	2	N	N	1c	2c	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	1	2	1	2	2	NP	N	N	1	2	N	N	NP	NP	2	3	1	2	1	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	3	NP	3	NP	3	NP	3	4	2	3	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP	2	NP	2	3	1	2	NP	NP	1	NP	1[d]	NP	1	NP
H-5	2	NP	2	NP	2	NP	2	NP	2	NP	1	NP	NP	NP	1	NP	1	NP	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

N = No separation requirement.

NP = Not Permitted.

a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section 406.3.2.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.
f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

Reason: Filling in the balance of Table 508.4 will avoid confusion and make the table more clear and functional.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is an editorial change and adds no new requirements to the code.

G88-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Committee members spoke both in support and opposition to this proposal which intends to replicate the existing information in the upper right half of the table in the lower left half. However errors were found in the proposal which showed that further refinement was needed. (Vote: 14-0)

Assembly Action: **None**

G88-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Ed Kullik, representing ICC Building Code Action Committee (bcac@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[f]

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M,S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	1	2	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	2	NP	2	NP	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	1	2	~~N~~ 1	~~N~~ NP	2	NP	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	N	1	1	2	~~N~~ 2	~~N~~ NP	1c	2c	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	1	2	1	2	2	NP	~~N~~ 1	~~N~~ 2	1	2	N	N	NP	NP	2	3	1	2	1	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	3	NP	3	NP	3	NP	3	4	2	3	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP	2	NP	2	3	1	2	NP	NP	1	NP	1[d]	NP	1	NP
H-5	2	NP	2	NP	2	NP	2	NP	2	NP	1	NP	NP	NP	1	NP	1	NP	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

N = No separation requirement.

NP = Not Permitted.

a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section 406.3.2.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.
f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

Commenter's Reason: Filling in the balance of Table 508.4 will avoid confusion and make the table more clear and functional. The public comment addresses the inconsistencies that were brought up during testimony.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal is an editorial change and adds no new requirements to the code.

G88-18

G89-18

IBC: 508.4.4.1, 509.4.1.1 (New)

Proposed Change as Submitted

Proponent: Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB) (TWB@iccsafe.org)

2018 International Building Code

508.4.4 Separation. Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.

Revise as follows

508.4.4.1 Construction. Required separations shall be *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. <u>Mass timber elements serving as fire barriers or horizontal assemblies to separate occupancies in Type IV-B or IV-C construction shall be separated from the interior of the building with an approved thermal barrier consisting of a minimum of 1/2 inch (12.7 mm) gypsum board or a noncombustible equivalent.</u>

Add new text as follows

<u>**509.4.1.1 Type IV-B and IV-C construction.** Where Table 509 specifies a fire-resistance-rated separation, mass timber elements serving as fire barriers or a horizontal assembly in Type IV-B or IV-C construction shall be separated from the interior of the incidental use with an approved thermal barrier consisting of a minimum of ½ inch (12.7 mm) gypsum board or a noncombustible equivalent.</u>

Reason: The Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board to explore the science of tall wood buildings and take action on developing code changes for tall wood buildings. The TWB has created several code change proposals with respect to the concept of tall buildings of mass timber and the background information is at the end of this Statement. Within the statement are important links to information, including documents and videos, used in the deliberations which resulted in these proposals.
This code change proposal represents one of many submitted designed to address a new type of construction called mass timber (e.g. new construction types IV-A, IV-B, and IV-C).

On this subject of “fire barriers,” the committee determined that additional measures were necessary to address cases where mass timber is serving as a fire barrier or horizontal assembly. Section 508.4 describes the third option for separating mixed occupancies within a building. Section 509.4 discusses the fire-resistance rated separation that is required for incidental uses within a larger use group. Section 509 also permits, when stated, protection by an automatic sprinkler system without fire barriers, however the construction enclosing the incidental use must resist the passage of smoke in accordance with Section 509.4.2.

The concern is that without any modifications to these provisions regulating separated occupancies and incidental uses, a fire barrier or horizontal assembly could be designed using mass timber that would comply with the fire resistance rating, but which would allow any exposed mass timber to contribute to the fuel load. This can occur in Types IV-B and IV-C construction.

The committee applied professional judgment by choosing to emulate the existing thermal barrier requirements by applying those requirements to these two sections. The intent of this proposal is to have the thermal barrier delay or prevent the ignition of the mass timber, thus delaying or preventing the mass timber’s contribution to the fuel load. This will also allow additional time for fire and life safety measures to be executed as well as allow first responders additional time to perform their services.

The committee’s intent is that the thermal barrier only needs to cover an exposed wood surface. The thermal barrier is not required in addition to any noncombustible protection that is required in Section 602.4, nor does it add to the fire resistance rating of the mass timber.

Mass timber walls or floors serving as fire barriers for separated uses (Section 508.4) would need to have a thermal barrier on both faces of the assembly.

For Section 509.4 (incidental use separations) the intent is to provide the thermal barrier only on the side where the hazard exists, that is, the side facing the incidental use. For example, if a mass timber floor assembly of the incidental use contains a noncombustible topping this provision would not require the addition of a thermal barrier on mass timber surfaces not facing the incidental use area. In addition, the thermal barrier would not be required if the sprinkler option is exercised.

It should be noted that this proposal is only addressing the contribution of exposed mass timber’s face to the fuel load of a fire, and is not recommending any modifications to the fire resistance requirements of Sections 508 or 509 or to the other mass timber provisions.

Background information: The ICC Board approved the establishment of an ad hoc committee for tall wood buildings in December of 2015. The purpose of the ad hoc committee is to explore the science of tall wood buildings and to investigate the feasibility and take action on developing code changes for tall wood buildings. The committee is comprised of a balance of stakeholders with additional opportunities for interested parties to participate in the four Work Groups established by the ad hoc committee, namely: Code; Fire; Standards/Definitions; and Structural. For more information, be sure to visit the ICC website https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/ (link active and up to date as of 12/27/17). As seen in the “Meeting Minutes and Documents” and “Resource Documents” sections of the committee web page, the ad hoc committee reviewed a substantial amount of information in order to provide technical justification for code proposals.

The ad hoc committee developed proposals for the followings code sections. The committee believes this package of code changes will result in regulations that adequately address the fire and life safety issues of tall mass timber buildings.

IBC Code Section	Description
403.3.2	Water supply requirements for fire pumps in high rise buildings of Type IVA and IVB construction.
504.3	Allowable building height (feet) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT construction.
504.4	Allowable building height (stories) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
506.2	Allowable building area for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
508.4.4.1 509.4.1.1 (new)	Requirements for mass timber building elements serving as fire barriers or horizontal assemblies in buildings of Type IVB of IVC construction.
602.4	Type of Construction requirements for new proposed types of construction: Types IVA, IVB and IVC. No changes to Type IV HT construction. Includes definitions for new terms: Mass timber and Noncombustible protection (mass timber). **THIS IS THE KEY CODE CHANGE PROPOSAL WHICH OUTLINES THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED NEW TYPE OF MASS TIMBER BUILDINGS. THE PROPOSAL ALSO ADDRESSES CONCEALED SPACES, ADHESIVE PERFORMANCE AND EXTERIOR WALL PROTECTION.**
703.8 (new)	The performance method to determine the increase to the fire resistance rating provided by noncombustible protection applied to the mass timber building element.
703.9 (new)	Requirements for sealants and adhesives to be placed at abutting edges and intersections of mass timber building elements. The reason statement references a Group B proposal to Chapter 17 for special inspection requirements of sealants and adhesives.
718.2.1	Requirements on the use of mass timber building elements used for Fireblocking.
722.7 (new)	Requirements for the fire resistance rating of mass timber elements, including minimum required protection and gypsum board attachment requirements.
3102	Requirements for membrane structures using Type IV HT construction.
3314.7 (new)	New special precautions during construction of buildings of Types IVA, IVB and IVC construction: Standpipes; Water supply for fire department connections; Noncombustible protection required for mass timber elements as construction height increases.
Appendix	Requirements for walls, floors and roofs of Type IV HT construction in buildings located in Fire Districts.
IFC Code Section	**Description**
701.6	Requirements which stipulate the owner's responsibility to maintain inventory of all required fire resistance rated construction in buildings of Types IVA and IVB construction. This includes an annual inspection and proper repair where necessary.
Proposed changes to be submitted in 2019 Group B	
IBC Chapter 17	Required special inspections of mass timber construction • Structural • Sealants and adhesives (see IBC 703.8)
IBC Chapter 23	An update to referenced standard APA PRG 320 Standard for Performance –rated Cross-laminated Timber which is currently undergoing revision to ensure the adequacy of the adhesives under fire conditions.

In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the tests, and many members witnessed the test in person or online. The results of the series of 5 fire tests provide additional support for these proposals, and validate the fire performance for each of the types of construction proposed by the committee. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of through-penetration fire stops, and to evaluate conditions for responding fire personnel.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3 ½ minutes, please visit:

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

G89-18

Public Hearing Results

Committee Action: As Modified

Committee Modification: 508.4.4.1 Construction. Required separations shall be fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. Mass timber elements serving as fire barriers or horizontal assemblies to separate occupancies in Type IV-B or IV-C construction shall be separated from the interior of the building with an approved thermal barrier consisting of a minimum of $^1/_2$ inch (12.7 mm) gypsum board or a ~~noncombustible equivalent~~ material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.
509.4.1.1 Type IV-B and IV-C construction. Where Table 509 specifies a fire-resistance-rated separation, mass timber elements serving as fire barriers or a horizontal assembly in Type IV-B or IV-C construction shall be separated from the interior of the incidental use with an approved thermal barrier consisting of a minimum of ½ inch (12.7 mm) gypsum board or a ~~noncombustible equivalent~~ material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

(Portions of proposal not shown are not modified.)

Committee Reason: The modification makes the proposal consistent with the current code. The proposal was approved based upon the proponents published reason statement. (Vote: 14-0)

Assembly Action: None

G89-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Jonathan Humble, representing American Iron and Steel Institute (jhumble@steel.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

508.4.4.1 Construction. Required separations shall be *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. Mass timber elements serving as fire barriers or horizontal assemblies to separate occupancies in Type IV-~~B or IV-~~ C construction shall be separated from the interior of the building with an approved thermal barrier consisting of a minimum of $^1/_2$ inch (12.7 mm) gypsum board or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

509.4.1.1 Type ~~IV-B and~~ IV-C construction. Where Table 509 specifies a fire-resistance-rated separation, mass timber elements serving as fire barriers or a horizontal assembly in Type IV-~~B or IV-~~C construction shall be separated from the interior of the incidental use with an approved thermal barrier consisting of a minimum of ½ inch (12.7 mm) gypsum board or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

Commenter's Reason: We recommend that the Type IV-B mass timber designation be deleted from the tall wood building proposals.

The origins of the development of the types of construction were originally developed to “account for the response or participation that a building’s structure will have in a fire condition originating within the building as a result of the occupancy or the fuel load” (Example source from BOCA National Building Code 1993 Commentary). The modern day types of construction are parsed out into three primary categories of construction; noncombustible (Types I and II), noncombustible/combustible (Types III and IV) and combustible (Type V). Subcategories were created to identify the protection; Type A for protected and Type B for unprotected.

What we have within proposals G75-18, G80-18, G84-18, G89-18, and G108-18 is the addition of a new construction category that has been proposed based on the need to satisfy aesthetics based on the combination of Types IV-A and IV-C, which is a departure from the black and white construction categories based on construction that is non-combustible or combustible. We feel this inappropriate for the codes to begin to designate designer type construction categories.

In the past such mixing and matching of construction types into building or structure is more suited to the IBC Section 104.11 (Alternative materials, design and methods of construction and equipment), or through use of the ICC International Performance Code or performance analysis. We feel that these are the most appropriate options for the mixing-and-matching of construction types in building design.

(Note to staff: The modifications shown to the term "material" are an outcome of the cdpACCESS system and not part of this public comment.)

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This will not increase or decrease the cost of construction as this code change proposal and public comment address information that was not previously contained in the code, therefore there is no cost impact when compared to present requirements.

Public Comment 2:

Proponent: Dan Nichols, representing ICC Code Correlation Committee (ccc@iccsafe.org).

Commenter's Reason: The Code Correlation Committee (CCC) is not taking a position on this code change. The CCC submitted this public comment in order to bring a correlation issue to the attention of the full voting membership for the Public Comment Hearings and the Online Governmental Consensus Vote to allow the voting membership to coordinate actions on a package of code changes submitted dealing with tall wood buildings of mass timber construction. This package includes the parent proposal G108-18; if disapproved, the related proposals G28-18, G75-18, G80-18, G84-18, G89-18, FS5-18, FS6-18, FS73-18, FS81-18 and F266-18, will not be correlated with any existing code text if they are approved.
The Code Correlation Committee is a standing committee of the International Code Council whose objectives, procedures and organization are set forth in Council Policy CP#44-13. The objective of the Code Correlation Committee is to maintain technical and editorial consistency among the International Codes and to assist staff in the evaluation and processing of code change proposals and comments that are exclusively editorial.

G89-18

G90-18

IBC: , 508.1, 508.5, 508.5.1, 508.5.2, 508.5.3, 508.5.4, 508.5.5, 508.5.6, 508.5.7, 508.5.8, 508.5.9, 508.5.10, 508.5.11

Proposed Change as Submitted

Proponent: Ed Kulik, Chair, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Building Code

Delete without substitution

~~**SECTION 419 LIVE/WORK UNITS**~~

Revise as follows

508.1 General. Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3 ~~or~~ , 508.4, 508.5, or a combination of these sections.

Exceptions:

1. Occupancies separated in accordance with Section 510.
2. Where required by Table 415.6.2, areas of Group H-1, H-2 and H-3 occupancies shall be located in a *detached building* or structure.
3. ~~Uses within live/work units, complying with Section 419, are not considered separate occupancies.~~

~~**419.1**~~**508.5** ~~**General.**~~**Live/Work Units.** A *live/work unit* shall comply with Sections ~~419.1~~ 508.5 through ~~419.9.~~508.5.11.

Exception: Dwelling or sleeping units that include an office that is less than 10 percent of the area of the *dwelling unit* are permitted to be classified as *dwelling units* with accessory occupancies in accordance with Section 508.2.

~~**419.1.1**~~**508.5.1 Limitations.** All of the following shall apply to live/work areas:

1. The *live/work unit* is permitted to be not greater than 3,000 square feet (279 m^2) in area.
2. The nonresidential area is permitted to be not more than 50 percent of the area of each *live/work unit*.
3. The nonresidential area function shall be limited to the first or main floor only of the *live/work unit*.
4. Not more than five nonresidential workers or employees are allowed to occupy the nonresidential area at any one time.

~~**419.2**~~**508.5.2 Occupancies.** *Live/work units* shall be classified as a Group R-2 occupancy. Separation requirements found in Sections 420 and 508 shall not apply within the *live/work unit* where the *live/work unit* is in compliance with Section ~~419.~~ 508.5. Nonresidential uses that would otherwise be classified as either a Group H or S occupancy shall not be permitted in a *live/work unit*.

Exception: Storage shall be permitted in the *live/work unit* provided that the aggregate area of storage in the nonresidential portion of the *live/work unit* shall be limited to 10 percent of the space dedicated to nonresidential activities.

~~**419.3**~~**508.5.3 Means of egress.** Except as modified by this section, the *means of egress* components for a *live/work unit* shall be designed in accordance with Chapter 10 for the function served.

~~**419.3.1**~~**508.5.4 Egress capacity.** The egress capacity for each element of the *live/work unit* shall be based on the occupant load for the function served in accordance with Table 1004.5.

~~**419.3.2**~~**508.5.5 Spiral stairways.** *Spiral stairways* that conform to the requirements of Section 1011.10 shall be permitted.

~~**419.4**~~**508.5.6 Vertical openings.** Floor openings between floor levels of a *live/work unit* are permitted without enclosure.

~~[F]~~ ~~419.5~~508.5.7 **Fire protection.** The *live/work unit* shall be provided with a monitored *fire alarm* system where required by Section 907.2.9 and an *automatic sprinkler system* in accordance with Section 903.2.8.

~~419.6~~508.5.8 **Structural.** Floors within a *live/work unit* shall be designed for the live loads in Table 1607.1, based on the function within the space.

~~419.7~~508.5.9 **Accessibility.** Accessibility shall be designed in accordance with Chapter 11 for the function served.

~~419.8~~508.5.10 **Ventilation.** The applicable *ventilation* requirements of the International Mechanical Code shall apply to each area within the *live/work unit* for the function within that space.

~~419.9~~508.5.11 **Plumbing facilities.** The nonresidential area of the *live/work unit* shall be provided with minimum plumbing facilities as specified by Chapter 29, based on the function of the nonresidential area. Where the nonresidential area of the *live/work unit* is required to be *accessible* by Section 1107.6.2.1, the plumbing fixtures specified by Chapter 29 shall be *accessible*.

Reason: Relocating Section 419 on Live/Work Units to Section 508 Mixed Occupancies provides a clearer description under Mixed Use Occupancies since the unit is not only residential nor business use. An example is a doctor's office occupying part of a detached dwelling, or townhouses with an office, store or restaurant on the first floor and a residence occupying parts or all of upper floors.
This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2017 the BCAC has held 3 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial relocation of existing requirements.

G90-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The committee approved the change recognizing that live/work units are a method of addressing mixed occupancy in a space and therefore is well placed in Section 508. The Chapter 4 location was felt to be no longer needed as these units have become more mainstream and not 'special' in nature. (Vote: 8-6)

Assembly Action: **None**

G90-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter ICC (sthomas@coloradocode.net)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

310.3.1 **Live/Work Units** Live/work units located within townhouses that comply with Section 508.5 are permitted to comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.

508.5 Live/Work Units. A *live/work unit* shall comply with Sections 508.5 through 508.5.11.

~~**Exception**~~ **Exceptions:**

1. Dwelling or sleeping units that include an office that is less than 10 percent of the area of the *dwelling unit* are permitted to be classified as *dwelling units* with accessory occupancies in accordance with Section ~~508~~ 508.2
2. Live/work units located within townhouses that comply with this section are permitted to comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.

Commenter's Reason: It has always been understood that live-work units located in townhouses could be constructed under the International Residential Code (IRC). In fact, the Effective Use of the International Building Code in the Preface states, The IRC can also be used for the construction of live/work units (as defined in Section 419) and small bed and breakfast-style hotels where there are five or fewer guest rooms and the hotel is owner occupied . Although this is not part of the specific code requirements, it does set forth the intent that live/work units could be constructed under the IRC. In addition, Section 101.2 of the IRC includes an exception that allows live/work units to be constructed under that that code. The exception states, "Live/work units located in townhouses and complying with the requirements of Section 419 of the International Building Code". This proposal would provide consistency between the two codes to allow townhouses to be constructed under the IRC as long as they also comply with Section 419 of the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Since it was already assumed that live/work could be constructed under the IRC, there is no cost difference.

G90-18

G91-18

IBC: Table [F] TABLE 509

Proposed Change as Submitted

Proponent: Ed Kulik, Chair, representing ICC Building Code Action Committee (BCAC@iccsafe.org)

THIS CODE CHANGE WILL BE HEARD BY THE FIRE CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE

2018 International Building Code

Revise as follows

[F] TABLE 509
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input [a]	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower [a]	1 hour or provide automatic sprinkler system
Refrigerant machinery room [a]	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E,I and R occupancies.
Incinerator rooms [a]	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies otherthan Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops notclassified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with paddedsurfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste andlinen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Stationary storage battery systems having an energy capacity greater than the threshold quantity specified in Table 1206.2 of the International Fire Code	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Electrical installations and transformers [a]	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements.

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m^3.

<u>a. See Chapter 6 of the International Fire Code for additional construction related requirements</u>

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2017 the BCAC has held 3 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac.
This is a simple footnote pointer so designers are aware of additional construction and/or installation requirements for these incidental use building systems that are located in Chapter 6 of the International Fire Code.

This proposal is part of a comprehensive update to IFC Chapter 6 by the F-CAC. F-CAC fully supports this proposal.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal adds a pointer to existing requirements in the IFC. No new or additional construction requirements are being introduced into the IBC.

G91-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal was disapproved as it was seen as an unnecessary pointer. There appears to be very little related to Table 509 found within Chapter 6 of the IFC. (Vote: 11-3)

Assembly Action: **None**

G91-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Ed Kullik, representing ICC Building Code Action Committee (bcac@iccsafe.org)requests As Submitted.

Commenter's Reason: Section 509 is used during the design process of the building. The proposed pointer, in the form of a footnote to IBC Table 509 for specific room or area types, directs the code user to the additional applicable construction/installation requirements in Chapter 6 of the Fire Code with the Building Code for these incidental uses, which otherwise might be missed.
Reference to Chapter 6 of the Fire Code is applicable, because it focuses on building systems and services as they relate to potential safety hazards and when and how they should be installed. This chapter brings together all building system- and service-related issues for convenience and provides a more systematic view of buildings. The following building services and systems construction/installation requirements for the following are addressed: fuel-fired appliances, electrical equipment, wiring and hazards, mechanical refrigeration, elevator operation, maintenance and fire service keys, commercial kitchen hoods, commercial kitchen cooking oil storage and hyperbaric facilities.

Additionally, the FCAC submitted 17 proposals as part of a comprehensive package addressing technical and organizational changes to Chapter 6 of the Fire Code. These changes included additional construction and installation requirements for building systems and services which were approved at the Committee Action Hearing, including installation of fuel oil tanks within buildings and non-portable fuel-fired appliances, construction of refrigeration machinery rooms, and listed and labeled electrical equipment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal adds a pointer to existing requirements in the IFC. No new or additional construction requirements are being introduced into the IBC.

G91-18

G93-18

IBC: 509.3

Proposed Change as Submitted

Proponent: David Collins, representing The American Institute of Architects (dcollins@preview-group.com); Stephen Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter ICC (sthomas@coloradocode.net)

2018 International Building Code

[F] TABLE 509
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu perhour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E,I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies otherthan Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops notclassified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with paddedsurfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste andlinen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Stationary storage battery systems having an energy capacity greater than the threshold quantity specified in Table 1206.2 of the International Fire Code	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements.

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m^3.

509.2 Occupancy classification. Incidental uses shall not be individually classified in accordance with Section 302.1. Incidental uses shall be included in the building occupancies within which they are located.

Delete without substitution

~~**509.3 Area limitations.** Incidental uses shall not occupy more than 10 percent of the *building area* of the *story* in which they are located.~~

Reason: We submitted changes to eliminate the 10% area limitation on incidental uses over the last two code cycles. Each of those proposals were disapproved by the committee and the membership. We were told by the opponents, the way to fix the problem is to require incidental uses over 10% of the story area to be classified as an occupancy. Independently we each drafted a proposed change to say that if one incidental use; or an aggregate of incidental uses on a story exceeds the 10% limit that they would be classified as a distinct occupancy. The more we tried to provide rationale for such a change, to more the construct came crashing down.
The original purpose of incidental uses that are all specifically listed in Table 509 is to address a hazard of one type or another. Each of the uses in Table 509 poses a hazard to the balance of the primary use of the building or story. The solutions to address those risks are rated separations, automatic sprinkler system or both. The hazard exists whether the use is 5% of a story, 15% or a story or 50% of a story. The protection needs to be provided regardless of the area of the incidental use(s). The 10% limit is particularly impractical and onerous if strictly enforced on the health care industry. Laboratories, laundry rooms, maintenance shops, storage rooms; waste and linen collection - going over 10% is a frequent design issue.

The solution urged on us is to say things that are an incidental use when limited to 10% of the story (and part of the primary occupancy) are to be called a different occupancy when they get larger doesn't work either way you try to wrap the code around it.

A. Distinct uses - no longer incidental uses. If we say that these uses exceeding 10% of story are something else and no longer an incidental use, then the protections required by Table 509 disappear. If we assign other occupancies then we are left to rely on Section 508 mixed occupancies to provide protections. But often the protections will be less. In a non-separated approach you may get a fully sprinklered building, but you won't get rated separations. In a separated mixed occupancy approach you might get sprinklers; you might get rated separations; and sometimes you might get both, but you aren't going to be assured of the protections required for the smaller things allowed under incidental uses.

B. Distinct uses - but still incidental uses. If we say that these uses exceeding 10% are another occupancy AND remain an incidental use in order to preserve the protections. What have we done? We've proved that the 10% limit is meaningless because you are still getting the protections of incidental uses regardless of size.

A final point about assigning other occupancy categories to these uses (when exceeding 10%) is that the application of the code will be inconsistent from jurisdiction to jurisdiction; from project to project.

Eliminating the 10% limit makes sure that each of these uses in Table 509 will be consistently protected from project to project; jurisdiction to jurisdiction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is intended to clarify the code language.

G93-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: After returning this item from the Table, the proponents stated they were unable to arrive at a compromise. There was a consensus that these items require protections as provided in Section 509. There was not a consensus on whether the 10% limit could be eliminated outright or if the elimination needs to be balanced by new provisions to address larger installations. When asked by the proponents, the committee was more supportive of efforts to fix the provisions over leaving them as they stand. (Vote: 11-3)

Assembly Action: **None**

G93-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen Thomas, Colorado Code Consulting, LLC, representing Colorado Chapter ICC (sthomas@coloradocode.net) ; David Collins representing AIA (dcollins@preview-group.com) ; Sarah Rice (srice@preview-group.com); Wayne Jewell (wayne.jewell@greenoaktwp.com)requests As Modified by This Public Comment.

Replace as follows:

2018 International Building Code

509.2 Occupancy classification. ~~Incidental uses shall not be individually~~ An incidental use area shall be classified in accordance with ~~Section 302.1. Incidental uses shall be included in the building occupancies within which they are located~~the occupancy of that portion of the building in which it is located or the building shall be classified as a mixed occupancy and shall comply with Section 508.

509.3 Area limitations. ~~Incidental~~ The area of incidental uses shall not ~~occupy more than 10 percent of the *building area* of the *story* in which they are located~~be limited within a building.

Commenter's Reason: There is a serious hole in the current code as it relates to incidental uses. The current code limits incidental uses to 10% of the area of the story that they are located within, similar to accessory occupancies in Section 508.2.3. The problem is that there is no direction in the code as to what to do when the incidental use exceeds 10% of the story area or it is the entire building. We have tried to delete the 10% requirement over the past few code cycles to solve this issue. However, the committee has disapproved the change each time including this cycle. Therefore, we are changing our approach to respond to the committee and the opposition testimony to address this issue.
The committee and opposition all stated that if the incidental use exceeded 10% of the area, then it should be classified as a specific occupancy. However, the current Section 509.2 states that you cannot classify an incidental use as an occupancy. So, this public comment revises that section to allow the design professional to classify the use as an occupancy or keep it as an incidental use. If they classify the use as an occupancy, then they would need to comply with Section 508 and determine whether it is an accessory occupancy, nonseparated occupancy or separated occupancy. It would be left to the discretion of the design professional.

Section 509.3 has been revised to state that the area of incidental uses is no longer limited. The primary purpose of this revision is for healthcare facilities. Most of the uses listed in Table 509 are located within healthcare occupancies. In many cases, these areas exceed the 10% limitation and has created a problem. This would allow healthcare to have as many incidental uses as they want and be consistent with NFPA 101 Life Safety Code. This has been a goal of the Health Care Subcommittee over the past few code cycles.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
In some cases, the separation between the uses could be eliminated.

G93-18

G94-18

IBC: 510.2

Proposed Change as Submitted

Proponent: Lawrence Lincoln, Salt Lake City Corporation, representing Self (larry.lincoln@slcgov.com)

2018 International Building Code

510.2 Horizontal building separation allowance. A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of *fire walls*, limitation of number of *stories* and type of construction where all of the following conditions are met:

1. The buildings are separated with a *horizontal assembly* having a *fire-resistance rating* of not less than 3 hours. Where vertical offsets are provided as part of a *horizontal assembly*, the vertical offset and the structure supporting the vertical offset shall have a *fire-resistance rating* of not less than 3 hours.
2. The building below, including the *horizontal assembly*, is of Type IA construction.
3. *Shaft, stairway, ramp* and escalator enclosures through the *horizontal assembly* shall have not less than a 2-hour *fire-resistance rating* with opening protectives in accordance with Section 716.

   Exception: Where the enclosure walls below the *horizontal assembly* have not less than a 3-hour *fire-resistance rating* with opening protectives in accordance with Section 716, the enclosure walls extending above the *horizontal assembly* shall be permitted to have a 1-hour *fire-resistance rating*, provided:

   1. The building above the *horizontal assembly* is not required to be of Type I construction;
   2. The enclosure connects fewer than four *stories*; and
   3. The enclosure opening protectives above the *horizontal assembly* have a *fire protection rating* of not less than 1 hour.
4. Where buildings above the horizontal assembly are of Type III, IV or V construction, stairways within enclosures specified in Item 3 shall be constructed of either noncombustible materials or fire retardant treated wood.

   5.~~4.~~ The building or buildings above the *horizontal assembly* shall be permitted to have multiple Group A occupancy uses, each with an *occupant load* of less 300, or Group B, M, R or S occupancies.

   6. ~~5.~~ The building below the *horizontal assembly* shall be protected throughout by an approved *automatic sprinkler system* in accordance with Section 903.3.1.1, and shall be permitted to be any occupancy allowed by this code except Group H.

   7. ~~6.~~ The maximum *building height* in feet (mm) shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the *grade plane*.

Reason: IBC section 1011.7 requires that Stairway construction be built of materials consistent with the types permitted for the type of construction of the building. Buildings designed in accordance with section 510.2 are inherently of two different types of construction where the horizontal assembly is the dividing line. When taking into consideration the materials that would be consistent with the type of construction of the stairway construction within a fire-rated stair enclosure, the transition from combustible materials (above the horizontal assembly) to noncombustible materials (below the horizontal assembly) makes no sense within the fire-rated stair enclosure when the type of construction above the horizontal assembly is of type III, IV or V and the type of construction below the horizontal assembly is type I-A (required by section 510.2). In other words, it makes no sense to transition from combustible materials to noncombustible materials when you are within the same environment (the fire-rated stair enclosure). Please note that this code proposal would allow fire-retardant-treated wood as a construction material within that portion of the fire-rated stair enclosure that is part of the type I-A construction. Since fire is never anticipated to originate within a fire-rated stair enclosure, this allowance seems reasonable.

Cost Impact: The code change proposal will decrease the cost of construction
The proposed code change will decrease the cost of construction as this code change would lessen a code requirement.

G94-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee saw the wording of G95-18 as a better solution to this issue. (Vote: 12-2)

Assembly Action: **None**

G94-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Lawrence Lincoln, representing Self (larry.lincoln@slcgov.com)requests As Modified by This Public Comment.

Further modify as follows:

2018 International Building Code

510.2 Horizontal building separation allowance. A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of *fire walls*, limitation of number of *stories* and type of construction where all of the following conditions are met:

1. The buildings are separated with a *horizontal assembly* having a *fire-resistance rating* of not less than 3 hours. Where vertical offsets are provided as part of a *horizontal assembly*, the vertical offset and the structure supporting the vertical offset shall have a *fire-resistance rating* of not less than 3 hours.
2. The building below, including the *horizontal assembly*, is of Type IA construction.
3. *Shaft, stairway, ramp* and escalator enclosures through the *horizontal assembly* shall have not less than a 2-hour *fire-resistance rating* with opening protectives in accordance with Section 716.

   Exception: Where the enclosure walls below the *horizontal assembly* have not less than a 3-hour *fire-resistance rating* with opening protectives in accordance with Section 716, the enclosure walls extending above the *horizontal assembly* shall be permitted to have a 1-hour *fire-resistance rating*, provided:

   1. The building above the *horizontal assembly* is not required to be of Type I construction;
   2. The enclosure connects fewer than four *stories*; and
   3. The enclosure opening protectives above the *horizontal assembly* have a *fire protection rating* of not less than 1 hour.

4. Where buildings above the horizontal assembly are of Type III, IV or V construction, stairways within the enclosures specified in Item 3 shall be allowed to be constructed of ~~either noncombustible materials or fire-retardant-treated wood.~~any material allowed by the code.
5. The building or buildings above the *horizontal assembly* shall be permitted to have multiple Group A occupancy uses, each with an *occupant load* of less 300, or Group B, M, R or S occupancies.
6. The building below the *horizontal assembly* shall be protected throughout by an approved *automatic sprinkler system* in accordance with Section 903.3.1.1, and shall be permitted to be any occupancy allowed by this code except Group H.
7. The maximum *building height* in feet (mm) shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the *grade plane*.

Commenter's Reason: IBC section 1011.7 requires that Stairway construction be built of materials consistent with the types permitted for the type of construction of the building. Buildings designed in accordance with section 510.2 are inherently of two different types of construction where the horizontal assembly is the dividing line. When taking into consideration the materials that would be consistent with the type of construction of the stairway construction located within a fire-rated stair enclosure, the transition from combustible materials (above the horizontal assembly) to noncombustible materials (below the horizontal assembly) makes no sense within the fire-rated stair enclosure when the type of construction above the horizontal assembly is of Type III, IV or V and the type of construction below the horizontal assembly is Type I-A (as required by section 510.2). In other words, it makes no sense to transition from combustible materials to noncombustible materials when you are within the same environment (the fire-rated stair enclosure). By mentioning Item 3 in this code change proposal, clarity is provided to the code user clearly indicating that combustible materials ('any material allowed by the code') are allowed to be used within the stairway enclosures required by Item 3, when the building above the horizontal assembly is of Type III, IV or V construction. 'Pointers' from IBC section 1011.7 is unnecessary since IBC section 510.2 is a more specific requirement. Since fire is never anticipated to originate from within a fire-rated stair enclosure, regardless of the fire-rating of the stair enclosure, this code change allowance seems reasonable.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proposed public comment and code change will decrease the cost of construction as this code change would lessen a code requirement of the installation of noncombustible materials to that of combustible materials.

G94-18

G95-18

IBC: 510.2, 1011.7, 1023.2 (IFC[BE] 1011.7, 1023.2)

Proposed Change as Submitted

Proponent: Lee Kranz, representing City of Bellevue, WA (lkranz@bellevuewa.gov)

2018 International Building Code

Revise as follows

510.2 Horizontal building separation allowance. A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of *fire walls*, limitation of number of *stories* and type of construction where all of the following conditions are met:

1. The buildings are separated with a *horizontal assembly* having a *fire-resistance rating* of not less than 3 hours. Where vertical offsets are provided as part of a *horizontal assembly*, the vertical offset and the structure supporting the vertical offset shall have a *fire-resistance rating* of not less than 3 hours.
2. The building below, including the *horizontal assembly*, is of Type IA construction.
3. *Shaft, stairway, ramp* and escalator enclosures through the *horizontal assembly* shall have not less than a 2-hour *fire-resistance rating* with opening protectives in accordance with Section 716.

   Exception: Where the enclosure walls below the *horizontal assembly* have not less than a 3-hour *fire-resistance rating* with opening protectives in accordance with Section 716, the enclosure walls extending above the *horizontal assembly* shall be permitted to have a 1-hour *fire-resistance rating*, provided:

   1. The building above the *horizontal assembly* is not required to be of Type I construction;
   2. The enclosure connects fewer than four *stories*; and
   3. The enclosure opening protectives above the *horizontal assembly* have a *fire protection rating* of not less than 1 hour.
4. <u>Interior exit stairways located within the Type IA building are permitted to be of combustible materials where both of the following requirements are met:</u>

   <u>4.1.</u> <u>The building above the Type IA building is of Type III, IV, or V construction.</u>
   <u>4.2.</u> <u>The stairway located in the Type IA building is enclosed by 3-hour fire-resistance rated construction with opening protectives in accordance with Section 716.</u>

<u>5.</u> The building or buildings above the *horizontal assembly* shall be permitted to have multiple Group A occupancy uses, each with an *occupant load* of less 300, or Group B, M, R or S occupancies.
~~5.~~<u>6.</u> The building below the *horizontal assembly* shall be protected throughout by an approved *automatic sprinkler system* in accordance with Section 903.3.1.1, and shall be permitted to be any occupancy allowed by this code except Group H.
~~6.~~<u>7.</u> The maximum *building height* in feet (mm) shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the *grade plane*.

1011.7 Stairway construction. *Stairways* shall be built of materials consistent with the types permitted for the type of construction of the building~~, except that wood *handrails shall be permitted for all types of construction*~~.

<u>**Exceptions**</u>:

1. <u>Wood handrails shall be permitted in all types of construction.</u>
2. <u>Interior exit stairway in accordance with Section 510.2</u>

1023.2 Construction. Enclosures for interior exit *stairways* and *ramps* shall be constructed as *fire barriers* in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. *Interior exit stairway* and *ramp* enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more and not less than 1 hour where connecting less than four stories. The number of stories connected by the interior exit *stairways* or *ramps* shall include any *basements*, but not any *mezzanines*. *Interior exit stairways* and *ramps* shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.

Exceptions:

1. *Interior exit stairways* and *ramps* in Group I-3 occupancies in accordance with the provisions of Section 408.3.8.
2. *Interior exit stairways* within an *atrium* enclosed in accordance with Section 404.6.
3. <u>Interior exit stairway in accordance with Section 510.2.</u>

Reason: In podium buildings utilizing a 3-hour fire-resistance rated horizontal assembly constructed in accordance with Section 510.2 it is very common for the building above the horizontal assembly to be of combustible construction, including the landings, stair stringers and treads. The code currently requires that a transition be made from wood to metal, or some other non-combustible materials, within the stair enclosure at the point where the stair goes from being located in a combustible building to the Type IA non-combustible building. This is not practical or warranted. Fires do not typically start within the fire-resistance rated stair enclosure. Exception #4.2 of this proposal provides additional protection by requiring that the stair shaft be of not less than a 3-hour fire resistance rating with 3-hour rated door assemblies as required by Section 716. This essentially creates a vertical offset of the 3-hour horizontal assembly which is currently allowed by Section 510.2. This section states that “Where vertical offsets are provided as part of a horizontal assembly, the vertical offset and the structure supporting the vertical offset shall have a *fire-resistance rating* of not less than 3 hours.”
We have also included two 'pointer' exceptions in Chapter 10. Without the pointer exceptions someone might argue that these Chapter 10 provisions are more restrictive and override the exception in 510.2. The exemption for wood handrails currently found in the text of Section 1011.7 has been reformatted by placing it into exception #1.

Cost Impact: The code change proposal will decrease the cost of construction
Allowing stairs to be of combustible construction will be less expensive then if they were required to be of non-combustible materials. Also, the cost to design the stair will be reduced because a transition from wood to steel (or other non-combustible materials) will no longer be required.

G95-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The issue of stairway construction through podium buildings has been a issue for many jurisdictions and the cause of many alternative method reviews - and approvals. This proposal was preferable to G94-18. It provides a good clarification of the stair transition between upper and lower buildings. The presence of sprinklers throughout both buildings adds to the acceptability of this approach. (Vote: 14-0)

Assembly Action: **None**

G95-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen Skalko, Stephen V. Skalko, P.E. & Associates, LLC, representing Masonry Alliance for Codes and Standards (svskalko@svskalko-pe.com) ; William Hall, Alliance for Concrete Codes and Standards, representing Alliance for Concrete Codes and Standards (jhall@cement.org)requests Disapprove.

Commenter's Reason: G95-18 should be DISAPPROVED for the following reasons:

- The amount of wood material being introduced into the construction of the stair enclosure and exit stair by the new alternate provisions in Item (4) to 510.2 can increase the fire load associated with the means of egress significantly for podium style buildings covered by this section. Based on a review of the only (3) hour fire rated wood stud wall assemblies in the UL Directory, the complex wall details required to form the 3-hour enclosure require far more wood materials than typical 2X4 or 2X6 stud walls.

The 3-hour hour fire rated wall assemblies, U370, U382, U390 V304, showed the walls in the U-series require two separate stud walls be constructed, with a minimum 1-inch space between opposing studs, to create a cavity that is to be completely filled with a sprayed fiber cellulose material. The studs are spaced a maximum of 16-inches on center. The single V-series assembly requires the wall assembly to be constructed of 5-1/2-in X 6-in wood columns spaced at a maximum of 96-inches on center. The wood columns are connected together by horizontal 2 X 4 wood girts on each side spaced 16-inches on center.

The net effect of these assemblies will more than double the amount of wood (e.g. more studs, more top plates, etc.) presently permitted in the crucial means of egress enclosure within the Type IA construction for these podium style buildings.

- The proponent states *the proposal will decrease the cost of construction. Allowing stairs to be of combustible construction will be less expensive then if they were required to be of noncombustible materials* . That statement is not necessarily true based on a review of the listed wood stud wall assemblies required to meet the 3-hour fire resistance rating

The U-series 3-hour fire rated wall assemblies in the UL Directory (U370, U382, U390) require two separate stud walls (16-in o.c.) be constructed with a space between studs that is completely filled with a sprayed fiber cellulose material. The U-series wall assemblies are then covered with two layers of Type C gypsum board. The V-series assembly in the UL Directory (V304) is constructed of 5-1/2-in X 6-in wood columns @ 96-inches o.c. and connected together by horizontal 2 X 4 wood girts 16-inches o.c. on each side. Four (4) layers of 5/8-inch gypsum board are applied to the horizontal girts in staggered layers.

Based on other cost studies of wood frame walls versus masonry walls the costs for these complex wood stud walls could easily exceed that required for concrete or masonry walls (www.buildingstudies.org).

- The General Committee reason states *the presence of sprinklers throughout both buildings adds to the acceptability of this approach* . Nothing in this proposal requires buildings located above the 3-hour horizontal assembly to be sprinklered. It is possible to have multiple Group Assembly occupancies with separate fire area compartments in accordance with Section 707.3.10, or a Group B, M or S occupancy in the building above, without sprinkler protection being required. The proposal to allow the increased combustible construction for the stair enclosure and exit stair was approved incorrectly thinking that the buildings above and below the horizontal assembly are sprinklered.

G95-18 decreases the fire safety for the occupants and the fire service in buildings constructed using the podium provisions in Section 510.2 by allowing an increase in the amount of combustible materials based on reasons that are incorrect or not sufficiently justified.

Recommend DISAPPROVAL of G95-18

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The cost of construction will remain unchanged if the proposal is disapproved.

G95-18

G97-18

IBC: 510.4

Proposed Change as Submitted

Proponent: David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Building Code

Revise as follows

510.4 Parking beneath Group R. Where a ~~maximum one *story above grade plane*~~ Group S-2 parking garage, one story above grade plane, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with a grade entrance, is ~~provided under~~ located below a ~~building of~~ Group R building, the Group S-2 parking garage and Group R building shall be considered separate and distinct buildings. The number of *stories* to be used in determining the minimum type of construction of the Group R building shall be measured from the floor above ~~such a~~ the parking ~~area.~~ garage. The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a *fire-resistance rating* not less than the mixed occupancy separation required in Section 508.4.
The maximum building height in feet shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the grade plane.

Reason: The current language in this section is confusing and awkward. This section addresses the upper height limit in stories, but does not address it in feet.

Cost Impact: The code change proposal will decrease the cost of construction
By clarifying the intent of the code the cost of design, review and approval of projects should be simplifies and reduce the overall cost of construction.

G97-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The committee agreed with the proponents reason statement. (Vote: 8-6)

Assembly Action: **None**

G97-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Jeffrey Shapiro, representing National Fire Sprinkler Association (jeff.shapiro@intlcodeconsultants.com)requests Disapprove.

Commenter's Reason: Although this change was intended as a simple cleanup, there is a major unintended technical change that eliminates the current requirement for fire sprinklers to be included in the garage level.
In the 2018 code, Section 903.2.8 requires all BUILDINGS containing a Group R fire area to be sprinklered, and because horizontal separation in Section 510.4 is not currently recognized as a basis for creating separate buildings, the Group R fire area triggers Section 903.2.8 and requires the entire building, including the garage to be sprinklered. The text being added by this proposal stating, "the Group S-2 parking garage and the Group R building shall be considered separate and distinct buildings" changes how the code applies because it designates the S-2 garage as a separate building, thereby disconnecting the garage from the sprinkler requirement in Section 903.2.8. Hence, if this proposal is approved, a building built to Section 510.4 would not require sprinklers under the 2021 edition. Because this consequence was not mentioned or justified by the original proposal or at the committee hearing, the proposal needs to be DISAPPROVED.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
If the section is deleted, the code will then defer to Section 510.2 for pedestal construction.

G97-18

G108-18

IBC: 202, 602.4, 602.4.1, 602.4.1.1 (New), 604.2.4.1.2(New), 602.4.1.2.1 (New), 602.4.1.3 (New), 602.4.1.4 (New), 602.4.1.5 (New), 602.4.1.6 (New), 602.4.2, 602.4.2.1 (New), 602.4.2.2 (New), 602.4.2.2.1 (New), 602.4.2.2.2 (New), 602.4.2.2.3 (New), 602.4.2.2.4 (New), 602.4.2.3 (New), 602.4.2.4 (New), 602.4.2.5 (New), 602.4.2.6 (New), 602.4.3, 602.4.3.1 (New), 602.4.3.2 (New), 602.4.3.3 (New), 602.4.3.4 (New), 602.4.3.5 (New), 602.4.3.6 (New), 602.4.4(New), , TABLE 601, TABLE 602

Proposed Change as Submitted

Proponent: Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB) (TWB@iccsafe.org)

2018 International Building Code

SECTION 202 DEFINITIONS

Revise as follows

~~[BS]~~ **WALL, LOAD-BEARING.** Any wall meeting either of the following classifications:

1. Any metal or wood stud wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.
2. Any *masonry* or concrete, or mass timber wall that supports more than 200 pounds per linear foot (2919 N/m) of vertical load in addition to its own weight.

Add new definition as follows

MASS TIMBER. Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross section dimensions of Type IV construction.

NONCOMBUSTIBLE PROTECTION (FOR MASS TIMBER).

Noncombustible material, in accordance with Section 703.5, designed to increase the fire-resistance rating and delay the combustion of mass timber.

Revise as follows

602.4 Type IV. ~~Type IV construction 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 minimum dimensions for permitted materials including solid timber, glued-laminated timber, structural composite lumber (SCL), and cross-laminated timber and details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.1 or 602.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rating or heavy timber complying with Section 2304.11.2.2 shall be permitted.~~
Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire resistance rating requirements of this section based on either the fire resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2 or 703.3. The minimum dimensions and permitted materials for building elements shall comply with the provisions of this section and Section 2304.11. Mass timber elements of Types IV A, IV B and IV C construction shall be protected with noncombustible protection applied directly to the mass timber in accordance with Sections 602.4.1 through 602.4.3. The time assigned to the noncombustible protection shall be determined in accordance with Section 703.8 and comply with 722.7.

Cross-laminated timber shall be labeled as conforming to the heat performance requirements of Section 6.1.3.4 of DOC PS1 and have no delamination in any specimen, except where occurring at a localized characteristic when permitted in the product standard.

Exterior load-bearing walls and nonload-bearing walls shall be mass timber construction, or shall be of noncombustible construction.

> **Exception:** Exterior load-bearing walls and nonload-bearing walls of Type IV-HT Construction in accordance with Section 602.4.4.

The interior building elements, including nonload-bearing walls and partitions, shall be of mass timber construction or of noncombustible construction.

Exception: Interior building elements and nonload-bearing walls and partitions of Type IV-HT Construction in accordance with Section 602.4.4..

Combustible concealed spaces are not permitted except as otherwise indicated in Sections 602.4.1 through 602.4.4. Combustible stud spaces within light frame walls of Type IV-HT construction shall not be considered concealed spaces, but shall comply with Section 718.

In buildings of Type IV-A, B, and C, construction with an occupied floor located more than 75 feet above the lowest level of fire department access, up to and including 12 stories or 180 feet above grade plane, mass timber interior exit and elevator hoistway enclosures shall be protected in accordance with Section 602.4.1.2. In buildings greater than 12 stories or 180 feet above grade plane, interior exit and elevator hoistway enclosures shall be constructed of non-combustible materials.

Add new text as follows

602.4.1 **Type IV-A.** Building elements in Type IV-A construction shall be protected in accordance with Sections 602.4.1.1 through 602.4.1.6. The required fire resistance rating of noncombustible elements and protected mass timber elements shall be determined in accordance with Section 703.2 or Section 703.3.

602.4.1.1 **Exterior protection.** The outside face of exterior walls of mass timber construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a). All components of the exterior wall covering, shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.1.2 **Interior protection.** Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mas timber roofs, shall be protected with materials complying with Section 703.5

602.4.1.2.1 **Protection time.** Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(a), but not less than 80 minutes. The use of materials and their respective protection contributions listed in Table 722.7.1(b) shall be permitted to be used for compliance with Section 722.7.1.

602.4.1.3 **Floors.** The floor assembly shall contain a noncombustible material not less than one inch in thickness above the mass timber. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. The underside of floor assemblies shall be protected in accordance with 602.4.1.2.

602.4.1.4 **Roofs.** The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.1.2. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.1.5 **Concealed spaces.** Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the International Mechanical Code , and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Sections 602.4.1.2.

602.4.1.6 **Shafts.** Shafts shall be permitted in accordance with Sections 713 and Section 718. Both the shaft side and room side of mass timber elements shall be protected in accordance with Section 602.4.1.2.

602.4.2 **Type IV-B.** Building elements in Type IV-B construction shall be protected in accordance with Sections 602.4.2.1 through 602.4.2.6.The required fire resistance rating of noncombustible elements or mass timber elements shall be determined in accordance with Section 703.2 or Section 703.3.

602.4.2.1 **Exterior protection.** The outside face of exterior walls of mass timber construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a). All components of the exterior wall covering shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354, and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.2.2 **Interior protection.** Interior faces of all mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected, as required by this section, with materials complying with Section 703.5.

602.4.2.2.1 Protection time. Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(a), but not less than 80 minutes. The use of materials and their respective protection contributions listed in Table 722.7.1(b) shall be permitted to be used for compliance with Section 722.7.1.

602.4.2.2.2 Protected area. All interior faces of all mass timber elements shall be protected in accordance with Section 602.4.2.2.1, including the inside face of exterior mass timber walls and mass timber roofs.

Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20% of the floor area in any dwelling unit or fire area; or
2. Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40% of the floor area in any dwelling unit or fire area; or
3. Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with section 602.4.2.2.3.
4. Mass timber columns and beams which are not an integral portion of walls or ceilings, respectively, shall be permitted to be unprotected without restriction of either aggregate area or separation from one another.

602.4.2.2.3 Mixed unprotected areas. In each dwelling unit or fire area, where both portions of ceilings and portions of walls are unprotected, the total allowable unprotected area shall be determined in accordance with Equation 6-1.

$(U_{tc}/U_{ac}) + (U_{tw}/U_{aw}) \leq 1$ (Equation 6-1) where:

U_{tc} = Total unprotected mass timber ceiling areas

U_{ac} = Allowable unprotected mass timber ceiling area conforming to Section 602.4.2.2.2, Exception 1

U_{tw} = Total unprotected mass timber wall areas

U_{aw} = Allowable unprotected mass timber wall area conforming to Section 602.4.2.2.2, Exception 2

602.4.2.2.4 Separation distance between unprotected mass timber elements. In each dwelling unit or fire area, unprotectedportions of mass timber walls and ceilings shall be not less than 15 feet from unprotected portions of other walls and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls measured horizontally along the floor.

602.4.2.3 Floors. The floor assembly shall contain a noncombustible material not less than one inch in thickness above the mass timber. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. The underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.

602.4.2.4 Roofs. The interior surfaces of roof assemblies shall be protected in accordance with 602.4.2.2 except, in nonoccupiable spaces, they shall be treated as a concealed space with no portion left unprotected. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.2.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the International Mechanical Code, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.

602.4.2.6 Shafts. Shafts shall be permitted in accordance with Section 713 and Section 718. Both the shaft side and room side of mass timber elements shall be protected in accordance with Section 602.4.1.2.

602.4.3 Type IV-C. Building elements in Type IV-C construction shall be protected in accordance with Sections 602.4.3.1 through 602.4.3.6.The required fire resistance rating of building elements shall be determined in accordance with Section 703.2 or Section 703.3.

602.4.3.1 Exterior protection. The exterior side of walls of combustible construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a). All components of the exterior wall covering, shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.3.2 Interior protection. Mass timber elements are permitted to be unprotected.

602.4.3.3 Floors. Floor finishes in accordance with Section 804 shall be permitted on top of the floor construction.

602.4.3.4 Roofs. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.3.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the International Mechanical Code, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a).

602.4.3.6 Shafts. Shafts shall be permitted in accordance with Section 713 and Section 718. Shafts and elevator hoistway and interior exit stairway enclosures shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a), on both the inside of the shaft and the outside of the shaft.

602.4.4 Type IV-HT. 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 heavy timber or structural composite lumber (SCL), without concealed spaces. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, structural composite lumber (SCL) and cross laminated timber (CLT) and details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than one hour fire resistance rating or heavy timber conforming with Section 2304.11.2.2 shall be permitted.

Revise as follows

~~602.4.1~~602.4.4.1 Fire-retardant-treated wood in exterior walls. *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.

~~602.4.2~~602.4.4.2 Cross-laminated timber in exterior walls. *Cross-laminated timber* complying with Section 2303.1.4 shall be permitted within exterior wall assemblies not less than 6 inches (152 mm) in thickness with a 2-hour rating or less, provided the exterior surface of the cross-laminated timber is protected by one the following:

1. *Fire-retardant-treated wood* sheathing complying with Section 2303.2 and not less than $^{15}/_{32}$ inch (12 mm) thick;
2. *Gypsum board* not less than $^{1}/_{2}$ inch (12.7 mm) thick; or
3. A noncombustible material.

~~602.4.3~~602.4.4.3 Exterior structural members. Where a horizontal separation of 20 feet (6096 mm) or more is provided, wood columns and arches conforming to heavy timber sizes complying with Section 2304.11 shall be permitted to be used externally.

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	A	B	C	HT	A	B
Primary structural frame[f] (see Section 202)	3[a, b]	2[a, b]	1[b]	0	1[b]	0	3[a]	2[a]	2[a]	HT	1[b]	0
Bearing walls Exterior[e, f] Interior	 3 3[a]	 2 2[a]	 1 1	 0 0	 2 1	 2 0	 3 3	 2 2	 2 2	 2 1/HT	 1 1	 0 0
Nonbearing walls and partitions Exterior	See Table 602											
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1 1/2	1	1	HT	1[b,c]	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 in roof construction shall not be required, including protection of primary structural frame members, 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 complying with Section 2304.11 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.

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCEa, d, g

FIRE SEPARATION DISTANCE =X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[e]	OCCUPANCYGROUP F-1, M, S-1[f]	OCCUPANCYGROUP A, B, E, F-2, I, R[i], S-2, U[h]
$X < 5$[b]	All	3	2	1
$5 \le X < 10$	IA, IVA Others	3 2	2 1	11
$10 \le X < 30$	IA, IB, IVA, IVB IIB, VB Others	2 1 1	1 0 1	1[c] 0 1[c]
$X \ge 30$	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 412.3.1.
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.
i. For a Group R-3 building of Type II-B or Type V-B construction, 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.

Reason: The Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board to explore the science of tall wood buildings and take action on developing code changes for tall wood buildings. The TWB has created several code change proposals with respect to the concept of tall buildings of mass timber and the background information is at the end of this Statement. Within the statement are important links to information, including documents and videos, used in the deliberations which resulted in these proposals.
The TWB and it various WGs held meetings, studied issues and sought input from various expert sources around the world. The TWB has posted those documents and input on its website for interested parties to follow its progress and to allow those parties to, in turn, provide input to the TWB.

At its first meeting, the TWB discussed a number of performance objectives to be met with the proposed criteria for tall wood buildings:

1. No collapse under reasonable scenarios of complete burn-out of fuel without automatic sprinkler protection being considered.
2. No unusually high radiation exposure from the subject building to adjoining properties to present a risk of ignition under reasonably severe fire scenarios.
3. No unusual response from typical radiation exposure from adjacent properties to present a risk of ignition of the subject building under reasonably severe fire scenarios.
4. No unusual fire department access issues.
5. Egress systems designed to protect building occupants during the design escape time, plus a factor of safety.
6. Highly reliable fire suppression systems to reduce the risk of failure during reasonably expected fire scenarios. The degree of reliability should be proportional to evacuation time (height) and the risk of collapse.

The comprehensive package of proposals from the TWB meet these performance objectives.

Definitions

Included in the proposal for Section 602.4 are three new/revised definitions; Wall, Load-Bearing; Mass Timber; and Noncombustible protection (for mass timber). They are important to understanding the subsequent proposed change to Section 602.4.

Load-bearing wall: The modification to the term "load-bearing wall" has been updated to include "mass timber" as a category equivalent to that of masonry or concrete. Based on the research done by the wood trade associations, mass timber walls (e.g. sawn, glued-laminated, cross-laminated timbers) have the ability to support the minimum 200 pounds per linear foot vertical load requirement.

Mass Timber: The term "mass yimber" is being proposed to represent both the legacy heavy timber (a.k.a. Type IV construction) and the three (3) new construction types that are proposed for Chapter 6 of the IBC. The purpose of creating this term and definition was to establish a single term which represented the various sawn and engineered timber products that are referenced in IBC Chapter 23 (Wood) and in PRG-320 "Standard for Performance-rated Cross-laminated Timber."

"Noncombustible Protection (For Mass Timber): The definition of "Noncombustible Protection (For Mass Timber)" is created to address the passive fire protection of mass timber. Mass timber is permitted to have its own fire-resistance rating (e.g., Mass Timber only) or have a fire resistance rating based on the fire resistance through a combination of the mass timber fire-resistance plus protection by non-combustible materials as defined in Section 703.5 (e.g., additional materials that delay the combustion of mass timber, such as gypsum board). While it is not common to list a code section number within a definition it was felt necessary in this case to ensure that the user was able to understand the intent. The protection by a non-combustible material will act to delay the combustion of the Mass Timber.

Types of Construction

The Committee recognized that tall, mass timber buildings around the world generally fell into three categories: one in which the mass timber was fully protected by noncombustible protection, a second type in which the protection was permitted to be omitted to expose the wood in certain limited amounts of walls or ceilings, and a third type in which the mass timber for the structure was permitted to be unprotected.

The TWB also determined that fire testing was necessary to validate these concepts. At its first meeting, members discussed the nature and intention of fire testing so as to ensure meaningful results for the TWB and, more specifically, for the fire service. Subsequently a test plan was developed. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stairway. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of joints, and to evaluate conditions for responding fire personnel. The Fire WG then refined the test plan, which was implemented with a series of five, full-scale, multiple-story building tests at the Alcohol, Tobacco and Firearms (ATF) laboratories in Beltsville, MD. The results of those tests, as well as testing conducted by others, helped form the basis upon which the Codes WG developed its code change proposals. This code change proposal is one of those developed by the Codes WG and approved by the TWB.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3-1/2 minutes each, please visit: http://bit.ly/ATF-firetestvideos.

Both of these links were confirmed active on 12/27/17.

The completely protected type of construction, as noted above, is identified as Type IV-A. The protection is defined by a new section, 722.7, proposed in a separate code change. Testing has shown that mass timber construction protected with noncombustible protection, primarily multiple layers of 5/8-inch Type X gypsum board, can survive a complete burnout of a residential fuel load without engaging the mass timber in the fire. (See video or report above.) In considering this type of construction and its potential height and/or allowable area, the TWB wanted to make sure that code users realize that the protection specified in the text applies to all building elements. Thus, the text clearly requires protection for the floor surface, all wall and ceiling surfaces, the inside roof surfaces, the underside of floor surfaces, and shafts. In addition, Type IV-A construction is proposed to have the same fire resistance rating requirements as the existing Type I-A construction, which sets forth requirements for 2-hour and 3-hour structural elements. The specified fire resistance rating for Type IV-A construction is conservative in that the fire resistance rating of the structural elements was selected to be able to passively sustain the fuel loads associated with the various occupancies without the benefit of automatic sprinkler protection, and without involving the contribution of the structural members, similar to the strategy employed in the IBC for Type I construction.

Type IV-B allows some exposed wood surfaces of the ceiling, the walls or columns and beams. The amount of exposed surface permitted to be installed, as well as the required separation between unprotected portions, is clearly specified to limit the contribution of the structure in an interior fire. For example, two different walls may share the unprotected area but the two walls must be separated by a distance of 15 feet. Type IV-B has been subjected to the same fire tests under the same conditions as Type IV-A and the results demonstrate that a predictable char layer develops on mass timber in the same fashion as traditional sawn lumber, provided that substantial delamination is avoided. (See video or report above.) It should be noted that, while portions of the mass timber may be unprotected, concealed spaces, shafts and other specified areas are required to be fully protected by noncombustible protection. Type IV-B is provided with the same base fire resistance requirements as the existing Type I-B construction, which sets forth requirements for 2-hour structural elements. Please note that the allowance per IBC Section 403.2.1.1 to reduce I-B construction to 1-hour structural elements is not proposed for Type IV-B construction. Essentially, where a building is permitted to be constructed of I-B construction and has 1-hour protection, that same building will still require 2-hour structural elements for Type IV-B construction.

Type IV-C construction permits fully exposed mass timber. Important caveats are that concealed spaces, shafts, elevator hoistways, and interior exit stairway enclosures are not permitted to be exposed, but instead are required to have noncombustible protection. The IV-C construction is differentiated from traditional Heavy Timber construction in that Type IV-C construction is required to be 2-hour fire rated. While the added fire rating is required, the committee does not propose any additional height, in terms of feet, for Type IV-C buildings; in other words, the height in feet for Type IV-C and Type IV-HT are identical. However, due to the added fire resistance ratings, the committee has proposed added floors for some occupancy groups of Type IV-C construction.

Tables 601 and 602: Included in the proposal are modification of Tables 601 and 602. This is necessary to set the performance requirement for these new types of construction based upon mass timber. It should be noted that these Fire Resistance Ratings are set to have the requirements similar to those of Type I construction. In other words, IV-A has the same FRR as I-A; IV-B has the same FRR as I-B. Because there is no Type I corollary to IV-C, it was set the same as IV-B. The IV-C has to achieve all its fire resistance by the performance of the mass timber itself because no noncombustible protection is required. This is reflected in greatly reduced permitted height, in both feet and stories, in other TWB proposals to Table 504.3, 504.4 and 506.2.

Background information: The ICC Board approved the establishment of an ad hoc committee for tall wood buildings in December of 2015. The purpose of the ad hoc committee is to explore the science of tall wood buildings and to investigate the feasibility and take action on developing code changes for tall wood buildings. The committee is comprised of a balance of stakeholders with additional opportunities for interested parties to participate in the four Work Groups established by the ad hoc committee, namely: Code; Fire; Standards/Definitions; and Structural. For more information, be sure to visit the ICC website https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/ (link active and up to date as of 12/27/17). As seen in the “Meeting Minutes and Documents” and “Resource Documents” sections of the committee web page, the ad hoc committee reviewed a substantial amount of information in order to provide technical justification for code proposals.

The ad hoc committee developed proposals for the followings code sections. The committee believes this package of code changes will result in regulations that adequately address the fire and life safety issues of tall mass timber buildings.

IBC Code Section	Description
403.3.2	Water supply requirements for fire pumps in high rise buildings of Type IVA and IVB construction.
504.3	Allowable building height (feet) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT construction.
504.4	Allowable building height (stories) for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
506.2	Allowable building area for buildings of Type IVA, IVB and IVC construction. No changes to Type IV HT.
508.4.4.1 509.4.1.1 (new)	Requirements for mass timber building elements serving as fire barriers or horizontal assemblies in buildings of Type IVB of IVC construction.
602.4	Type of Construction requirements for new proposed types of construction: Types IVA, IVB and IVC. No changes to Type IV HT construction. Includes definitions for new terms: Mass timber and Noncombustible protection (mass timber). **THIS IS THE KEY CODE CHANGE PROPOSAL WHICH OUTLINES THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED NEW TYPE OF MASS TIMBER BUILDINGS. THE PROPOSAL ALSO ADDRESSES CONCEALED SPACES, ADHESIVE PERFORMANCE AND EXTERIOR WALL PROTECTION.**
703.8 (new)	The performance method to determine the increase to the fire resistance rating provided by noncombustible protection applied to the mass timber building element.
703.9 (new)	Requirements for sealants and adhesives to be placed at abutting edges and intersections of mass timber building elements. The reason statement references a Group B proposal to Chapter 17 for special inspection requirements of sealants and adhesives.
718.2.1	Requirements on the use of mass timber building elements used for Fireblocking.
722.7 (new)	Requirements for the fire resistance rating of mass timber elements, including minimum required protection and gypsum board attachment requirements.
3102	Requirements for membrane structures using Type IV HT construction.
3314.7 (new)	New special precautions during construction of buildings of Types IVA, IVB and IVC construction: Standpipes; Water supply for fire department connections; Noncombustible protection required for mass timber elements as construction height increases.
Appendix	Requirements for walls, floors and roofs of Type IV HT construction in buildings located in Fire Districts.
IFC Code Section	**Description**
701.6	Requirements which stipulate the owner's responsibility to maintain inventory of all required fire resistance rated construction in buildings of Types IVA and IVB construction. This includes an annual inspection and proper repair where necessary.
Proposed changes to be submitted in 2019 Group B	
IBC Chapter 17	Required special inspections of mass timber construction • Structural • Sealants and adhesives (see IBC 703.8)
IBC Chapter 23	An update to referenced standard APA PRG 320 Standard for Performance –rated Cross-laminated Timber which is currently undergoing revision to ensure the adequacy of the adhesives under fire conditions.

In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the tests, and many members witnessed the test in person or online. The results of the series of 5 fire tests provide additional support for these proposals, and validate the fire performance for each of the types of construction proposed by the committee. The fire tests consisted of one-bedroom apartments on two levels, with both apartments having a corridor leading to a stair. The purpose of the tests was to address the contribution of mass timber to a fire, the performance of connections, the performance of through-penetration fire stops, and to evaluate conditions for responding fire personnel.

To review a summary of the fire tests, please visit:

http://bit.ly/ATF-firetestreport

To watch summary videos of the fire tests, which are accelerated to run in 3 ½ minutes, please visit:

http://bit.ly/ATF-firetestvideos

Both of these links were confirmed active on 12/27/17.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

Analysis: The standards referenced in the changes in this proposal, DOC PS1, ASTM E1354, ASTM E84 and UL 723, are already referenced in the International Codes.

G108-18

Public Hearing Results

Committee Action: As Modified

Committee Modification: 602.4 Type IV.
Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire resistance rating requirements of this section based on either the fire resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2 or 703.3. The minimum dimensions and permitted materials for building elements shall comply with the provisions of this section and Section 2304.11. Mass timber elements of Types IV A, IV B and IV C construction shall be protected with noncombustible protection applied directly to the mass timber in accordance with Sections 602.4.1 through 602.4.3. The time assigned to the noncombustible protection shall be determined in accordance with Section 703.8 and comply with 722.7.

Cross-laminated timber shall be labeled as conforming to PRG 320 - 18 as referenced in Section 2303.1.4. ~~the heat performance requirements of Section 6.1.3.4 of DOC PS1 and have no delamination in any specimen, except where occurring at a localized characteristic when permitted in the product standard.~~

Exterior load-bearing walls and nonload-bearing walls shall be mass timber construction, or shall be of noncombustible construction.

Exception: Exterior load-bearing walls and nonload-bearing walls of Type IV-HT Construction in accordance with

602.4.1.1 Exterior protection.

The outside face of exterior walls of mass timber construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1~~(a)~~. All components of the exterior wall covering, shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.1.2.1 Protection time.

Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(1~~a~~), but not less than 80 minutes. The use of materials and their respective protection contributions listed in Table 722.7.1(2~~b~~) shall be permitted to be used for compliance with Section 722.7.1.

602.4.2.1 Exterior protection.

The outside face of exterior walls of mass timber construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1~~(a)~~. All components of the exterior wall covering shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354, and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.2.2.1 Protection time.

Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(1~~a~~), but not less than 80 minutes. The use of materials and their respective protection contributions listed in Table 722.7.1(2~~b~~) shall be permitted to be used for compliance with Section 722.7.1.

602.4.3.1 Exterior protection.

The exterior side of walls of combustible construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1~~(a)~~. All components of the exterior wall covering, shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.3.5 Concealed spaces.

Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the International Mechanical Code, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1~~(a)~~.

602.4.3.6 Shafts.

Shafts shall be permitted in accordance with Section 713 and Section 718. Shafts and elevator hoistway and interior exit stairway enclosures shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1~~(a)~~, on both the inside of the shaft and the outside of the shaft.

(Portions of proposal not shown are not modified.)

Committee Reason: Some portions of the modification were editorial and other portions were needed as the referenced standard needed to be incorporated into the code change. The definitions clarify that there are different types of mass timber construction. It is a a rational way of addressing protected vs. unprotected construction. This allows the code to keep up with innovations in construction practice that are actually occurring in the field. This is an opportunity for faster construction with less foundation. All testing was done that should have been done, and more than has ever been done for other construction types. (Vote: 13-1)

Assembly Action: **None**

G108-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Ali Fattah, City of San Diego, representing Selfrequests As Modified by This Public Comment.

Further modify as follows:

2018 International Building Code

602.4.2.2.2 Protected area. All interior faces of all mass timber elements shall be protected in accordance with Section 602.4.2.2.1, including the inside face of exterior mass timber walls and mass timber roofs.

~~**Exceptions:** Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:~~

~~1. Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20% of the floor area in any dwelling unit or fire area; or~~
~~2. Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40% of the floor area in any dwelling unit or fire area; or~~
~~3. Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with section 602.4.2.2.3.~~
~~4. Mass timber columns and beams which are not an integral portion of walls or ceilings, respectively, shall be permitted to be unprotected without restriction of either aggregate area or separation from one another.~~

~~602.4.2.2.3~~ Mixed unprotected areas. ~~In each dwelling unit or fire area, where both portions of ceilings and portions of walls are unprotected, the total allowable unprotected area shall be determined in accordance with Equation 6-1.~~ ~~$(U_{tc}/U_{ac}) + (U_{tw}/U_{aw}) \leq 1$ (Equation 6-1) where:~~

~~U_{tc} = Total unprotected mass timber ceiling areas~~

~~U_{ac} = Allowable unprotected mass timber ceiling area conforming to Section 602.4.2.2.2, Exception 1~~

~~U_{tw} = Total unprotected mass timber wall areas~~

~~U_{aw} = Allowable unprotected mass timber wall area conforming to Section 602.4.2.2.2, Exception 2~~

Commenter's Reason: This public comment is submitted to address practical enforcement difficulties that will arise when permitting partially protected CLT and mass timber elements based on a determination of the floor area of a unit or a percentage of the fire area. This will very difficult to establish in the field and it will be difficult over the life of the building to keep track of these modifications. In fact alterations where drywall is removed may also be exempt from a building permit. by the IBC in chapter 1.
Three types of construction have been developed by the Tall Wood Ad-hoc Committee (unprotected, protected and better protected) that did an excellent job in explaining the code changes allowing tall wood buildings to anyone interested in participating. While there was limited opposition raised a the Committee Action Hearings by representatives from competing materials industries, and some regulatory members opposed to certain provisions had taken a wait and see approach and wanted to watch the debate. I happened to be on the fence receptive to both views. On the one hand if an assembly is protected why should there be a concern for what is in the assembly. On the other hand if the protection is breached the CLT can contribute to the fire load in that after the building contents have fully burned there is the possibility that the wood could continue to burn the fire testing notwithstanding. But I am in support of the concept and believe enough justification has been provided allow adoption into the code even if there is not 100% consensus.

A flaw in the sections proposed to be deleted in this public comment is that Section 711.2 requires that horizontal assemblies be continuous and that the supporting construction shall be protected to afford the required fire resistance rating of the horizontal assembly supported. The sections allow omission of the required protective covering for what may be good reasons with technical justification but in violation of the code concept that the load path should be maintained and that the full assembly needs to be protected to its supports.

Additionally there seems to be no amount of tolerance because the percentage of the unit area has to be converted to feet and square feet, so the consequence of exposing 5 more square feet for example can not be quantified by the Building Official. Also what happens when dwelling units are combined in whole or in part does the area of the new unit establish the base line? The fire area will be more tan 20% or the 40% so does 1 tenant space get all the exposed wood ceiling and the adjacent no. Who will keep track of all the drywall removal.

We have had poor experiences with partially protected steel buildings where the protection was required for occupancy separations and not the type of construction and the proposal will be worst since it has the potential to bridge tenant spaces. I think it adds unnecessary complexity that can be addressed on a case by case basis through an alternate methods application. Additionally a ceiling will required to establish a sound transmission class and an IIC rating and by allowing the omission the two sections will make the task of determining compliance even more complex.

It is better to have a protected type of construction and an unprotected type of construction just like all the other building materials with the sub A and B designators for most type of construction. We request that the membership of ICC support the efforts of the Tal Wood Ad-hoc committee but not support the regulations proposed to be deleted.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of the public comment and code change proposal will minimally increase the cost of construction. However the proposal will streamline the permit approval and inspection process because it eliminates the effort and thus the costs to the jurisdiction and the property owner necessary to keep track of the quantity of exposed walls and ceilings within a fire area that can span multiple tenants and floor to floor. Since this is a new requirement that will not be implemented until 2022 it is difficult to quantify the cost impact since valuations are not available for the new types of construction. ICC's valuation for Type IV construction housing a = Group R-2 is $139.91 and assume $3/sqft for sprinklers therefore assume an approximate valuation of $145 per sq ft. Installed drywall is approximately $2.5 per sq ft so increasing drywall by 40% increases valuation by 1.72%.

It is worth noting that by omitting gypsum board from the ceilings and walls required to comply with sound transmission requirements in IBC Chapter 12 will incur additional costs for field testing.

This is a new technology and the code requires either protected or unprotected construction the deleted sections allow a hybrid. There is limited cost data at this time.

Public Comment 2:

Proponent: Jonathan Humble, representing American Iron and Steel Institute (jhumble@steel.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

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**	A	~~B~~	C	**HT**	**A**	**B**
Primary structural frame[f] (see Section 202)	3[a, b]	2[a, b]	1[b]	0	1[b]	0	3[a]	~~2[a]~~	2[a]	HT	1[b]	0
Bearing walls Exterior[e, f] Interior	3 3[a]	2 2[a]	1 1	0 0	2 1	2 0	3 3	~~2~~ ~~2~~	2 2	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602											
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	0	~~0~~	0	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	2	~~2~~	2	HT	1	0
Roof construction and associated secondary members (see Section 202)	$1\frac{1}{2}$[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	$1\frac{1}{2}$	~~1~~	1	HT	1[b,c]	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 in roof construction shall not be required, including protection of primary structural frame members, 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 complying with Section 2304.11 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.

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCEa, d, g

FIRE SEPARATION DISTANCE =X (feet)	**TYPE OF CONSTRUCTION**	**OCCUPANCY GROUP H[e]**	**OCCUPANCYGROUP F-1, M, S-1[f]**	**OCCUPANCYGROUP A, B, E, F-2, I, R[i], S-2, U[h]**
X < 5[b]	All	3	2	1
5 ≤ X < 10	IA, IVA Others	32	2 1	11
10 ≤ X < 30	IA, IB, IVA~~, IVB~~ IIB, VB Others	21 1	1 0 1	1[c] 0 1[c]
X ≥ 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 412.3.1.
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.
i. For a Group R-3 building of Type II-B or Type V-B construction, 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.

602.4 Type IV. Ttimber (HT) or structural composite lumber (SCL) without concealed spaces. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, structural composite lumber (SCL), and cross-laminated timber and details of
Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire resistance rating requirements of this section based on either the fire resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2 or 703.3. The minimum dimensions and permitted materials for building elements shall comply with the provisions of this section and Section 2304.11. Mass timber elements of Types IV A ~~, IV B~~ and IV C construction shall be protected with noncombustible protection applied directly to the mass timber in accordance with Sections 602.4.1 through 602.4.3. The time assigned to the noncombustible protection shall be determined in accordance with Section 703.8 and comply with 722.7.

Cross-laminated timber shall be labeled as conforming to PRG 320 - 18 as referenced in Section 2303.1.4.

Exterior load-bearing walls and nonload-bearing walls shall be mass timber construction, or shall be of noncombustible construction.

Exception: Exterior load-bearing walls and nonload-bearing walls of Type IV-HT Construction in accordance with Section 602.4.4.

The interior building elements, including nonload-bearing walls and partitions, shall be of mass timber construction or of noncombustible construction.

Exception: Interior building elements and nonload-bearing walls and partitions of Type IV-HT Construction in accordance with Section 602.4.4..

Combustible concealed spaces are not permitted except as otherwise indicated in Sections 602.4.1 through 602.4.4. Combustible stud spaces within light frame walls of Type IV-HT construction shall not be considered concealed spaces, but shall comply with Section 718.

In buildings of Type IV-A~~, B,~~ and C, construction with an occupied floor located more than 75 feet above the lowest level of fire department access, up to and including 12 stories or 180 feet above grade plane, mass timber interior exit and elevator hoistway enclosures shall be protected in accordance with Section 602.4.1.2. In buildings greater than 12 stories or 180 feet above grade plane, interior exit and elevator hoistway enclosures shall be constructed of non-combustible materials.

~~**602.4.2 Type IV-B.** Building elements in Type IV-B construction shall be protected in accordance with Sections 602.4.2.1 through 602.4.2.6.The required fire resistance rating of noncombustible elements or mass timber elements shall be determined in accordance with Section 703.2 or Section 703.3.~~

~~**602.4.2.1 Exterior protection.** The outside face of exterior walls of mass timber construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1. All components of the exterior wall covering shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m^2, a total heat release of less than 20 MJ/m^{2}and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354, and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.~~

~~**602.4.2.2 Interior protection.** Interior faces of all mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected, as required by this section, with materials complying with Section 703.5.~~

~~**602.4.2.2.1 Protection time.** Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions listed in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.~~

~~**602.4.2.2.2 Protected area.**~~

~~All interior faces of all mass timber elements shall be protected in accordance with Section 602.4.2.2.1, including the inside face of exterior mass timber walls and mass timber roofs.~~

~~**Exceptions:**Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:~~

~~1.Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20% of the floor area in any dwelling unit or fire area; or~~
~~2.Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40% of the floor area in any dwelling unit or fire area; or~~
~~3.Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with section 602.4.2.2.3.~~
~~4.Mass timber columns and beams which are not an integral portion of walls or ceilings, respectively, shall be permitted to be unprotected without restriction of either aggregate area or separation from one another.~~

~~**602.4.2.2.3 Mixed unprotected areas.** In each dwelling unit or fire area, where both portions of ceilings and portions of walls are unprotected, the total allowable unprotected area shall be determined in accordance with Equation 6-1.~~
~~$(U_{tc}/U_{ac}) + (U_{tw}/U_{aw}) \leq 1$ (Equation 6-1) where:~~

~~U_{tc} = Total unprotected mass timber ceiling areas~~

~~U_{ac} = Allowable unprotected mass timber ceiling area conforming to Section 602.4.2.2.2, Exception 1~~

~~U_{tw} = Total unprotected mass timber wall areas~~

~~U_{aw} = Allowable unprotected mass timber wall area conforming to Section 602.4.2.2.2, Exception 2~~

~~**602.4.2.2.4 Separation distance between unprotected mass timber elements.** In each dwelling unit or fire area, unprotectedportions of mass timber walls and ceilings shall be not less than 15 feet from unprotected portions of other walls and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls measured horizontally along the floor.~~

~~**602.4.2.3 Floors.** The floor assembly shall contain a noncombustible material not less than one inch in thickness above the mass timber. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material.~~

~~The underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.~~

~~**602.4.2.4 Roofs.** The interior surfaces of roof assemblies shall be protected in accordance with 602.4.2.2 except, in nonoccupiable spaces, they shall be treated as a concealed space with no portion left unprotected. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.~~

~~**602.4.2.5 Concealed spaces.** Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the International Mechanical Code, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.~~

~~**602.4.2.6 Shafts.** Shafts shall be permitted in accordance with Section 713 and Section 718. Both the shaft side and room side of mass timber elements shall be protected in accordance with Section 602.4.1.2.~~

Commenter's Reason: We recommend that the Type IV-B mass timber designation be deleted from the tall wood building proposals.

The origins of the development of the types of construction were originally developed to “account for the response or participation that a building’s structure will have in a fire condition originating within the building as a result of the occupancy or the fuel load” (Example source from BOCA National Building Code 1993 Commentary). The modern day types of construction are parsed out into three primary categories of construction; noncombustible (Types I and II), noncombustible/combustible (Types III and IV) and combustible (Type V). Subcategories were created to identify the protection; Type A for protected and Type B for unprotected.

What we have within proposals G75-18, G80-18, G84-18, G89-18, and G108-18 is the addition of a new construction category that has been proposed based on the need to satisfy aesthetics based on the combination of Types IV-A and IV-C, which is a departure from the black and white construction categories based on construction that is non-combustible or combustible. We feel this inappropriate for the codes to begin to designate designer type construction categories.

In the past such mixing and matching of construction types into building or structure is more suited to the IBC Section 104.11 (Alternative materials, design and methods of construction and equipment), or through use of the ICC International Performance Code or performance analysis. We feel that these are the most appropriate options for the mixing-and-matching of construction types in building design.

(NOTE: Remainder of the section will need to be renumbered as will other related correlating sections.)

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This will not increase or decrease the cost of construction as this code change proposal and public comment address information that was not previously contained in the code, therefore there is no cost impact when compared to present requirements.

Public Comment 3:

Proponent: Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)requests As Modified by This Public Comment.

Further modify as follows:

2018 International Building Code

602.4.1.1 Exterior protection. <u>Combustible materials, including but not limited to assemblies and materials tested in accordance with Section 1410, shall not be used as any part of the building exterior.</u>

<u>Exceptions:</u>

1. Mass timber shall be permitted for exterior construction where all exterior facing surfaces are ~~The outside face of exterior walls of mass timber construction shall be~~ protected with noncombustible protection ~~with~~ having a minimum assigned time of 80 minutes for high-rise buildings and 40 minutes ~~as determined in~~ for other buildings in accordance with Section 722.7.1~~. All components of the exterior wall covering, shall be of noncombustible material except water resistive barriers~~ , during which time the mass timber shall not ignite.
2. The exterior wall shall be permitted to include a water-resistive barrier having a peak heat release rate of less than ~~150kW~~ 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than ~~18MJ~~ 18 MJ/kg as determined in accordance with ASTM E1354, and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.2.1 Exterior protection. Combustible materials, including but not limited to assemblies and materials tested in accordance with Section 1410, shall not be used as any part of the building exterior.

Exceptions:

1. Mass timber shall be permitted for exterior construction where all exterior facing surfaces are protected with noncombustible protection having ~~The outside face of exterior walls of mass timber construction shall be protected with non-combustible protection with~~ a minimum assigned time of 80 minutes for high-rise buildings and 40 minutes ~~as determined in~~ for other buildings in accordance with Section 722.7.1~~. All components of the exterior wall covering shall be of noncombustible material except water resistive barriers~~ , during which time the mass timber shall not ignite.
2. The exterior wall shall be permitted to include a water-resistive barrier having a peak heat release rate of less than ~~150kW~~150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than ~~18MJ~~18 MJ/kg as determined in accordance with ASTM E1354, and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

602.4.3.1 Exterior protection. Combustible materials, including but not limited to assemblies and materials tested in accordance with Section 1410, shall not be used as any part of the building exterior.

Exceptions:

1. Mass timber shall be permitted for exterior construction where all exterior facing surfaces are protected with noncombustible protection having ~~The exterior side of walls of combustible construction shall be protected with non-combustible protection with~~ a minimum assigned time of 80 minutes for high-rise buildings and 40 minutes ~~as determined in~~ for other buildings in accordance with Section 722.7.1~~. All components of the exterior wall covering, shall be of noncombustible material except water resistive barriers~~ , during which time the mass timber shall not ignite.
2. The exterior wall shall be permitted to include a water-resistive barrier having a peak heat release rate of less than ~~150kW~~150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than ~~18MJ~~18 MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84 or UL 723. The ASTM E 1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m^2.

Commenter's Reason: The intent of this public comment is generally consistent with the original provisions, but modifications have been suggested to accomplish the following:
1. Strengthen the text to make it clear that a compliant water-resistive barrier is the ONLY combustible material permitted in the building exterior, with the exception of properly protected mass timber. This includes a clarification specifically prohibiting NFPA 285 assemblies to prevent the prospect of such assemblies being proposed as an alternative method of compliance. This is necessary because of changes proposed to NFPA 285 that would expand the use of NFPA 285 assemblies to include combustible structures. Until such time that NFPA 285 has been thoroughly vetted with respect to questions raised under FS99-18, this specific prohibition is necessary for Type IV construction given interest that has already been documented.

2. Require increased protection of exterior mass timber members for high-rise buildings. The risks associated with an exterior face fire involving a heavy timber structure, outside of the sprinklered envelope and minimally accessible or inaccessible to firefighters due to height, is too great for a 40-minute exposure, particularly recognizing that the exposure used in fire test methods specified in Section 703.3 (such as ASTM E119) are not necessarily representative of the heat

flux that might be associated with exterior fire conditions (such as a wind-driven fire event). There is no guarantee, and in fact it s not likely, that an assembly having a 40-minute rating in a standardized fire test will actually provide 40 minutes of protection in an actual fire event. Doubling the protection, essentially adding a second layer of 5/8-inch Type X gypsum board, is a prudent step to provide additional safety given limited experience with tall mass timber buildings.

3. Clarify that the noncombustible protection must do more than simply increase the fire-resistance rating of the exterior wall members. For exterior walls, given the concerns cited above, it is important that ignition of the structural members must be prevented for the prescribed time period. Presumably, this would already be accomplished by the currently specified test method, but it is appropriate for the requirement to be specifically stated.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Yup, this is going to cost more, but the cost is justified. Frankly, I prefer limiting mass timber to heights to below the high-rise threshold, but this is offered as an attempt to reach a negotiated solution, to address my primary concern with taller buildings, which is exterior fire spread, vs. a more stringent height restriction.

Public Comment 4:

Proponent: Gilburt Shields-Whitten, self, representing selfrequests As Submitted.

Commenter's Reason: One thing is clear from reading through the public comments for the ICC code change proposal for Tall Wood Buildings: the concrete industry is desperate to stop mass timber. The ICC should not be fooled by their latest efforts to mislead members of the public and the code community.
It s no secret that the National Ready Mixed Concrete Association (NRMCA) has been running a well-funded campaign to stop wood for some time. Their latest scheme to stuff the ballot with comments against mass timer is patently obvious.

How obvious?

Nearly every proponent submitting a request to DISAPPROVE code change proposal G108-18 works for a businesses in the concrete and cement industry based on the email address or company name provided.

All but a handful of comments have been copied and pasted based on talking points provided by NRMCA in a Call-To-Action document that was sent out to members at the end of June. PCA also provided suggested talking points.

Compare the suggested language below to the comments and you will see they are identical, including typos and grammatical errors.

Why would NRMCA and others do this? In their own words, money and market share.

The lastest video produced by NRMCA makes the claim is made that the builders and wood industry conspired to weaken building codes which has resulted in rampant fires and costing money and lives

And at their annual meeting, the show that Right now every single six-story building made with wood leaves half a million dollars of this industry s money on the table.

However, cross-laminated timber, which most of you have heard of at this point, is another big threat to putting concrete first. It has the potential to halt the progress of Build With Strength.

Don t be fooled by this and focus on the science.

ACTION REQUESTED! STOP TALL WOOD Urge the International Code Council (ICC) to Vote No on Mass Timber Proposals that Threaten Public Safety

This is an **extremely** critical issue and NRMCA needs your help in providing a public comment for **Disapproval on G108-18, a proposal that would allow Cross Laminated Timber use in up to 18 story buildings in the International Building Code.** Complete instructions are listed below as well as sample comments. Please consider taking this important step for your industry and please share with as many concrete industry colleagues as possible. Deadline for public

> Select *Reason* and either enter (or copy paste) the sample reasons below, modify the sample reasons, or enter your own reason statement.

Some sample reasons you may want to consider for your Public Comment are:

- - There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
  - Allowing wood structures to be built above the level of fire department access is a serious mistake.
  - Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
  - Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.
  - There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
  - It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
  - Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
  - Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
  - The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?

    Select *Cost Impact* and enter (or copy paste) the text below:

- - - Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

The International Code Council soon will vote on proposed code changes that among other things would allow tall wood buildings to be built up to 18 stories, despite a lack of rigorous scientific or in-the-field fire and structural testing.

NOW IS THE TIME TO TAKE ACTION by urging the ICC to say no to these dangerous proposals that are up for a final vote which closes on Nov 27, 2018. Join the public hearing process to let your voices be heard. This highly-combustible mass timber must be stopped! However, and to be clear, your comments need to be technical in nature and substantive. Just saying wood burns or I don t like CLT (while true) is not enough.

SUBMIT PUBLIC COMMENTS: Online public comments can be submitted by **July 16, 2018** through the ICC s cdpACCESS website.

PCA s talking points:

STOP TALL WOOD PROPOSALS AT THE INTERNATIONAL CODE COUNCIL Background and Talking Points Multi-story mass timber buildings being considered by the International Code Council will present a threat to health and safety. The ICC code change proposals, and TALL WOOD structures built with cross-laminated timber (CLT) generally, are:

UNTESTED, UNPROVEN AND UNSOUND

UNTESTED: Wood-industry funded tests performed in the U.S. and Canada were completely inadequate, failing to examine real-world structural risk factors, potential firefighting safety impacts and other important risk factors to public health and safety. No exterior fire testing was performed for TALL WOOD. The limited testing done was irrelevant to the proposed code changes related to TALL WOOD as high as 18 stories. No tests were done to factor in wind, which impacts fire-fighting and property damage. Fire tests did not factor in heavy loads from upper stories, nor did they examine firefighting impacts from contents of storage or mercantile buildings. Fire sealants and connections were not done correctly, thus highlighting the problem with understanding the dangers TALL WOOD structures.

UNPROVEN: While non-combustible concrete and steel have been used for centuries to build tall buildings and structures, mass timber products, like cross-laminated timber, are unknown and unproven construction materials. Only the wood industry has information about how CLT performs and connects with other building materials, including dry wall, steel and concrete. Contractors and code officials have no experience in inspecting TALL WOOD buildings, thus raising potential structural and fire risks. The adhesives used in producing CLT have not been standardized, further raising risks associated with fire and structural performance. It is unclear how CLT performs with water damage from fire response efforts, heavy rain and floods or natural disasters.

UNSOUND: Common sense knows, and every day we see, that TALL WOOD buildings are high-risk and dangerous to public health and safety when it comes to natural and man-made disasters like hurricanes and wildfires. TALL WOOD buildings would be taller than the vast majority of firefighting equipment raising life safety and property damage risk exponentially.

Potential uses for TALL WOOD structures, such as dorms or assisted-living facilities, would put the most vulnerable Americans in harm s way. Submit public comments by July 16th or attend public hearings October 24-31 in Richmond, Va. Help STOP TALL WOOD ICC code changes!

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Approval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 5:

Proponent: Gary Bridgens, representing Mass Timber Code Coalition (info@buildtallbuildsafe.com)requests As Modified by Committee.

Commenter's Reason: PUBLIC COMMENT

SUBMITTED BY GARY BRIDGENS

ON BEHALF OF THE MASS TIMBER CODE COALITION

The Mass Timber Code Coalition has been organized to provide information on the code proposals drafted by the Ad Hoc Committee on Tall Wood Buildings

Mass timber is not new to the *International Building Code* (IBC). Currently listed as Type IV Heavy Timber, this construction type is a proven option that fully complies with the structural and fire resistive requirements of the IBC. The code recognizes that mass timber is a fundamentally different material than dimension lumber used in more familiar stick built wood construction. The code also recognizes the inherent fire resistance of mass timber, where charring in a fire event provides protection of inner structures, as well as a consistent and predictable rate of charring.

With the expansion of the mass timber supply chain, panels of cross-laminated timber (CLT), nail-laminated timber (NLT) and glue-laminated timber (Glulam), requests for approvals of tall mass timber buildings (TMTB) by local authorities have become more common. Estimates by industry sources have identified 35 current proposals for tall mass timber buildings, ranging from 7 to 24 stories, in 21 different jurisdictions.

Importantly, this interest in tall mass timber construction has been reliant on various local codes and approval processes. The IBC does not currently account for these tall wood buildings, beyond the current Type IV Heavy Timber height and area limitations.

The Ad Hoc Committee on Tall Wood Buildings (AHC-TWB)

To ensure the IBC keeps pace with the changing construction marketplace, the Board of Directors of the International Code Council (ICC) appointed the Ad Hoc Committee on Tall Wood Buildings (AHC-TWB) in 2015. The AHC-TWB included members from the code official, regulatory, construction, engineering, architectural, fire services and materials communities.

The AHC-TWB was specifically charged with investigating the science of mass timber construction, undertaking any necessary new research and recommending any code changes needed to ensure safety in TMTB. The AHC-TWB set performance criteria of its own: any code change developed was required to achieve the following.

No collapse under scenarios of complete burn-out of fuel without automatic sprinkler protection;
No high radiation exposure from the subject building to adjoining properties that risk ignition under severe fire scenarios;
No unusual response from radiation exposure from adjacent properties that risk ignition of the subject building under severe fire scenarios;
No unusual fire department access issues;
Egress systems to protect occupants during design escape times plus a margin of safety;
Enhanced and redundant fire protection systems to ensure performance during various fire scenarios.

Code Change Proposals

After two years of work, the AHC-TWB has produced 14 code change proposals. All 14 of these proposals were recommended for approval by various ICC committees at the recent ICC 2018 Group A Committee Action Hearing.

The key change, G108-18, defines three new categories of Type -IV Mass Timber construction:

Type IV-A: 1 to 18 stories based on Occupancy Classification. 3-hour fire resistance rating with non-combustible protection throughout;

Type IV-B: 1 to 12 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection on most mass timber surfaces;

Type IV-C: 1 to 9 stories based on Occupancy Classification. 2-hour fire resistance rating with non-combustible protection for critical areas; exit enclosures, etc.

Each new construction type defined by the AHC-TWB (Type IV-A, B and C) has fire resistance requirements as robust or more robust than those required for comparable non-combustible (concrete and steel) buildings.

Other provisions provide standards for mass timber manufacturing, height/area restrictions, active and passive fire protection systems, fire safety during construction, enhanced water supply requirements, and standards for sealants and adhesives.

Fire Resistance of Mass Timber

Citing fire and market concerns, both the Portland Cement Association and the National Ready Mix Concrete Association have criticized the AHC-TWB code change proposals as untested and unsound. However, these criticisms fail to consider that:

> The purpose of the International Building Code is to provide building officials with the tools they need to ensure public and first-responder safety. It is not to choose winners and losers in the market, nor is it to defend any single industry s position;
> Tall mass timber buildings already built are performing well;
> Mass timber (and heavy timber before it) has undergone extensive fire resistance testing in multiple fire scenarios by Underwriters Laboratories, the Southwest Research Institute, the National Research Council of Canada and the U.S. Government s ATF Fire Research Laboratory, the world s largest indoor fire investigation lab.

Numerous mass timber floor/ceiling and wall assemblies have been tested at national laboratories using ASTM E119 standards. This testing history shows that mass timber has repeatedly achieved the hourly fire resistance requirements of the code. This is in part because of charring properties that provide a steady and predictable measurement of fire resistance. Additionally, detailed code requirements for non-combustible protection applied to the mass timber greatly enhance the hourly rating. Further, fire protection systems (active and passive) also ensure safety in mass timber structures.

The AHC-TWB benefitted from recent tests in 2017 at the U.S. ATF Fire Research Laboratory on full-scale mass timber buildings. Most tests assumed an unlikely failure of sprinkler systems:

> Mass timber apartment with full fuel load. Fully protected by Type X gypsum wall board. Fire self-extinguished after 3 hours with no significant charring on mass timber surfaces;
> Mass timber apartment with full fuel load. 20% exposed CLT ceiling. Test concluded at 4-hour mark after fuel burnout. CLT self-extinguished after charring;
> Mass timber apartment with full fuel load. 2 CLT walls fully exposed. Fuel burnout at 4-hours. CLT walls self-extinguished after charring;
> Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire quickly extinguished;
> Mass timber apartment with full fuel load. All CLT surfaces fully exposed. One sprinkler system. Fire allowed to grow to flashover (23 minutes) then quickly extinguished.

In fact, proposed Type IVA, B and C fire resistance requirements are the same or more robust than comparable steel and concrete construction. Further detail can be obtained at buildtallbuildsafe.com.

Benefits of Mass Timber Construction

In addition to the obvious environmental attributes of using a renewable resource in construction and the boost for the economies in timber-producing regions, builders and communities cite several distinctive benefits that make mass timber buildings an attractive option:

Builders report several benefits, including:

- **Job site safety.** Mass timber panels are easy to install and can be delivered to a work site as needed, rather than stockpiled. Moreover, worker training is easier as is exposure to job site risk;
- **Job site efficiency.** Persistent labor shortages are eased as more workers are qualified to work with mass timber panels. Jobs are built more quickly and materials are delivered as needed, thereby reducing costs;
- **Design.** The favorable strength-to-weight ratio of CLT and the characteristics of wood offer more design options and more attractive built environments, improving business performance.

Local communities embrace mass timber construction:

- **Faster and quieter.** The dislocation experienced by neighboring communities is reduced in mass timber projects. In addition to lower fire risks, things occur more quickly and panels are installed more simply than comparable steel and concrete sites;
- **Greener.** Forestry officials cite the carbon sequestration properties of wood, but also the benefits to forest management of using wood products more efficiently and effectively, thereby further reducing decay and fire risk;
- **Energy efficient.** Manufacturing mass timber is less energy intensive then other building materials. More importantly, the superior insulation characteristics of wood far outperform steel and concrete structures.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

Public Comment 6:

Proponent: Brian M Adkins, Gonsalves & Santucci, Inc. DBA Conco (The Conco Companies), representing self (badkins@conconow.com)requests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?
- In addition to all of the reasons above I believe it would be a colossal mistake to allow for inferior construction to take the place of the longevity and success that has been proven in the cast-in-place concrete industry.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 7:

Proponent: Leslie Ainsworth, representing Self (les@lesainsworth.com)requests Disapprove.

Commenter's Reason: Who would want to live in an 18 story building made of wood? What fire department would want to respond to a 2nd story fire in an 18 story building made of wood. There is no complete testing justification to increase the height limit to exceed 6 stories. Neither the Fire Code Action Committee or the Building Code Action Committee voted to support this measure. Wood is not as fire resistant as non combustible building materials such as concrete and steel. This measure will cost lives. Who wants this on their conscience?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This will make the building more dangerous, and worth less in the future

Public Comment 8:

Proponent: ALBERT ANDREWS, ANDREWS CONCRETE PUMPING, representing ANDREWS CONCRETE PUMPING PRESIDENTrequests Disapprove.

Commenter's Reason: <u>HAVE WE NOT LEARNED FROM THE PAST? WOOD STRUCTURES ARE BLOWN AWAY IN HIGH WINDS, CRUMBLE DURING NATURAL DISASTERS, CONSUMED DURING A FIRE IN MINUTES OR DAMAGED BEYOND REPAIR. WOOD STRUCTURES WILL NOT STAND THE TEST OF TIME. DO YOU WANT YOURSELF OR YOUR FAMILY AND FRIENDS IN WOOD BUILT HOTELS, MID OR HIGH RISE OFFICE BUILDINGS, MULTI STORY COMDOMINIUMS OR APARTMENTS? THEY ARE UNSUSTAINABLE AND LIFE THREATENING. INSURANCE RATES WILL SKY ROCKET AS SEEN IN THE PAST WHEN STRUCTURES DON'T STAND UP TO MOTHER NATURE OR OUR MISTAKES. THERE IS A REASON WHY STONE, MASONRY, CONCRETE AND STEEL STRUCTURES LAST. BE DOLLAR WISE AND MORALLY CORRECT. YOU WILL SLEEP BETTER KNOWING YOU MADE THE RIGHT DECISION.</u>

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1" per hour in a fire, then after 2 hours in a fire, a 6" thick CLT wood load bearing wall will only have 2" of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 9:

Proponent: Hari Krishna R Bandi, representing The Conco Companies (hbandi@conconow.com); Jennifer Nenni (jnenni@conconow.com); Carl Walker (carl@centralpumping.com)requests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake.Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel

Bibliography: Don't have one

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 10:

Proponent: Kenneth Barefield, Conco, representing Conco Companies (kbarefield@conconow.com)requests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 11:

Proponent: Jeffrey Bolichowski, MasonryWorx, representing MasonryWorx (jeff@armstrongstrategy.com)requests Disapprove.

Commenter's Reason: These comments represent the position of MasonryWorx, the provincial association for Ontario's brick, block and stone masonry industry.

Non-combustible concrete and steel have been used for centuries to build tall buildings and structures. However, mass timber products, like cross-laminated timber, are unknown and unproven. Common sense and history both demonstrate that tall wooden buildings are high-risk and pose significant dangers to public health and safety. This is particularly true when these wooden towers are tested by natural and man-made disasters such as hurricanes and wildfires.

There is currently no complete testing or engineering justification for tripling the height limitation for mass timber from the present six storeys to 18.

In fact, wood industry-funded tests in the United States and Canada were completely inadequate. These tests failed to examine real-world structural risk factors, potential firefighting safety impacts from weather, or material-related risk factors to public health and safety.

No exterior fire testing was performed for tall wood buildings, and the limited testing done was irrelevant to the proposed changes. The tests did not factor in wind, heavy loads from upper storeys, or firefighting impacts from contents of storage or mercantile buildings. Fire sealants and connections were also not done correctly.

The most significant oversights are wind and water testing. There has been no wind component involved in the fire testing of mass timber assemblies, despite the wind pressures tall buildings inevitably face. Similarly, mass timber systems have not been tested with the additional water load which accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident which opens a sprinkler head. These oversights are serious and glaring, and represent critical safety flaws.

Permitting wood structures to be built above the level of fire department access is a serious public safety risk, particularly with many fire departments unable to easily procure high-ladder trucks. These buildings would present significantly greater fire risks: Wood does not offer the resilience and fire protection of materials which do not combust, such as concrete block.

Particularly troubling is that, while cross-laminated timber will char in a fire, charring is not the same thing as not combusting. A char rate of 1" per hour in a fire will result in a six-inch-thick CLT wood load-bearing wall being left with only 2" of structure left after just two hours of burning. This is not acceptable, and it is not addressed in the code change proposal.

This change would permit the construction of tall buildings with dangerous materials which are untested, unproven and unsound. History and precedent have shown the dangers of tall wood buildings again and again.

Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes. Given the serious flaws in the testing process and the enormous safety hazards involved, we urge the ICC to vote NO on the use of highly-combustible mass timber in tall buildings.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 12:

Proponent: Timothy Bourcier, Commercial Metals Company, representing self (tim.bourcier@cmc.com); Daniel Zechmeister (dan@masonryinfo.org); James Farny (jamiefarny@yahoo.com); Mark Young (markyoung@brundagebone.com); Robert Mercer (r.brett.mercer@gmail.com); Jason Chojnacki (jason.chojnacki@vcimentos.com); Jason Grafton (jgrafton@cckservices.com); Kate Caddell (kate@ajandris.com); Brad Cottrell (brad.cottrell@cmc.com); Billy Milligan (billy.milligan@cmc.com); Amy Trygestad (atrygestad@crsi.org); Kelly Walker (kelly@masonryinfo.org); Rouzbeh Mahmoudzadeh (rmahmoudzadeh@conconow.com); Melissa Kline (makline777@gmail.com); Anthony Johnson (tjohnson@crsi.org); Holly Bertuccelli (hbertuccelli@conconow.com)requests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc, there is no information on the performance of the proprietary connections during fires.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

- Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements

Public Comment 13:

Proponent: Brandon Bowers, representing Concorequests Disapprove.

Commenter's Reason: Unsafe, unethical and a mere shortcut for immoral reasons. Corporate greed once again coming into play leaving several thousand innocent people at risk.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 14:

Proponent: Michael Ziemba, Vototantim, representing self (mike.ziemba@vcimentos.com)requests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of other non-combustible materials like concrete and steel. Allowing wooden structures to be built above fire dept. access is not safe. Neither the Fire Code Action Committee or the Building Code Action Committee have voted to support this code change.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 15:

Proponent: Ben Brown, self, representing Self (bbrown@chasephipps.com)requests Disapprove.

Commenter's Reason: Safety and sustainability must guide this decision. Tall timber buildings are a fire hazard, this has been proven over and over again. We can't repeat our mistakes of the past. We also need buildings that are built to last. Concrete and steel can be tested and meet specifications over and over again.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 16:

Proponent: Gary Brown, representing R L McCoy (garybrown@rlmccoy.net)requests Disapprove.

Commenter's Reason: Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout.
A test standard for adhesives has been proposed, but not fully vetted by the cognizant committees.

It's still a wood by-product, once enough heat is created it will start to burn.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 17:

Proponent: Michael Calderon, representing The Conco Companiesrequests Disapprove.

Commenter's Reason: Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but no fully vetted by the cognizant committees.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 18:

Proponent: Ross Carbo, representing self (rcarbo@conconow.com)requests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 19:

Proponent: Kerem Cetinbas, representing MAC Corporation of VA (info@macofva.com)requests Disapprove.

Commenter's Reason:

- There are many unanswered questions in regard to the safety for the code change. Kindly note the comments below.
- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 20:

Proponent: dean chandler, representing self (dchandler@conconow.com)requests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 21:

Proponent: John Chrysler, Masonry Institute of America, representing Masonry Institute of America (jc@masonryinstitute.org)requests Disapprove.

Commenter's Reason: ● There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
● Allowing wood structures to be built above the level of fire department access is a serious mistake.

● Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

● Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.

● There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.

● It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?

● Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.

● Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.

● The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 22:

Proponent: Alex Cody, representing The Conco Companies (acody@conconow.com)requests Disapprove.

Commenter's Reason:

- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 23:

Proponent: Gregory Colvin, representing self (greg@ohioconcrete.org); Alpa Swinger (aswinger@cement.org); Robert Hamilton (bob.hamilton@conforms.com)requests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposal section provides information that was not previously set forth in the code, thus there is no cost impact when compared with the present requirements.

Public Comment 24:

Proponent: ANNA DART, Conco Companies, representing Self; Leah Gunther, representing American Concrete Pumping Association (leah@concretepumpers.com)requests Disapprove.

Commenter's Reason:

- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 25:

Proponent: Charles Day, Votorantim / St Marys cemnt LLC, representing Self; John Doubikin (john.doubikin@vcimentos.com); Michael Marzka (michael.marzka@vcimentos.com); Bruce Moroz (bruce.moroz@vcimentos.com); David Jones (djones@addisontx.gov); Lawrence Novak (lnovak@cement.org)requests Disapprove.

Commenter's Reason:

- - Wood absorbs water, and the resulting rot and mold can seriously impair a wood structures' overall anticipated performance. Note: non-combustible materials such as concrete, masonry and structural steel do not rot.
  - The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?
  - Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
  - Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
  - It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
  - There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
  - To date, there has been no full scale CLT fire tests done to ASTM standards.
  - Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Charring wood will add fuel to the fire and increase the heat and smoke output relative to noncombustible materials. Note: if the char rate is 1" per hour in a fire, then after 2 hours in a fire, a 6" thick CLT wood load bearing wall will only have 2" of structural material left. This is not acceptable and is not addressed in the code change proposals.
  - Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete, masonry and steel.
  - Allowing wood framed structures to be built above the level of fire department access is a serious mistake. The vast majority of municipal ladder trucks cannot reach above the 7th floor.
  - There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

- Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 26:

Proponent: joe dickinson, Walker Concrete Company, LLC, representing Walker Concrete Company, LLC; michael stevens (mstevens@natcem.com); Spencer Weitman (sweitman@natcem.com); Steve Wise (swise@natcem.com); Steve Lode (slode@natcem.com); Mark Mitzel (mmitzel@natcem.com); Bart Moore (bmoore@natcem.com)requests Disapprove.

Commenter's Reason: • Inadequate and/or incomplete testing and engineering do not provide justification for exceeding the existing height limitation for wood construction from 6 stories and raising it to 18 stories for Tall Wood structures.
• Allowing Tall Wood structures to be built above the level of fire department access puts building occupants and firefighters at significant additional risk.

• Wood does not offer the resilience and fire protection due to both manmade and natural disasters compared to non-combustible alternatives like concrete and steel.

• Cross-Laminated Timber chars in a fire. Charring is <u>not equivalent </u>to non-combustible. Charring is a deterioration of the wood (e.g. a 6" load bearing CLT with a char rate of 1" per hour will have lost over 60% of it structural strength after 2 hours in a fire). This is not acceptable and is not addressed in the code change proposals.

• There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.

• It is unknown what impacts will occur to a Tall Wood structure if water accumulates as a result of a fire sprinkler system discharge due either to fire or an accidental activation. Moreover, testing has not been performed to determine the structural performance when additional water is applied by active firefighting and the resulting damage such as swelling of the wood, combined impacts of water and high temperature to the structural integrity of the manufactured wood as well as connection systems. In addition, the potential for water damage must address the short as well as long-term impacts of mold and dry rot.

• Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.

• Adhesives used between the layers of CLT are currently not standardized. The absence of a standard is key to determining whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives was proposed, but not fully vetted by the cognizant committees.

• The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities. In addition there is insufficient information on the performance of the proprietary connections during fires.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 27:

Proponent: Donald Doggett, Doggett Concrete, Inc., representing Doggett Concrete inc (ddoggett@doggettconcrete.com)requests Disapprove.

Commenter's Reason: This is a dangerous trend that will create fire hazards and structural risk that far outweigh any potential benefits for construction.

Bibliography: http://vancitycondoguide.com/concrete-vs-wood-buildings/ "Well, it’s a popular question, concrete vs wood buildings- which is better and what do you recommend I buy? It’s a longstanding debate and today i’ll shed some light on the debate and hopefully give you some key takeaways to help you with your purchasing decision. Concrete buildings, although generally more expensive than wood frame buildings, are worth it in the long term. It’s important to always look long term, in all aspects of life. The same thinking can be applied to when investing in your next condo."

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There are no cost savings for the public that will be passed along. There will be increased cost in maintenance

Public Comment 28:

Proponent: Doug Dreiling, Buzzi Unicem USA, representing self (douglas.dreiling@buzziunicemusa.com)requests Disapprove.

Commenter's Reason: There are too many reasons, one of the biggest is the lack of independent testing. My son in-law is a fire fighter and he is very concerned with the dangers in a fire. The toxicity of the glues and fire retardants to start with. There was a fire just last year in Overland Park, KS, of a CLT, and the fire was so hot that house a half a mile away were affected with hot ambers.
Common sense tells you wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Public Comment 29:

Proponent: William Dwyer, representing Putzmeister America (dwyerb@putzam.com)requests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake. Also, wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 30:

Proponent: Bonnie Erickson, representing Self (bonnie_erickson2010@comcast.net)requests Disapprove.

Commenter's Reason: This is crazy, who wants to live in a high rise built with wood? Who wants to fight that fire? Who wants to insure it? Who wants to be responsible for the lives lost? And who wants to own it 20 years from now?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Code change will not increase or decrease construction cost, and will devalue the building

Public Comment 31:

Proponent: Patrick Ford, Matsen Ford Design Associates, Inc., representing selfrequests Disapprove.

Commenter's Reason: Reason: These code changes would allow for structurally unsafe conditions to be inherently designed into tall buildings. As proposed, they would introduce new categories of Type IV construction into the code and expand the number of storeys, allowable areas, and maximum heights of buildings framed with combustible materials. I believe that for several reasons, this would greatly increase the risk to firefighters and building occupants, as well as neighboring buildings. Several of the major decisions that went into the creation of this proposal were based on "engineering judgment" and significant extrapolation of test data from a two storey test building to buildings with dozens more storeys.
Aside from the potentially dangerous and unproven provisions in general, there are several specifics relative to structural connections in these new building types and sizes. I do not believe that these were addressed or at the very least not adequately addressed.

The new building types and increased limits allowed for in these proposals should not be allowed, and the proposals should be disapproved for the following reasons:

> The AHC-TWB report that was instrumental in many of the provisions indicates that connections were tested, but in fact, no exposed connections were ever tested in any of the assemblies.
> The compartment tests did not test any connections, nor did any of the standard ASTM tests, including the E84, E119, E814, nor the NFPA 285 tests.
> The full scale test did not have any exposed connections, yet the code explicitly notes exposed steel and metal caps or brackets allowed in type IV construction within the wood chapter. The exposed metal connectors and their fasteners penetrate well beneath the typical char layer of the structural member, significantly reducing the strength of the member at and near the connection itself. This can create many hot spots and potential critical structural failure locations throughout a tall building. No other tests addressed this issue either.
> Adhesive based splice connections remain unproven, the overall adhesive requirements being based on a testing protocol derived after a failed test.
> The Small Scale Adhesive Qualification Test Protocol (CSA 077 SSA.2) could conceivably be directed toward such connections or splices, but it is a test that lasts only 5 minutes per side of the tested specimen.
> As an additional note, the full scale test was run on only a two storey structure, leaving any critical structural connections that may have been needed to support only a single storey above. With code proposals allowing for many times this, these concerns should be much more carefully vetted before approval.

It should also always be remembered that in no other type of tall building allowed by the code, is the structure itself also fuel for the fire.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 32:

Proponent: Mariah Garcia, representing Conco (mgarcia@conconow.com)requests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is dangerous and a serious mistake! Wood does not offer the resilience and fire protection of non-combustible alternatives such as concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 33:

Proponent: Nathan Germany, representing Tri-Way Concrete Pumping, Inc. (nathangermany@tri-wayconcretepumping.com)requests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories, as wood does not offer the resilience and fire protection of non-combustible alternatives such as concrete and steel. In addition, Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. For example: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals. Plus, there has been no wind component involved in the fire testing of Mass Timber assemblies. Additionally, the adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. While a testing standard for these adhesives has been proposed, it has not been fully vetted by the cognizant committees. This type of testing is essential and failing to do so would be egregious mistake. In closing, allowing wood structures to be built above the level that allows for fire department access is a serious mistake. It poses a safety risk to not only to fire department rescuers, but to the general public living/working in and adjacent to these buildings, as their structural integrity will easily be compromised during a fire. This is a mistake.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 34:

Proponent: Steve Gonsalves, representing Concorequests Disapprove.

Commenter's Reason: Neither the fire code action committee nor the Building Code Action Committee voted to support this series of code changes. This is a serious and dangerous mistake! Allowing wood structures to be built above the level of fire department access is dangerous. Wood does not offer the support and resilience or fire protection of non combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 35:

Proponent: Edq Griffith, representing St. Marys Cement, Inc. (ed.griffith@vcimentos.com)requests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel, this is a serious safety issue and has been evidenced by disastrous fires.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 36:

Proponent: Robert Grupe, representing Grupe Gypsum Consulting, LLC (rcgconsult@outlook.com)requests Disapprove.

Commenter's Reason: Overall building performance is predicated on the individual systems that comprise the structure. Further these systems are a series of individual building materials that are integrated based on their

performance attributes, and compatibility with adjacent building materials. The proposed Tall Wood-frame construction is based primarily on the use of Cross Laminated Timber, CLT. However the proposal does not address potential compatibility issues, and in some cases lacks critical data to support required performance. Therefore, the CLT, system is not ready for use in wholesale high-rise construction. There are at least two critical system design areas that require additional testing and verification. These two examples are offered here to provide areas of specific concern. These examples are expressed in specific published white papers on the use of Cross-Laminated Timber.
The first example is on acoustics, specifically that of sound transmission through floor-assemblies. The current International Building Code has established minimum requirements for floor-to-floor transmission. In a published white paper entitled ***Mass Timber High-Rise Design Research: Museum Tower in Los Angeles Reimagined in Mass Timber*** (2015) the following statement is made regarding acoustics:

Testing is required to determine the ability of this assembly to obtain the code-required acoustic performance.

The paper covered the design of a timber-framed high-rise building. The acoustical design of the structure was centered around two floor-ceiling systems proposed for this project, both of which did not have any acoustic testing to substantiate compliance. The above comment followed a written description of each proposed floor/ceiling assembly.

Another issue of concern relating to additional required research is the proper design of connections that can accommodate the naturally occurring shrinking and swelling of CLT members primarily due to seasonal changes. The issue is the compatibility and serviceability of sealants and membranes that are incorporated into the CLT system. The following is taken from the ***CLT Handbook*** (2013):

Differential movement between CLT and other wood-based products or materials (in case of mixed materials and systems) need to be taken into account at the design and detailing stages due to potential shrinkage-induced stress that could undermine the connection capacity in CLT. More information and guidelines related to detailing will be provided in future versions of this document as additional studies need to be performed.

The point to be made here is that these are critical components in system and ultimately building design that require additional testing and research. It is obvious from the above mentioned white paper and handbook that the composite action of the independent building materials that make up the building systems have yet to be fully researched, tested, and detailed for use in general construction.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 37:

Proponent: Larry Williams, Steel Framing Industry Association, representing Steel Framing Industry Associationrequests Disapprove.

Commenter's Reason: G108-18 proposes to modify IBC Section 202, Table 601, and various sections of 602, to recognize cross laminated timber (CLT) as a special class of Type IV construction.
The structural and fire resistance performance of cross-laminated timber is fundamentally determined by the performance of the adhesive used to hold the layers of the product together. Delamination as a result of exposure of CLT to heat and flame have been identified as an issue of concern through both independent research and tests conducted under the supervision of members of the Ad Hoc Tall Wood Committee.

The solution to this concern was the addition of language in the proposal to reference PRG 320-18 which had not been published at the time of the submission of the proposed G108-18. Since the proposal was submitted, the PRG 320-18 has been published with an Appendix B that is intended to provide a test procedure to be used in evaluating the elevated temperature performance of adhesives.

This Appendix B has been public for less than 6 months, and consequently has no history of use that would validate assumptions that we are being asked to make. In addition, it clearly states that not all factors needed for a risk assessment are incorporated into the development of the Appendix. Further, the task of verifying that any of the methods discussed in the Appendix is left to the user.

Given the important role that adhesives play in the structural performance and safety of a bonded system, too little is known or provided that would ensure that 180-foot tall structures would be safe in the event of a fire or exposure to heat.

The leap in assumptions that fire tests on a two-storey mock up can be extrapolated to fire performance of an 18-story building is an unreasonable extension in the allowance for use of "professional judgement."

Proponents of G108-18 and related proposals state that the expected fire performance of mass timber buildings was “validated by a series of full scale multiple-story fire tests.” However, the actual model tested was only two storeys in height, and from this test users are expected to have confidence that a 180-foot tall building construction with cross-laminated timber will exhibit identical performance.

The fundamental problem of this assumption is that some characteristics of large fires have not been observed on small fires, either because they do not occur in small fires or because they are too small to be detected. It seems likely that a different set of controls of fire behavior may take over after a fire reaches a certain size or intensity. The difficulty of extrapolating from small to large fires is further complicated by the fact that behavior of fire is a pattern phenomenon--the behavior at one point is often dependent on the behavior at another point. The behavior of one part of a fire may change even if burning conditions at that point do not vary when the characteristics of the fire at some other point changes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with current requirements.

Public Comment 38:

Proponent: Eric Gutierrez, Self, representing Selfrequests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 39:

Proponent: steve gynn, Votorantim, representing Votorantim (steven.gynn@vcimentos.com)requests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel. The safety aspects alone without the support of the construction committees are enough to stop this action. Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
What testing has been completed to prove the long term viability of tall wood structures in the event of a fire?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements

Public Comment 40:

Proponent: Frederick Hahn, Construction Forms, representing Self (rick.hahn@conforms.com)requests Disapprove.

Commenter's Reason: UNTESTED: Wood-industry funded tests performed in the U.S. and Canada were completely inadequate, failing to examine real-world structural risk factors, potential firefighting safety impacts from weather, and material-related risk factors to public health and safety.
UNPROVEN: While non-combustible concrete and steel have been used for centuries to build tall buildings and structures, mass timber products, like cross-laminated timber, are unknown and unproven construction materials.

UNSOUND: Common sense knows, and history shows, that TALL WOOD buildings are high-risk and dangerous to public health and safety when it comes to natural and man-made disasters like hurricanes and wildfires.

With recent fires that have occurred both during and after construction of these tinderboxes, there should be at the very least better studies done by independent sources. Concrete and steel have been proven over decades to be a far safer building from a fire safety standpoint.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 41:

Proponent: Patrick Hainault, Matsen Ford Design Associates, Inc., representing Selfrequests Disapprove.

Commenter's Reason: "Tower of Fire destroys LA apartment complex under construction." This headline in the December 8, 2014 LA Times barely scratches the surface in describing the dangers from fires in buildings under construction when those buildings are framed with wood and wood-based materials. This fire not only destroyed at least 239 of the rental units and 2/3rds of the complex at the Da Vinci Apartments but caused significant damage to neighboring buildings and infrastructure, and greatly burdened the surrounding community in general. Yet, this proposal will dramatically raise the allowable heights and areas of buildings made from combustible materials.
It is not rationale to increase the allowable height of buildings as in this proposal when significant problems in much smaller buildings still present a well-documented risk to life and property. The assembly should overturn the committee decision to effectively prohibit the type of proposed construction until and if it can be proven safe during and after construction. The following paragraphs expand on the issues the assembly should consider in evaluating this proposal.

How do we even begin to come to grips with the risk to adjacent properties and occupied buildings during the construction phase when an 18- story wood structure allowed by this proposal is burning in a suburban or urban area? Without safeguards well beyond those currently in the code (or proposed as part of a series of related proposals) to protect adjacent properties and infrastructure, the impacts will be devastating. For example, the Da Vinci fire caused:

- Damage to adjacent buildings. At least four nearby buildings were damaged. The building at 221 N. Figueroa St., where the computers and cubicles melted, had significant damage on its 15 floors, with 300 windows blown out. Three floors were also damaged in the Los Angeles County Department of Health Services building at 313 N. Figueroa. LA Department of Water and Power staff identified at least 160 damaged windows. A Los Angeles Department of Building and Safety spokesman reported windows blew out in the north tower of its department headquarters, and the heat and smoke triggered sprinklers that soaked carpets and desks. Overall, the Da Vinci Apartments fire caused an estimated $111.5 million in damages, including $80 million in damage to city properties from the fire and the water used to extinguish it and $20-$30 million to the apartment complex.

- Damage to Infrastructure. A Caltrans spokesman estimated the fire caused $1.5-million damage to the freeway. Roads were closed around the area including a major commuter route during rush hour. Caltrans officials reported an exit sign over the 110 Freeway melted and would have to be replaced, forcing another freeway closure later the same week.
- Extensive impacts on the community. The attached study of the economic risk to taxpayers and the community posed by mid-rise apartments produced by assistant adjunct professor Urvashi Kaul at Columbia University captures the total cost impacts from fires like the Da Vinci apartments and smaller incidents. This study finds that:
  - In Los Angeles County, alone, fires in mid-rise residential buildings with combustible frames could have a negative impact of $22.6B over 15 years, including $17.14B in direct losses from property damage.
  - On average, fire in a mid-rise residential building constructed using combustible framing material costs the Los Angeles County a total of $141.81 per square foot in potential economic impact and $2.38 per square foot in lost tax revenues.
  - Potential impact the County may face in a single year could be $1.7 billion, including $1.3 billion in direct property damage.

The assembly is also urged to reconsider the argument that cladding requirements proposed to address fires in buildings under construction will resolve these issues. As demonstrated in a large fire from 2015 in a wood-framed apartment building in Edgewater, NJ, cladding will not stop a fire from spreading once the framing in part of the building ignites. It doesn't create a barrier between unexposed framing and exposed framing, but only provides some resistance to ignition from within or outside of the building. The Edgewater fire spread rapidly throughout the buildings once framing behind a wall was ignited during repairs to the occupied and fully-clad building.

The Da Vinci and Edgewater fires are not uncommon incidents. Dozens of similar fires have occurred (see more at http://buildwithstrength.com/america-is-burning/) in buildings under construction since the market began broadly taking advantage of relatively recent changes to the IBC that allowed taller and larger wood-framed buildings. In a similar fire in Houston, the life of a construction worker literally hung in the balance as he was rescued from a burning wood framed building just seconds before the stories above came crashing down. The assembly can prevent these types of risks from greatly expanding by disapproving this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of

construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 42:

Proponent: William Hall, Portland Cement Association, representing Alliance for Concrete Codes and Standards (jhall@cement.org)requests Disapprove.

Commenter's Reason: At the recent ICC Committee hearings in Columbus, OH, your committee **FAILED you.** The general committee charged with looking at proposals and weighing justification **FAILED** to do their job when it came to Tall Wood Buildings. Despite overwhelming testimony that fire tests were inadequate, the committee simply ignored the fact that the TWB ADHOC committee only considered a two story residential structure during testing, and then used **'Engineering Judgment"** to determine that those results will be sufficient for 18 stories. They **FAILED** to ask for justification to allow other occupancy groups a 100% increase in height.
WHERE is the testing for all the other occupancy groups? 100% increases in story height are proposed for other use groups **without any justification.**

The ICC TWB ADHOC Committee has taken it upon themselves to develop a prescriptive TWB approach that **exceeds the allowable heights of every country in the world**. The United States just recently began looking at Mass Timber for taller buildings and yet, if this proposal goes through, ICC will allow mass timber 6 stories higher than any other country.

Not only will the U.S. allow the tallest wood buildings, we will also allow 12 story Mercantile, Storage and Factory to be built **without** gypsum covering on 40% of the CLT surface. Again, more than any other Country.

While mass timber may be an acceptable building material, it has not gone through the testing rigors that are needed for safe high rise buildings**. Do not let the U.S. be the testing ground for these Tall Wood Buildings.**

Vote for Disapproval

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No effect

Public Comment 43:

Proponent: Mary Murphy Harrison, representing Barney & Dickenson Inc (mmh@stny.rr.com)requests Disapprove.

Commenter's Reason:
Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete, masonry, and steel.

There has been no wind testing of wood structures above 6 stories.

Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood/Mass Timber code Changes.

Most fire departments do not have the ability to fight fires above 6 stories effectively.

Water from sprinklers will accumulate in lower floors causing concerns for mold, water load, and water damage.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 44:

Proponent: Lindsey Haugh, Conco, representing Conco (lhaugh@mail.csuchico.edu)requests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel and with the frequency of wildfire devastation (especially in California) this act would permit possibility of future destruction.

Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 45:

Proponent: Shawna Helber, C.E. Collins & Assoc., representing Selfrequests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake.
Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 46:

Proponent: Jennifer Herrera, representing Conco (jherrera@conconow.com)requests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. Allowing wood structures to be built above the level of fire department access is a serious mistake. Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel. Allowing wood structures to be built above the level of fire department access is a serious mistake.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel. Wood is a serious mistake!! This will put the lives of people in danger if there were to be a fire or earthquake and people were on the top stories of a wooden structure.

Public Comment 47:

Proponent: Frank Howard, representing Howard Concrete Pumping Co., Inc. (fhoward1@howardconcretepumping.com)requests Disapprove.

Commenter's Reason:
Allowing wood structures to be built above the level of fire department access is a
serious mistake, and Wood does not offer the resilience and fire protection of non
-combustible alternatives like concrete and steel. Further,there is currently no complete testing or engineering justification for expanding the
height limitation for mass timber from 6 stories to 18 stories.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 48:

Proponent: Shane Huff, representing MMC Materials, Inc.requests Disapprove.

Commenter's Reason: I am opposed to increasing the current height limitations on mass timber construction for the following reasons:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1" per hour in a fire, then after 2 hours in a fire, a 6" thick CLT wood load bearing wall will only have 2" of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 49:

Proponent: Anthony Inglese, representing self; Peter Lalley (plalley@conconow.com)requests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 50:

Proponent: Heidi Jandris, A. Jandris & Sons, Inc., representing A. Jandris & Sons, Inc.requests Disapprove.

Commenter's Reason: Fire test (ASTM E119) dates back to a time when homes were furnished with natural materials such as cotton, leather, wool and wood. Modern homes are furnished with much more flammable materials, which are petroleum based; carpets, foam furniture, plastic based coverings, etc. These materials are much more combustible and much quicker to reach flash point. Wood structures with increasingly flammable interior furnishings, often with toxic flame retardants as the answer are not compatible. Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel. Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes. Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
UNTESTED: Wood-industry funded tests performed in the U.S. and Canada were completely inadequate, failing to examine real-world structural risk factors, potential firefighting safety impacts from weather, and material-related risk factors to public health and safety.

UNPROVEN: While non-combustible concrete and steel have been used for centuries to build tall buildings and structures, mass timber products, like cross-laminated timber, are unknown and unproven construction materials.

UNSOUND: Common sense knows, and history shows, that TALL WOOD buildings are high-risk and dangerous to public health and safety when it comes to natural and man-made disasters like hurricanes and wildfires.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 51:

Proponent: Shawn Kalyn, Votorantim St Marys Cement LLC, representing selfrequests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories
VOC (volatile organic compounds) with the adhesives used in the glues of CLT s and flame retardants should be investigated for the limits of exposure for indoor air quality of inhabitants.

Moisture control and agents used for the prevention of mold control needs to be addressed for both construction and occupancy. Mold spores can bloom during construction as shown in OSB board where agents used did not control or kill of the spore growth internally within the product.

Allowing wood framed structures to be built above the level of fire department access is a serious mistake. The vast majority of municipal ladder trucks cannot reach above the 7th floor.

Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete, masonry and steel.

Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Charring wood will add fuel to the fire and increase the heat and smoke output relative to noncombustible materials. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.

To date, there has been no full scale CLT fire tests done to ASTM standards. There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.

It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?

Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.

Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.

The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?

Wood absorbs water, and the resulting rot and mold can seriously impair a wood structures overall anticipated performance. Note: non-combustible materials such as concrete, masonry and structural steel do not rot.

Bibliography: Shawn Kalyn B.Eng LEED AP bd+c
Technical Services Engineer

-In the building and construction industry for over 25 years.

-Graduate of Ryerson University in 2000 with degree in Civil Engineering

-took an oath "Calling of the Engineer"

-Work on CSA, ASTM and other industry standards

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

- Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 52:

Proponent: Janet Kasson, representing American Concrete Pumping Association (janet@concretepumpers.com)requests Disapprove.

Commenter's Reason: The code change will not increase or decrease the cost of construction

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 53:

Proponent: Danielle Kleinhans, representing Concrete Reinforcing Steel Institute (dkleinhans@crsi.org)requests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories and wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 54:

Proponent: Steven Kosmatka, Portland Cement Association, representing Portland Cement Association (skosmatka@cement.org)requests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives. Most fire departments cannot handle an 18 story fire in a building made of combustible material. Residents in nursing home or assisted living facilities would not be able to escape. Fire fighters cannot get 18 stories of wheel chair bound occupants down the stairs and out in time.
Fire and related engineering research is not adequate to support the proposal.

Please disapprove this proposal.

Bibliography: There is no properly conducted fire research with wind forces at 18 stories available to support the proposal's claims.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. 18 story wood construction is currently not allowed, therefore disapproving this action has no impact on construction cost relative to current code.

Public Comment 55:

Proponent: Robert Krulik, Ohio Concrete, representing self (bob@ohioconcrete.org)requests Disapprove.

Commenter's Reason:
- Wood absorbs water, and the resulting rot and mold can seriously impair a wood structures' overall anticipated performance. Non-combustible materials such as concrete, masonry and structural steel do not rot.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
- Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 56:

Proponent: Guillermo Velarde, representing Concorequests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a mistake that places lives in serious danger.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 57:

Proponent: Meredith Lambert, Conco, representing Conco (mlambert@conconow.com)requests Disapprove.

Commenter's Reason: I believe that this proposal promotes construction methodology which is not fire safe or in the best interests of the general public for materials. Further it is irresponsible to use wood in this manner further impacting the deforestation of our country and others.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 58:

Proponent: elizabeth Langhauser, representing Self (bplanghauser@gmail.com)requests Disapprove.

Commenter's Reason: Allowing wood structures to be build above the level of fire department access is a serious mistake. Furthermore, there is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 59:

Proponent: John Lee, Cemstone Products Company, representing Selfrequests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake.
There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.

Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.

There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.

It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?

Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.

Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.

The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 60:

Proponent: Danny Mace, representing Self; Paul Tennis (pdtennis@comporium.net)requests Disapprove.

Commenter's Reason:
There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
Allowing wood structures to be built above the level of fire department access is a serious mistake.
Wood does not offer the resilience and fire protection of non -combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 61:

Proponent: Mark Manahan, Gonsalves & Santucci, Inc., representing selfrequests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?
- This would increase the use of wood products in construction and contribute to deforestation and environmental problems.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

- This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 62:

Proponent: DOUGLAS MARQUIS, Conco, representing selfrequests Disapprove.

Commenter's Reason: As a witness to the devastation of a multi-level residential wood structure, I am opposed to building tall residential structures from combustible materials. Wood simply does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
The process should seriously reconsider supporting an approval when neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.

The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires?

I'm concerned this decision has already been rubber stamped for approval prior to this process.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 63:

Proponent: William Marsh, Hydro Rents Carolina, representing Hydro Rents Carolina (bill.marsh@hydro-rents.com)requests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. Additionally, wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 64:

Proponent: Christy Martin (Marie C. Martin) Exe. Director, Concrete Promotional Group, Inc., representing Concrete Promotional Group, Inc.requests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- Allowing wood framed structures to be built above the level of fire department access is a serious mistake. The vast majority of municipal ladder trucks cannot reach above the 7^{th} floor.
- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete, masonry and steel.
- Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Charring wood will add fuel to the fire and increase the heat and smoke output relative to noncombustible materials. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals.
- To date, there has been no full scale CLT fire tests done to ASTM standards.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
- The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?
- Wood absorbs water, and the resulting rot and mold can seriously impair a wood structures overall anticipated performance. Note: non-combustible materials such as concrete, masonry and structural steel do not rot.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 65:

Proponent: Chris Mason, Prairie Material, representing Prairie Materialrequests Disapprove.

Commenter's Reason: I'm not convinced that there has been sufficient testing on the properties of the materials (and joining materials) in the event of a fire, as well as thee long-term effects of water.
I m also concerned that the environmental gains may be overstated and, when taking into account, the life-cycle cost to obtain, process, deliver and assemble, the any potential gains would be negligible and not worth the risk.

On a very human and practical level, I wouldn't want to have my kids or grandkids sleeping in a wood high-rise. It s unsettling to think what could happen with regard to stairwells, elevator shafts and access for emergency services personnel, when taking into considerations flammability and generated heat.

I hope unbiased research and testing can continue and am not in favor green lighting the change at this time.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
It is yet unknown the extent to which this code change proposal may or may not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus, it appears there is not a known cost impact when compared with present requirements.

Public Comment 66:

Proponent: Tina McIntyre, CalPortland, representing self (tmcintyre@calportland.com)requests Disapprove.

Commenter's Reason:
There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. A matter of safety must be considered.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of

construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. this proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 67:

Proponent: Dan McCoy, PE, representing R. L. McCoy, Inc. (danmccoy@rlmccoy.net)requests Disapprove.

Commenter's Reason: I've been concerned in recent years that wood has been getting stretched beyond reasonable limits. It used to be we were limited to four floors without some special analysis. We don't like using it for tall structures but sometimes, if it's allowed by code, contractors and/or architects will push it. Unfortunately, there are creep issues that can affect plumbing, etc. and the fire protection issue is very real. There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel. Hopefully, the code council looks at this more closely.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 68:

Proponent: Ganesha Mohanram, Conco Companies, representing Conco Companies (gmohanram@conconow.com)requests Disapprove.

Commenter's Reason: We all know and been studying the difference between Wood construction and Concrete Construction. We have been talking how safe concrete structures when compared to wood construction. Cros laminated Timber chars in fire; however charring is not equivalent to non-combustible. Note: if the char rate is 1 per hour in a fire, then after 2 hours in a fire, a 6 thick CLT wood load bearing wall will only have 2 of structural material left. This is not acceptable and is not addressed in the code change proposals. And currently there is no satisfied engineering justification on construction high raised i.e from 6 stories to 18 stories with mass timber thus, allowing wood structures to be built above the level of fire department access is a serious mistake.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 69:

Proponent: Debbie Moreno, representing Conco (dmoreno@conconow.com)requests Disapprove.

Commenter's Reason:

- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. I would never live or work in a high rise that is made of wood. A fire can take down a high rise in minutes, also the fact that would can rot overtime......

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 70:

Proponent: Todd Morgan, Ramcrete, Inc, representing Ramcreterequests Disapprove.

Commenter's Reason: Allowing wood structures to be built about the level of fire department access is a serious mistake and puts many lives in harms way. Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete or steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 71:

Proponent: Marc Nard, Portland Cement Association, representing Portland Cement Association (mnard@cement.org)requests Disapprove.

Commenter's Reason: Mass Timber is a new and incompletely tested building method. There has been insufficient / inadequate testing of the complete system to date. As code officials prescriptive limits are strictly adhered to. You would not allow even a single story increase in the currently allowed construction height of 6 stories. If a contractor asked to be allowed to build to 7 stories he would be told NO that would exceed the height code allows. Now not only is the wood industry seeking to simply exceed the height limitation of 6 stories by one story the desire is to extend the height beyond 6 stories and in fact, without proper testing, NO wind testing or proper justification randomly raise the height allowance three times the current limit allowed to 18 stories. for Mass Timber structures.
18 Story structures far exceeds the level of fire department access. I have 12 years experience as a firefighter in the States of Indiana and Michigan and would urge DISAPPROVAL. Not being able to reach the fire in a combustible building is a recipe for disaster. Common sense and the experience learned from high rise fires dictates that to be safe we use NONCOMBUSTIBLE materials, Type 1 and Type II construction not just open the door for untested systems to be built as high rises. Having combustible construction above the level of fire department access puts occupants, fire fighters and emergency services persons at unnecessary risks.

Wood structures will burn and this affects them and adjacent structures as well. It simply does not provide the Resiliency, Safety and Piece of Mind that Concrete and Steel offer. Fire testing to date has been done on two story structures. We need testing on an 18 story structure both with and without sprinkler protection (they can fail or be inoperative on occasion) and we need testing with wind and water pooling to see how the system reacts to the additional deteriorating factors.

Cross Laminated Timber / Mass Timber burns and chars in a fire. Wood is a combustible product. Given enough heat and oxygen it acts as a fuel and will burn. Note: if the char rate is 1 per hour in a typical fire then after a 2 hour fire exposure a 6 inch wall assembly is now missing 4 inches of structural material. There is no repair method offered so that if there is a kitchen fire and the material is damaged no one as decided it would be an advantage to develop and disseminate the repair procedures prior to building and occupying these structures. This is a major mistake.

To date no standard, including NFPA 285, has a wind component that has been part of the testing of Mass Timber. The recent loss of life in the London high rise fire shows clearly that wind is an accelerating factor in a high rise fire. Support DISAPPROVAL do not experiment with structures people live in and use. Do the testing on full size structures prior to putting these extended height allowances into the code and be certain we test for wind effect.

In the case of a fire event there are two major overriding issues beyond the combustibility of wood products. First, where does the water go after a sprinkler head is activated either by fire or by accidental event (kids throwing a ball in an apartment and hitting a sprinkler head). Second, if the fire department does have to fight an active fire the additional volume of water from attack lines adds to the already added load of sprinkler head water. The connectors have not been tested. There is no provision for a drainage system. What effect will this have on adhesives holding these systems together. What about weather that causes windows to blow out and rain or wind blown debris to enter and pool in the structure. Mold and mildew are a serious concern that have not been addressed. The behavior of Mass Timber / CLT in high rise structures is completely dependent on proper connections. All connections being used to date are considered proprietary meaning that there is no information available to the public on their design capacities and failure rate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proponent has submitted a Cost Impact statement that declares that this will not increase the cost of construction. CLT / Mass Timber is a brand new technology which is bound to have a cost increase on the cost of construction using current code compliant non-combustible construction materials.

Disapproving this code change proposal will not increase or increase the cost of construction.

The proposed text provides information that was not previously in the code and thus there is no comparative data. This only underlines the necessity for approximate cost of construction materials and does not alleviate the need for comparison cost of construction values. Perspective building owners and designers have to have some gauge to go by as they determine materials cost in construction.

Public Comment 72:

Proponent: Gwen Wang, Portland Cement Association, representing Self (gwang@cement.org)requests Disapprove.

Commenter's Reason:

There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. Allowing wood structures to be built above the level of fire department access is a serious mistake.

Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 73:

Proponent: Mark Nowak, representing Steel Framing Industry Associationrequests Disapprove.

Commenter's Reason: This proposal should be disapproved for the following reasons:

The proposed language prohibits the use of combustible materials on the exterior of walls and in concealed spaces. This creates a conflict with the International Energy Conservation Code (IECC) and ASHRAE Standard 90.1 (Energy Standard for Buildings except Low Rise Residential Buildings).

Given all buildings will require continuous or other combustible insulation under the IECC or ASHRAE 90.1*****, the two-story fire tests conducted in support of this proposal are inadequate****** to extrapolate to buildings of the heights and number of stories permitted under the series of proposals that includes G108, G-75, G80, and G84-18.

Code officials and designers will face a dilemma over how to interpret the new requirements against the energy code requirements. One possible interpretation would effectively give these buildings an exemption to the use of the 90.1 and IECC envelope energy requirements, given there are no practical alternatives for compliance. The end result will be inconsistent enforcement or no energy code enforcement.

The proponents are attributing to these newly defined Type IV assemblies a performance level equivalent to some non-combustible materials, but traditional noncombustible materials can be constructed with combustible continuous exterior insulation. Clearly, the new Type IV construction categories do not offer the same level of protection, or the proponents would not have placed such a significant limitation on commonly-used combustible materials.

This proposal attempts to introduce several new categories of Type IV construction into the code that will greatly expand the number of stories, allowable area, and maximum height of buildings framed with materials made from combustible wood products such as cross-laminated timber. This greatly increases the risk to firefighters, building occupants, and neighboring buildings and infrastructure. Many of the major decisions that went into the creation of this proposal were based on expert opinion and relied on significant extrapolation to buildings with up to 9 times as many stories as the tests that were conducted. However, even within the context of these shortcomings, several key issues as discussed above were not adequately addressed or not addressed at all.

******With the IECC and 90.1, combustible material (insulation) on the exterior and/or in concealed spaces is almost always necessary for compliance. Even under the performance compliance path using energy modeling, it would be almost impossible to avoid the use of combustible continuous exterior insulation in the northern climate zones. Of the three major foam plastic insulation materials commonly used in buildings for continuous insulation - EPS, XPS, and polyisocyanurate - all are combustible.*

*******There are no tests that were submitted to support that the proposed assemblies can meet the fire propagation tests in NFPA 285 (required in Chapter 26 of the IBC). Although the two-story tests conducted in support of the proposal were not intended to address this issue, that itself is a significant oversight. Simply declaring that noncombustible materials can't be used is not sufficient to overlook other code requirements that require such materials.*

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 74:

Proponent: Gabriel Ojeda, Fritz-Pak Corporation, representing Fritz-Pak Corporation (gabrielojeda@fritzpak.com)requests Disapprove.

Commenter's Reason: It was 104F yesterday in Dallas Texas. Can you imagine first responders having to deal with ambient heat plus having to fight a fire in a wood structure. There hasn't been enough testing and research on building over 6 stories to be safe for the occupants and first responders. Fire fighting equipment does not reach above 6 stories. Allowing construction of wood structures without enough testing and experience is not right.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Code change will not change or decrease cost of construction. However it will increase the risks that first responders must endure.

Public Comment 75:

Proponent: Thomas OMalley, Schwing America Inc, representing Schwing America Increquests Disapprove.

Commenter's Reason:

- Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
- Allowing wood structures to be built above the level of fire department access is a serious mistake.
- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 76:

Proponent: Maizer Ouijdani, Conco, representing Concorequests Disapprove.

Commenter's Reason:

- Allowing wood structures to be built above the level of fire department access is a serious mistake. Do not forget what happened in Chicago!

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 77:

Proponent: Jim Pajk, Votorantim St. Marys Cement LLC, representing self; Thomas Tietz (tom.tietz@cncement.org); Steve Parker (steve.parker@farmersbranchtx.gov)requests Disapprove.

Commenter's Reason:

- - There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
  - Allowing wood framed structures to be built above the level of fire department access is a serious mistake. The vast majority of municipal ladder trucks cannot reach above the 7th floor.
  - Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete, masonry and steel.
  - Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Charring wood will add fuel to the fire and increase the heat and smoke output relative to noncombustible materials. Note: if the char rate is 1" per hour in a fire, then after 2 hours in a fire, a 6" thick CLT wood load bearing wall will only have 2" of structural material left. This is not acceptable and is not addressed in the code change proposals.
  - To date, there has been no full scale CLT fire tests done to ASTM standards.
  - There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
  - It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?
  - Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.
  - Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.
  - The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?
  - Wood absorbs water, and the resulting rot and mold can seriously impair a wood structures' overall anticipated performance. Note: non-combustible materials such as concrete, masonry and structural steel do not rot.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

- Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 78:

Proponent: Tien Peng, representing National Ready Mixed Concrete Association (tpeng@nrmca.org)requests Disapprove.

Commenter's Reason: While the Ad Hoc Committee had intended to validate the fire performance of cross laminated timber in fire conditions of buildings, the AWC/ATF compartment testing was limited in scope and not a thorough predictor of fire behavior for high rise building made of a new material. The testing so far is insufficient to capture the fire response characteristics in question. No tests were done to factor in wind, exterior performance, panel connections or moisture, which impacts material performance, fire-fighting and property damage. CLT is a great innovation for the wood industry but it s not ready for prime time and it s certainly not ready for us to build safely to 270 feet and 18 stories. The ICC should not adopt code provisions that will put people at risk.
1. CLT Reliability and Predictability Issues

Cross laminated timber does not have a long enough history todemonstrate their reliability and predictability. The structural design of modern tall buildings is governed by the need to efficiently transfer loading, particularly that from wind, whilst providing increasingly complex building functionality. The use of cross laminated timber implies a highly optimized systems which means the least amount of material to enabled efficient load transfer. Thus, in the event of a fire there is an increased risk not typical in mid-rise constructions, and especially not in a two-story mock up in a lab.

The NFPA with ARUP *Fire Safety Challenges of Tall Wood Buildings*paper noted(NFPA 2013)[i]:

- In a real fire situation, the load-bearing elements in CLT are expected to load-share , or redistribute in a method that is not easily predicted in simple fire testing.
- Previous CLT fire testing has resulted in delamination and char fall-off when exposed to fire conditions.
- This has the potential to increase the fire temperature and burning rate within the compartment, and could impact the structural fire resistance at later stages in the fire duration.

The full-scale fire testing in Norway (SPFR A15101 2016)[ii]showed:

- The temperature increased fast and flashover was reached after four minutes.
- Temperatures were significantly higher than the standard time-temperature curve according to EN 1363-1
- The fire did not cool down before manual suppression was initiated when the test room collapsed 1-hour 36 minutes after ignition
- The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin.
- The charring rate varied much faster than expected

We should not be putting lives in high rises at risk with this level of material unpredictability.

2. Exposed CLT Fire / Moisture /Delamination Issues

The National Institute of Standards (NIST) tests complete previously said there were concerns that flashover occurred earlier with CLTs, heat delamination of the exposed CLT affected its fire performance and a large re-flash occurred on the exposed wall with delamination of the second ply of the CLT. (NIST 2017)[i]

While fire departments understand the risk of collapse with solid wood, there is not enough documentation or history of bonded or laminated wood structures, and they may fail sooner under fire conditions. The problem is that under fire conditions an adhesive may either thermally soften or chemically degrade causing the member to lose its strength, leading to structural collapse. Hence, we see delamination from the NIST testing as well as the very real construction failure on portions of the new College of Forestry building at Oregon State University where a large section of subflooring made of cross-laminated timber gave way between the second and third stories.

Moisture is an important issue for delamination and in many parts of the country the laminated mass timber panels will experience an environment which may exceed the testing limits. Wood will change in all three orthogonal dimensions with changes in moisture, and the changes are not even. This not only means that some species swell more because of their higher density, but also wood of non-uniform density displays non-uniform swelling. Moreover, as wood swells and shrinks, adhesives do not follow with the same volumetric expansion. RDH Building Science full-scale mock-up study (Lepage 2017) [ii]notes that, The research indicates that CLT and mass timber is susceptible to dangerously high moisture contents, particularly when exposed to liquid water in horizontal applications. and other research indicate that CLT is at risk of structural damage by decay and rotting fungi (Zabel and Morrell 1992)[iii]

Clearly, we should not be putting lives in high rises at risk with this level of material unpredictability.

3. Fire / Connections Vertical Fire Spread

All connections used in current projects are proprietary and no information is publicly available regarding their performance. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors. Typically, the floor slab provides a robust barrier inhibiting external fire spread so long as it remains firmly supported by the structure. However, the AWC/ATF compartment fire testing had not adequately accounted for the connections in the CLT technologies to meet this crucial objective. The deformation of the connections when exposed to fire can expose gaps and flammable materials which can lead to spread both upwards through flaming, and downwards through dripping molten materials. Once fire starts spreading away from the floor of origin the safety of the occupants is compromised. Examples of vertical fire spread include:

- Las Vegas Hilton, USA: 22 Stories in approximately 25 minutes
- Caracas Tower, Venezuela: 17 floors in a 24-hour period
- Windsor Tower, Spain: 19 floors, ~7 hours for spread, 24 hours total fire duration
- TVCC Tower, China: 44 floors, around 15 minutes

4. Fire / Stack Effect

A similar concerning pattern emerges when discussing wind and air movement fire performance. One problem common to high-rises but not found in low-rise buildings is the stack effect movement of air inside the building.This air movement is critical to understand what happens during a fire event, as it can intensify a fire or allow flames and combustion gases to move beyond the room of origin. Fire personnel responding to a high-rise fire event need to understand where smoke and toxic gases may be going. Yet, shrinkage, moisture and creep, common in wood products including CLT, will create unpredictable opportunities for air movement within a building.

Air pressure and thermal differential with the use of CLT panels can shift the neutral pressure plane of the building. In cold weather (positive stack effect), the velocity of air channeling into the core from the lower floors is a very real concern to the occupants when they have to defend in place as well as fire service if the fire egress is compromised with smoke. In warm weather (reverse stack effect), where typically the staging floor is two floors below the fire floor, there can be concern of contamination, if there is unpredictability of where the fire path may be taking.

5. Fire / Wind

We typically associate wind with brush and wildland fires but it s just as important in structural fires.

- In 2009 a Texas probationary fire fighter and captain die as a result of rapid fire progression in a wind driven residential fire. Sustained winds from east/south-east at 17 mph with gusts up to 26 mph.
- Virginia Firefighters Battle Three-Alarm Townhouse Fire in 2011. In assessing the high winds and the fire conditions Battalion Barnes says fire crews tried to attack the flames inside two townhouses, but were forced back by intense heat and falling ceilings.

- In 2012 Prince George s County (Maryland), firefighters arrive on scene to a structure fire with winds impacting the rear of the structure. Shortly after forcing the front door open, they saw a dramatic change in fire behavior. As they made entry, they quickly experienced high velocity and high temperature gases, injuring seven firefighters, two critically.

The American Wood Council compartment fire tests did not account for wind loads.

Wind can add to the hazard to a low-rise fire, but it is most concerning around the upper floors of tall buildings. And high-rise fires create unique safety challenges for occupants and firefighters, even without the influence of wind. Wind can change the FLOW PATH of a fire and in some cases create a blowtorch effect and untenable conditions. When a window in the fire apartment fails, the influx of wind can create significant and rapid increases in the heat production of a fire. Smoke and heat spreading through corridors and stairwells, for instance, can inhibit occupants ability to escape and can limit firefighters ability to rescue them. Conditions in a corridor are of critical importance because it is the route that firefighters use to approach a fire and that occupants use to exit a building.

During the course of any structure fire, the wind may also influence exterior conditions and firefighter safety. Accelerated winds near high rises are caused by the downdraft effect , where the air hits a building and, with nowhere else to go, is pushed up, down and around the sides. The air forced downwards increases wind speed at street level. Tests conducted by National Institute of Standards and Technology (NIST 2012), the Fire Fighting Technology Group, FFTG, on positive pressure ventilation determined that an external wind speed of as low as 10 mph could cause a vented room within a structure to quickly spread from an apartment unit to a vent point, represented by a stairwell door. The spreading had floor-to-ceiling and wall-to-wall fire involvement with blowtorch effects. Moreover, if several towers stand near each other, the channeling effect, a wind acceleration created by air having to be squeezed through a narrow space. This Venturi effect will endanger the adjacent buildings.

6. Fire on Exterior

The AWC/ATF compartment fire tests did not account for exterior fire conditions and the proposed exterior proposal does not meet the required testing of CLT assemblies.

An important aspect of fire behavior in the affected building involves the burning behavior of materials on the exterior. While the AWC/ATF test demonstrated an understanding of CLT in an interior fire situation, the circumstances contributing to ignition scenarios of the exterior can be equally complex and equally important. In the past few years we have seen a number of deadly high-rise fires that propagated on the exterior of the structure.

- 2018 Almas Tower in Dubai, UAE
- 2017 Marco Polo apartment complex in Hawaii
- 2018 *Grenfell* Tower *fire* in West *London*

Simply testing the interior fire scenario does not capture potentially important parameters affecting CLT elements in tall wood buildings. If a fire in a heavy-timber building is not extinguished by the initial attack, a tremendous conflagration with flames coming out of the windows will spread fire to adjoining buildings by radiated heat. In a high-rise fire event, it is essential that the fire be prevented from spreading upwards or downwards from the floor of origin, endangering the lives of those waiting on more remote floors.

Notably missing from the proposals is how the mass timber exterior assembly in buildings over 40 feet in heightwould comply with NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components*.

- *Section 1403.5*: For combustible water-resistive barriers in buildings over 40 feet in height of Type I, II, III, or IV construction.
- *Section 1407.10.4*: For metal composite materials (MCM) used on buildings of Type I, II, III, and **IV**construction.
- *Section 1409.10.4*: For high-pressure decorative exterior-grade compact laminates (HPL) exterior wall coverings used on buildings of Type I, II, III, and **IV**construction.
- *Section 1509.6.2*: Combustible mechanical equipment screens used on buildings of Type I, II, III, and **IV**buildings.
- *Section 2603.5.5*: Exterior walls of buildings of Type I, II, III, and**IV**construction of any height incorporating foam plastic insulation, except for one-story sprinklered buildings.

This is a requirement yet there is no reference to NFPA 285 testing of exterior CLT assemblies. One test by Nordic Engineered Wood published under the Canadian ULC S134 is not enough of a sample size to validate the tall wood proposals. Again, there is not enough historical fires with cross laminated timber to provide information that can be used in an 85-ft building, much less one at 270 feet.

7. Limits of Redundancy

The ICC TW-AHC claimed the added safety factor of active sprinkler systems adds to the safety of the proposals. Without a doubt, the inclusion of fire sprinkler systems in our buildings since the late 1980 s has been effective at increasing the chances of survival in a fire. But when systems don t operate as intended (such as in a freeze failure with water damage) or fail in a high-rise fire condition, the impact can be large, not just in monetary terms, but also in the lives of the occupants and fire fighters.

The full-scale fire testing completed in Norway showed the The sprinklers in the adjacent corridor did not stop the fire from spreading out from the room of origin. (SPFR A15101 2016).[iv] Moreover, according to NFPA s report *U.S. Experience with Sprinklers*, sprinklers were effective at controlling the fire in 96% of fires in which they operated, but sprinklers were only effective in 88% of the fires large enough to activate them. The reported sprinkler failures (660 per year) were twice as common as reported fires in which sprinklers were ineffective and did not control the fire. A National Institute of Standards and Technology (NIST) study, *Estimates of Operational Reliability of Fire Protection Systems*, also demonstrates this over-reliance on fire sprinklers is misguided.

8. Untested Reference Standard

State and local governments that adopt and enforce model building codes which references a number of standards. Yet, the proposals regularly cite the newly referenced standard, *ANSI/APA PRG 320-2018: Standard for Performance-Rated Cross-Laminated Timber*, an untested document. The reference to ANSI/APA PRG 320-2018 resolves nothing and takes no legal responsibility for performance failure. APA PRG 320 has no real history of use or validation as a reliable document and no jurisdiction refers to this document. It is premature to utilize a standard that is rarely referenced and start building to 18 stories from it.

[i]https://www.nist.gov/el/fire-research-division-73300/national-fire-research-laboratory-73306/fire-safety-challenges-0
[ii]https://buildingsciencelabs.com/wp-content/uploads/2017/11/CCBST-2017-Moisture-Uptake-Testing-for-CLT-Floor-Panels.pdf
[iii]Zabel RA, Morrell JJ (2012) Wood microbiology: decay and its prevention. Academic press.
[iv]http://www.mypaper.se/html5/customer/355/11143/?page=21
[i]https://sustainable-fire-engineering.sustainable-design.ie/wp-content/uploads/2015/08/NFPA-FPRF_Tall-Wood-Buildings-Fire-Safety-Challenges_2013.pdf
[ii]http://www.mypaper.se/html5/customer/355/11143/?page=21

Bibliography: [i]https://www.nist.gov/el/fire-research-division-73300/national-fire-research-laboratory-73306/fire-safety-challenges-0
[ii]https://buildingsciencelabs.com/wp-content/uploads/2017/11/CCBST-2017-Moisture-Uptake-Testing-for-CLT-Floor-Panels.pdf

[iii]Zabel RA, Morrell JJ (2012) Wood microbiology: decay and its prevention. Academic press.

[iv]http://www.mypaper.se/html5/customer/355/11143/?page=21

[i]https://sustainable-fire-engineering.sustainable-design.ie/wp-content/uploads/2015/08/NFPA-FPRF_Tall-Wood-Buildings-Fire-Safety-Challenges_2013.pdf

[ii]http://www.mypaper.se/html5/customer/355/11143/?page=21

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed public comment would **reduce cost of construction**. Substantiation and references below.

1. Research:

A recent feasibility study [[i]] reveals that CLT construction is significantly more costly than other well-established construction methods such as concrete. Renowned structural engineers, Cary Kopczynski & Company found that the cost of the CLT structural system for a typical 10 story apartment building would cost $48 to $56 per square foot compared to $42 to $46 per square foot for concrete, translating nearly **20% premium** for Cross Laminated Timber.

2. Brock Commons, British Columbia

Per “University of British Columbia: Report to The Board of Governors, Tall Wood Student Residence, Brock Commons Phase 1” Report [[ii]], dated September 30, 2014,

- “The capital cost for the project is estimated at $44 million ($40m standard construction, plus $4m wood premium).”
- “The $4m estimated premium for advanced wood design and construction is to be funded from external sources including $3.45m secured to date from the Canada Wood Council (CWC) and Forest Innovation Investment.”

This is a **10% premium** for Cross Laminated Timber at the 18-Story Brock Commons.

3. Framework Oregon:

Per the January 5, 2018 *Portland Oregonian* article “Wheeler Defends Decision to Invest In Pricey Complex” of the Portland Oregonian[[iii]],

- “While each unit is expected to cost an average $480,000 to build, the city’s contribution will amount to $100,000 per apartment.”
- Despite a pledge from Mayor Ted Wheeler to bring down the cost of affordable housing in Portland, the Portland Housing Bureau had nonetheless awarded the building $6 million toward the $29 million total. (A **21% subsidy** by the taxpayers for the 12- Story Framework project).

By the July 16, 2018 *Willamette Week* (*WW*) article “Plans for Record-Setting Timber Tower in Downtown Portland Fall Through” [[iv]] reported,

- The building, which was slated to include 60 *affordable* apartments, was projected to cost $651.43 per square foot, *WW* reported in December. (The 660-square foot two bedroom apartments were projected to cost $567,389 to build.)

4. Lumber Pricing:

And this doesn’t consider the recent price increases of softwood lumber that have risen wildly from $424 per board foot a year ago to $536 in the second quarter of 2018. That’s a **26% increase** in just one year. At the same time, concrete prices rose at a stable rate of 5%.

[i] http://buildingstudies.org/pdf/related_studies/Cross_Laminated_Timber_Feasibility_Study_Feb-2018.pdf
[ii] http://bog2.sites.olt.ubc.ca/files/2014/09/3.2_2014.09_Tall-Wood-Building.pdf
[iii] https://www.oregonlive.com/politics/index.ssf/2018/01/portland_mayor_ted_wheeler_def.html
[iv] http://www.wweek.com/news/city/2018/07/16/plans-for-record-setting-timber-tower-in-downtown-portland-fall-through/

Public Comment 79:

Proponent: Chris Pernicano, representing San Diego Concrete Pumping Inc. (pernicanospumping@san.rr.com)requests Disapprove.

Commenter's Reason: Allowing wood structures to be built above fire department access is a big mistake
Wood does not offer the resilience and fire protection of non combustible materials such as concrete and steel

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 80:

Proponent: Nick Popoff, St Marys Cement/Votorantim, representing Self (njpopoff@comcast.net)requests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete, masonry and steel. To increase the height from 6 stories to 18 stories doesn't appear to be wise from a combustibility perspective. From a resilience and durability perspective, 18 stories is a lot of building that won't be able to stand the test of time...nor withstand some of natures forces. I fear for the safety of anyone living in a wood structure higher than 6 stories

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
There will be no savings with this proposal...life cycle analysis will be diminished...the greatest risk is fire.

Public Comment 81:

Proponent: Nicholas Porte, Portland Cement Association, representing PCA (nporte@cement.org)requests Disapprove.

Commenter's Reason:

- Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes
- Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Charring wood will add fuel to the fire and increase the heat and smoke output relative to noncombustible materials.

Public Comment 82:

Proponent: Miguel Quiroz-Mosqueda, The Conco Companies, representing Selfrequests Disapprove.

Commenter's Reason: When neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes we should understand why, not just keep trying to push this proposal forward.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 83:

Proponent: Greg Ralph, representing ClarkDietrich Engineering Servicesrequests Disapprove.

Commenter's Reason: The proposal greatly expands the allowable height and area of Type IV construction with materials made from **combustible** wood products, namely cross-laminated timber. Much of these changes are based on opinion and extrapolation of small scale testing. The expanded provisions tremendously increase the risk to occupants, first responders and all adjacent structures.
The glue that holds the strands of the CLT together is the critical link to the structural and fire performance. The proponents themselves have identified delamination due to exposure to fire and heat as an area of concern. Adequate testing to verify the durability of the adhesive has not been provided.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with the present requirements.

Public Comment 84:

Proponent: JONATHAN RAMOS, Conco, representing Concorequests Disapprove.

Commenter's Reason: To provide and ensure safe buildings in California. Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 85:

Proponent: Franzine Rendon, self, representing selfrequests Disapprove.

Commenter's Reason:
- There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
- There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.
- It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 86:

Proponent: Ryan Richardson, The Conco Companies, representing The Conco Companiesrequests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake and could lead to extremely large disasters in our country. Even if a fire suppression system "could be" capable of extinguishing the initial fire the structure itself could not handle the subsequent damages from water. I think that the initially the cost of these buildings might seem appealing, but after a few years and some accidents/disasters the costs would skyrocket. Driven by insurance and repair costs, and many of reasons that will become apparent if these structures are approved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 87:

Proponent: G Michael Robinson, representing Carolina Stalite Co.requests Disapprove.

Commenter's Reason: Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood/Mass Timber Code changes. There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories. Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 88:

Proponent: Larry Rowland, Lehigh White Cment Company, representing selfrequests Disapprove.

Commenter's Reason: Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes. Tall Wood construction with mass timbers is untested. The wood-industry funded tests performed in the U.S. and Canada were completely inadequate, failing to examine real-world structural risk factors, potential firefighting safety impacts from weather, and material-related risk factors to public health and safety. Cross-Laminated Timber (CLT) chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.
Tall Wood construction is unproven**:** While non-combustible concrete and steel have been used for centuries to build tall buildings and structures, mass timber products, like cross-laminated timber, are unknown and unproven construction materials. It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues. I state again, neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.

Tall Wood construction is unsound**:** Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees. Furthermore the behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities. There is no information on the performance of the proprietary connections during fires. Common sense knows, and history shows, that TALL WOOD buildings are high-risk and dangerous to public health and safety when it comes to natural and man-made disasters like hurricanes and wildfires.

Bibliography: Satisfied

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 89:

Proponent: Todd Schrimpf, The Conco Companies, representing Selfrequests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.
Allowing wood structures to be built above the level of fire department access is a serious mistake.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 90:

Proponent: Sue Schumacher, Collins and Associates, representing Selfrequests Disapprove.

Commenter's Reason:
Allowing wood structures to be built above the level of fire department access is a serious mistake.

Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood Ad-Hoc. There is no information on the performance of the proprietary connections during fires?

Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1" per hour in a fire, then after 2 hours in a fire, a 6" thick CLT wood load bearing wall will only have 2" of structural material left. This is not acceptable and is not addressed in the code change proposals.

On a personal note - Prior to beginning graduate school in Toledo, Ohio, my daughter leased an existing apartment not even questioning what the building was made of. Prior to moving in, a fireworks rocket hit the roof and caught fire; before the fire department could even arrive on the scene, the entire building was engulfed in flames and several attached buildings were lost as well before they were able to put it out. Questioning how this could happen, we later learned the buildings were constructed with wood. I thank God that she wasn't living there at the time of the fire and shudder to think what might have happened if she were.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 91:

Proponent: Jim Schumacher, retired, representing selfrequests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake. Too many people could die in wood built apartments fires

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of

construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 92:

Proponent: Adam Shoemaker, ClarkDietrich, representing ClarkDietrich (adam.shoemaker@clarkdietrich.com)requests Disapprove.

Commenter's Reason: This proposal aims to add three new Type IV Fire-Resistant Rating (FRR) Requirements to Table 601. In the IBC Section 602.1 it states that The building elements shall have a ***fire-resistance rating*** not less than that specified in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602. Where required to have a fire-resistance rating by Table 601, ***building elements shall comply with the applicable provisions of Section 703.2.*** In IBC Section 703.2 it then states that The fire-resistance rating of building elements, components or assemblies ***shall be determined in accordance with the test procedures set forth in ASTM E119 or UL 263*** or in accordance with Section 703.3. Section 703.3 again calls for comparisons against ASTM E119 and UL 263. The fire testing that was done to support this proposal did not include any ASTM E119 or UL 263 testing, therefor it should not be approved.
In addition, Section 602.2 states that 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 this code. I don t believe you can justify allowing Type IV combustible structural elements to have the same FRR as Type I and II NON-combustible structural elements. This is not a conservative or proven safe approach and should not be allowed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No cost impact.

Public Comment 93:

Proponent: James Singleton, representing selfrequests Disapprove.

Commenter's Reason: At a time when carbon dioxide is at an all time high in our atmosphere composition. We need to mitigate the impact of deforestation of our planet. The change in this proposal would set an increase of demand of lumber products which greatly impacts our environment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment results in no change to existing code test. Therefore there is no change in the cost of construction.

Public Comment 94:

Proponent: Stephen Skalko, Stephen V. Skalko, P.E. & Associates, LLC, representing Stephen V. Skalko, P.E. & Associates, LLC (svskalko@svskalko-pe.com)requests Disapprove.

Commenter's Reason: G108-18 should be disapproved because the issue of fire resistance of connections for mass timber construction has not been sufficiently addressed in this proposal. The present code requirements for nominal heavy timber members have an approximate 1-hour fire resistance. This code proposal adds three new types of heavy timber construction (Types IV-A, IV-B and IV-C) which have fire resistance requirements for the primary structural frame and secondary members for at least two hours (three-hours for Type IV-A primary members). There is no language to direct the code user on what should be provided or expected to protect the connections for these higher fire resistances. The topic of fire resistance protection of connections has been treated too lightly considering the importance of these connections for maintaining structural stability for these taller mass timber buildings during and after a fire incident.
The ICC Tall Wood Building Committee was told that there are proprietary connections that have been used in Europe to accomplish these higher fire resistance ratings required. However, documentation in the form of fire tests, technical reports or other reference material has not been provided to substantiate these claims.

And the CLT Handbook available for designers is not much help either [CLT Cross-Laminated Timber Handbook US Edition, 2013]. In Chapter 8, Fire, Section 5 Connections the handbook states:

Due to the high thermal conductivity of steel, metallic fasteners and plates directly exposed to fire may heat up and conduct heat into the wood members. The wood components may then experience charring on the exposed surface and around the fastener. As a result, the capacity of the metallic connection is reduced to the strength reduction of the steel fasteners at *elevated temperatures and the charring of the wood members. Therefore, where a fire resistance rating is required by the IBC, connections and fasteners are required to be protected from fire exposure by wood, gypsum board or other protection approved for the required rating .*

While the protection cited may increase the fire endurance of the metallic portions of the connections, the connection elements will still be subjected to elevated temperatures during a fire event. Data has not been provided to demonstrate what those elevated temperatures will be with the various protection systems noted so there is no way to evaluate the potential for internal charring of connector holes. There is also no methodology provided that would allow for a comprehensive post-fire evaluation of the remaining structure.

A technical research report on connections for tall wood buildings prepared for the National Research Council of Canada reported that the fire resistance for concealed connections may be on the order of 1 to 1-1/2 hours [Canadian Commission on Building and Fire Codes, Standing Committee on Fire Protection, *Review of Fire Resistant Design of Connections*, January 2017, page 8]. The report conclusion suggests that some extra overlay of wood may be necessary for the 2-hour and 3-hour fire resistance of mass timber provisions proposed by the ICC TWB Committee. This is not to suggest that 2-hour fire or 3-hour resistances of connections cannot be achieved. But, connections must be given extra attention and standard methods for the industry may not be sufficient.

This extra attention is what is lacking in the ICC TWB Code Proposals. Nothing in the proposals brings to the attention of the designer or code official this very important fire aspect of providing proper fire rated connections for the prescriptive CLT requirements. Before the membership approves provisions for taller mass timber buildings, the ICC TWB Committee should have the opportunity to perform their due diligence by a review of connections with fire resistances greater than 1-hour for mass timber buildings based on fire tests reports, technical reports or other reference material documenting that 2-hour and 3-hour fire resistance ratings can be achieved.

Because of the need to study in more depth what and how 2-hour and 3-hour fire rated connections for these proposed mass timber buildings is accomplished, this proposal should be DISAPPROVED and sent back to the ICC TWB Committee to address this critical shortcoming.

G108-18 should be disapproved because the issue of fire resistance of connections for mass timber construction has not been sufficiently addressed in this proposal. The present code requirements for nominal heavy timber members have an approximate 1-hour fire resistance. This code proposal adds three new types of heavy timber construction (Types IV-A, IV-B and IV-C) which have fire resistance requirements for the primary structural frame and secondary members for at least two hours (three-hours for Type IV-A primary members). There is no language to direct the code user on what should be provided or expected to protect the connections for these higher fire resistances. The topic of fire resistance protection of connections has been treated too lightly considering the importance of these connections for maintaining structural stability for these taller mass timber buildings during and after a fire incident.

The ICC Tall Wood Building Committee was told that there are proprietary connections that have been used in Europe to accomplish these higher fire resistance ratings required. However, documentation in the form of fire tests, technical reports or other reference material has not been provided to substantiate these claims.

And the CLT Handbook available for designers is not much help either [CLT Cross-Laminated Timber Handbook US Edition, 2013]. In Chapter 8, Fire, Section 5 Connections the handbook states:

Due to the high thermal conductivity of steel, metallic fasteners and plates directly exposed to fire may heat up and conduct heat into the wood members. The wood components may then experience charring on the exposed surface and around the fastener. As a result, the capacity of the metallic connection is reduced to the strength reduction of the steel fasteners at elevated temperatures and the charring of the wood members. Therefore, where a fire resistance rating is required by the IBC, connections and fasteners are required to be protected from fire exposure by wood, gypsum board or other protection approved for the required rating .

While the protection cited may increase the fire endurance of the metallic portions of the connections, the connection elements will still be subjected to elevated temperatures during a fire event. Data has not been provided to demonstrate what those elevated temperatures will be with the various protection systems noted so there is no way to evaluate the potential for internal charring of connector holes. There is also no methodology provided that would allow for a comprehensive post-fire evaluation of the remaining structure.

A technical research report on connections for tall wood buildings prepared for the National Research Council of Canada reported that the fire resistance for concealed connections may be on the order of 1 to 1-1/2 hours [Canadian Commission on Building and Fire Codes, Standing Committee on Fire Protection, *Review of Fire Resistant Design of Connections*, January 2017, page 8]. The report conclusion suggests that some extra overlay of wood may be necessary for the 2-hour and 3-hour fire resistance of mass timber provisions proposed by the ICC TWB Committee. This is not to suggest that 2-hour fire or 3-hour resistances of connections cannot be achieved. But, connections must be given extra attention and standard methods for the industry may not be sufficient.

This extra attention is what is lacking in the ICC TWB Code Proposals. Nothing in the proposals brings to the attention of the designer or code official this very important fire aspect of providing proper fire rated connections for the prescriptive CLT requirements. Before the membership approves provisions for taller mass timber buildings, the ICC TWB Committee should have the opportunity to perform their due diligence by a review of connections with fire resistances greater than 1-hour for mass timber buildings based on fire tests reports, technical reports or other reference material documenting that 2-hour and 3-hour fire resistance ratings can be achieved.

Because of the need to study in more depth what and how 2-hour and 3-hour fire rated connections for these proposed mass timber buildings is accomplished, this proposal should be DISAPPROVED and sent back to the ICC TWB Committee to address this critical shortcoming.

G108-18 should be disapproved because the issue of fire resistance of connections for mass timber construction has not been sufficiently addressed in this proposal. The present code requirements for nominal heavy timber members have an approximate 1-hour fire resistance. This code proposal adds three new types of heavy timber construction (Types IV-A, IV-B and IV-C) which have fire resistance requirements for the primary structural frame and secondary members for at least two hours (three-hours for Type IV-A primary members). There is no language to direct the code user on what should be provided or expected to protect the connections for these higher fire resistances. The topic of fire resistance protection of connections has been treated too lightly considering the importance of these connections for maintaining structural stability for these taller mass timber buildings during and after a fire incident.

The ICC Tall Wood Building Committee was told that there are proprietary connections that have been used in Europe to accomplish these higher fire resistance ratings required. However, documentation in the form of fire tests, technical reports or other reference material has not been provided to substantiate these claims.

And the CLT Handbook available for designers is not much help either [CLT Cross-Laminated Timber Handbook US Edition, 2013]. In Chapter 8, Fire, Section 5 Connections the handbook states:

Due to the high thermal conductivity of steel, metallic fasteners and plates directly exposed to fire may heat up and conduct heat into the wood members. The wood components may then experience charring on the exposed surface and around the fastener. As a result, the capacity of the metallic connection is reduced to the strength reduction of the steel fasteners at elevated temperatures and the charring of the wood members. Therefore, where a fire resistance rating is required by the IBC, connections and fasteners are required to be protected from fire exposure by wood, gypsum board or other protection approved for the required rating .

While the protection cited may increase the fire endurance of the metallic portions of the connections, the connection elements will still be subjected to elevated temperatures during a fire event. Data has not been provided to demonstrate what those elevated temperatures will be with the various protection systems noted so there is no way to evaluate the potential for internal charring of connector holes. There is also no methodology provided that would allow for a comprehensive post-fire evaluation of the remaining structure.

A technical research report on connections for tall wood buildings prepared for the National Research Council of Canada reported that the fire resistance for concealed connections may be on the order of 1 to 1-1/2 hours [Canadian Commission on Building and Fire Codes, Standing Committee on Fire Protection, *Review of Fire Resistant Design of Connections*, January 2017, page 8]. The report conclusion suggests that some extra overlay of wood may be necessary for the 2-hour and 3-hour fire resistance of mass timber provisions proposed by the ICC TWB Committee. This is not to suggest that 2-hour fire or 3-hour resistances of connections cannot be achieved. But, connections must be given extra attention and standard methods for the industry may not be sufficient.

This extra attention is what is lacking in the ICC TWB Code Proposals. Nothing in the proposals brings to the attention of the designer or code official this very important fire aspect of providing proper fire rated connections for the prescriptive CLT requirements. Before the membership approves provisions for taller mass timber buildings, the ICC TWB Committee should have the opportunity to perform their due diligence by a review of connections with fire resistances greater than 1-hour for mass timber buildings based on fire tests reports, technical reports or other reference material documenting that 2-hour and 3-hour fire resistance ratings can be achieved.

Because of the need to study in more depth what and how 2-hour and 3-hour fire rated connections for these proposed mass timber buildings is accomplished, this proposal should be DISAPPROVED and sent back to the ICC TWB Committee to address this critical shortcoming.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Mass timber buildings require protection of connections.

Public Comment 95:

Proponent: Jason Krohn, Precast/Prestressed Concrete Institute, representing Precast/Prestressed Concrete Institute (jkrohn@pci.org)requests Disapprove.

Commenter's Reason: G108-18 should be disapproved because the long-term performance of adhesives used in the cross-laminated timber after exposure to fire have not been thoroughly examined. Presentations on the results of fire tests performed on CLT by the National Research Council of Canada for the National Fire Protection Research Foundation were given to the ICC TWB Committee. One of the areas of concern that showed up in Phase 2 of those tests was delamination of a CLT floor/ceiling panel during the cooldown period of a test which resulted in a regrowth of the fire within the compartment. The delamination was attributed to a bonding failure of the adhesive that had been used in the manufacture of the CLT floor/ceiling panel after exposure to high heat.
To address this test finding, revisions to the adhesive requirements in 2015 edition of ANSI/APA PRG 320, *Standard for Performance Rated Cross-Laminated Timber* were incorporated through the APA standards process. PRG 320-2015 is referenced in the IBC as the performance standard for CLT members. In the 2018 edition of PRG 320 the adhesives used for CLT panels are required to be evaluated and meet criteria in the Annex B of the Standard titled *Practice for Evaluating Elevated Temperature Performance of Adhesives Used in Cross-Laminated Timber.* However, those criteria are for the purpose of evaluating the performance of adhesives used in CLT exposed to heat and flame under controlled conditions (Section B1.4). The pass/fail criteria in Section B1.3 expect the CLT floor-ceiling slab to sustain the applied load during the specified fire exposure for a period of 240 minutes without char layer fall-off resulting in fire regrowth during the cooling phase of a fully developed fire .

While this testing may be sufficient to show that an adhesive would have prevented delamination for the specified time period, it does not in any way demonstrate that the adhesives are still capable of providing the long term structural performance after exposure to elevated temperatures experienced during a fire event. And, neither does ANSI 405, *Standard for Adhesives for Use in Structural Glue Laminated Timber*, which is referenced in PRG 320, address long-term performance of adhesives that have been subjected to fire exposure. Like PRG 320, Section 2.1.7 of ANSI 405 is intended to qualify adhesives according to the CSA 0177 small scale flame test to avoid delamination due to intensive heat, such as fire exposure (C2.1.7). No methodology has been provided that would allow for a comprehensive post-fire evaluation of the remaining structure.

Before the membership approves provisions for taller mass timber buildings the ICC TWB Committee should have the opportunity to perform their due diligence by a review of the long-term performance of adhesives that have been subjected to fire exposure. This is especially important for buildings that may be as tall as 18-stories.

Because of the need to study in more depth the long-term performance of adhesives that have been subjected to fire exposure, this proposal should be DISAPPROVED and sent back to the ICC TWB Committee to address this critical issue.

G108-18 should be disapproved because the long-term performance of adhesives used in the cross-laminated timber after exposure to fire have not been thoroughly examined. Presentations on the results of fire tests performed on CLT by the National Research Council of Canada for the National Fire Protection Research Foundation were given to the ICC TWB Committee. One of the areas of concern that showed up in Phase 2 of those tests was delamination of a CLT floor/ceiling panel during the cooldown period of a test which resulted in a regrowth of the fire within the compartment. The delamination was attributed to a bonding failure of the adhesive that had been used in the manufacture of the CLT floor/ceiling panel after exposure to high heat.

To address this test finding, revisions to the adhesive requirements in 2015 edition of ANSI/APA PRG 320, *Standard for Performance Rated Cross-Laminated Timber* were incorporated through the APA standards process. PRG 320-2015 is referenced in the IBC as the performance standard for CLT members. In the 2018 edition of PRG 320 the adhesives used for CLT panels are required to be evaluated and meet criteria in the Annex B of the Standard titled *Practice for Evaluating Elevated Temperature Performance of Adhesives Used in Cross-Laminated Timber.* However, those criteria are for the purpose of evaluating the performance of adhesives used in CLT exposed to heat and flame under controlled conditions (Section B1.4). The pass/fail criteria in Section B1.3 expect the CLT floor-ceiling slab to sustain the applied load during the specified fire exposure for a period of 240 minutes without char layer fall-off resulting in fire regrowth during the cooling phase of a fully developed fire .

While this testing may be sufficient to show that an adhesive would have prevented delamination for the specified time period, it does not in any way demonstrate that the adhesives are still capable of providing the long term structural performance after exposure to elevated temperatures experienced during a fire event. And, neither does ANSI 405, *Standard for Adhesives for Use in Structural Glue Laminated Timber*, which is referenced in PRG 320, address long-term performance of adhesives that have been subjected to fire exposure. Like PRG 320, Section 2.1.7 of ANSI 405 is intended to qualify adhesives according to the CSA 0177 small scale flame test to avoid delamination due to intensive heat, such as fire exposure (C2.1.7). No methodology has been provided that would allow for a comprehensive post-fire evaluation of the remaining structure.

Before the membership approves provisions for taller mass timber buildings the ICC TWB Committee should have the opportunity to perform their due diligence by a review of the long-term performance of adhesives that have been subjected to fire exposure. This is especially important for buildings that may be as tall as 18-stories.

Because of the need to study in more depth the long-term performance of adhesives that have been subjected to fire exposure, this proposal should be DISAPPROVED and sent back to the ICC TWB Committee to address this critical issue.

G108-18 should be disapproved because the long-term performance of adhesives used in the cross-laminated timber after exposure to fire have not been thoroughly examined. Presentations on the results of fire tests performed on CLT by the National Research Council of Canada for the National Fire Protection Research Foundation were given to the ICC TWB Committee. One of the areas of concern that showed up in Phase 2 of those tests was delamination of a CLT floor/ceiling panel during the cooldown period of a test which resulted in a regrowth of the fire within the compartment. The delamination was attributed to a bonding failure of the adhesive that had been used in the manufacture of the CLT floor/ceiling panel after exposure to high heat.

To address this test finding, revisions to the adhesive requirements in 2015 edition of ANSI/APA PRG 320, *Standard for Performance Rated Cross-Laminated Timber* were incorporated through the APA standards process. PRG 320-2015 is referenced in the IBC as the performance standard for CLT members. In the 2018 edition of PRG 320 the adhesives used for CLT panels are required to be evaluated and meet criteria in the Annex B of the Standard titled *Practice for Evaluating Elevated Temperature Performance of Adhesives Used in Cross-Laminated Timber.* However, those criteria are for the purpose of evaluating the performance of adhesives used in CLT exposed to heat and flame under controlled conditions (Section B1.4). The pass/fail criteria in Section B1.3 expect the CLT floor-ceiling slab to sustain the applied load during the specified fire exposure for a period of 240 minutes without char layer fall-off resulting in fire regrowth during the cooling phase of a fully developed fire .

While this testing may be sufficient to show that an adhesive would have prevented delamination for the specified time period, it does not in any way demonstrate that the adhesives are still capable of providing the long term structural performance after exposure to elevated temperatures experienced during a fire event. And, neither does ANSI 405, *Standard for Adhesives for Use in Structural Glue Laminated Timber*, which is referenced in PRG 320, address long-term performance of adhesives that have been subjected to fire exposure. Like PRG 320, Section 2.1.7 of ANSI 405 is intended to qualify adhesives according to the CSA 0177 small scale flame test to avoid delamination due to intensive heat, such as fire exposure (C2.1.7). No methodology has been provided that would allow for a comprehensive post-fire evaluation of the remaining structure.

Before the membership approves provisions for taller mass timber buildings the ICC TWB Committee should have the opportunity to perform their due diligence by a review of the long-term performance of adhesives that have been subjected to fire exposure. This is especially important for buildings that may be as tall as 18-stories.

Because of the need to study in more depth the long-term performance of adhesives that have been subjected to fire exposure, this proposal should be DISAPPROVED and sent back to the ICC TWB Committee to address this critical issue.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Using proper adhesives for long term resistance to the effects of fire are part of mass timber construction.

Public Comment 96:

Proponent: James Sorensen, representing Alberta Masonry Councilrequests Disapprove.

Commenter's Reason: Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel. Concrete products have a much longer lifespan, reduce insurance premiums and require less maintenance. It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements. Concrete products will also reduce the long term maintenance costs of buildings.

Public Comment 97:

Proponent: ALAN SPARKMAN, Tennessee Concrete Association, representing Tennessee Concrete Association, Executive Directorrequests Disapprove.

Commenter's Reason: There are a number of important reasons I am opposed:
There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.

• Allowing wood structures to be built above the level of fire department access is a serious mistake.

• Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non- combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.

• There has been no wind component involved in the fire testing of Mass Timber assemblies. This type of testing should be essential and required for any building system to be used at the heights anticipated in this proposal.

• It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and subsequent water damage and mold issues are likely to be significant.

• Neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes.

• Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.

• The behavior of CLT is completely dependent on the connections, and all connections used to date are proprietary. There is no publicly available information on their design or capacities, even for the Tall Wood AdHoc. There is no information on the performance of the proprietary connections during fires, and the performance of different systems and materials will have a significant impact on the performance of these buildings for fire as well as wind and earthquakes.

Bibliography: Satisfied

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 98:

Proponent: Malcolm Stolarski, representing calportlandrequests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake, because wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 99:

Proponent: Robert Sullivan, representing CEMEX, Inc. (robertl.sullivan@cemex.com)requests Disapprove.

Commenter's Reason: There is currently no complete testing or engineering justification for expanding the height limitation for mass timber from 6 stories to 18 stories.
Allowing wood structures to be built above the level of fire department access is a serious mistake for the following reasons:

1) Wood does not offer the resilience and fire protection of non-combustible alternatives like concrete and steel.

2) Cross-Laminated Timber chars in a fire; however, charring is not equivalent to non-combustible. Note: if the char rate is 1” per hour in a fire, then after 2 hours in a fire, a 6” thick CLT wood load bearing wall will only have 2” of structural material left. This is not acceptable and is not addressed in the code change proposals.

3) There has been no wind component involved in the fire testing of Mass Timber assemblies. This is a serious mistake. This type of testing is essential.

4) It is unknown what will happen to water that accumulates as a result of a fire sprinkler system discharge as a result of fire or accidental incident that opens a sprinkler head. The system has not been tested with the additional water load and what of the water damage and mold issues?

5) Most importantly, neither the Fire Code Action Committee nor the Building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Changes. Adhesives used between the layers of CLT have not been standardized and are key to whether the CLT delaminates during fire and continues to advance till complete burnout. A test standard for the adhesives has been proposed, but not fully vetted by the cognizant committees.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 100:

Proponent: LEE THOMPSON, CHAMPION CONCRETE PUMPING, representing PRESIDENTrequests Disapprove.

Commenter's Reason: Allowing wood structures to be built above the level of fire department access is a serious mistake. Neither the fire code action committee nor the building Code Action Committee voted to support this series of Tall Wood / Mass Timber Code Change.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 101:

Proponent: Patrick A. Thompson, Advanced Pumping LLC, representing Advanced Pumping LLC (pthompson@advancedpumping.net)requests Disapprove.

Commenter's Reason: Tall wood buildings are not safe. There is eminent risk to the lives of the occupants and first responders. Examples are the wood frame building that burned down in Mexico recently.
Wood does not offer the resilience and fire protection of steel or concrete, or fire proof coatings on steel. I would rather take my chances in a steel framed building, than a cross laminated wood framed building. Where is the proof that after the same length of time the cross laminated frame building would have the structural integrity for the first responders to make it in and out.

What happens when the fire starts at the lower floors and climbs up the building creating its own chimney affect. Or heaven forbid, the fire creates its own windstorm, and causes more oxygen to come in contact with the fuel "wood"???

How does someone verify the type of glue used in the lamination process will not add fuel to the fire???

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 102:

Proponent: Amy Vander Heyden, Conco, representing Concorequests Disapprove.

Commenter's Reason: As a licensed architect it is my professional obligation to protect the health, safety, and welfare of the public in buildings. I disapprove the proposed adoption of increased wood structures. There is insufficient testing and documentation that cross--laminated timber is sufficient in the event of a fire. Note the following:

- Charring is not equivalent to non-combustible so the dimensions of the timber would need to be significantly larger to compensate for required fire ratings.
- Missing testing and documentation of the wind component involved in fire testing
- Missing testing and documentation of the accumulation of water loads from sprinklers and long term mold risk during a rebuild.
- Neither the Fire Code Action Committee nor the Building Code Action Committee supported these changes.
- Incomplete testing, documentation, and regulation of the adhesives used within the layers of CLT
- Missing standardization, documentation, and legislation of connection details for which the structural integrity of the building is contingent.

Proceeding with this initiative is irresponsible and puts the public at unnecessary risk.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this code change proposal will not increase or decrease the cost of construction. This proposed section provides the information that was not previously set forth in the code, thus there is no cost impact when compared with present requirements.

Public Comment 103:

Proponent: Dan Nichols, representing ICC Code Correlation Committee (ccc@iccsafe.org).

Commenter's Reason: The Code Correlation Committee (CCC) is not taking a position on this code change. The CCC submitted this public comment in order to bring a correlation issue to the attention of the full voting membership for the Public Comment Hearings and the Online Governmental Consensus Vote to allow the voting membership to coordinate actions on a package of code changes submitted dealing with tall wood buildings of mass timber construction. This package includes the parent proposal G108-18; if disapproved, the related proposals G28-18, G75-18, G80-18, G84-18, G89-18, FS5-18, FS6-18, FS73-18, FS81-18 and F266-18, will not be correlated with any existing code text if they are approved.
The Code Correlation Committee is a standing committee of the International Code Council whose objectives, procedures and organization are set forth in Council Policy CP#44-13. The objective of the Code Correlation Committee is to maintain technical and editorial consistency among the International Codes and to assist staff in the evaluation and processing of code change proposals and comments that are exclusively editorial.

G108-18

G113-18

IBC: 603.1

Proposed Change as Submitted

Proponent: John Williams, Chair, representing Healthcare Committee (AHC@iccsafe.org)

2018 International Building Code

Revise as follows

603.1 Allowable materials. Combustible materials shall be permitted in buildings of Type I or II construction in the following applications and in accordance with Sections 603.1.1 through 603.1.3:

1. *Fire-retardant-treated wood* shall be permitted in:

    1.1. Nonbearing partitions where the required *fire-resistance rating* is 2 hours or less.
    1.2. Nonbearing *exterior walls* where fire-resistance-rated construction is not required.
    1.3. Roof construction, including girders, trusses, framing and decking.

    ~~Exception~~ Exceptions:

    1. In buildings of Type IA construction exceeding two *stories above grade plane*, *fire-retardant-treated wood* is not permitted in roof construction where the vertical distance from the upper floor to the roof is less than 20 feet (6096 mm).
    2. Group I-2, combustible roof construction shall be covered by minimum of a Class A roof covering or roof assembly, and shall be separated from the story below by a horizontal assembly with a fire-resistance rating of not less than 2 hours.

    1.4. Balconies, porches, decks and exterior stairways not used as required exits on buildings three *stories* or less above grade plane.
2. Thermal and acoustical insulation, other than foam plastics, having a *flame spread index* of not more than 25.

    Exceptions:

    1. Insulation placed between two layers of noncombustible materials without an intervening airspace shall be allowed to have a *flame spread index* of not more than 100.
    2. Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a *flame spread index* of not more than 200.

3. Foam plastics in accordance with Chapter 26.
4. Roof coverings that have an A, B or C classification.
5. *Interior floor finish* and floor covering materials installed in accordance with Section 804.
6. Millwork such as doors, door frames, window sashes and frames.
7. *Interior wall and ceiling finishes* installed in accordance with Section 803.
8. *Trim* installed in accordance with Section 806.
9. Where not installed greater than 15 feet (4572 mm) above grade, show windows, nailing or furring strips and wooden bulkheads below show windows, including their frames, aprons and show cases.
10. Finish flooring installed in accordance with Section 805.
11. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and that do not establish a *corridor* serving an *occupant load* of 30 or more shall be permitted to be constructed of *fire-retardant-treated* wood, 1-hour fire-resistance-rated construction or of wood panels or similar light construction up to 6 feet (1829 mm) in height.
12. Stages and platforms constructed in accordance with Sections 410.2 and 410.3, respectively.
13. Combustible *exterior wall coverings*, balconies and similar projections and bay or oriel windows in accordance with Chapter 14 and Section 705.2.3.1.
14. Blocking such as for handrails, millwork, cabinets and window and door frames.
15. Light-transmitting plastics as permitted by Chapter 26.
16. Mastics and caulking materials applied to provide flexible seals between components of *exterior wall* construction.
17. Exterior plastic veneer installed in accordance with Section 2605.2.
18. Nailing or furring strips as permitted by Section 803.15.
19. Heavy timber as permitted by Note c to Table 601 and Sections 602.4.3 and 705.2.3.1.
20. Aggregates, component materials and admixtures as permitted by Section 703.2.2.
21. Sprayed fire-resistant materials and intumescent and mastic fire-resistant coatings, determined on the basis of *fire resistance* tests in accordance with Section 703.2 and installed in accordance with Sections 1705.14 and 1705.15, respectively.
22. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with Section 714.
23. Materials used to protect joints in fire-resistance-rated assemblies in accordance with Section 715.
24. Materials allowed in the concealed spaces of buildings of Types I and II construction in accordance with Section 718.5.
25. Materials exposed within plenums complying with Section 602 of the International Mechanical Code.
26. Wall construction of freezers and coolers of less than 1,000 square feet (92.9 m^2), in size, lined on both sides with noncombustible materials and the building is protected throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

Reason: This proposal creates conformance with more restrictive federal certification requirements (K162). The goal here is to create a complete two hour assembly below the lowest combustible member. This creates added layers of

protection for protect in place environment from fires originating in mechanical equipment, embers from adjacent fires, etc.
This proposal is submitted by the ICC Committee on Healthcare (CHC). The CHC was established by the ICC Board to evaluate and assess contemporary code issues relating to healthcare facilities. This is a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. In 2017 the CHC held 2 open meetings and numerous conference calls, *which included members of the committees as well as any interested parties, to discuss and debate the proposed changes*. Information on the CHC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CHC effort can be downloaded from the CHC website at: https://www.iccsafe.org/codes-tech-support/cs/icc-committee-on-healthcare/.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase cost based on the added 2-hour horizontal separation and potentially higher roof cover rating. However, it does not add cost to the healthcare industry because certified facilities already follow these requirements in the context of the CMS federal standards.

G113-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: NFPA 101 requirements of 2012 would allow this material. There should be a public comment on this that fixes the threshold. (Vote: 10-4)

Assembly Action: **None**

G113-18

Individual Consideration Agenda

Public Comment 1:

Proponent: John Williams, representing Healthcare Committee (ahc@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

603.1 Allowable materials. Combustible materials shall be permitted in buildings of Type I or II construction in the following applications and in accordance with Sections 603.1.1 through 603.1.3:

1. *Fire-retardant-treated wood* shall be permitted in:

   1.1. Nonbearing partitions where the required *fire-resistance rating* is 2 hours or less.
   1.2. Nonbearing *exterior walls* where fire-resistance-rated construction is not required.
   1.3. Roof construction, including girders, trusses, framing and decking.

   Exceptions:

   1. In buildings of Type IA construction exceeding two *stories above grade plane*, *fire-retardant-treated wood* is not permitted in roof construction where the vertical distance from the upper floor to the roof is less than 20 feet (6096 mm).
   2. Group I-2, ~~combustible~~ roof construction <u>containing fire-retardant-treated-wood</u> shall be covered by minimum of a Class A roof covering or roof assembly, and ~~shall be separated from the story below by a horizontal assembly with~~ <u>the roof assembly shall have</u> a fire-resistance rating ~~of not less than 2 hours~~<u>if required by the construction type</u>.

   1.4. Balconies, porches, decks and exterior stairways not used as required exits on buildings three *stories* or less above grade plane.

2. Thermal and acoustical insulation, other than foam plastics, having a *flame spread index* of not more than 25.

   Exceptions:

   1. Insulation placed between two layers of noncombustible materials without an intervening airspace shall be allowed to have a *flame spread index* of not more than 100.
   2. Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a *flame spread index* of not more than 200.

3. Foam plastics in accordance with Chapter 26.
4. Roof coverings that have an A, B or C classification.
5. *Interior floor finish* and floor covering materials installed in accordance with Section 804.
6. Millwork such as doors, door frames, window sashes and frames.
7. *Interior wall and ceiling finishes* installed in accordance with Section 803.
8. *Trim* installed in accordance with Section 806.
9. Where not installed greater than 15 feet (4572 mm) above grade, show windows, nailing or furring strips and wooden bulkheads below show windows, including their frames, aprons and show cases.
10. Finish flooring installed in accordance with Section 805.
11. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and that do not establish a *corridor* serving an *occupant load* of 30 or more shall be permitted to be constructed of *fire-retardant-treated* wood, 1-hour fire-resistance-rated construction or of wood panels or similar light construction up to 6 feet (1829 mm) in height.
12. Stages and platforms constructed in accordance with Sections 410.2 and 410.3, respectively.
13. Combustible *exterior wall coverings*, balconies and similar projections and bay or oriel windows in accordance with Chapter 14 and Section 705.2.3.1.
14. Blocking such as for handrails, millwork, cabinets and window and door frames.
15. Light-transmitting plastics as permitted by Chapter 26.
16. Mastics and caulking materials applied to provide flexible seals between components of *exterior wall* construction.
17. Exterior plastic veneer installed in accordance with Section 2605.2.
18. Nailing or furring strips as permitted by Section 803.15.
19. Heavy timber as permitted by Note c to Table 601 and Sections 602.4.3 and 705.2.3.1.
20. Aggregates, component materials and admixtures as permitted by Section 703.2.2.
21. Sprayed fire-resistant materials and intumescent and mastic fire-resistant coatings, determined on the basis of *fire resistance* tests in accordance with Section 703.2 and installed in accordance with Sections 1705.14 and 1705.15, respectively.
22. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with Section 714.
23. Materials used to protect joints in fire-resistance-rated assemblies in accordance with Section 715.
24. Materials allowed in the concealed spaces of buildings of Types I and II construction in accordance with Section 718.5.
25. Materials exposed within plenums complying with Section 602 of the International Mechanical Code.
26. Wall construction of freezers and coolers of less than 1,000 square feet (92.9 m^2), in size, lined on both sides with noncombustible materials and the building is protected throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

Commenter's Reason: The committee correctly disapproved the proposed language, which was intended to cover non-fire retardant treated wood. In its current location, the proposal outlines what is required for FRT. There is a federal requirement that the roofs be covered with a class A rated roof, and that is reflected here. It also reminds the user to ensure that if the construction type requires a fire rated assembly, then roof assembly that contains the FRT must meet this rating.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction This proposal will increase cost based on the potentially higher roof cover rating. However, it does not add cost to the healthcare industry because certified facilities already follow these requirements in the context of the CMS federal standards.

G113-18

G121-18

IBC: 1204.1

Proposed Change as Submitted

Proponent: Peter Valkov, City of Fargo, ND, representing City of Fargo, North Dakota (pvalkov@cityoffargo.com); Christine Rose, City of Fargo, representing City of Fargo (crose@cityoffargo.com)

2018 International Building Code

Revise as follows

1204.1 General. Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with Section 1204.2 or shall be provided with artificial light in accordance with Section 1204.3. Exterior glazed openings shall open directly onto a *public way* or onto a *yard* or *court* in accordance with Section 1205.
<u>In Group E and I-4 occupancies, rooms intended to be used as classrooms or day care rooms shall be provided with natural light. Artificial light shall not be substituted for such required natural light.</u>

Reason: I am driven to propose this change on behalf of all little members of our society who cannot propose this change themselves.
Through my profession, I am reviewing many day care and school plans. Every time I see a classroom without windows, every time I see day care using an old building purposed for store or storage and hastily re-purposed for day care without any regard for the need of natural light (and this happens too often), I feel extremely sad. I am also very concerned that we as a society force <u>our kids</u> to places that have no natural light. We force them as they do not have choice, or say, or option to make a decision.

Researching the importance of natural light for the health and the intellectual development in little children gives me hope such a change is more than needed and possible, it is long overdue.

Having discussed my idea with colleagues in the City of Fargo and design professionals from the area also provided me with positive feedback. Architects, I have spoken to, also confirmed this change is possible from a design standpoint and it won't provide burden on the schools and day care facilities alike.

Therefore, today, I state my hope this change is made integral part of the building code as a part of our constant quest for healthier and safer buildings. Buildings that promote better and more natural environment for those amongst us that need it the most!

Bibliography: 1. http://www.bristolite.com/blog/natural-light-and-education-the-benefits-of-daylighting-for-schools-and-colleg
2. https://www.corbettinc.com/blog/2017/4/26/our-top-3-reasons-natural-light-benefits-students-schools

3. https://www.aia.org/articles/19541-six-design-decisions-that-will-entice-client:31

4. https://www.aia.org/press-releases/80866-aia-selects-2016-upjohn-research-initiative-

5. http://www.healthyschools.org/downloads/Daylighting.pdf

6. https://globaldigitalcitizen.org/healthy-classrooms-infographic

7. http://www.sunlightinside.com/light-and-health/natural-light-improves-student-performance/

8. https://aiau.aia.org/courses/aia2030-online-series-course-6-daylighting-and-integrated-lighting-design

9. https://www.google.com/search?
safe=strict&biw=1381&bih=796&tbm=isch&sa=1&ei=aPlTWsilMqucjwTa5bHoCg&q=natural+light+schools&oq=natural+light
ab.3...33783.35478.0.36292.6.5.1.0.0.0.96.419.5.5.0....0...1c.1.64.psy-ab..0.0.0....0.EFczITCz0e8

10. Bellia, L., A. Pedace, and G. Barbato, “Lighting in Educational Environments: An Example of A Complete Analysis of The E
Daylighting and Electric Light on Occupants.” Building and Environment 68 (2013): 50-65

11. Day, Christopher, and Anita Midjber. Environment and Children: Passive Lessons From the Everyday Environment. Oxfor
Press, 2007.

12. Demir, Ayse. “Impact of Daylighting on Student and Teacher Performance.” Journal of Educational Instructional Studies in
(2013)

13. Heschong, Lisa, Roger L. Wright, and Stacia Okura. “Daylighting Impacts on Human Performance in School.” Journal of the
Engineering Society 31, no.2 (2002): 101-114.

http://www.tandfonline.com/doi/pdf/10.1080/00994480.2002.10748396#.UokrsG TF2TI.

14. https://www.corbettinc.com/blog/2017/4/26/our-top-3-reasons-natural-light-benefits-students-schools

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The need and requirement for windows is already a part of the International Building Code. Therefore, I do not foresee any changes in construction cost as a result from such a change.

G121-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: While the committee understands the concerns addressed by the proposal, many start up schools begin in the basement of a facility which often are already provided with sprinkler systems and code compliant egress facilities to make the building safe. This proposal would be too limiting regarding the types of spaces that could be used for such start up schools. Furthermore, many classrooms are not on an outside wall and may not have the oportunity to install skylights. If the proponent returns with a public comment, the committee also recommends that the proposed modifications be considered. The proponent mentioned existing buildings, which should be addressed in the International Existing Bulding Code. (Vote: 14-0)

Assembly Action: **None**

G121-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Tom Zaremba, representing Glazing Industry Code Committee requests As Submitted.

Commenter's Reason: This is the first Code cycle for this laudable Proposal. The original Proponent did an excellent job of substantiating the health and environmental benefits of natural light, particularly for children whose brains and emotional habits are still developing and who are required to be in school or in day care during long portions of the daylight hours they experience throughout their most formative years. The importance of natural light to human health is quickly moving from research to building design, and its importance cannot responsibly be ignored.
The Committee viewed the Proposal's purpose favorably and did not dispute these benefits. However, it disapproved the Proposal out of concern it would impose a barrier to starting schools and day care centers in Church basements and similar existing buildings, either by making them too expensive to retrofit or by preventing them entirely.

However, under IBC Sections 305.1.1 and 303.1.4, educational rooms accessory to places of worship with occupant loads < 100 per room (which includes virtually all educational rooms in these types of facilities) are not considered separate occupancies. Similarly, under IBC Section 305.2.1 and 305.2.2, rooms in religious facilities providing day care (which includes educational, supervision or personal care services) during services or for 5 or fewer children also remain as part of the Group A-3 Occupancy. In both situations relating to religious facilities, the educational or day care rooms would not change from Group A-3 so this Proposal would not affect them.

The Committee was also concerned that some classrooms are not on exterior walls or under roofs so as to permit skylights. However, Section 1204.2.1 permits such rooms to use natural light from adjoining spaces to meet the natural light requirements of the Code. It is already common for interior rooms have wall window and door lites that allow in light from corridors and social spaces along exterior walls.

We recognize the Proposal might benefit from modified language, either in this Cycle or the next, but the issue is too important to abandon without further discussion. The importance of natural light to human health is moving from research to building design practice, and it is time to recognize its importance by including it in these IBC occupancies. Since the *new* education and institutional day care facilities being built today will affect the health and welfare of our children for decades to come, this Proposal will ensure that our school children will benefit from natural lighting for years to come.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The additional requirements could add design costs to the cost of construction

G121-18

G122-18

IBC: 1206.1

Proposed Change as Submitted

Proponent: Lee Kranz, representing Washington Association of Building Officials Technical Code Development Committee (lkranz@bellevuewa.gov)

2018 International Building Code

Revise as follows

1206.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent *dwelling units* and *sleeping units* or between *dwelling units* and *sleeping units* and adjacent public areas. ~~such as halls, *corridors*, *stairways* or *service areas*.~~

Reason: There are building designs where a dwelling unit or sleeping unit in a mixed occupancy building may be adjacent to a commercial space where airborne and structure-borne sound is significant and may interrupt the occupants of the dwelling or sleeping unit unless the common interior walls, partitions and floor/ceiling assemblies are designed to limit sound transmissions to an acceptable level. This proposal deletes the examples currently listed at the end of Section 1206.1 which effectively broadens the scope of uses where sound abatement requirements can be enforced and provides the building official with authority to require sound abatement when appropriate. Occupants of the affected dwelling units and sleeping units may not realize that additional sound abatement has been provided but the quality of their lives will improve as a result.

Cost Impact: The code change proposal will increase the cost of construction
This code change has the potential to increase the cost of construction because there may be a need to provide sound abatement between dwelling units or sleeping units and adjacent public areas.

G122-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is not an expansion of the scope of this provision. It is a clarification. This is not limited to the areas that have been stricken. It includes public areas "such as," meaning many other things. Chapter 12 is interior environment. Exterior building features are not addressed in Chapter 12. (Vote: 8-7)

Assembly Action: **None**

G122-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org)requests Disapprove.

Commenter's Reason: The intent of the original proposal, as described in the reason statement, is to expand the sound transmission requirements in order to provide sound abatement between dwelling or sleeping units that are adjacent to commercial spaces in a mixed occupancy building. It removes the examples of public areas, providing the building official the authority to determine when sound abatement is appropriate between dwelling units and public areas. The IBC des not define "Public Areas". The IBC does, however, define "Public-Use Areas" and "Public Entrance". Any common area within a residential building (i.e. fitness room, library, party room) that is only accessible to building tenants and their guests is not a "Public Area". This would include corridors and stairways that can only be accessed by tenants and their guests in a secured building.

As stated in the proposal, the intent is to broaden the scope of uses where sound abatement requirements can be enforced, effectively providing the building official the authority to define what a "Public Area" is. However, the proposal may end up reducing the areas where sound abatement is required since "Public Areas" is not defined in the IBC. Furthermore, since "Service Areas" was removed from the list of examples of a public area, it would remove the need to provide sound abatement between dwelling units and these types of spaces. "Service Area" is a defined term in the IBC.

The proposed changes to this section of the IBC would make it difficult to consistently determine and enforce which common interior walls and partitions and floor/ceiling assemblies require sound transmission ratings. "Public Areas" is a term that is broad and debatable.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
Will not increase the cost of construction compared to current code.

G122-18

G124-18

IBC: 1206.2

Proposed Change as Submitted

Proponent: Michael Schmeida, Gypsum Association, representing Gypsum Association (mschmeida@gypsum.org)

2018 International Building Code

Revise as follows

1206.2 Airborne sound. Walls, partitions and floor-ceiling assemblies separating *dwelling units* and *sleeping units* from each other or from public or service areas shall have a sound transmission class of not less than 50, or not less than 45 if field tested, for airborne noise where tested in accordance with ASTM E90. Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by <u>an</u> engineering analysis <u>either conducted or reviewed by an approved acoustical professional</u> based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

Reason: There are several engineering analysis tools for sound performance on the market. However, if the design professional is unfamiliar with acoustical engineering, they can be very misleading and therefore lead to a building performing under the expected performance levels. And as acoustical considerations are something most design professionals are not very familiar with at this point in time, the opportunity for error is above average. This change is intended to make sure that systems specified using the engineering analysis option are properly scrutinized by experts in acoustics and therefore are most likely going to perform as expected.

Cost Impact: The code change proposal will increase the cost of construction
The estimated cost impact would be $500. However, it should be pointed out that the engineering analysis is an option – there are other ways to meet the criteria of this section already mandated by the code where no additional cost would be incurred.

G124-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This would put a burden on the code official. There is a lack of certification for this. It could be in conflict with 1206.2 and 1206.3. A professional engineer can do this. (Vote: 14-0)

Assembly Action: **None**

G124-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Matthew Golden, Pliteq, representing Pliteq, Director of Research (mgolden@pliteq.com); Joseph Bridger (joe@sacnc.com)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

1206.2 Airborne sound. Walls, partitions and floor-ceiling assemblies separating *dwelling units* and *sleeping units* from each other or from public or service areas shall have a sound transmission class of not less than 50, or not less than 45 if field tested, for airborne noise where tested in accordance with ASTM E90. ~~Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90.~~ Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

Commenter's Reason: The current code change request was designed to fix an issue that was created with the previous cycle s change to this section (2018). That previous change added the following sentence to 1206.2: Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90.

There are two main issues with this language. The first is that there is no industry-agreed-upon method or approved standard to conduct this analysis. The referenced ASTM standard (E90) is only for measurements; it does not address extrapolation or interpolation of measured data to make judgments about other untested assemblies.

The second is with regard to who is qualified to conduct this analysis. Building acoustics is a small and specialized field. Unfortunately, there are professionals who believe that they know acoustics sufficiently to make these judgments who do not. Further, there is no current licensure for acoustical engineering, anyone can claim to be an expert in the field. (There has been a Professional Engineering in Acoustics available in Oregon but it is not longer offered. The Institute of Noise Control Engineering (INCE) has a Board Certification in Noise Control Engineering but it is not a licensure) Since it is a specialized field, even engineers licensed in other fields will generally not have adequate knowledge to determine acoustical performance of an untested assembly. Inaccurate judgments have been submitted and approved as code officials generally do not have sufficient acoustical expertise to determine if they are inaccurate. As a result, the committee s concern of burdening the code officials with the proposed change is already an existing reality under the 2018 code language.

Understanding the Committee s concerns with the proposed code modification, this revised modification is now proposed to address both the committee s concerns and the problems that have been occurring under the 2018 code. We propose to revert to the 2015 language by deleting the sentence until an appropriate licensure is established. This alleviates the burden on the code officials that currently exists without adding the burden of determining who is or is not qualified to make the judgment.

Bibliography: ASTM Standard E90, 2009 (2016). Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements, ASTM International, West Conshohocken, PA, 2009, DOI: 10.1520/E0090-09R16, www.astm.org.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The code change has no financial impact.

Public Comment 2:

Proponent: Samantha Rawlings, Veneklasen Associates, representing Veneklasen Associates (srawlings@veneklasen.com)requests As Modified by This Public Comment.

Replace as follows:

2018 International Building Code

1206.2 Airborne sound. Walls, partitions and floor-ceiling assemblies separating *dwelling units* and *sleeping units* from each other or from public or service areas shall have a sound transmission class of not less than 50, or not less than 45 if field tested, for airborne noise where tested in accordance with ASTM E90. ~~Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90.~~ Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

1206.3 Structure-borne sound. Floor-ceiling assemblies between *dwelling units* and *sleeping units* or between a *dwelling unit* or *sleeping unit* and a public or service area within the structure shall have an impact insulation class rating of not less than 50, or not less than 45 if field tested, where tested in accordance with ASTM E492. ~~Alternatively, the impact insulation class of floor-ceiling assemblies shall be established by engineering analysis based on a comparison of floor-ceiling assemblies having impact insulation class ratings as determined by the test procedures in ASTM E492.~~

Commenter's Reason: The current code change request was designed to fix an issue that was created with the previous cycle s change to this section (2018). That previous change added the following sentence to 1206.2 and a similar sentence to 1206.3:
Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90.

The issue with this section is that there is no industry-agreed-upon method or approved standard to conduct this analysis. The referenced ASTM standards (E90 for 1206.2 and E492 for 1206.3) are for measurements only; they do not address extrapolation or interpolation of measured data to make judgments about other untested assemblies. Further, there are professionals who believe that they know acoustics sufficiently to make these judgments who do not. Since there is no licensure for acoustical engineering, anyone can claim to be an expert in the field. Further, it is a specialized field that even engineers licensed in other fields will generally not have adequate knowledge to determine acoustical performance of an untested assembly. Inaccurate judgments have been submitted and approved as code officials generally do not have sufficient acoustical expertise to determine if they are inaccurate. As a result, the committee s concern of burdening the code officials with the proposed change is already an existing reality under the 2018 code language.

Understanding the Committee s concerns with the proposed code modification, this revised modification is now proposed to address both the committee s concerns and the problems that have been occurring under the 2018 code. We propose to revert to the 2015 language by deleting the sentences. This alleviates the burden on the code officials that currently exists without adding the burden of determining who is or is not qualified to make the judgment. It also eliminates the potential conflict with 1206.3, by making the same changes to 1206.2 and 1206.3.

Bibliography: ASTM Standard E90, 2009 (2016). Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements, ASTM International, West Conshohocken, PA, 2009, DOI: 10.1520/E0090-09R16, www.astm.org.
ASTM Standard E492, 2009 (2016). Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine, ASTM International, West Conshohocken, PA 2009, DOI: 10.1520/E0492-09R16E01

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The code change has no financial impact.

G124-18

G125-18

IBC: 1206.2, Chapter 35

Proposed Change as Submitted

Proponent: Michael Schmeida, representing Gypsum Association (mschmeida@gypsum.org)

2018 International Building Code

Revise as follows

1206.2 Airborne sound. Walls, partitions and floor-ceiling assemblies separating *dwelling units* and *sleeping units* from each other or from public or service areas shall have a sound transmission class of not less than 50, or not less than 45 if field tested, for airborne noise where tested in accordance with ASTM E90. Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. <u>Intersections between walls and floors and wall-to-wall intersections shall be sealed or otherwise treated in accordance to ASTM C919.</u> This requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

Add new standard(s) follows

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959
US

<u>C919-12(2017)</u>:

<u>Standard Practice for Use of Sealants in Acoustical Applications</u>

Reason: This change addresses sound flanking paths not previously addressed, requiring intersections to be sealed. If unsealed, these paths can reduce the effectiveness of walls by at least 5 STC points versus the tested systems. A differential of 3 STC points becomes perceptible by humans and 5 points is the threshold at which it becomes a nuisance. Sound intrusion via these unsealed intersections can cause noticeable deterioration in sound isolation performance.

Nuisance noise has a measurable impact on human health. A report by the World Health Organization on noise effects and morbidity linked "noise annoyance" (as it was called in the report) to increased risk for several health issues including arthritic symptoms, hypertension, and migraines.

The code already contains requirements for sound transmission, but by not addressing intersections, it leaves a sound transmission path which can negate the effects of other measures taken to reduce sound transmission.

The handbook of sound engineers states that "an acoustical sealant is required to caulk all joints of a partition if the highest TL (transmission loss) is to be attained."

This simple and relatively inexpensive step will ensure sound transmission performance in actual installations lives up to the expectations set by laboratory testing.

Bibliography: WHO LARES Final Report, Noise Effects on Morbidity, Niemann and Maschke, Berlin Center for Public Health

Handbook for Sound Engineers, Jones, D. (2008), pp. 77-78

Noise Control Manual for Residential Buildings, Harris, D.A., (1997), pp. 73-76.

Cost Impact: The code change proposal will increase the cost of construction
This proposal is estimated to add approximately $20 per room requiring sealing to construction costs, for sealant and labor.

Analysis: A review of the standard proposed for inclusion in the code, ASTM C919-12(2017), with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proponent asked for disapproval. The increased cost could be a concern. (Vote: 13-1)

Assembly Action: **None**

G125-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Tim Earl, representing The Gypsum Association (tearl@gbhinternational.com)requests As Modified by This Public Comment.

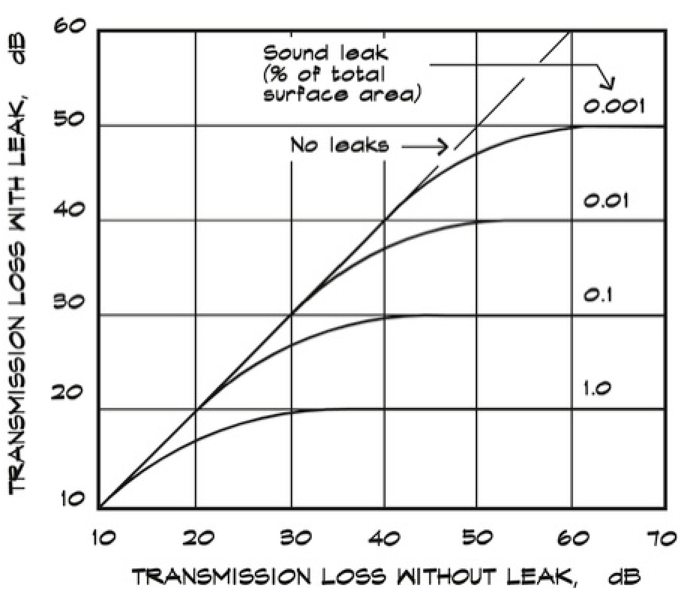
Modify as follows:

2018 International Building Code

1206.2 Airborne sound. Walls, partitions and floor-ceiling assemblies separating *dwelling units* and *sleeping units* from each other or from public or service areas shall have a sound transmission class of not less than 50, or not less than 45 if field tested, for airborne noise where tested in accordance with ASTM E90. Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. ~~Intersections~~ All intersections between ~~walls and floors and wall-to-wall~~ wall-to-wall and wall-to-ceiling assemblies shall be either treated with joint compound and joint tape in accordance with ASTM C840 or sealed in accordance with sections 7 and 8 of ASTM C919. All floor-to-wall assembly intersections shall be sealed ~~or otherwise treated~~ in accordance ~~to ASTM C919. This~~ with sections 7 and 8 of ASTM C919. This requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

Commenter's Reason: The proponent asked for disapproval of the original proposal at Committee Action Hearings in order to provide a better proposal that was both more accurate and in line with current practices.
Work has shown that flanking from improperly treated joints can reduce the sound performance as demonstrated in the figure from Long, Marshall. *Architectural Acoustics, 2nd Edition*. Academic Press, 02/2014.

Composite transmission loss of a leaky panel as a function of the total precentage of leaks (Reynolds, 1981)



The code already addresses many of the other major sources of flanking, not having back-to-back outlet boxes as an example, but it does not address joints of partitions. As the figure shows, reducing the leakage by a factor of 10 improves performance by approximately 10dB. 3dB to 5dB is perceptible and 10 dB roughly reflects a doubling in performance. Even going from 1/100 of the wall leaking to 1/10,000 improves performance.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The expected cost of doing this with sealants alone would be approximately $20/room, based on the estimate of one quart tube of acoustical caulk needed per room to seal the top and bottom and the few minutes to do it, assuming two of the walls need sealed. Since the tape and mud method is already done in the installation of drywall, those wall to wall, wall to floor, and wall to ceiling intersections not typically sealed and would not result in any added substantial cost – in most cases a couple of dollars or less, based on an estimate of an additional 10 feet of joints per room needing to be sealed.

G125-18

G130-18 Part II

IPMC: 404.6

Proposed Change as Submitted

Proponent: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Property Maintenance Code

Revise as follows

404.6 Efficiency unit. Nothing in this section shall prohibit an efficiency ~~living~~ dwelling unit from meeting the following requirements:

1. A unit occupied by not more than one occupant shall have a minimum clear floor area of 120 square feet (11.2 m^2). A unit occupied by not more than two *occupants* shall have a minimum clear floor area of ~~220~~ 190 square feet (~~20.4~~ 17.6 m^2). A unit occupied by three *occupants* shall have a minimum clear floor area of ~~320~~ 260 square feet (~~29.7~~ 24.1 m^2). These required areas shall be exclusive of the areas required by Items 2 and 3.
2. The unit shall be provided with a kitchen sink, cooking appliance and refrigeration facilities, each having a minimum clear working space of ~~30~~ 40 inches (~~762~~ 990 mm) in front. Light and *ventilation* conforming to this code shall be provided.

   Exception: Dwelling units not required to be Accessible units, Type A units and Type B units shall have a clear working space of not less than 30 inches (762 mm) in front of the kitchen sink, cooking appliacne and refrigerator.
3. The unit shall be provided with a separate *bathroom* containing a water closet, lavatory and bathtub or shower.
4. The maximum number of *occupants* shall be three.

Reason:

Cost Impact: The code change proposal will decrease the cost of construction

G130-18 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Referencing accessible units in the IPMC will cause confusion as most property maintenance inspectors can not be expected to identify accessible units and therefore may misapply the provisions. (Vote: 7-2)

Assembly Action: **None**

G130-18 Part II

Individual Consideration Agenda

Public Comment 1:

Proponent: Ed Kullik, representing ICC Building Code Action Committee (bcac@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Property Maintenance Code

404.6 Efficiency unit. Nothing in this section shall prohibit an efficiency dwelling unit from meeting the following requirements:

1. A unit occupied by not more than one occupant shall have a minimum clear floor area of 120 square feet (11.2 m^2). A unit occupied by not more than two *occupants* shall have a minimum clear floor area of 190 square feet (17.6 m^2). A unit occupied by three *occupants* shall have a minimum clear floor area of 260 square feet (24.1 m^2). These required areas shall be exclusive of the areas required by Items 2 and 3.
2. The unit shall be provided with a kitchen sink, cooking appliance and refrigeration facilities, each having a minimum clear working space of ~~40~~ 30 inches (~~990~~ 762 mm) in front. Light and *ventilation* conforming to this code shall be provided~~.~~

   ~~**Exception:** Dwelling units not required to be Accessible units, Type A units and Type B units shall have a clear working space of not less than 30 inches (762 mm) in front of the kitchen sink, cooking appliacne and refrigerator~~.
3. The unit shall be provided with a separate *bathroom* containing a water closet, lavatory and bathtub or shower.
4. The maximum number of *occupants* shall be three.

Commenter's Reason: This public comment restores the minimum clear working space in front of the kitchen facilities in an efficiency unit to 30 inches and deletes the exception that refers to Accessible units, Type A units and Type B units. The 40 inch clearance is required for a new building constructed in accordance with the IBC and the A117.1 standard, but is not necessarily required for an existing building. For an existing building, increasing the clear working space to 40 inches would only be required if the unit were altered or added to. Ordinary maintenance and repairs would not trigger a need to bring the clear working space into compliance.

The typical activity that would be required of a tenant or owner cited under the IPMC to bring the unit up to minimum health and safety standards is most likely the repair or replacement of a non-working appliance, or the repair or replacement of deteriorated floor, wall or ceiling finishes. The IPMC in turn requires such work (or any other work to correct conditions cited by the property maintenance inspector) to be in accordance with the IEBC. Unless the work was extensive enough to qualify as a Level 2 Alteration under the IEBC, an upgrade for accessibility would not be required. If such a level of work is needed, the IEBC would likely require the owner or their authorized agent (e.g. architect, contractor or other professional hired by the owner) to apply for a building permit and submit construction documents. Presumably, either the owner s authorized agent or the building official would catch the need to increase the clear working space.

The primary reason the IPMC committee voted to disapprove G130, Part II was over concerns the typical property maintenance inspector would not necessarily be familiar with ICC A117.1, ADA or the Fair Housing Act Design Guidelines, and therefore not know what Accessible Units, Type A units and Type B units are. The BCAC agrees with the committee that it isn t necessary for the property maintenance inspector to know when the clearance needs to be increased, as that would be triggered by work done under the IEBC and reviewed by the building department, and has removed the language of concern. As there were no other objections to the proposal, the BCAC asks the Committee Action of Disapprove be overturned and this Public Comment be considered.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of the public comment and code change proposal will not increase or decrease the cost of construction because the resulting change is simply to allow smaller areas for efficiency units.

G130-18 Part II

NOTE: G130-18 Part I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

G130-18 Part I

IBC: 1207.4

Proposed Change as Submitted

Proponent: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE GENERAL CODE DEVELOPMENT COMMITTEE. PART II WILL BE HEARD BY THE PROPERTY MAINTENANCE CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

2018 International Building Code

Revise as follows

1207.4 Efficiency dwelling units. An efficiency ~~living~~ dwelling unit shall conform to the requirements of the code except as modified herein:

1. The unit shall have a living room of not less than ~~220~~ 190 square feet (~~20.4~~ 17.6 m^2) of floor area. An additional ~~100~~ 70 square feet (~~9.3~~ 6.5 m^2) of floor area shall be provided for each occupant of such unit in excess of two.
2. The unit shall be provided with a separate closet.
3. ~~The~~ For other than Accessible, Type A and Type B dwelling units, the unit shall be provided with a kitchen sink, cooking appliance and ~~refrigeration facilities~~refrigerator, each having a clear working space of not less than 30 inches (762 mm) in front. Light and *ventilation* conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

Reason: The market is trending toward smaller living areas in multi-family R-2 structures particularly in urban areas. US Census statistics show that in 2000, app. 46,000 rental units built were less than 1,000 sq.ft. In 2015, 114,000 units and in 2016, 99,000 units were less than 1,000 sq.ft. The Urban Land Institute reported in 2013 that major Municipalities including New York City, San Francisco, Boston, Dallas and Philadelphia are allowing smaller apartments with Seattle and Portland (OR) having no minimum sizes. The proposed reduction allows for a modest decrease (13.6%) in the required living room area and (30%) in the floor area for each occupant of such unit in excess of two. Code Professionals are receiving proposals for dwelling units in R2 structures that are nonconforming with the minimum standards in the IBC. The Room Area standard for dwelling units in BOCA and SBBC as well as the 2000 edition of IBC required that one room must have a minimum floor area of 150 sq.ft. This was reduced to 120 sq.ft in the 2003 IBC and remains today. The minimum living room area for efficiency units in the 2000 IBC is the same as the 2018 IBC. No reduction has been proposed even though the overall dwelling unit room area standard has been reduced. The proposal complies with the current language in IBC Section 1207.3. which requires that habitable rooms be at least 120 sq.ft.

IBC 1207.4: The change from "living unit" to "dwelling unit" is to use a defined term to describe these efficiency apartments. The change in Item 3 corrects potential existing conflicts with Chapter 10 of ICC A117.1. which requiring a clear working space of 40 inches in front of the kitchen sink, cooking appliance and refrigerator for Accessible, Type A or B units. The change from "refrigeration facilities" to "refrigerator" is to use a more clearly understood term, and eliminate someone believing that another type of fixture, such as a beer cooler, would be sufficient.

IPC 404.6: The changes to the IPC are for coordination with the revisions to the IBC for efficiency apartments.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2017 the BCAC has held 3 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac.

Cost Impact: The code change proposal will decrease the cost of construction
This proposal could decrease the cost of construction where efficiency apartments are built to the lower minimum sizes required by the text that is proposed.

G130-18 Part I

Public Hearing Results

Committee Action: As Submitted

Committee Reason: This proposal addresses the increasing real need for smaller dwelling units. This proposed language is useable and enforceable. (Vote: 8-6)

Assembly Action: None

G130-18 Part I

G133-18

IBC: 1209.3.1, 1209.3.1.1

Proposed Change as Submitted

Proponent: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com)

2018 International Building Code

~~[P]~~ **1209.3.1 Water closet compartment.** Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.

Exceptions:

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 occupancy housing areas.

Add new text as follows

1209.3.1.1 Water closet compartment size. Where a compartment is provided, the compartment shall be not less than 30 inches (762 mm) in width and not less than 60 inches (1524 mm) in depth for floor-mounted water closets and not less than 30 inches (762 mm) in width and 56 inches (1422) in depth for wall-hung water closets. The compartment shall provide not less than 21 inches (533 mm) of clearance in front of the water closet to any wall, fixture or door.

Reason: This proposal is bringing language from the IPC into the IBC where designers that utilize the IBC can find this information more readily. Most architectural firms do not have an IPC in their office, but rather rely upon the IBC to provide the information needed for the design aspect of the project. This code change brings language directly from the IPC with specifics that will be utilized by a designer so that the toilet room layout will comply with the requirements of the IPC. There is specific information in the IBC on the requirements for urinal partitions, so bringing language in specific to the toilet partitions would be a natural supplement to the information already provided

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is just adding language that already exists in the IPC so this will not impact the construction cost.

Analysis: This is a [P] controlled section. This is a matter of IBC-G Committee deciding whether it is appropriate to have the same language contained in the IPC placed in the IBC. Technical changes to this section should not be made by IBC-G.

G133-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is an area that is quite often missed and should be referenced. A public comment may be in order. But where do we stop regarding bringing in requirements from other codes? That is a slippery slope. It may be more appropriate to have a simple and brief pointer. Chapter 29 may be the proper place for this. (Vote: 13-0)

Assembly Action: **None**

G133-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com); David Collins (dcollins@preview-group.com)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

[P] 2903 Installation of Fixtures

[P] 2903.1 Setting Fixtures shall be set level and in proper alignment with reference to adjacent walls.

[P] 2903.1.1 Water closets, urinals, lavatories and bidets. A water closet, urinal, lavatory or bidet shall not be set closer than 15 inches (381 mm) from its center to any side wall, partition, vanity or other obstruction. Where partitions or other obstructions do not separate adjacent fixtures, fixtures shall not be set closer than 30 inches (762 mm) center to center between adjacent fixtures. There shall be not less than a 21-inch (533 mm) clearance in front of a water closet, urinal, lavatory or bidet to any wall, fixture or door. Water closet compartments shall be not less than 30 inches (762 mm) in width and not less than 60 inches (1524 mm) in depth for floor-mounted water closets and not less than 30 inches (762 mm) in width and 56 inches (1422 mm) in depth for wall-hung water closets.

Exception: An accessible children's water closet shall be set not closer than 12 inches (305 mm) from its center to the required partition or to the wall on one side.

[P] 2903.1.2 Public Lavatories In employee and public toilet rooms, the required lavatory shall be located in the same room as the required water closet.

[P] 2903.1.3 Location of fixtures and piping Piping, fixtures or equipment shall not be located in such a manner as to interfere with the normal operation of windows, doors or other means of egress openings.

[P] 2903.1.4 Water closet compartment Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.

Exceptions:

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 housing areas.

[P] 2903.1.5 Urinal Partitions Each urinal utilized by the public or employees shall occupy a separate area with walls or partitions to provide privacy. The horizontal dimension between walls or partitions at each urinal shall be not less than 30 inches (762 mm). The walls or partitions shall begin at a height not greater than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

Exceptions:

1. Urinal partitions shall not be required in a single-occupant or family/assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.

Commenter's Reason: The committee disapproved the code change saying that it was a slippery slope bringing more language for requirements from other codes. This language is essential to the designer when designing a building. Both architects and interior designers need to know what the minimum code requirements are for toilet compartments and the spacing of the fixtures. By not having this language in the IBC, they are not aware of the requirements as most designers only utilize the IBC. Without some direction or pointer in the IBC, they will not know what these requirements are and their designs will not be code compliant.
The committee suggested my proposed language be placed in Chapter 29, so I have created a new section within the Chapter that has pulled language directly from the IPC relative to fixture installation.

The committee also wanted a simple and brief pointer. I am not sure how much more simple and brief it can be other than to tell someone to go to a specific section in the IPC. However, I have brought language directly from the IPC to make sure everything relative to fixtures was provided for design purposes. If this language ever changes, I am hopeful that it will be updated from the IPC and strongly urge the CCC to make sure this is scoped by the IPC.

The table below indicates where the language was taken from in the IPC to become part of the IBC.

Proposed IBC	2018 IPC
2903.1	405.3
2903.1.1	405.3.1
2903.1.2	405.3.2
2903.1.3	405.3.3
2903.1.4	405.3.4
2903.1.5	405.3.5

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase or decrease the cost of construction .

This is just adding language that already exists in the IPC so this will not impact the construction cost.

G133-18

G135-18

IBC: Chapter 12, 1201.1, SECTION 1210, 1210.1, 1210.2, 1210.2.1, 1210.2.2, 1210.2.3, 1210.2.4, 1210.2.5, 1210.2.6, 1210.2.7, 1210.2.8, 2010.2.9, 1210.2.10, 1210.2.11, 1210.3, 1210.3.1, 1210.3.2, 1210.3.3, 1210.3.4, 1210.3.5, Table TABLE 1210.3, 1210.3.6, 1210.3.7

Proposed Change as Submitted

Proponent: Craig Conner, representing self (craig.conner@mac.com); Jani Palmer, representing Environmental Protection Agency (Palmer.Janise@epa.gov)

2018 International Building Code

CHAPTER 12 INTERIOR ENVIRONMENT

Revise as follows

1201.1 Scope. The provisions of this chapter shall govern ventilation, temperature control, lighting, *yards* and *courts*, sound transmission, room dimensions, surrounding materials ~~and~~ , rodentproofing associated with the interior spaces of ~~buildings.~~ buildings, and radon.

Add new text as follows

SECTION 1210 RADON

1210.1 Applicability. Section 1210 shall apply to use groups E and I located in radon zone 1 as defined in IRC Table AF101(1).

> **Exception:** Compliance with Section 1210 shall not be required where the authority having jurisdiction has defined the radon zone as Zone 2 or 3.

1210.2 Radon testing. Radon testing shall be performed in accordance with Sections 1210.2.1 through 1210.2.11.

1210.2.1 Airtightness. Testing shall be performed after the building passes its airtightness test.

1210.2.2 Fan. Where the system includes a fan, testing shall be performed after the radon control system installation is complete and operating with the fan.

1210.2.3 Lowest level. Testing shall be performed at the lowest level that will be occupied, inclusive of unfinished spaces. Spaces that are physically separated and severed by different HVAC systems shall be tested separately.

1210.2.4 Spaces not tested. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen.

1210.2.5 Test kits and monitors. Testing shall be performed with a commercially available test kit or with a continuous radon monitor that can be calibrated. Testing with test kits shall include two tests, which shall be averaged. Testing shall be in accordance with the testing device manufacturer's instructions.

1210.2.6 Testing agency. Testing shall be performed by the builder, a registered design professional or an approved third party.

1210.2.7 Time period. Testing shall extend at least 48 hours or to the minimum specified by the testing device manufacturer, which ever is longer. This initial testing shall be permitted to extend past occupancy.

1210.2.8 Test results. Test results shall be provided directly to the owner by the test lab or testing party. The test results shall be delivered before or after occupancy.

2010.2.9 Additional test kit. An additional pre-paid test kit shall be provided to the owner to use when they choose. The test kit shall include mailing, or emailing the results from the testing lab to the owner. The builder shall also be permitted to receive the test results.

1210.2.10 Test result. This section does not require a specific test result, rather it requires the test be performed and the results be provided to the registered design professional or owner.

1210.2.11 Test result report. The registered design professional or owner shall be informed prior to occupancy and in writing that "A radon test result of 4 pCi/L or above is the 'action level' set by the U.S. Environmental Protection Agency (EPA. EPA recommends radon reduction measures to lower radon levels below 4 pCi/L." Or "For a radon test result of 4 pCi/L or above [name of builder or jurisdiction having authority] recommends radon reduction measures to lower radon levels below 4 pCi/L."

1210.3 Radon reduction measures. Radon reduction measures shall be in accordance with Sections 1210.3.1 through 1210.3.6 and Table 1210.3.

1210.3.1 Soil-gas barriers and base course. A base course in accordance with Section 1805.4.1 shall be installed below slabs and foundations. There shall be a continuous base course under each soil-gas retarder that is separated by foundation walls or footings. Foundation walls and floors in contact with the soil shall be damp proofed or waterproofed in accordance with Section 1805. Punctures, tears and gaps around penetrations of the soil-gas retarder shall be repaired or covered with an additional soil-gas retarder. The soil-gas retarder shall be a continuous 6-mil (0.15 mm) polyethylene or an approved equivalent. Approved alternative soil gas collection areas, such as sealed crawlspaces, shall be permitted.

1210.3.2 Soil gas collection. There shall be an unobstructed path for soil gas flow within the base course and out through the vent in the roof. Soil gases below the foundation shall be collected by a perforated pipe with a diameter of not less than 4 inches (10 cm) and not less than10 ft (3 m) in total length that is mechanically fastened to a tee with two horizontal openings within the base course for radon collection or an equivalent method. The tee fitting connection within the base course and the soil gas vent pipe that extends to the roof shall be designed to prevent clogging of the radon collection path. Alternately the soil gas collection shall be by approved radon collection mats or an equivalent approved method.

1210.3.3 Soil gas entry routes. Openings in slabs, soil-gas retarders, and joints such as plumbing, ground water control systems, soil-gas vent pipes, piping and structural supports, shall be sealed against air leakage at the penetrations with a polyurethane caulk, expanding foam or other approved sealing method. Gaps, seams and joints below grade in walls and footings that surround soil gas collection areas shall be closed with cementious materials, damp proofing, or other approved products. Closure shall be provided to prevent air migration between the base course that serves soil gas collection and exterior foundation drain systems located outside of the walls or footings that surround the soil gas collection areas. Masonry unit walls below grade shall provide a barrier between soil gas and interior spaces, including but not limited to, barriers within the hollow masonry units, full grouting, solid masonry units or other approved method. Sumps intended for ground water control shall have gasketed lids or be otherwise sealed and shall not be connected to the soil-gas exhaust system.

1210.3.4 Soil gas vent. A gas-tight vent pipe not less than 3 to 4 inches in diameter shall extend from the soil-gas permeable layer through the roof. Alternately, the vent shall extend from the soil-gas permeable layer to at least 30 feet above grade and shall not be less than 4 feet vertically above or 10 feet horizontally away from operable windows, doors or skylights. The vent pipe shall be sloped to avoid collecting condensate or rainwater. The vent pipe size shall not be reduced at any location as it goes from gas collection to the roof. Exposed and visible interior vent pipes shall be identified with not less than one label reading "Radon Reduction System" on each floor and in habitable attics.

1210.3.5 Vent pipe diameter. The minimum vent pipe diameter shall be as specified in Table 1210.3.5.

TABLE 1210.3.5
Maximum Vented Foundation Area

Maximum Area Vented	**Minimum Pipe Diameter**
2,500 ft^2 (232 m^2)	3 inch (7.6 cm)
4,000 ft^2 (372 m^2)	4 inch (10 cm)
Unlimited	6 inch (15.2 cm)

1210.3.6 Multiple vented areas. In dwellings where interior footings or other barriers separate the soil- gas permeable layer, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or individual vent pipes shall terminate separately above the roof.

1210.3.7 Fan. Each sub-slab soil-gas exhaust system shall include a fan, or dedicated space for the post-construction installation of a fan. The electrical supply for the fan shall be located within 6 feet (1.8 m) of the fan.

Reason: Radon in schools presents a significant health risk. Thousands of schools are affected by radon. EPA found that 41% of schools that had high radon were located geographically within Zone 1 (high radon potential), It is common knowledge that there is no way to know your building's radon level unless you test. Post-construction mitigation is very expensive; preventative measures, such as adding radon reducing features during construction, can save future costs and lives.

Cost Impact: The code change proposal will increase the cost of construction
The cost of three test kits with prepaid analysis and prepaid postage is less than $80, probably less than $50 in builder quantity including tax. Where there were multiple spaces that are physically separated and served by different HVAC systems each space would incur that cost.

The cost of the measures in the building varies widely with building size. Many elements of the radon resistant features are already required by code; for example, the base coarse under the foundation, and air tightness for the building; these would not add cost for the radon system.

G135-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal contains a large amount of unenforceable language. A lot of substantiation was provided for schools, but not all Group I occupancies. The timing may not be right to make radon mitigation mandatory as there are testing and liability issues that still need to be worked out. There is science behind this proposal and it appears to be a significant problem, but school boards, possibly at the state level, should have been engaged. The starting place for this may be best as an appendix, much like in the residential code. It would be better to bring the tables over rather than reference the residential code. (Vote: 14-0)

Assembly Action: **None**

G135-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Craig Conner, representing Environmental Protection Agency (craig.conner@mac.com); Jani Palmer, EPA; Gary Hodgden, AQP Inc, representing AQP Inc (gary@aair.com); Bruce Snead, representing self (bsnead@ksu.edu)requests As Modified by This Public Comment.

Further modify as follows:

2018 International Building Code

1210.1 Applicability. Section 1210 shall apply to use groups E and ~~I~~ I4 located in radon zone 1 as defined in ~~IRC~~ Table ~~AF101(1).~~1210.1.

> **Exception:** Compliance with Section 1210 shall not be required where the authority having jurisdiction has defined the radon zone as Zone 2 or 3.

1210.2.1 Airtightness. Testing shall be performed after the building passes its airtightness ~~test~~requirements.

1210.2.3 Lowest level. Testing shall be performed at the lowest level that will be occupied, inclusive of unfinished spaces. Spaces that are physically separated and ~~severed~~ served by different HVAC systems shall be tested separately.

1210.2.7 Time period. Testing shall extend at least 48 hours or to the minimum specified by the testing device manufacturer, which ever is longer. ~~This initial testing shall be permitted to extend past occupancy.~~

1210.2.8 Test ~~results~~ reported. Written test results from the test lab or testing party ~~The test results shall be delivered before or after occupancy.~~ shall be provided with the construction documents.

2010.2.9 Additional test kit. An additional pre-paid test kit shall be provided ~~to~~ for the owner to use when they choose. The test kit shall include mailing, or emailing the results from the testing lab to the owner. ~~The builder shall also be permitted to receive the test results.~~

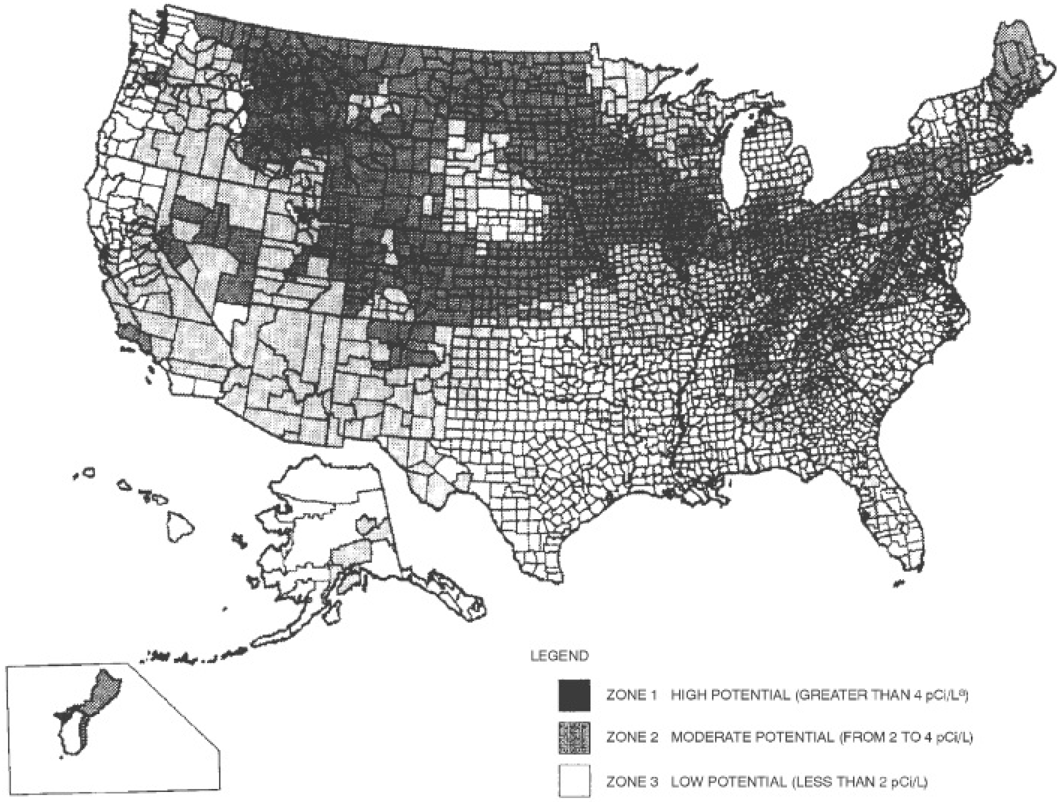
1210.2.10 Test ~~result.~~result and fan. ~~This section does not require a specific test result, rather it requires the test be performed and the results be provided to the registered design professional or owner.~~Where the radon test result is 4 pCi/L or greater the radon vent pipe fan shall be installed.

~~**1210.2.11 Test result report.** The registered design professional or owner shall be informed prior to occupancy and in writing that "A radon test result of 4 pCi/L or above is the 'action level' set by the U.S. Environmental Protection Agency (EPA. EPA recommends radon reduction measures to lower radon levels below 4 pCi/L." Or "For a radon test result of 4 pCi/L or above [name of builder or jurisdiction having authority] recommends radon reduction measures to lower radon levels below 4 pCi/L."~~

1210.3.2 Soil gas collection. There shall be an unobstructed path for soil gas flow within the base course and ~~out~~ outside through the vent ~~in the roof.~~ . Soil gases below the foundation shall be collected by a perforated pipe with a diameter of not less than 4 inches (10 cm) and not less than10 ft (3 m) in total length that is mechanically fastened to a tee with two horizontal openings within the base course for radon collection or an equivalent method. The tee fitting connection within the base course and the soil gas vent pipe that extends to the roof shall be designed to prevent clogging of the radon collection path. Alternately the soil gas collection shall be by approved radon collection mats or an equivalent approved method.

1210.3.4 Soil gas vent. A gas-tight vent pipe not less than 3 to 4 inches in diameter shall extend from the soil-gas permeable layer through the roof. Alternately, the vent shall extend ~~from the soil-gas permeable layer to~~ to at least 30 feet above grade and shall not be less than 4 feet vertically above or 10 feet horizontally away from operable windows, doors or ~~skylights.~~ skylights; and the room opposite the side vent shall be tested for radon. The vent pipe shall be sloped to avoid collecting condensate or rainwater. The vent pipe size shall not be reduced at any location as it goes from gas collection to the roof. Exposed and visible interior vent pipes shall be identified with not less than one label reading "Radon Reduction System" on each floor and in habitable attics.

1210.3.6 Multiple vented areas. In dwellings where interior footings or other barriers separate the soil- gas permeable layer, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates ~~above the roof~~ outside or individual vent pipes shall terminate ~~separately above the roof.~~outside separately.



a. pCi/L standards for picocuries per liter of air. The U.S. Environmental Protection Agency (EPA) recommends that homes that measure 4 pCi/L and greater be mitigated.

The map assigns each U.S. county to one of three zones based on radon potential. Radon Zone 1 has the highest radon potential. Table AF101 lists the Zone 1 counties illustrated on the map.

FIGURE 1210.1
EPA MAP OF RADON ZONES

TABLE 1210.1
HIGH RADON-POTENTIAL (ZONE 1) COUNTIES

ALABAMA	Morgan	Stanton	Washington	Morris	Lehigh	Fairfax
Calhoun	Moultrie	Trego	Watonwan	Somerset	Luzerne	Falls Church
Clay	Ogle	Wallace	Wilkin	Sussex	Lycoming	Fluvanna
Cleburne	Peoria	Washington	Winona	Warren	Mifflin	Frederick
Colbert	Piatt	Wichita	Wright	**NEW MEXICO**	Monroe	Fredericksburg
Coosa	Pike	Wyandotte	Yellow Medicine	Bernalillo	Montgomery	Giles
Franklin	Putnam	**KENTUCKY**	**MISSOURI**	Colfax	Montour	Goochland
Jackson	Rock Island	Adair	Andrew	Mora	Northampton	Harrisonburg
Lauderdale	Sangamon	Allen	Atchison	Rio Arriba	Northumberland	Henry
Lawrence	Schuyler	Barren	Buchanan	San Miguel	Perry	Highland
Limestone	Scott	Bourbon	Cass	Santa Fe	Schuylkill	Lee
Madison	Stark	Boyle	Clay	Taos	Snyder	Lexington
Morgan	Stephenson	Bullitt	Clinton	**NEW YORK**	Sullivan	Louisa
Talladega	Tazewell	Casey	Holt	Albany	Susquehanna	Martinsville
CALIFORNIA	Vermilion	Clark	Iron	Allegany	Tioga	Montgomery
Santa Barbara	Warren	Cumberland	Jackson	Broome	Union	Nottoway
Ventura	Whiteside	Fayette	Nodaway	Cattaraugus	Venango	Orange
COLORADO	Winnebago	Franklin	Platte	Cayuga	Westmoreland	Page
Adams	Woodford	Green	**MONTANA**	Chautauqua	Wyoming	Patrick
Arapahoe	**INDIANA**	Harrison	Beaverhead	Chemung	York	Pittsylvania

Baca	Adams	Hart	Big Horn	Chenango	**RHODE ISLAND**	Powhatan
Bent	Allen	Jefferson	Blaine	Columbia	Kent	Pulaski
Boulder	Bartholomew	Jessamine	Broadwater	Cortland	Washington	Radford
Chaffee	Benton	Lincoln	Carbon	Delaware	**S. CAROLINA**	Roanoke
Cheyenne	Blackford	Marion	Carter	Dutchess	Greenville	Rockbridge
Clear Creek	Boone	Mercer	Cascade	Erie	**S. DAKOTA**	Rockingham
Crowley	Carroll	Metcalfe	Chouteau	Genesee	Aurora	Russell
Custer	Cass	Monroe	Custer	Greene	Beadle	Salem
Delta	Clark	Nelson	Daniels	Livingston	Bon Homme	Scott
Denver	Clinton	Pendleton	Dawson	Madison	Brookings	Shenandoah
Dolores	De Kalb	Pulaski	Deer Lodge	Onondaga	Brown	Smyth
Douglas	Decatur	Robertson	Fallon	Ontario	Brule	Spotsylvania
El Paso	Delaware	Russell	Fergus	Orange	Buffalo	Stafford
Elbert	Elkhart	Scott	Flathead	Otsego	Campbell	Staunton
Fremont	Fayette	Taylor	Gallatin	Putnam	Charles Mix	Tazewell
Garfield	Fountain	Warren	Garfield	Rensselaer	Clark	Warren
Gilpin	Fulton	Woodford	Glacier	Schoharie	Clay	Washington
Grand	Grant	**MAINE**	Granite	Schuyler	Codington	Waynesboro
Gunnison	Hamilton	Androscoggin	Hill	Seneca	Corson	Winchester
Huerfano	Hancock	Aroostook	Jefferson	Steuben	Davison	Wythe
Jackson	Harrison	Cumberland	Judith Basin	Sullivan	Day	**WASHINGTON**
Jefferson	Hendricks	Franklin	Lake	Tioga	Deuel	Clark
Kiowa	Henry	Hancock	Lewis and Clark	Tompkins	Douglas	Ferry
Kit Carson	Howard	Kennebec	Madison	Ulster	Edmunds	Okanogan
Lake	Huntington	Lincoln	McCone	Washington	Faulk	Pend Oreille
Larimer	Jay	Oxford	Meagher	Wyoming	Grant	Skamania
Las Animas	Jennings	Penobscot	Missoula	Yates	Hamlin	Spokane
Lincoln	Johnson	Piscataquis	Park	**N. CAROLINA**	Hand	Stevens
Logan	Kosciusko	Somerset	Phillips	Alleghany	Hanson	**W. VIRGINIA**
Mesa	LaGrange	York	Pondera	Buncombe	Hughes	Berkeley
Moffat	Lawrence	**MARYLAND**	Powder River	Cherokee	Hutchinson	Brooke
Montezuma	Madison	Baltimore	Powell	Henderson	Hyde	Grant
Montrose	Marion	Calvert	Prairie	Mitchell	Jerauld	Greenbrier
Morgan	Marshall	Carroll	Ravalli	Rockingham	Kingsbury	Hampshire
Otero	Miami	Frederick	Richland	Transylvania	Lake	Hancock
Ouray	Monroe	Harford	Roosevelt	Watauga	Lincoln	Hardy
Park	Montgomery	Howard	Rosebud	**N. DAKOTA**	Lyman	Jefferson
Phillips	Noble	Montgomery	Sanders	All Counties	Marshall	Marshall
Pitkin	Orange	Washington	Sheridan	**OHIO**	McCook	Mercer
Prowers	Putnam	**MASS.**	Silver Bow	Adams	McPherson	Mineral
Pueblo	Randolph	Essex	Stillwater	Allen	Miner	Monongalia
Rio Blanco	Rush	Middlesex	Teton	Ashland	Minnehaha	Monroe
San Miguel	Scott	Worcester	Toole	Auglaize	Moody	Morgan
Summit	Shelby	MICHIGAN	Valley	Belmont	Perkins	Ohio
Teller	St. Joseph	Branch	Wibaux	Butler	Potter	Pendleton
Washington	Steuben	Calhoun	Yellowstone	Carroll	Roberts	Pocahontas
Weld	Tippecanoe	Cass	**NEBRASKA**	Champaign	Sanborn	Preston
Yuma	Tipton	Hillsdale	Adams	Clark	Spink	Summers
CONNECTICUT	Union	Jackson	Boone	Clinton	Stanley	Wetzel

Fairfield	Vermillion	Kalamazoo	Boyd	Columbiana	Sully	**WISCONSIN**
Middlesex	Wabash	Lenawee	Burt	Coshocton	Turner	Buffalo
New Haven	Warren	St. Joseph	Butler	Crawford	Union	Crawford
New London	Washington	Washtenaw	Cass	Darke	Walworth	Dane
GEORGIA	Wayne	**MINNESOTA**	Cedar	Delaware	Yankton	Dodge
Cobb	Wells	Becker	Clay	Fairfield	**TENNESEE**	Door
De Kalb	White	Big Stone	Colfax	Fayette	Anderson	Fond du Lac
Fulton	Whitley	Blue Earth	Cuming	Franklin	Bedford	Grant
Gwinnett	**IOWA**	Brown	Dakota	Greene	Blount	Green
IDAHO	All Counties	Carver	Dixon	Guernsey	Bradley	Green Lake
Benewah	**KANSAS**	Chippewa	Dodge	Hamilton	Claiborne	Iowa
Blaine	Atchison	Clay	Douglas	Hancock	Davidson	Jefferson
Boise	Barton	Cottonwood	Fillmore	Hardin	Giles	Lafayette
Bonner	Brown	Dakota	Franklin	Harrison	Grainger	Langlade
Boundary	Cheyenne	Dodge	Frontier	Holmes	Greene	Marathon
Butte	Clay	Douglas	Furnas	Huron	Hamblen	Menominee
Camas	Cloud	Faribault	Gage	Jefferson	Hancock	Pepin
Clark	Decatur	Fillmore	Gosper	Knox	Hawkins	Pierce
Clearwater	Dickinson	Freeborn	Greeley	Licking	Hickman	Portage
Custer	Douglas	Goodhue	Hamilton	Logan	Humphreys	Richland
Elmore	Ellis	Grant	Harlan	Madison	Jackson	Rock
Fremont	Ellsworth	Hennepin	Hayes	Marion	Jefferson	Shawano
Gooding	Finney	Houston	Hitchcock	Mercer	Knox	St. Croix
Idaho	Ford	Hubbard	Hurston	Miami	Lawrence	Vernon
Kootenai	Geary	Jackson	Jefferson	Montgomery	Lewis	Walworth
Latah	Gove	Kanabec	Johnson	Morrow	Lincoln	Washington
Lemhi	Graham	Kandiyohi	Kearney	Muskingum	Loudon	Waukesha
Shoshone	Grant	Kittson	Knox	Perry	Marshall	Waupaca
Valley	Gray	Lac Qui Parle	Lancaster	Pickaway	Maury	Wood
ILLINOIS	Greeley	Le Sueur	Madison	Pike	McMinn	**WYOMING**
Adams	Hamilton	Lincoln	Nance	Preble	Meigs	Albany
Boone	Haskell	Lyon	Nemaha	Richland	Monroe	Big Horn
Brown	Hodgeman	Mahnomen	Nuckolls	Ross	Moore	Campbell
Bureau	Jackson	Marshall	Otoe	Seneca	Perry	Carbon
Calhoun	Jewell	Martin	Pawnee	Shelby	Roane	Converse
Carroll	Johnson	McLeod	Phelps	Stark	Rutherford	Crook
Cass	Kearny	Meeker	Pierce	Summit	Smith	Fremont
Champaign	Kingman	Mower	Platte	Tuscarawas	Sullivan	Goshen
Coles	Kiowa	Murray	Polk	Union	Trousdale	Hot Springs
De Kalb	Lane	Nicollet	Red Willow	Van Wert	Union	Johnson
De Witt	Leavenworth	Nobles	Richardson	Warren	Washington	Laramie
Douglas	Lincoln	Norman	Saline	Wayne	Wayne	Lincoln
Edgar	Logan	Olmsted	Sarpy	Wyandot	Williamson	Natrona
Ford	Marion	Otter Tail	Saunders	**PENNSYLVANIA**	Wilson	Niobrara
Fulton	Marshall	Pennington	Seward	Adams	**UTAH**	Park
Greene	McPherson	Pipestone	Stanton	Allegheny	Carbon	Sheridan
Grundy	Meade	Polk	Thayer	Armstrong	Duchesne	Sublette
Hancock	Mitchell	Pope	Washington	Beaver	Grand	Sweetwater
Henderson	Nemaha	Ramsey	Wayne	Bedford	Piute	Teton

Henry	Ness	Red Lake	Webster	Berks	Sanpete	Uinta
Iroquois	Norton	Redwood	York	Blair	Sevier	Washakie
Jersey	Osborne	Renville	**NEVADA**	Bradford	Uintah	
Jo Daviess	Ottawa	Rice	Carson City	Bucks	**VIRGINIA**	
Kane	Pawnee	Rock	Douglas	Butler	Alleghany	
Kendall	Phillips	Roseau	Eureka	Cameron	Amelia	
Knox	Pottawatomie	Scott	Lander	Carbon	Appomattox	
La Salle	Pratt	Sherburne	Lincoln	Centre	Augusta	
Lee	Rawlins	Sibley	Lyon	Chester	Bath	
Livingston	Republic	Stearns	Mineral	Clarion	Bland	
Logan	Rice	Steele	Pershing	Clearfield	Botetourt	
Macon	Riley	Stevens	White Pine	Clinton	Bristol	
Marshall	Rooks	Swift	**NEW HAMPSHIRE**	Columbia	Brunswick	
Mason	Rush	Todd	Carroll	Cumberland	Buckingham	
McDonough	Saline	Traverse	**NEW JERSEY**	Dauphin	Buena Vista	
McLean	Scott	Wabasha	Hunterdon	Delaware	Campbell	
Menard	Sheridan	Wadena	Mercer	Franklin	Chesterfield	
Mercer	Sherman	Waseca	Monmouth	Fulton	Clarke	

Commenter's Reason: Protection of public health, safety and welfare is the core goal of the I-codes. I-codes are greatly reducing risks from hazards such as fire, earthquake, tornado, winds, electrocution, falling, and unsafe plumbing, Reducing risks from lung cancer caused by buildings is similarly needed, especially where children are likely to be present.
This proposal apples only to schools and daycares (use groups E and I4) in areas with high radon potential. Schools and daycares should not contribute to future lung cancers in children.

American Cancer Society says “The leading cause of lung cancer in non-smokers is exposure to radon gas.” (ref 1) The link between radon and lung cancer has been firmly established for about 20 years (ref 2). Radon is estimated to cause about 21,000 deaths per year from lung cancer (ref 2). Children exposed to high levels of radon are more likely to develop lung cancer later in life. (ref 3). Given the large number of fatalities induced by radon in buildings and the sensitivity of children, radon should be reduced in schools and daycares in high radon potential areas.

Most radon originates under the building foundation; therefore, most of the radon reduction construction is under the foundation. Installing radon reduction measures after the new foundation is in place is expensive.

More than half the states have some kind of statewide radon requirement or have local jurisdictions that have adopted radon requirements. You can look at your state law and radon in the LawAtlas. The LawAtlas covers both schools and daycares, as well as other aspects of radon law. (http://lawatlas.org/datasets/state-radon-laws click “explore”, click your state)

Jurisdictions and schools boards have shown great concern for radon by their actions. Multiple states and school districts have recognized the need to protect school children from radon. These jurisdictions and school districts are primarily in the high radon potential zone (Zone 1) where this code change would apply. As reported by the LawAtlas, eight states require school testing. Those states are Colorado, Connecticut, Florida, Minnesota, New Jersey, Rhode Island, Virginia and West Virginia. Illinois recommends testing. Some states -- Connecticut, Rhode Island and West Virginia -- require that radon-resistant construction features be built into new schools that are located in high radon potential areas.

Multiple states and jurisdictions have recognized the need to protect children in daycare. These are primarily in the high radon potential zone (Zone 1) where this change would apply. As reported by the LawAtlas, some form of radon testing and/or mitigation in daycares is required in ten states. Those states are Connecticut, Iowa, Illinois, Michigan, New Hampshire, Rhode Island, New Jersey, Florida, and Idaho daycares.

Deaths from radon significantly exceed deaths from other building-related risks; such as fires, falls, electrocution, tornadoes, hurricanes, winds, fires, etc. In part this is because the codes have reduced these other risks, but have not yet addressed radon. Radon reduction should be added to the IBC.

This public comment responds to multiple comments from the committee and others:

--“air tightness test” was changed to “air tightness requirements”, in recognition that commercial building have air tightness requirements, but may not be tested.

--Radon test results shall be included with construction documents.

--Test results delivered after occupancy would be after code enforcement authority has expired; therefore, the language allowing test results to be delivered after occupancy was removed.

--Radon zone map and table were brought into the IBC as requested by the committee. Zone table will be two pages long when formatted like in IRC.

Comments were made both for and against the radon-reduction requirements being in the main body of the code or an appendix. Due to the large death toll from radon in buildings and the impact on children, the proponents believe radon reduction and testing should be in the main body of the code for schools and daycares.

Bibliography: 1) Lung Cancer Risks for Non-Smokers. American Cancer Society. Nov 6, 2017
https://www.cancer.org/latest-news/why-lung-cancer-strikes-nonsmokers.html

2) U.S. National Research Council Committee on the Biological Effects of Ionizing Radiation. 1999.

https://www.nap.edu/read/5499/chapter/1#viiihttps://www.nap.edu/read/5499/chapter/5#97

Historically the link between radon and lung cancer was not understood. Radon is an invisible, tasteless and odorless gas. There is a long period between exposure to radon and the symptoms of lung cancer. Recognition that radon increased lung cancers came from early studies of uranium miners, and was later confirmed more broadly. In 1999 it was concluded that residential radon, as well as smoking, were the most important contributors to the lung cancer. Note table 3-10, summed “total male” and “total female” for both “ever-smokers” and “never-smokers” Actual value in table is 21,800, but is rounded to 21,000.

3) “Canadian Lung Cancer Relative Risk from Radon Exposure for Short Periods in Childhood Compared to a Lifetime”International Journal of Environmental Research and Public Health. 2013 May; 10(5): 1916–1926.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3709356/

The study concluded: ”*... exposure to radon during childhood increases the lifetime risk of developing lung cancer ... if a child lived in a home with very high radon concentration for only a few years, the risk of developing lung cancer later in the life could be equivalent to a lifetime exposure to moderate radon concentration*.”

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost of three test kits with prepaid analysis and prepaid postage is less than $100, probably less than $70 in builder quanity including tax. Where there were multiple spaces that are physically seperated and served by different HVAC systems each space would incur that cost.

The cost of the radon mitigation measures in the building varies widely with building size. Many elements of the radon resistant features are already required by code; for example, the base coarse under the foundation, and air tightness for the building; these would not add cost for the radon system.

G135-18

G136-18

IBC: 202, 503.1.4, 1510.2.2

Proposed Change as Submitted

Proponent: Ed Kulik, Chair, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Building Code

SECTION 202 DEFINITIONS

Revise as follows

~~**[BG]**~~ **PENTHOUSE.** An enclosed, unoccupied rooftop structure used for sheltering mechanical and electrical equipment, tanks, elevators and related machinery, stairways and vertical shaft openings.

503.1.4 Occupied roofs. A roof level or portion thereof shall be permitted to be used as an occupied roof provided the occupancy of the roof is an occupancy that is permitted by Table 504.4 for the story immediately below the roof. The area of the occupied roofs shall not be included in the *building area* as regulated by Section 506. An occupied roof shall not be included in the building height or number of stories as regulated by Section 504 provided the penthouses and other enclosed roof structures comply with Section 1510.

Exceptions:

1. The occupancy located on an occupied roof shall not be limited to the occupancies allowed on the *story* immediately below the roof where the building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and occupant notification in accordance with Section 907.5 is provided in the area of the occupied roof.
2. Assembly occupancies shall be permitted on roofs of open parking spaces of Type I or Type II construction, in accordance with the exception to Section 903.2.1.6.

SECTION 1510 ROOFTOP STRUCTURES

[BG] 1510.1 General. The provisions of this section shall govern the construction of rooftop structures.

1510.1.1 Area limitation. The aggregate area of penthouses and other enclosed rooftop structures shall not exceed one-third the area of the supporting roof deck. Such penthouses and other enclosed rooftop structures shall not be required to be included in determining the building area or number of stories as regulated by Section 503.1. The area of such penthouses shall not be included in determining the fire area specified in Section 901.7.

[BG] 1510.2 Penthouses. Penthouses in compliance with Sections 1510.2.1 through 1510.2.5 shall be considered as a portion of the story directly below the roof deck on which such penthouses are located. Other penthouses shall be considered as an additional story of the building.

[BG] 1510.2.1 Height above roof deck. Penthouses constructed on buildings of other than Type I construction shall not exceed 18 feet (5486 mm) in height above the roof deck as measured to the average height of the roof of the penthouse. Penthouses located on the roof of buildings of Type I construction shall not be limited in height.

Exception: Where used to enclose tanks or elevators that travel to the roof level, penthouses shall be permitted to have a maximum height of 28 feet (8534 mm) above the roof deck.

~~**[BG]**~~ **1510.2.2 Use limitations.** Penthouses shall not be used for purposes other than the shelter of mechanical or electrical equipment, tanks, elevators and related machinery, stairways or vertical shaft openings in the roof ~~assembly.~~assembly, including ancillary spaces used to access elevators and stairways.

Reason: This is part of a series of 3 proposals dealing with occupied roofs. See BCAC proposals to Section 1006 and 1009.
Although it was felt the original intent of the egress associated with occupied roofs was clear, we felt there were a few remaining provisions that left doubt as to what was intended. It had been reported that some code officials had interpreted the existing code provision to treat an unoccupied roof as an additional story so as to decrease the actual allowable stories in Chapter 5. To clarify that occupied roofs are not considered stories and are permitted to be used

provide that egress is provided in accordance with all applicable sections of the IBC and IFC purposes in a manner “as if they were a story” without applying other “story” requirements like those associated with height and area limitations in Chapter 5 or fire area provisions of Chapter 9, we propose the above modifications as summarized below:

In Section 202, the definition of “PENTHOUSE” is proposed to be modified by adding the word “stairway”. This reinforces the existing and proposed language in Section 1510 that excludes certain allowable rooftop structures from being considered additional stories. The definition was not modified to include vestibule type areas as this is addressed in the proposed change to Section 1510.2.2.

The proposal in Section 503.1.4 Occupied roofs, adds a clarifying statement to support the concept that occupied roofs and other enclosed structures in Section 1510 are not an additional story.

Proposed modifications to Section 1510 Rooftop Structures include the additions of the word “Stairways” and the term, including ancillary spaces used to access elevators and stairways.” to Section 1510.2.2. Use Limitations.

As flat/ low-slope rooftops are increasingly, and intentionally, being designed and utilized for occupancies similar to those on occupied floor levels below, modifications to the current code are necessary to define *rooftop structures* that are occupied and ancillary to approved occupied roof uses and to clarify that these structures must comply with means of egress requirements, but are not a story for height and area limitations. In addition, the proposed modifications described above align the limitations for *Occupied roof ancillary structures* with those for penthouses as a reasonable approach based upon the shared characteristics of the two structure types.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2017 the BCAC has held 3 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-action-committee-bcac.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is a clarification reminder of the scope of requirements included in the identified sections.

G136-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is an excellent clarification of the code and is coordinated with what was done in the last cycle. (Vote: 14-0)

Assembly Action: **None**

G136-18

Individual Consideration Agenda

Public Comment 1:

Proponent: John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (XPSA) (jwoestman@kellencompany.com)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

<u>**Occupied Roof** An unenclosed roof or area of a roof designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants are engaged at labor, and which is equipped with means of egress meeting the requirements of this code.</u>

Commenter's Reason: There needs to be a clear definition of an occupied roof to help alleviate confusion with the definition of occupiable space. A roof is not an enclosed space, therefore the thermal barrier requirements, smoke development index, etc., used with interior finishes in an enclosed space does not apply. Rather, the occupied roof is constructed as a roof meeting the Occupancy Classification and Use in Section 302.1, height and area limitations in Section 503.1, as well as structural and egress requirements as specified by the code. The existing roof fire requirements in IBC Sections 1505.1, 1508.1, 2603.3 Exception 3, 2603.4.1.5 and 2603.6 also apply to occupied roofs.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Adding a definition should not increase or decrease the cost of construction.

G136-18

G137-18

IBC: 2703 (New), 2703.1 (New), 2703.2 (New), 2703.3 (New), 2703.4 (New), Chapter 35

Proposed Change as Submitted

Proponent: Jonathan Roberts, UL LLC, representing UL LLC (jonathan.roberts@ul.com)

2018 International Building Code

Add new text as follows

SECTION 2703 LIGHTNING PROTECTION SYSTEMS

2703.1 General. Where provided, lightning protection systems shall comply with Sections 2703.2 through 2703.4

2703.2 Installation. Lightning protection systems for all new buildings and additions shall be installed in accordance with one of the following methods:

1. NFPA 780.
2. UL 96A.
3. Other approved methods.

UL 96A shall not be utilized for structures used for the production, handling, or storage of ammunition, explosives, flammable liquids or gases, and other explosive ingredients including dust.

2703.3 Additions to existing systems. Where additions are constructed to a building containing a lightning protection system and the existing building's lightning protection system is connected to the new lightning protection system, the entire system shall be inspected and brought into compliance with current standards.

2703.4 Surge protection. Surge protection devices shall be installed for all normal and emergency electrical systems and all communications systems in accordance with Section 2703.2 and NFPA 70.

Add new standard(s) follows

UL

UL LLC
333 Pfingsten Road
Northbrook IL 60062-2096

96A-2016:

Standard for Installation Requirements for Lightning Protection Systems

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy MA 02169-7471

780-17:

Standard for the Installation of Lightning Protection Systems

Reason: Requirements pertaining to Lightning Protection Systems are not currently found within the building code. This code change does not require the installation of lighting protection systems, but simply provides guidance to those that are installing and inspecting lighting protection. NFPA 780 and UL 96A are two standards that are widely used within the industry, but are not very well known to code officials. These standards are in harmony with the provisions of the National Electrical Code, NFPA 70. UL 96A can be used for the installation and inspection of many lightning protection systems but the standard has limitations that are identified in this proposal. This proposal also recognizes the existence of other approved methods currently used, and thus this proposal is not intended to limit these installations. This proposal is intended to provide the code official with help in addressing the installation of these types of systems.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The cost will not increase since these requirements are being used today to install and inspect lightning protection systems.

Analysis: A review of the standards proposed for inclusion in the code, NFPA 780-17 and UL 96A-2016, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

G137-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: When you have a non-mandatory requirement, it should be in an appendix or a standard. If someone wanted to do something less than this, they should not be mandated to do this unless a specific code requirement drives it. NFPA 70 already addresses this. It has not been demonstrated that there is a real problem. (Vote: 9-4)

Assembly Action: **None**

G137-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Jonathan Roberts, UL LLC, representing UL LLC (jonathan.roberts@ul.com)requests As Submitted.

Commenter's Reason: Lightning protection systems, though not required by the building or electrical code, if installed incorrectly can pose a significant hazard to persons and property and be ineffective in providing protection from lightning.
There are potential safety hazards if a lightning protection system is installed incorrectly:

The installation of lightning protection systems is much different from the installation of general electrical wiring. This is due to the high current densities, high rates of current rise, and resulting mechanical forces that happen during a lightning event. For these reasons, specialized material and installation methods such as those specified in NFPA 780 and UL 96A should be followed and the installation should only be installed by qualified personnel trained and certified in the installation of lightning protection systems. Some of the hazards that can arise during a lightning event from an incorrectly installed lightning protection system are:

- Side flashing between lightning conductors and conductive objects within the building resulting in a potential fire.
- Increased shock hazards from a rise in step and touch potential around lightning conductors and grounding electrodes.
- Damage to building structural components such as concrete foundations and steel columns and beams.

With this in mind a building with an incorrectly installed lightning protection system can pose a greater hazard then one without a lighting protection system.

Comprehensive lightning protection system installation is not adequately addressed in building and electrical codes:

While NFPA 70, the National Electrical Code references NFPA 780 it does so only in non-enforceable informational notes. Those informational notes referencing NFPA 780 only follow grounding and bonding requirements found in Article 250 and Chapter 8 for communications systems. The NEC contains some general grounding and bonding requirements for lightning protection systems but does not contain requirements such as, material, air terminal placement, or conductor routing found in the standards that are critical for a safe and effective system.

Lightning protection systems are not required, but if installed should be installed to the appropriate standards:

This proposal does not require the installation of a lightning protection system but will provide guidance to the code official and installer for the appropriate safety standards for installation of these systems if they are installed. NFPA 780 and UL 96A are two standards that are widely used within the industry, but are not well known to code officials.

Including requirements in Chapter 27 will ensure safety of lightning protection systems:

Including this new Section in Chapter 27 instead of an Appendices will make the necessary requirements readily available for the code official to enforce without the jurisdiction having to take additional steps to adopt an Appendix for such a critical issue. There are numerous examples of ICC codes sections that provide mandatory requirements for non-required equipment and systems. For example IBC 3110.3 does not require a vehicular gate opener but when one is provided it shall be listed in accordance with UL 325. Another example is IFC 901.4.2. This section addresses the installation of nonrequired fire sprinkler systems and requires that they meet the applicable parts of the IFC and IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
NFPA 780 and UL 96A are two standards that are already widely used within the lightning protection industry therefore the cost of construction would not increase as a result of this code change.

G137-18

G139-18

IBC: 3001.2, DOJ

Proposed Change as Submitted

Proponent: Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

2018 International Building Code

Revise as follows

3001.2 Emergency elevator communication systems for the deaf, hard of hearing and speech impaired. ~~An emergency two-way communication system shall be provided that:~~

~~1.~~ ~~Is a visual and text-based and a video-based 24/7 live interactive system.~~

~~2.~~ ~~Is fully~~ The elevator emergency communication shall provide effective communication as required by Section 36.303 of ADA Title III. The emergency communication shall be installed in accordance with the provisions of ASME A17.1/CSA B44 and NFPA 72 and shall be accessible by the deaf, hard of hearing and speech impaired,~~and shall include voice-only options for hearing individuals.~~

~~3.~~ ~~Has the ability to communicate with emergency personnel utilizing existing video conferencing technology, chat/text software or other *approved* technology.~~available twenty-four hours a day, seven days a week, as a live interactive system.

Add new standard(s) follows

DOJ United States Department of Justice Civil Rights Division
ADA Title III Regulations - Americans with Disabilities Act, Public Accommodations and Commercial Facilities

Reason: Section 3001 defines the scope and reference standards for elevator Emergency Communication design requirements. This proposal removes an elevator design requirements from the building code, restoring it to the reference standards. The added reference to the ADA Title III is the regulation specifically for effective communication with the deaf, hard of hearing and speech impaired.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal will neither increase or decrease the cost of construction because it is simply restoring the technical requirements to the reference standards as opposed to including them in the IBC.

Analysis:

A review of DOJ ADA Title III Regulations, as proposed for inclusion in the code, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

ASME A17.1/CSA B44 and NFPA 72, as referenced in this proposal, are currently referenced in the code.

G139-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: G138-18 and G139 are trying to accomplish the same thing. The G138-18 approach is the correct approach. There is an agreement that if this criteria may be added to A117.1 in time. This can be addressed in in public comment period. However, it should be noted that, if this was approved and there were no public comments, this could trump the previous committee action to approve G138-18. (Vote: 14-0)

Assembly Action: **None**

G139-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

3001.2 Emergency elevator communication systems for the deaf, hard of hearing and speech impaired. The elevator emergency communication shall provide effective communication ~~as required by Section 36.303 of ADA Title III. The emergency communication ,~~ shall be installed in accordance with the provisions of ASME A17.1/CSA B44 and NFPA 72 and shall be accessible by the deaf, hard of hearing and speech impaired, <u>and be</u> available twenty-four hours a day, seven days a week, as a live interactive system.

Commenter's Reason: Section 3001 defines the scope and reference standards for elevators and other conveyance systems. Technical requirements are found in the ASME A17.1/CSA B44 Safety Code for Elevators and Escalators. New detailed technical requirements for Emergency Communication design have been approved for the 2019 edition of A17.1/B44 to address. This proposal retains the base requirement for the system in the IBC but references the technical requirements being adding in the A17/B44 elevator code to provide guidance for designers and enforcement authorities. The requirements in A17.1/B44 were developed for consistency with the guidelines in the ADA Title III which is the regulation specifically for effective communication with the deaf, hard of hearing and speech impaired. The requirements in A17.1/B44 were developed through a rigorous consensus process and the working group included the proponent of the original IBC proposal, Mr. Cid, as well as other representatives with extensive accessibility experience.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal will neither increase nor decrease the cost of construction because it is simply referencing the technical requirements in the ASME A17.1/CSA B44 standards as opposed to including them in the IBC.

Public Comment 2:

Proponent: Andrew Cid, representing Barrier Free Solutions For The Deaf and Hard of Hearingrequests Disapprove.

Commenter's Reason: ONLINE COMMENT IN OPPOSITION TO #139-18 THAT WAS SUBMITTED BY INDUSTRY
First off, I want to say that I have been encouraged by the continuing cooperation provided by the elevator industry, the A17 ASME professionals and industry representatives in communicating with me, the accessibility community and its supporters, in striving to improve accessibility in elevators for millions of U.S. citizens and for the Deaf and Hard of Hearing, Speech Impaired and the Visually Challenged communities. Thank you to all of you who are working on this important issue. There are no adversaries on either side, only cooperating professionals who endeavor to improve safety in the U.S.

There was a comment provided in the Analysis section in proposal G139-18, submitted by the elevator industry, that referenced the ICC criteria for reference standards in CP#28. It is noted that this particular ICC document appears to be for the reference to the DOJ ADA Title III Regulation in the proposal G139-18, but in reviewing the provisions of Section 3.6 would appear to be applicable to an existing referenced standard only if technical revisions are being made. **In 3.6.3.1.2 it is noted that code change proposals which include technical revisions to the code text to coordinate with a proposed update of an existing referenced standard <u>*shall include the submission of the proposed*</u>**

***update to the standard in at least a consensus draft form in accordance with Section 3.4*. <u>If the proposed update of the existing standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and *shall not be processed on this procedural technicality*</u>.**

Therefore, based on the lack of the elevator industry providing technical revisions to the existing A17.1 standard for emergency communication system in their proposal under #139-18 or even a particular reference to future activities on possible revisions to capture the intent of the recent provisions adopted in 3001.2 in the IBC further demonstrates that there is no specific support to incorporate the provisions of the IBC 3001.2 into the A17.1 document with their intent to retain the current provisions as found in the A17.1 document.

<u>Based on the first paragraph, please note that since the draft / proposed standard language to A17 was not submitted in #139-18, then #139-18 should not proceed on an ICC technicality.</u>

It may also appear that industry, despite the hard work of task force efforts to draft appropriate language to fully capture the spirit of 3001.2 (effective 2018), may not yet want to provide full explicit and clear provisions that can be fully utilized by the general public, especially the 75 million of the general population that may be (50M) deaf, hard of hearing and (25M) speech impaired.

To date, I do admit that I am very encouraged that industry is willing to provide, albeit small, incremental steps to improve access in elevators through their efforts and cooperation with us. However, industry has not yet agreed to a standard that captures the full intent and spirit of the new IBC code 3001.2 for 2018, which is to provide emergency use of full two-way face to face video (between both authorized personnel and the entrapped occupant), pre-programmed text questions/replies (no typing required on either end), or even the use of a qualified Sign Language Interpreter, as needed (which would be a very infrequent or rare occurrence, in an emergency).

A point of clarification as I am continuing my learning of the overall process of the relationship between codes and referenced standards that it would be acceptable to have a direct reference to a standard for particular provisions if the standard contains the fully relevant requirements. At this time, it does not appear that there have been any provisions offered by the A17.1 committee which would capture the FULL spirit and intent of the provisions of 3001.2 which has been accepted by the ICC membership.

This is in line with the ICC committee statement on my proposal that noted certain actions with this proposal could be taken if the A17.1 standard incorporated the desired language through it may simply be a duplication of the language, not a conflict which at this time does not appear to be in the offering.

I look forward to continue working with industry on a standard that captures the full spirit and intent of 2018 3001.2. I commend industry s cooperation and of its representatives and colleagues thus far, in working with the accessibility community, in striving to improve the lives of millions of U.S. citizens through an assurance of complete safety and accessibility in public spaces.

Bibliography: There is no attachment provided for this.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no cost impact of this Public Comment.

G139-18

G140-18

IBC: 3002.3, 3002.3.1

Proposed Change as Submitted

Proponent: Ed Kulik, Chair, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Building Code

Revise as follows

3002.3 Emergency signs **for other than occupant evacuation elevators..**. Where other than occupant evacuation elevators are provided, an *approved* pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the ~~exit stairways~~ exits and not to use the elevators in case of fire. The sign shall read: IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT ~~STAIRS.~~

~~Exceptions~~ Exception:

~~1.~~ The emergency sign shall not be required for elevators that are part of an accessible *means of egress* complying with Section 1009.4.

~~2. The emergency sign shall not be required for elevators that are used for occupant self-evacuation in accordance with Section 3008.~~

Add new text as follows

3002.3.1 Emergency signs for occupant evacuation elevators. Where occupant evacuation elevators are provided, an approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use occupant evacuation elevators in the event of fire. The sign shall read: IN CASE OF FIRE, THIS OCCUPANT EVACUATION ELEVATOR IS AVAILABLE FOR EXITING THE BUILDING.

Analysis: Duplicated text in the International Fire Code not shown for brevity.

Reason: This is one of 17 proposals being submitted as a package relating to technical and organizational changes proposed for Chapter 6 of the Fire Code. While the Code Committees will consider each proposal independently, the intent is for approval of all proposals in this package which have been submitted as a correlated set of companion code change proposals.
This proposal correlates with the series of proposals to the IFC Chapter 6 submitted by the F-CAC for correlation of Elevator requirements and specification of required signage for all elevators.

This proposal addresses the emergency signage for the elevators in the IBC and the IFC. The changes are reflected in the IBC as these are the parent sections for these requirements. If approved this language will be duplicated in Chapter 6 of the IFC. This also correlates with the signage requirements in ASME A17.1. Exit stairways were changed to "exits" because there could be ramps instead of stairways.

Two distinct sections are established between occupant evacuation elevators and other than those elevators.

This proposal also adds standardized language to both the IBC and te IFC for occupant evacuation elevator signage to ensure consistency between codes and to provide clear and concise building occupant instruction for their use.

This proposal is submitted by the ICC Building Code Action Committee (BCAC) in support of the FCAC's efforts. BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2017 the BCAC has held 3 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac.

Cost Impact: The code change proposal will decrease the cost of construction
By providing standardized language for the emergency signs for occupant evacuation elevators, and correlating for consistency the standardized language for other elevators.

G140-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is confusion regarding cueing at elevator lobbies and whether the elevator is available or not. The proposal doesn't specify clearly. The code official may enforce the requirement at all elevator call stations, not just occupant elevators. The flaw in this proposal is dealing with the typical highrise situations. It is should not be every elevator in every lobby. The use of the term "is" will create a situation where occupants may wait for an elevator that never comes. Tinker with the words "is" and "may" and possibly "pictoral." There may be a way to link the signage to the visual requirement that is going to be part of the A117.1 automated system......so that when someone goes to an elevator lobby they would know whether the elevator will come or not....or when to go to the stairs. There is a need to identify the elevators, but this is not the way to do it. Maybe simple a sign saying "evacuation elevator, "occupant elevator," "when directed," or "this elevator available...: (Vote: 14-0)

Assembly Action: **None**

G140-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

3002.3 Emergency signs for other than occupant evacuation elevators... Where other than occupant evacuation elevators are provided, an *approved* pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exits and not to use ~~the~~ these elevators in case of fire. The sign shall read: IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE AVAILABLE EXIT.

Exception:

The emergency sign shall not be required for elevators that are part of an accessible *means of egress* complying with Section 1009.4.

_

3002.3.1 Emergency signs for occupant evacuation elevators. Where occupant evacuation elevators are provided in accordance with Section 3008, an approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station ~~on all floors instructing~~ notifying occupants to use occupant evacuation elevators in the event of fire. The sign shall read: ~~IN CASE OF FIRE, THIS~~ THESE OCCUPANT EVACUATION ~~ELEVATOR IS AVAILABLE FOR EXITING THE BUILDING~~ELEVATORS ARE AVAILABLE AS AN EXIT.

Commenter's Reason: IBC Section 3008.1.1 requires that “signage shall be provided to denote which elevators are available for occupant evacuation.” However, the code does not provide standardized language for that signage. Requiring standardized language would reduce confusion for the occupants regarding the use of these elevators, by providing consistency and clarity for the required signage.

As noted in the proposed new text for Section 3002.3.1, the standardized language for these occupant elevators is only applicable to the elevator call stations serving those elevators designated as occupant elevators in accordance with the requirements in IBC Section 3008.

Modifications have been made to the original proposal to address the specific direction from the code development committee.

The proposed standardized language for the sign is in alignment with ASME A17.1.

This text is repeated in IFC Section 606.3.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This would require a sign at occupant evacuation elevators. A sign was already required at other elevators.

G140-18

G149-18

IBC: 3112, 3112.1, 3112.2

Proposed Change as Submitted

Proponent: Steve Martin, Florida Division of Emergency Management, representing Florida Division of Emergency Management (steve.martin@em.myflorida.com); Douglas Wise, Building Officials Association of Florida, representing Building Officials Association of Florida (douglasbwise@att.net)

2018 International Building Code

Add new text as follows

3112 PUBLIC USE RESTROOM BUILDINGS IN FLOOD HAZARD AREAS

3112.1 General. Public use restroom buildings that contain toilet rooms, bathrooms, showers and changing rooms, and those portions of buildings that contain toilet rooms, bathrooms, showers and changing rooms, and where such buildings and portions of buildings are intended for public use and located on publicly owned lands in flood hazard areas, shall comply with the requirements of this section. Public use restrooms that are not elevated or dry floodproofed in accordance with Section 1612 shall comply with Section 3112.2. Portions of buildings that include uses other than public use toilet rooms, bathrooms, showers and changing rooms shall comply with Section 1612.

3112.2 Flood resistance. Public use restrooms that are located in flood hazard areas shall comply with the requirements of ASCE 24, except for elevation requirements, and shall comply with all of the following criteria:

1. The building footprint is not more than 1,500 square feet.
2. Located, designed and constructed to resist the effects of flood hazards and flood loads to minimize flood damage from a combination of wind and water loads associated with the base flood.
3. Anchored to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy during conditions of the base flood.
4. Constructed of flood damage-resistant materials.
5. Where enclosed by walls, the walls have flood openings.
6. Mechanical and electrical systems are located above the base flood elevation.
7. Plumbing fixtures and plumbing connections are located above the base flood elevation.
8. An emergency plan, approved by the jurisdiction, is submitted to the building official where the building design specifies implementation of protection measures prior to the onset of flooding conditions.

Exceptions:

1. Minimum electric service required to address life safety and electric code requirements is permitted below the base flood elevation.
2. Plumbing fixtures and connections are permitted below the base flood elevation provided the fixtures and connections are designed and installed to minimize or eliminate infiltration of floodwaters into the sanitary sewage system and discharges from sanitary sewage systems into floodwaters.

Reason: Thousands of communities and state agencies have public open space and parks along rivers and shorelines. Many communities experience economic value from tourism and public access to areas that feature water resources. Under the current requirements of the IBC, restrooms for public use that are located in flood hazard areas must meet the same requirements as residential and commercial buildings. In flood hazard areas other than coastal high hazard areas and Coastal A Zones (i.e., in flood zones identified on Federal Emergency Management Agency Flood Insurance Rate Maps with the letter "A"), restroom buildings must either be elevated or dry floodproofed to or above the elevations required by the IBC/ASCE 24. In coastal high hazard areas (flood Zone V) and Coastal A Zones, restroom buildings must be elevated to or above the elevations required by the IBC/ASCE 24.

In Florida and other coastal states, this has resulted in construction of public use restrooms as high as 6 to 18 feet above grade. This poses many challenges, not the least of which is access. Figures 1, 2, 3 and 4 (below) illustrate elevated restrooms with long ramps. While ramps can be built to meet ADA requirements, to reach some heights required in some flood hazard areas the ramps may be as long as 300 feet. In coastal high hazard areas, such ramps likely conflict with the NFIP requirements that elevated buildings be “free of obstruction,” and the presence of such ramps would likely interfere with the ability of walls around enclosures to break away under flood conditions. Those same provisions are required by IBC Section 1612, Flood Loads, which references ASCE 24, Flood Resistant Design and Construction.

Long ramps defeat accessibility when the distance of travel still renders restroom facilities inaccessible to many persons with disabilities or limited mobility. Although the IBC (and FEMA) permits elevators to extend below the base flood elevation, installing elevators to provide access to elevated public use restrooms is expensive and creates many maintenance issues, and a high rate of failure to function, especially in beach areas where blowing sand and windborne salt aerosols create corrosive conditions.

This proposal creates a new section in IBC Chapter 31, Special Construction to limit the scope to public use restrooms that include public use toilet rooms, bathrooms, showers and changing rooms and spaces. Portions of such buildings that include other uses would have to fully comply with the elevation and other flood resistant requirements of IBC Section 1612, Flood Loads, which references ASCE 24, Flood Resistant Design and Construction.

In recognition that most public use restrooms are built on public land using public funds, the proposal is to limit the potential financial losses associated with flooded public facilities in two ways: by limiting the footprint to not more than 1,500 square feet and by specifying design requirements that minimize or eliminate physical damage when flooding occurs. Enabling public use restrooms to be designed to withstand the hydrodynamic and hydrostatic loads below the base flood elevation is an appropriate alternative to the extremely high cost for design, construction and maintenance of highly elevated public restrooms and their required access ramps or elevators.

Although the proposed design requirements are intended to preclude significant damage during flood conditions up to and including conditions of the design flood (e.g., the base or 100-year flood), more severe floods can and do occur. Figure 5 (below) illustrates one modest design option that demonstrates the feasibility of the proposal. It shows a small masonry restroom on a beach after Hurricane Irma pushed onshore. The drawings for the building show below-grade piling support and it appears the masonry units were filled. Despite approximately 6-8 feet of flooding (including waves), there is no evidence of structural damage and the non-structural damage appears readily repairable.

The proposal includes requirements for flood resistance similar to those found in IBC Appendix G, Section G1001 for Utility and Miscellaneous Group U and similar to the requirements of ASCE 24-14 for Flood Design Class 1 (which is essentially equivalent to Structure/Risk Category I). Those requirements effectively are the same as the NFIP requirements in 44 Code of Federal Regulations Section 60.3(a)(3)(ii), (iii), and (iv). FEMA deems the flood provisions of the I-Codes, with reference to ASCE 24, to meet or exceed the requirements of the National Flood Insurance Program (NFIP).

The intent is to allow public use restrooms to be at-grade or above-grade but below the base flood (partially elevated), provided they meet the design requirements listed in 3112.2. The proponent acknowledges that, at present, FEMA guidance states that restroom buildings and comfort stations in coastal high hazard areas must be elevated and meet the same design and construction requirements as other buildings. This proposal is intended to meet the intent of all NFIP requirements, except elevation requirements, to minimize flood damage, while acknowledging the special needs and access required or appropriate for public use restrooms. The Florida Floodplain Management Association prepared a white paper on this subject: Policy and Design Options for Public Restrooms in Special Flood Hazard Areas (2014), www.FLfloods.org/ffmawhitepaper.

Figure 1. Florida, flood Zone V. Ramp wraps around entire building. Has composting toilets, battery and solar electric system, emergency plan requires pumping out tank and filling with clean water.

Figure 2. Coastal Mississippi, flood Zone V. This facility cost $1.1 million.

Figure 3. Florida, Gulf Coast, flood Zone V. Ramp built after original elevator determined to be unsustainable due to significant maintenance problems.

Figure 4. Southwest Florida, flood Zone V. Extensive ramp wraps around three sides.

Figure 5. Florida, after Hurricane Irma, flood Zone V. No evidence of structural damage after estimated 5 ft stillwater plus waves. From upper left: facing beach, side, interior, rear.

Bibliography: Policy and Design Options for Public Restrooms in Special Flood Hazard Areas, Florida Floodplain Management Associations, 2014. 55 pages. www.FLfloods.org/ffmawhitepaper

Cost Impact: The code change proposal will decrease the cost of construction
The proposal will lower the initial cost of construction and lower routine and long-term facility maintenance. The cost to construct as specified in this proposal to resist the effects of flood hazards and flood loads may be somewhat higher than a typical non-elevated restroom building that is not designed to resist flood loads and flood damage (not currently allowed). However, the cost for construction under the proposal will be less than the cost to elevate and provide and maintain elevators and extensive ramp systems (current method of compliance).

G149-18

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal has some merit, but the language is too loose. "Public" could mean any building that is considered public in the Americans with Disabilities Act. "Governmental entities" may be a better term. (Vote: 9-5)

Assembly Action: **As Submitted**

G149-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Steven Martin, Florida Division of Emergency Management, representing Florida Division of Emergency Management (steve.martin@em.myflorida.com); Douglas Wise, Palm Beach County, representing Building Officials Association of Florida (douglasbwise@att.net)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

3101.1 Scope. The provisions of this chapter shall govern special building construction including *membrane structures*, temporary structures, *pedestrian walkways* and tunnels, automatic vehicular gates, awnings and *canopies*, marquees, signs, towers, antennas, relocatable buildings, swimming pool enclosures and safety devices, ~~and~~ solar energy systems, and public use restroom buildings on publicly owned lands in flood hazard areas.

~~3112~~3114 PUBLIC USE RESTROOM BUILDINGS IN FLOOD HAZARD AREAS

~~3112~~3114.1 General. ~~Public use restroom buildings that contain toilet rooms, bathrooms, showers and changing rooms, and those portions of buildings that contain~~ For the purpose of this section, public restroom buildings are located on publicly owned lands in flood hazard areas and intended for public use. Public restroom buildings and portions of other buildings that contain public restrooms, are limited to toilet rooms, bathrooms, showers and changing rooms~~, and where such~~ . Public restroom buildings and portions of buildings ~~are intended for public use and located on publicly owned lands in flood hazard areas,~~ that contain public restrooms shall comply with the requirements of this section. Public use restrooms that are not elevated or dry floodproofed in accordance with Section 1612 shall comply with Section ~~3112~~3114.2. Portions of buildings that include uses other than public use toilet rooms, bathrooms, showers and changing rooms shall comply with Section 1612.

~~3112.2~~ 3114.2 Flood resistance. Public use restrooms ~~that are located~~ on publicly owned lands in flood hazard areas shall comply with the requirements of ASCE 24, except for elevation requirements, and shall comply with all of the following criteria:

1. The building footprint is not more than 1,500 square feet.
2. Located, designed and constructed to resist the effects of flood hazards and flood loads to minimize flood damage from a combination of wind and water loads associated with the base flood.
3. Anchored to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy during conditions of the base flood.
4. Constructed of flood damage-resistant materials.
5. Where enclosed by walls, the walls have flood openings.
6. Mechanical and electrical systems are located above the base flood elevation.
7. Plumbing fixtures and plumbing connections are located above the base flood elevation.
8. An emergency plan, approved by the jurisdiction, is submitted to the building official where the building design ~~specifies~~ documents specify implementation of protection measures prior to the onset of flooding conditions.

Exceptions:

1. Minimum necessary electric ~~service~~ equipment required to address health, life safety and electric code requirements is permitted below the base flood elevation in accordance with ASCE 24 provisions for electric elements installed below the minimum elevations.

2. Plumbing fixtures and connections are permitted below the base flood elevation provided the fixtures and connections are designed and installed to minimize or eliminate infiltration of floodwaters into the sanitary sewage system and discharges from sanitary sewage systems into floodwaters.

Commenter's Reason: This public comment addresses issues raised by committee members at the March 13, 2018 Committee Action Hearing by clarifying that this new section applies to public restroom buildings and portions of other buildings that contain public restrooms in flood hazard areas located only on publicly-owned land.
The intent is to provide an alternative to elevating public restrooms in publicly-owned open spaces and parks along rivers and shorelines which otherwise may be challenging to access for persons with limited mobility because of excessively long ramps. Restrooms designed and constructed in accordance with this section, which references ASCE 24, Flood Resistant Design and Construction, will be minimal in nature and designed to resist flooding with minimal, if any damage.

FEMA deployed a Mitigation Assessment Team after Hurricane Irma to investigate damage, including how public restrooms were affected. The results of that field work were not released as of the deadline for submission of this public comment. Florida Division of Emergency Management staff participated in the field work and, along with the other team members, observed some below-BFE small public restrooms designed to resist flood loads that sustained superficial damage (finishes and fixtures) and were readily repairable. At a June 2018 meeting between the Florida Division of Emergency Management and senior management officials with the FEMA Flood Insurance and Mitigation Administration, FEMA concurred with the public comment and indicated the agency would work to achieve consistency across agency programs to develop guidance or procedures based on the proposed amendment. No opposition to the proposal was expressed during that meeting.

Another clarification to the proposal is to specify the minimum necessary “electric equipment” (rather than “electric service”) that may be below the base flood elevation. ASCE 24 specifies requirements for electric elements installed below minimum required elevations, including conduits and cables; lighting circuits, switches, receptacles, and fixtures; wiring and splices suitable for submergence; and energizing from distribution panels located above and accessible from above flood elevation supplied by branch circuits originating from ground-fault circuit-interrupter breakers. ASCE 24 also requires installations to be in accordance with NFPA 70, National Electric Code. The proponents will submit to ICC proposed text for the commentary volume that describes allowances for light switches and fixtures, GFCI receptacles, exhaust fans, and electrical equipment and attendant utilities that are the minimum necessary to meet health and life safety requirements.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This public comment clarifies the intent and does not change the cost impact submitted as part of the original proposal.

Public Comment 2:

Proponent: Assembly Actionrequests As Submitted.

Commenter's Reason: This code change proposal is on the agenda for individual consideration because the proposal received a successful assembly action. The assembly action for Disapprove was successful by a vote of 53% (71) to 47% (63) by eligible members online during the period of May 9 - May 23, 2018.

G149-18

G151-18

IBC: (New), 3101.1, 3114 (New), 3114.1 (New), 3114.2 (New), 3114.3 (New), 3114.4 (New), 3114.5 (New), 3114.6 (New), 3114.7 (New), 3114.8 (New), 3114.8.1 (New), 3114.8.1.1 (New), 3114.8.2 (New), 3114.8.3 (New), 3114.8.4 (New), 3114.8.4.1 (New), 3114.8.4.2 (New), 3114.8.4.3 (New), 3114.8.5 (New), 3114.8.5.1 (New), 3114.8.5.2 (New), 3114.8.5.3 (New), 3114.8.5.3(1) (New), 3114.8.5.3(2) (New), 3114.8.5.3(4) (New), 3114.8.5.3(3) (New), 3114.8.5.3 (New), Chapter 35

Proposed Change as Submitted

Proponent: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Building Code

Add new definition as follows

INTERMODAL SHIPPING CONTAINER. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

Revise as follows

3101.1 Scope. The provisions of this chapter shall govern special building construction including *membrane structures*, temporary structures, *pedestrian walkways* and tunnels, automatic vehicular gates, awnings and *canopies*, marquees, signs, towers, antennas, relocatable buildings, swimming pool enclosures and safety devices, ~~and~~ solar energy ~~systems.~~systems and intermodal shipping containers.

Add new text as follows

SECTION 3114 INTERMODAL SHIPPING CONTAINERS

3114.1 General. The provisions of Section 3114 and other applicable sections of this code, shall apply to intermodal shipping containers that are repurposed for use as buildings or structures or as a part of buildings or structures.

Exceptions:

1. Intermodal shipping containers previously approved as existing relocatable buildings complying with Chapter 14 of the International Existing Building Code.
2. Stationary storage battery arrays located in intermodal shipping containers complying with Chapter 12 of the International Fire Code.
3. Intermodal shipping containers that are listed as equipment complying with the standard for equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.

3114.2 Construction Documents. The construction documents shall contain information to verify the dimensions and establish the physical properties of the steel components, and wood floor components, of the intermodal shipping container in addition to the information required by Sections 107 and 1603.

3114.3 Intermodal shipping container information. Intermodal shipping containers shall bear an existing data plate containing the following information as required by ISO 6346 and verified by an approved agency. A report of the verification process and findings shall be provided to the building owner.

1. Manufacturer's name or identification number
2. Date manufactured.
3. Safety approval number.
4. Identification number.
5. Maximum operating gross mass (kg) (Lbs)
6. Allowable stacking load for 1.8G (kg) (lbs)
7. Transverse racking test force (Newtons)
8. Valid maintenance examination date

Where approved by the building official, the markings and existing data plate are permitted to be removed from the intermodal shipping containers before they are repurposed for use as buildings or structures or as a part of buildings or structures.

3114.4 Protection against decay and termites. Wood structural floors of intermodal shipping containers shall be protected from decay and termites in accordance with the applicable provisions of Section 2304.12.1.1.

3114.5 Under-floor ventilation. The space between the bottom of the floor joists and the earth under any intermodal shipping container, except spaces occupied by basements and cellars, shall be provided with ventilation in accordance with Section 1202.4.

3114.6 Roof assemblies. Intermodal shipping container roof assemblies shall comply with the applicable requirements of Chapter 15.

> **Exception:** Single-unit stand-alone intermodal shipping containers not attached to, or stacked vertically over, other intermodal shipping containers, buildings or structures.

3114.7 Joints and voids. Joints and voids that create concealed spaces between intermodal shipping containers, that are connected or stacked, at 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 in accordance with Section 715.

3114.8 Structural. . Intermodal shipping containers which conform to ISO 1496-1 that are repurposed for use as buildings or structures, or as a part of buildings or structures, shall be designed in accordance with Chapter 16 and this section.

3114.8.1 Foundations. Intermodal shipping containers repurposed for use as a permanent building or structure shall be supported on foundations or other supporting structures designed and constructed in accordance with Chapters 16 through 23 of this code.

3114.8.1.1 Anchorage. Intermodal shipping containers shall be anchored to foundations or other supporting structures as necessary to provide a continuous load path for all applicable design and environmental loads in accordance with Chapter 16.

3114.8.2 Welds. All new welds and connections shall be equal to or greater than the original connections.

3114.8.3 Structural design. The structural design for the intermodal shipping containers repurposed for use as a building or structure, or as part of a building or structure, shall comply with Section 3114.8.4 or 3114.8.5.

3114.8.4 Detailed design procedure. A structural analysis meeting the requirements of this section shall be provided to the building official to demonstrate the structural adequacy of the intermodal shipping containers.

> **Exception:** Intermodal shipping containers designed in accordance with Section 3114.8.5.

3114.8.4.1 Material properties. Structural material properties for existing intermodal shipping container steel components shall be established by material testing where the steel grade and composition cannot be identified by the manufacturer's designation as to manufacture and mill test.

3114.8.4.2 Seismic design parameters. ~~The appropriate detailing requirements of ASCE 7; response modification coefficient, R; overstrength factor, â¦₀; deflection amplification factor, C_d; and limits on structural height, h_n, for the corrugated shear wall is permitted to be developed in accordance with generally accepted procedures where approved by the building official in accordance with Section 104.11.~~ The seismic force-resisting system shall be designed and detailed in accordance with one of the following:

1. Where all or portions of the corrugated steel container sides are considered to be the seismic force-resisting system, design and detailing shall be in accordance with the ASCE 7 Table 12.2-1 requirements for light-frame bearing-wall systems with shear panels of all other materials,occupancies with an *occupant load* of 50 or less.
2. Where portions of the corrugated steel container sides are retained, but are not considered to be the seismic force-resisting system, an independent seismic force-resisting system shall be selected, designed and detailed in accordance with ASCE 7 Table 12.2-1, or
3. Where portions of the corrugated steel container sides are retained and integrated into a seismic force-resisting system other than as permitted by Sectuion 3114.4.2 Item 1, seismic design parameters shall be developed from testing and analysis in accordance with Section 104.11 and ASCE 7 Section 12.2.1.1 or 12.2.1.2.

3114.8.4.3 Allowable shear value. The allowable shear values for the intermodal shipping container corrugated steel sheet panel side walls and end walls shall be demonstrated by testing and analysis accordance with Section 104.11.

Where penetrations are made in the side walls or end walls designated as part of the lateral force-resisting system, the penetrations shall be substantiated by rational analysis.

3114.8.5 Simplified structural design of single-unit containers. Single-unit intermodal shipping containers conforming to the limitations of Section 3114.8.5.1 shall be permitted to be designed in accordance with the simplified structural design provisions of Section 3114.8.5.

3114.8.5.1 Limitations. Use of Section 3114.8.5 is subject to all the following limitations:

1. The intermodal shipping container shall be a single-unit, stand-alone unit supported on a foundation and shall not be in contact with or supporting any other shipping container or other structure.
2. The intermodal shipping container top and bottom rails, corner castings, and columns or any portion thereof shall not be notched, cut, or removed in any manner.
3. The intermodal shipping container shall be erected in a level and horizontal position with the floor located at the bottom.
4. The intermodal shipping container shall be located in Seismic Design Category A, B, C or D.

3114.8.5.2 Simplified structural design. Where permitted by Section 3114.8.5.1, single-unit, stand-alone intermodal shipping containers shall be designed using the following assumptions for the corrugated steel shear walls:

1. The appropriate detailing requirements contained in Chapters 16 through 23.
2. Response modification coefficient, R=2,
3. Overstrength factor, Ω_0=2.5,
4. Deflection amplification factor, C_d = 2, and
5. Limits on structural height, h_n = 9.5 feet (2,900 mm).

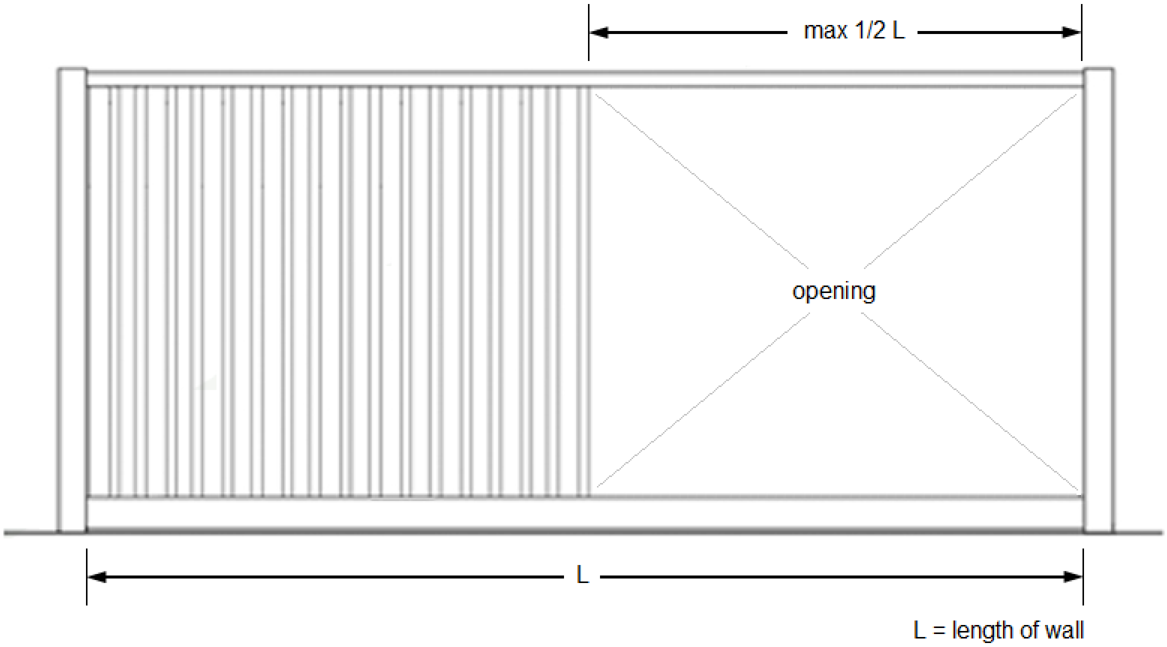
3114.8.5.3 Allowable shear. The allowable shear for the corrugated steel side walls (longitudinal) and end walls (transverse) for wind design and for seismic design using the coefficients of Section 3114.8.5.2 shall be permitted to have the allowable shear values set forth in Table 3114.8.5.3 provided that all of the following conditions are met:

1. The total linear length of all openings in any individual side walls or end walls shall be limited to not more than 50% of the length of that side walls or end walls, as shown in Figure 3114.8.5.3(1).
2. Any full height wall length, or portion thereof, less than 4 feet (305 mm) long shall not be considered as a portion of the lateral force-resisting system, as shown in Figure 3114.8.5.3(2).
3. All side walls or end walls used as part of the lateral force-resisting system shall have an existing or new boundary element on all sides to form a continuous load path, or paths, with adequate strength and stiffness to transfer all forces from the point of application to the final point of resistance, as shown in Figure 3114.8.5.3(3).
4. Where openings are made in container walls, floors, or roofs for doors, windows and other openings:
   4.1 The openings shall be framed with steel elements that are designed in accordance with Chapter 16 and Chapter 22.

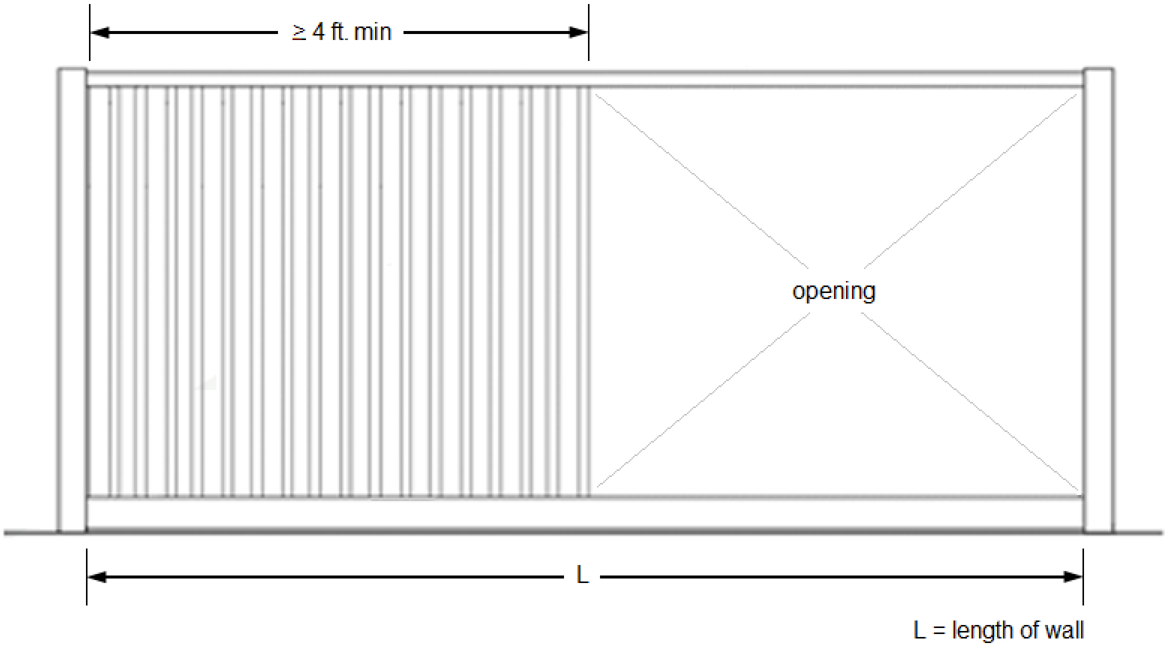
   4.2. The cross section and material grade of any new steel element shall be equal to or greater than the steel element removed.

5. A maximum of one penetration not greater than a 6-inch (152 mm) diameter hole for conduits, pipes, tubes or vents, or not greater than 16 square inches (10,322 sq mm) for electrical boxes, is permitted for each individual 8 foot length (2,438 mm) lateral force resisting wall. Penetrations located in walls that are not part of the wall lateral force resisting system shall not be limited in size or quantity. Existing intermodal shipping container vents shall not be considered a penetration, as shown in Figure 3114.8.5.3(4).
6. End wall door or doors designated as part of the lateral force-resisting system shall be welded closed.

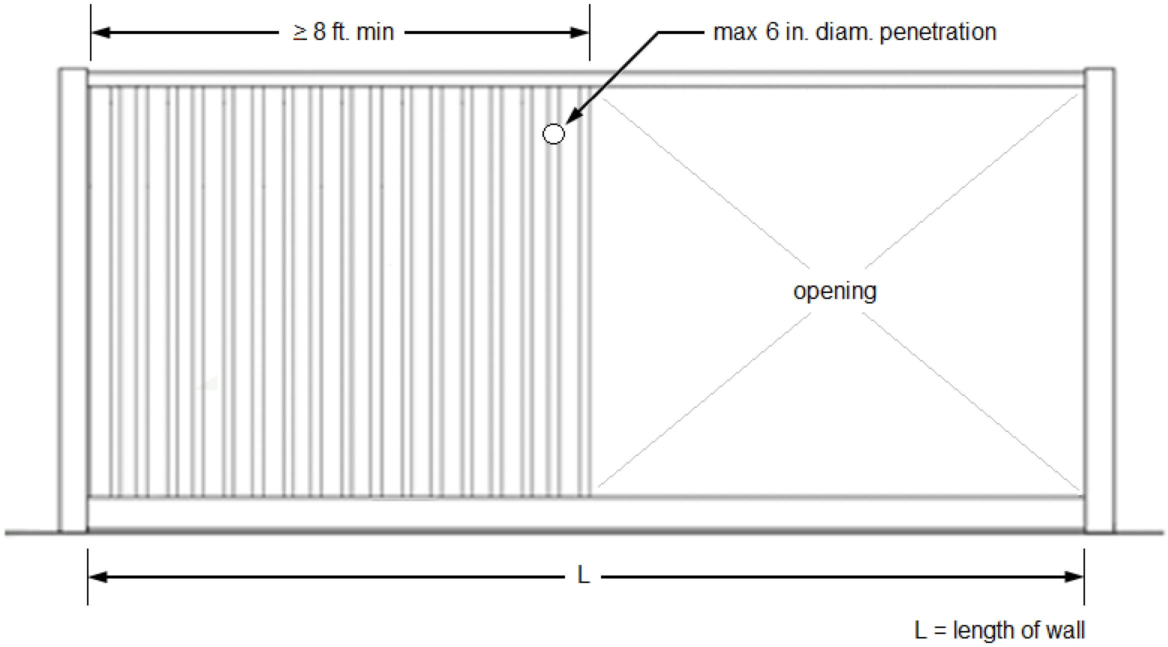
.



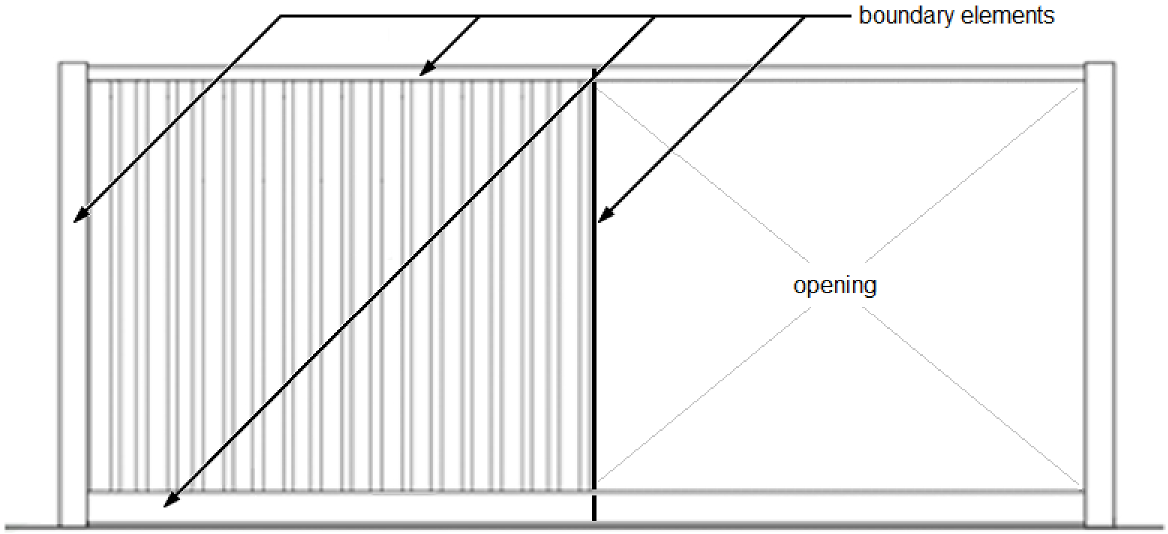
3114.8.5.3(1)
Bracing Unit Distribution--Maximum Linear Length



3114.8.5.3(2)
Bracing Unit Distribution -- Minimum Linear Length



3114.8.5.3(4)
Bracing Unit Distribution -- Penetration Limitations



3114.8.5.3(3)
Bracing Unit Distribution -- Boundary Elements

TABLE 3114.8.5.3
Allowable Strength Values for Intermodal Shipping Container Corrugated Steel Siding Shear Walls for Wind or Seismic Loading

CONTAINER DESIGNATION [2]	CONTAINER DIMENSION (Nominal Length)	CONTAINER DIMENSION (Nominal Height)	ALLOWABLE SHEAR VALUES (PLF) [1,3]	
			Side Wall	End Wall
1EEE	45 feet (13.7 M)	9.5 feet (2896 mm)	75	843
1EE		8.6 feet (2591 mm)		
1AAA	40 feet (12.2 M)	9.5 feet (2896 mm)	84	
1AA		8.5 feet (2592 mm)		
1A		8.0 feet (2438 mm)		
1AX		< 8.0 feet (2438 mm)		
1BBB	30 feet (9.1 M)	9.5 feet (2896 mm)	112	
1BB		8.5 feet (2591 mm)		
1B		8.0 feet (2438 mm)		
1BX		< 8.0 feet (2438 mm)		
1CC	20 feet (9.1 M)	8.5 feet (2591 mm)	168	
1C		8.0 feet (2438 mm)		
1CX		< 8.0 feet (2438 mm)		
1D	10 feet (3.0 M)	8.0 feet (2438 mm)	337	
1DX		< 8.0 feet (2438 mm)		

1. The allowable strength shear for the side walls and end walls of the intermodal shipping containers are derived from ISO 1496-1 and reduced by a factor of safety of 5.
2. Container designation type is derived from ISO 668.
3. Limitations of Sections 3114.8.5.1 shall apply

Add new standard(s) follows

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401
1214 Vernier

ISO 668: 2013:

Series 1 Freight Containers - Classifications, dimensions and ratings

ISO 1496-1: 2013:

Series 1 Freight Containers - Specification and Testing - Part 1: General Cargo Containers for General Purposes

ISO 6346: 1995, with Amendment 3: 2012:

Freight Containers - Coding, Identification and marking

Reason: This code change purpose is to introduce intermodal shipping containers into the International Building Code based on requests by code officials in the U.S. Prior to this proposal, several jurisdictions had created their own individual regulations or ordinances, or had administered additional requirements beyond the code (e.g. Section 104.11 “Alternative materials, design and methods of construction and equipment”) so as to be comfortable to ensure a safe structure. This code change proposal is in response to those requests to develop a set of consistent code provisions which cover the minimum safety requirements, but which do not duplicate existing code provisions.

This proposal covers:

- Creation of a new definition in order to separate the container from other I-code sections which refer to, but intentionally do not define, shipping containers,
- Creating exceptions so to differentiate the intermodal shipping container from other code sections which could be interpreted as applying to intermodal shipping containers under other applications (e.g. temporary storage, relocatable buildings, energy storage facilities, and listed equipment),
- Verification of containers construction, condition, and structural integrity to assist the structural engineer in the evaluation for building construction,
- References to other sections concerning foundations, decay and termite control, crawlspace ventilation, roof assemblies, interior finishes, and joints/intersections.
- Introduction of structural provisions unique to intermodal shipping containers and which do not duplicate the existing structural requirements, and
- Addition of three ISO standards for reference.

Chapter 2 - New definition - A new definition has been created in order that these provisions can be adequately enforced and not confused the other multiple varieties of definitions of containers currently in the market.

Section 3114.1 – This represents the charging statement that outlines the requirements for containers, and list the appropriate exceptions with the I-codes in order to coordinate with other provisions that may appear similar in nature and where intermodal shipping containers could possibly be used in those other applications.

Section 3114.2 – Construction documents – These provision emphasize the material requirements as specified in this section.

Section 3114.3 – Verification - These provisions focus on the characteristics of the intermodal shipping container prior to it being repurposed. In this case the provisions require a straight forward inspection by an approved agency, and verification of the data plate which is normally found on intermodal shipping containers. There was an intent not to specify who the approved agency would be for two reasons; 1) so as to allow the code official or state law(s) to handle this aspect recognizing that in each jurisdiction their requirements may be different, and 2) to avoid dictating an international agreement onto jurisdictions that are currently employed by the shipping and container manufacturers worldwide today. In this case, the standards are regulated by the International Convention of Safe Containers (CSC) that have policies and procedures for inspecting containers worldwide. These procedures include policies for Approved Continuous Examination Program (ACEP) at the time the container is used in production, and policies for third party inspection agencies. The list shown in this section is a extract from the ISO standard and serves as a reference of items to be verified in order to validate the type of container.

3114.4 through 3114.6 – While we have strived to focus on only those provisions that recognize the unique aspects of intermodal shipping containers, we felt that some direction references were appropriate. In this case specific pointers are provided to foundations, decay and termite control, crawlspace ventilation, and roof requirements addressing drainage and weather protection.

3114.7 – Joints and voids – This provision is provided to address the interstitial spaces that may be created when multiple intermodal shipping containers are connected or stacked, whereby that concealed space between the containers is protected to prevent fire and hot gasses from passing between containers.

Section 3114.8 – Structural - The structural provisions are divided into multiple categories, as follows: 1) the general characteristics for all containers; 2) engineered structural design; and 3) simplified method for single-unit stand-alone container.

3114.8.1 – Foundations or supports – Provisions have been included to outline the two options for securing the container; a foundation or the connection to another structure. This provision makes it clear that the load path anchorage is required for all containers and to ensure the designed performance provided by the remainder of the structural provisions.

3114.8.2 – Welds – An additional provision has been added to require that any new welds be designed and installed with welds of greater structural capabilities.

Section 3114.8.4 – Detailed structural analysis - The detailed analysis engineering approach represents the general engineering practice allowed for all other types of building constructions. For this section the engineer of record is allowed to practice as they normally would for any other building type. As may be noted much of this section requires submission through the alternative means and methods provisions in order to obtain a permit as information about intermodal shipping containers is not readily listed in the IBC provisions or referenced standards.

Section 3114.8.5 – Simplified analysis - The concept for the single container approach is to make the design and construction process simpler. The provisions include a strict listing of limitations for use of these provisions. The proposal also provides structural design information, and pre-established shear wall information that is contained in the ISO 1496-1 standard, which is used to design and construct intermodal shipping containers. The shear wall values were obtained from the ISO 1496-1 standard through engineering analysis using a factor of safety of 5. In addition, a provision was installed to limit the number and size of openings and service holes within the container, as well as to prevent building owners or designers from embellishing the size to something most engineers would define as an opening. This method is intended to address the simple structure approach and provide available information for use by the structural engineer to supplement their work.

Chapter 35 – Referenced Standards – Included with this proposal are three ISO standards which are relevant to the intermodal shipping container's construction. These standards are part of the industry standards regulated by the International Convention of Safe Containers (CSC) that have policies and procedures for inspecting containers worldwide.

BCAC - The International Code Council's Building Code Action Committee (BCAC) was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes and the public comments. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The ICC Building Code Action Committee created a task group to facilitate the development of this proposal. Members of the assigned task group included representatives from: City of Long Beach, CA; County of Mecklenburg, NC; Modular Building Institute; American Iron and Steel Institute; Underwriters Laboratories; and the Portland Cement Association. Additional contacts included the State of California (Division of State Architect, Housing and Community Development), City of San Diego; City of Los Angeles, CA; City of Seattle; Clark County, NV; Falcon Structures, RADCO a Twining Company, SEABOX Company, FEMA ATC Seismic Code Support Committee, and other guests who provided their individual expertise.

Cost Impact: The code change proposal will decrease the cost of construction
The code change proposal will decrease the cost of construction. This new code section will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for building construction. Current use of repurposed intermodal shipping containers requires the building owner or designee to submit through the alternative means and methods administrative provisions.

Analysis: A review of the standards proposed for inclusion in the code, ISO 668, ISO 1496-1 and ISO 6346, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2018.

G151-18

Public Hearing Results

Errata: The proposed table has been corrected.

Committee Action: As Modified

Committee Modification: 3114.1 General. The provisions of Section 3114 and other applicable sections of this code, shall apply to intermodal shipping containers that are repurposed for use as buildings or structures or as a part of buildings or structures.
Exceptions:

Intermodal shipping containers previously approved as existing relocatable buildings complying with Chapter 14 of the International Existing Building Code.
Stationary storage battery arrays located in intermodal shipping containers complying with Chapter 12 of the International Fire Code.
Intermodal shipping containers that are listed as equipment complying with the standard for equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.
Intermodal shipping containers used as experimental equipment or apparatuses.

3114.3 Intermodal shipping container information. Intermodal shipping containers shall bear an existing data plate containing the following information as required by ISO 6346 and verified by an approved agency. A report of the verification process and findings shall be provided to the building owner.

Manufacturer's name or identification number
Date manufactured.
Safety approval number.
Identification number.
Maximum operating gross mass or weight (kg) (Lbs)
Allowable stacking load for 1.8G (kg) (lbs)
Transverse racking test force (Newtons)
Valid maintenance examination date

Where approved by the building official, the markings and existing data are permitted to be removed from the intermodal shipping containers before they are repurposed for use as buildings or structures or as a part of buildings or structures.

3114.8.4.2 Seismic design parameters. ~~The appropriate detailing requirements of ASCE 7; response modification coefficient, R; overstrength factor; deflection amplification factor, C_d; and limits on structural height, h_n, for the corrugated shear wall is permitted to be developed in accordance with generally accepted procedures where approved by the building official in accordance with Section 104.11.~~ The seismic force-resisting system shall be designed and detailed in accordance with one of the following:

Where all or portions of the corrugated steel container sides are considered to be the seismic force-resisting system, design and detailing shall be in accordance with the ASCE 7 Table 12.2-1 requirements for light-frame bearing-wall systems with shear panels of all other materials.
Where portions of the corrugated steel container sides are retained, but are not considered to be the seismic force-resisting system, an independent seismic force-resisting system shall be selected, designed and detailed in accordance with ASCE 7 Table 12.2-1, or
Where portions of the corrugated steel container sides are retained and integrated into a seismic force-resisting system other than as permitted by Section 3114.4.2 Item 1, seismic design parameters shall be developed from testing and analysis in accordance with Section 104.11 and ASCE 7 Section 12.2.1.1 or 12.2.1.2.

3114.8.5.3 Allowable shear. The allowable shear for the corrugated steel side walls (longitudinal) and end walls (transverse) for wind design and for seismic design using the coefficients of Section 3114.8.5.2 shall be ~~permitted to have the allowable shear values set forth in~~ in accordance with Table 3114.8.5.3 provided that all of the following conditions are met:

The total linear length of all openings in any individual side walls or end walls shall be limited to not more than 50% of the length of that side walls or end walls, as shown in Figure 3114.8.5.3(1).
Any full height wall length, or portion thereof, less than 4 feet (305 mm) long shall not be considered as a portion of the lateral force-resisting system, as shown in Figure 3114.8.5.3(2).
All side walls or end walls used as part of the lateral force-resisting system shall have an existing or new boundary element on all sides to form a continuous load path, or paths, with adequate strength and stiffness to transfer all forces from the point of application to the final point of resistance, as shown in Figure 3114.8.5.3(3).
Where openings are made in container walls, floors, or roofs for doors, windows and other openings: 4.1. The openings shall be framed with steel elements that are designed in accordance with Chapter 16 and Chapter 4.2. The cross section and material grade of any new steel element shall be equal to or greater than the steel element removed.

5. A maximum of one penetration not greater than a 6-inch (152 mm) diameter hole for conduits, pipes, tubes or vents, or not greater than 16 square inches (10,322 sq mm) for electrical boxes, is permitted for each individual 8 foot length (2,438 mm) lateral force resisting wall. Penetrations located in walls that are not part of the wall lateral force resisting system shall not be limited in size or quantity. Existing intermodal shipping container vents shall not be considered a penetration, as shown in Figure 3114.8.5.3(4).

6. End wall door or doors designated as part of the lateral force-resisting system shall be welded closed.

TABLE 3114.8.5.3

Allowable ~~Strength~~ Shear Values for Intermodal Shipping Container Corrugated Steel Siding Shear Walls for Wind or Seismic Loading

(No changes to body of table)

The allowable ~~strength~~ shear for the side walls and end walls of the intermodal shipping containers are derived from ISO 1496-1 and reduced by a factor of safety of 5.
Container designation type is derived from ISO 668.
Limitations of Sections 3114.8.5.1 shall apply

(Portions of proposal not shown are not modified)

Committee Reason: The modifications add clarifications that will help the approval process go smoothly, but the committee would like to see a public comment to change the term "corrugated" container to "intermodal" container to be consistent with other language in the proposal. Other discrepancies in the modifications are minor and could also be cleaned up in the public comment process. The proposal addresses a need for guidance regarding the approval of intermodal shipping containers in the context of the building code. (Vote: 14-0)

Assembly Action: None

G151-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Ed Kullik, representing ICC Building Code Action Committee (bcac@iccsafe.org)requests As Modified by This Public Comment.

Modify as follows:

2018 International Building Code

3114.1 General. The provisions of Section 3114 and other applicable sections of this code, shall apply to intermodal shipping containers that are repurposed for use as buildings or structures or as a part of buildings or structures.

Exceptions:

1. Intermodal shipping containers previously approved as existing relocatable buildings complying with Chapter 14 of the International Existing Building Code.
2. Stationary storage battery arrays located in intermodal shipping containers complying with Chapter 12 of the International Fire Code.
3. Intermodal shipping containers that are listed as equipment complying with the standard for equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.
4. Intermodal shipping containers housing or supporting experimental equipment are exempt from the requirements of Section 3114 provided they comply with all of the following:
   4.1. Such units shall be single stand-alone units supported at grade level and used ~~as experimental equipment or apparatuses.~~ only for occupancies as specified under Risk Category I in Table 1604.5;
   4.2. Such units are located a minimum of 8 feet from adjacent structures, and are not connected to a fuel gas system or fuel gas utility; and
   4.3. In hurricane-prone regions and flood hazard areas, such units are designed in accordance with the applicable provisions of Chapter 16.

Commenter's Reason: Without scoping limits, this exception could permit varying uses and locations in which the container could pose substantial earthquake safety hazard to surrounding structures and persons. This could include containers located in or on structures, where container shifting could damage the structure, or fall and injure persons in the vicinity. This could also include fire hazard if a container shifts and gas lines are damaged.
This safety concern is addressed by the public comment language which provides scoping limits defining conditions under which risk is minimal such that regulation of the structural design and anchorage is not needed. The proposed language addresses:

- Occupancies that represent low risk to human life,
- Supported at grade where the risk of damage or injury due to falling is minimal,
- Eight foot distance to surrounding structures provides a zone for container shifting without causing damage to other structures,
- Prohibition of fuel gas intends to avoid fire ignition hazards should the container shift under seismic or wind loading,
- For hurricane prone and flood hazard areas, Chapter 16 will trigger requirements to reduce hazard.

These are believed to be scoping limits that can be readily screened for, permitting true low-hazard uses to occur with minimal regulation.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The resulting new provisions will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for building construction. Current use of repurposed intermodal shipping containers requires the building owner or designee to submit through the alternative means and methods administrative provisions.

Public Comment 2:

Proponent: Ed Kullik, representing ICC Building Code Action Committee (bcac@iccsafe.org)requests As Modified by This Public Comment.

Further modify as follows:

2018 International Building Code

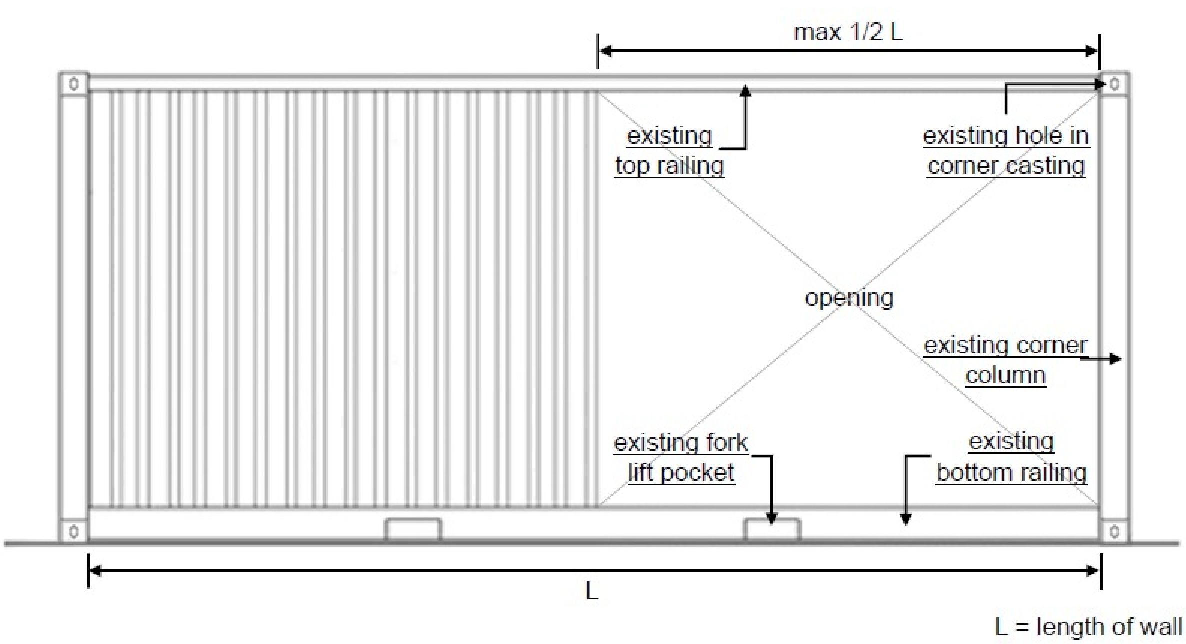
TABLE 3114.8.5.3
Allowable Shear Values for Intermodal Shipping Container Corrugated Steel ~~Siding Shear~~ Walls for Wind or Seismic Loading

CONTAINER DESIGNATION [2]	CONTAINER DIMENSION (Nominal Length)	CONTAINER DIMENSION (Nominal Height)	ALLOWABLE SHEAR VALUES (PLF) [1,3]		
			Side Wall	End Wall	
1EEE	45 feet (13.7 M)	9.5 feet (2896 mm)	75	843	
1EE		8.6 feet (2591 mm)			
1AAA	40 feet (12.2 M)	9.5 feet (2896 mm)	84		
1AA		8.5 feet (2592 mm)			
1A		8.0 feet (2438 mm)			
1AX					
1BBB	30 feet (9.1 M)	9.5 feet (2896 mm)	112		
1BB		8.5 feet (2591 mm)			
1B		8.0 feet (2438 mm)			
1BX					
1CC	20 feet (9.1 M)	8.5 feet (2591 mm)	168		
1C		8.0 feet (2438 mm)			
1CX					
1D	10 feet (3.0 M)	8.0 feet (2438 mm)	337		
1DX					

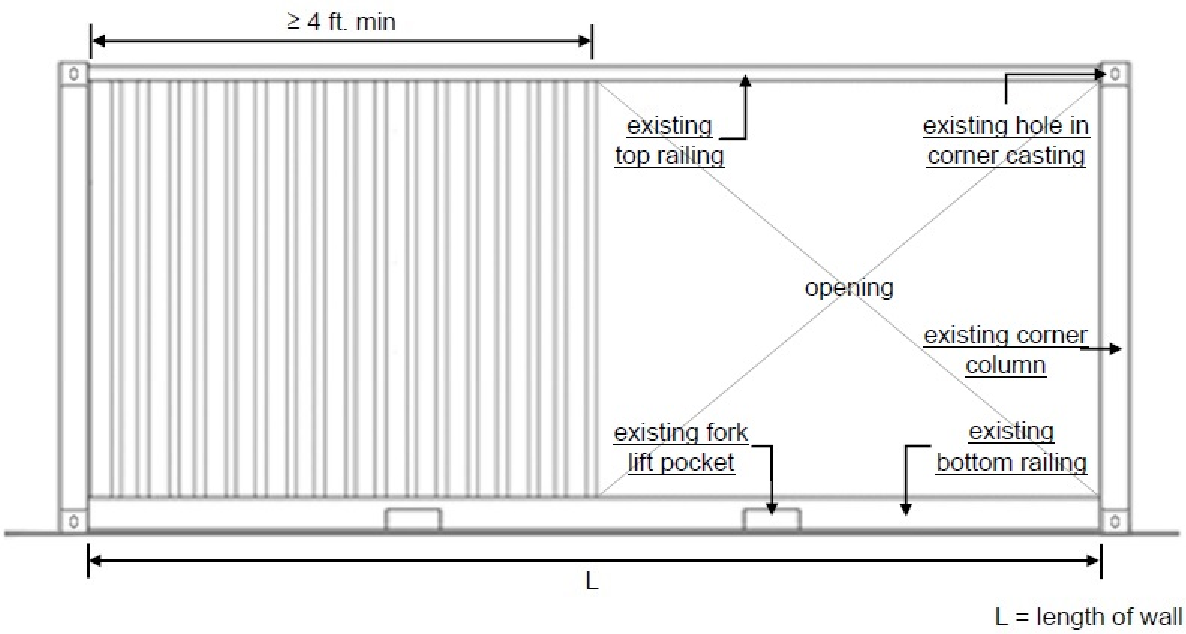
1. The allowable shear for the side walls and end walls of the intermodal shipping containers are derived from ISO 1496-1 and reduced by a factor of safety of 5.
2. Container designation type is derived from ISO 668.
3. Limitations of Sections 3114.8.5.1 shall apply

3114.8.4.2 Seismic design parameters. The seismic force-resisting system shall be designed and detailed in accordance with one of the following:

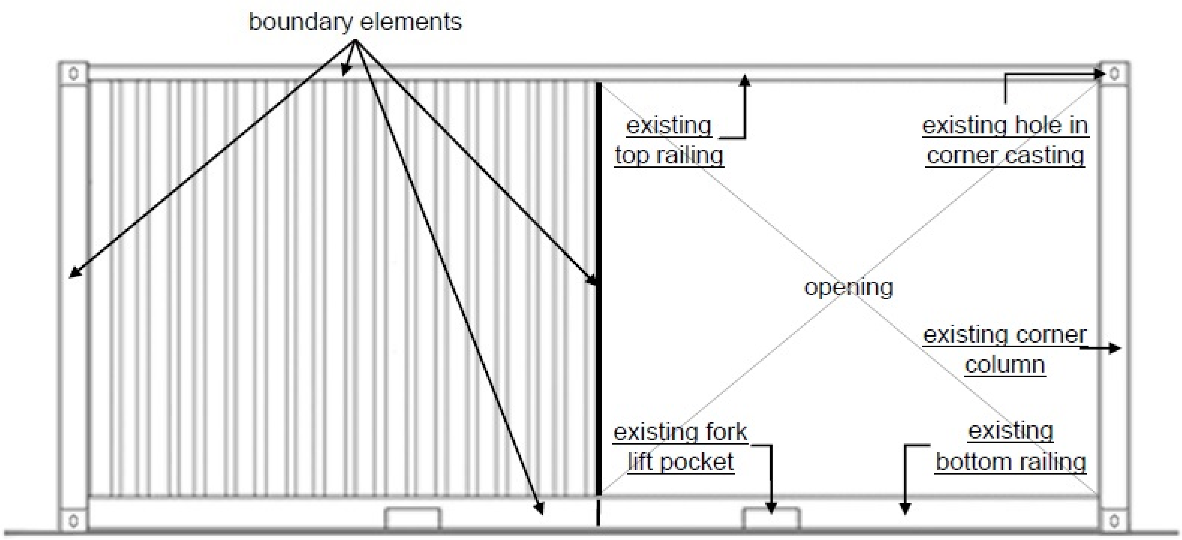
1. Where all or portions of the corrugated steel container sides are considered to be the seismic force-resisting system, design and detailing shall be in accordance with the ASCE 7 Table 12.2-1 requirements for light-frame bearing-wall systems with shear panels of all other materials,
2. Where portions of the corrugated steel container sides are retained, but are not considered to be the seismic force-resisting system, an independent seismic force-resisting system shall be selected, designed and detailed in accordance with ASCE 7 Table 12.2-1, or
3. Where portions of the corrugated steel container sides are retained and integrated into a seismic force-resisting system other than as paermitted by Sectuion 3114.4.2 Item 1, seismic design parameters shall be developed from testing and analysis in accordance with Section 104.11 and ASCE 7 Section 12.2.1.1 or 12.2.1.2.



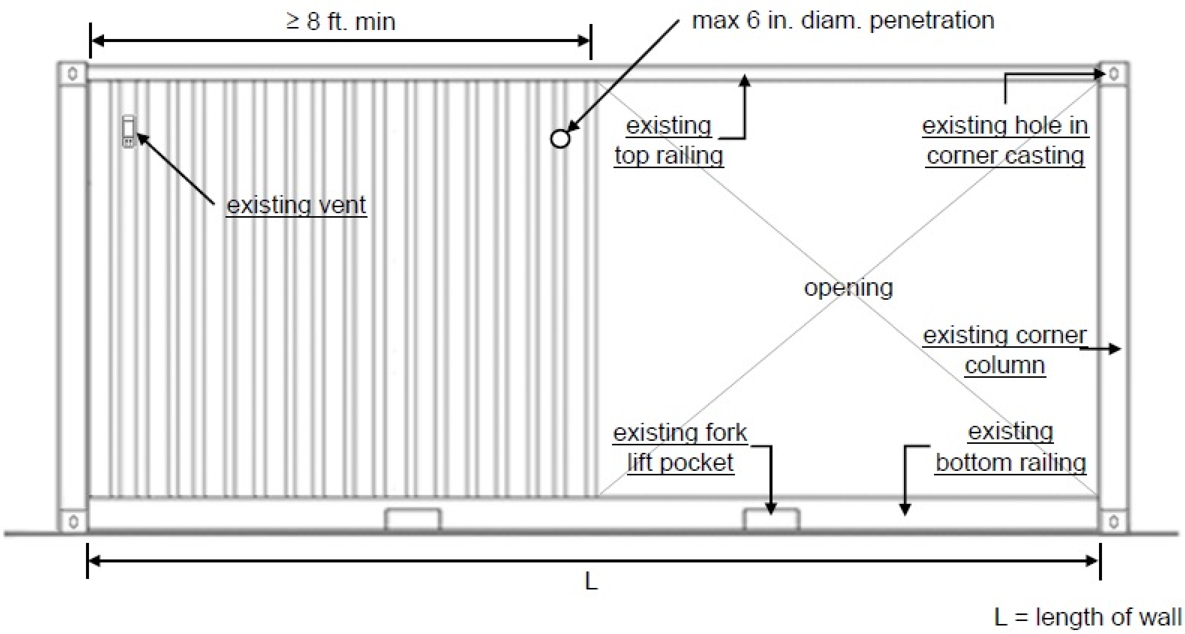
3114.8.5.3(1)
Bracing Unit Distribution--Maximum Linear Length



3114.8.5.3(2)
Bracing Unit Distribution -- Minimum Linear Length



3114.8.5.3(3)
Bracing Unit Distribution -- Boundary Elements



3114.8.5.3(4)
Bracing Unit Distribution -- Penetration Limitations

Commenter's Reason: Section 3114.8.4.2 – This is an editorial correction in order to cite the correct section number. Table 3114.8.5.3 title - This represents a change to heading to delete “siding shear”. The change is based on public testimony and comments received during the committee action hearing to keep terms consistent throughout the code change proposal.

Figures 3114.8.5.3 (1) through (4) – It was brought to our attention that it may be beneficial to identify parts of the intermodal shipping container more clearly rather than use a simple line drawing figure. This is for the benefit of the user to more readily recognize existing conditions versus the permissible cut-aways as allowed by Section 3114.8.5.3. In response we are proposing to add identifying text (the rails, lift slots, and holes) to illustrate those existing elements that are part of the manufacture of intermodal shipping containers.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of the public comment and code change proposal will not increase or decrease the cost of construction. The resulting new provisions will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for building construction. Current use of repurposed intermodal shipping containers requires the building owner or designee to submit through the alternative means and methods administrative provisions.