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December 14, 2020

Re: Code Amendment
Georgia Department of Community Affairs

Dear Sirs:

SUPPORT FOR AMENDMENT TO THE STATE OF GEORGIA MECHANICAL CODE

I wish to add my support for the amending of the State of Georgia Mechanical Code to add a restriction to the placement of split air conditioning air handlers in unconditioned attic spaces.
During my three terms in the General Assembly and now serving as a Public Service Commissioner, I witnessed the negative impact of placing split air conditioning air handlers in unconditioned attic spaces.

They include:
- Increase electricity use.
- Occupant discomfort.
- Impaired Indoor air quality.
- Poor equipment maintenance due to accessibility issues.

I estimate that there is a 5%-10% increase in heating and cooling energy use and energy cost when split air conditioning air handlers are in unconditioned attic spaces as compared to similar systems with air handlers in conditioner areas. This estimate does not include the effects of increase air leakage frequently found when placing split air conditioning air handlers in unconditioned attic spaces.

Thank you for your consideration.

Best regards,

Jason Shaw
Commissioner

Spray Foam Insulation and Subterranean Termite Inspection Issues

As building performance requirements have steadily increased to provide lower energy consumption, reduced air leakage, improved moisture management and building durability, the use of Spray Polyurethane Foam Insulation, (SPF) has grown significantly. This has created issues between the SPF industry and pest management companies.

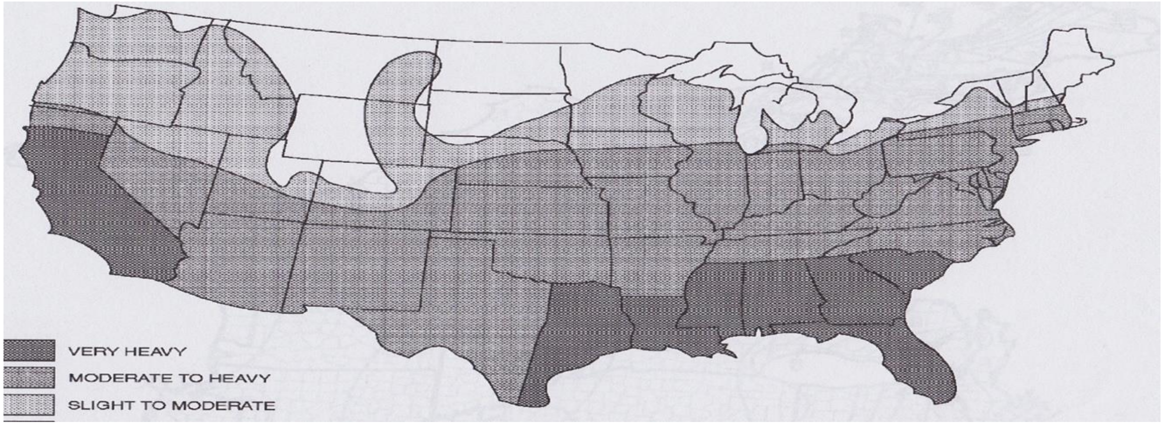
Termites cause more than $5 billion in structural damage each year in the United States. As part of the termite management process, inspections are performed by trained personnel at various points in the termite management process. Inspections may be performed to identify termite infestation and determine necessary control procedures, as part of a periodic, ongoing warranty/bond programs designed to detect and manage termite infestations (and re-infestations) as early as possible, and as part of real estate transfers (many state rules and all HUD/FHA guaranteed loans and many private lenders in most regions of the U.S.). Successful termite inspections are dependent on having visual access to identify evidence of infestation.

In the regions where subterranean termites are active, as shown in 2015 IRC Table R301.2.(6), (Figure 1), the use of SPF has created an issue with termite inspections. The areas of the building where SPF most commonly interferes with subterranean termite inspections are basement and crawl spaces in which SPF has been installed on the foundation walls, the mud sill and band joist areas. This assembly is known as a sealed or semi-conditioned crawl space, which requires the assembly to be insulated and have a continuous air barrier installed by code. The building industry has increasingly moved to using SPF to achieve its insulation and air barrier objectives. Building codes in Georgia and a few other states (NC, AL & MS) require 3” termite inspection gaps (no foam) at the top and bottom of the foundation wall, but still allow the band joist and mudsill to be covered with SPF. However, the installation of SPF on the band joist and mudsill covers the critical areas that the pest management companies need to visually inspect. The mudsill, band joist and joist ends are the first points at which termites can be detected as they enter the wood structure. Subterranean termites can pass through small 1/32” to 1/64” cracks and gain access to structural or decorative lumber by constructing shelter tubes and climbing up the inside or outside of the foundation wall. Termites can also enter buildings through cracks in the footing and traveling through voids in concrete masonry units. Inspection opportunities from the exterior of the building are often obstructed by brick or landscaping features, so inspection from inside the crawlspace is the only option. There are currently no alternative “viable” inspection methods or tools available to perform the inspections through SFF (see attachment “A”: “Spray Polyurethane Foam / Termite Detection Demonstration Project” completed by Dr. Brian Forschler, University of Georgia, Athens GA). Additionally, visual inspections are required by some states and mortgage companies.

A result of this issue has been that homeowners who retrofit their vented crawl spaces to unvented (semi-conditioned) to improve energy and moisture management performance, may be put in a situation that their existing termite bonds or warrantees are cancelled. This is due to the fact that the spray foam was installed according to building code requirements but covering the band joist and mudsill prevents termite inspectors from detecting subterranean termite infestations. New construction, based on the building codes can also have the same outcome, taking away the pest management industry's ability to inspect this crucial area. The Georgia Structural Pest Control Commission (GA SPCC) issued SPCC Notice: 18-04 Spray Foam Insulation & Pest Management on 6/20/18 (see attachment "B") which provides Georgia consumers with important information related to ***Polyurethane Spray Foam Insulation.***

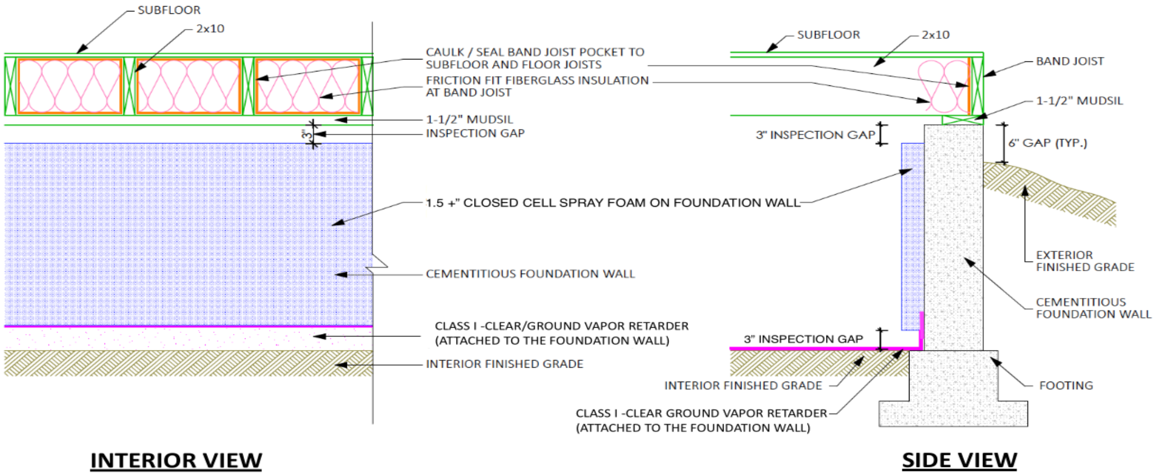
The overall solution to improve building performance and permit visual termite inspection is to provide the code required 3" inspection gaps on the top and bottom of the foundation wall and prohibit the installation of spray foam over the band joist and mudsill. The framing members would need to be caulked at the joints connecting the floor sheathing above, to the top of the foundation, as can be seen on Drawing 1. A non-rigid, removeable insulation, such as a fiberglass batt, would then be placed in the "pocket" to insulate the band joist and the mudsill. This will take extra time but will allow for the periodic inspections required to maintain termite warranties/bonds. Additionally, consumers will be able to take advantage of both valuable services, SPF and termite control.

Figure 1. <u>2015 IRC Table R 306.1.2 (6) Subterranean Termite Map</u>



<u>Drawing 1</u>

Unvented/Sealed Crawlspace with 1.5 +" Closed Cell Spray Foam on Foundation Wall and Removable insulation on Band Joist



Spray Polyurethane Foam / Termite Detection Demonstration Project (July – August 2019)

Introduction

The Demonstration Project described in this report was an attempt to gather information on the utility of identifying subterranean termite infestations in or on structural components covered with Spray Polyurethane Foam (SPF) insulation. The project was conducted in a crawlspace with an active infestation of the dark southeastern subterranean termite, *Reticultermes virginicus*. The crawlspace had hollow-block foundation walls and piers with wood framing above that which served as the support for the rooms on the first floor of the structure. Initial inspections were conducted on July 16, 2019 using visual search, moisture meters, infrared cameras, a laser thermometer and a microwave motion detector. Five inspectors, identified herein by number (1-5) each used a different approach. Inspector #1 conducted a visual search in conjunction with a moisture meter; #2 used visual inspection and an infrared camera; #3 used visual inspection, a moisture meter and motion detector; #4, moisture meter, borescope and infrared camera; and #5 used visual inspection, moisture meters and an infrared thermometer. Inspectors were given one hour to examine the crawlspace and place laminated cards (red arrow) at locations where they identified termite activity. The distribution of red arrows was recorded by photography after each inspection. Inspectors then agreed to 6 locations where SPF insulation would be applied to the hollow-block foundation wall (two locations) and wooden structural members (four locations) in the crawlspace. The application of SPF at each Location included half of the designated area covered using closed-cell (2-3 inches thick) and the other half open-cell (4-6 inches thick) SPF. The following day, 17 July, the crawlspace was for a second time inspected by the same teams using the same equipment and the number and distribution of red arrows recorded for comparison with the previous inspections. One month after SPF application, 15 August, an additional inspection was conducted by all parties after which destructive sampling was conducted to verify the presence of live termites at all Locations examined in this demonstration project.

Building: River Basin Center, School of Ecology, University of Georgia, Athens, GA 30602
Areas Inspected: Crawlspace in the north east corner of the structure
Site Description: The crawlspace measured 20X20X20X10-ft and was installed during a renovation of the building in 1999 (Figure 1). The crawlspace was defined by hollow block walls approximately 7-ft high with wood framing for the floor with four hollow block piers and one metal pole as supports for the floor in the center of the space. A vapor barrier was placed over the soil floor of the crawlspace on July15, 2019.

Description of equipment used by inspector (number) and equipment (type, model):
All inspectors had at least 20 years' experience conducting termite inspections. The firm that applied SPF has been in business for 5 years and has a A+ BBB rating.

#1, Ryobi, E49MM01 resistance (surface with digital readout in %)) and Protimeter Mini (BLD2001) a pin-type (subsurface with light-up scale in 1% increments from 6-30) moisture meters

#2, Infrared camera, FLIR E6

#3, Termatrac T3i All Sensor 3-n-1 unit with the following functions, Radar Technology confirms movement, Moisture sensors both Direct & Relative using Omni-Directional Technology (digital readout in %) and Thermal Sensor showing changes in surface temperature.

#4, Infrared camera, Protec IT 100; A moisture meter, Protimeter moisture meter system-logging MMS2 (digital readout in %) and a XLVU Videoprobe (a flexible borescope), Baker Hughes Co.

#5, Infrared thermometer, General IRT207, and two moisture meters; Tramex moisture encounter resistance (surface, range in 1% increments on a graph from 10-20%) and Delmhorst Instrument Co. PC-3 pin-type (subsurface, range in 2% increments that light-up display measuring from 8-30%).

Initial Inspection notes, 16 July:
The wooden structural members - joist header, sill plate, joists and cross beams - in the crawlspace provided numerous locations where visual evidence of subterranean termite infestation was clear and obvious. There also were 10 areas with subterranean termite shelter tubes on the exterior surface of the concrete block foundation.

All 5 inspectors collectively placed 38 red arrows in the crawlspace during the initial inspection in the area adjacent to the entryway along 40 feet of foundation wall from the southeast corner to the northwest corner of the crawlspace (Locations 0, 15, 20, 30 and 35 38). The range of arrows placed per inspector was 3 to 14 (Table 2).

Surface temperatures on all substrates – block or wood – did not vary more than 0.9 degrees Celsius (1.6 degrees Fahrenheit) between any of the surfaces in the crawlspace with no pattern related to signs of termite activity. The Flir IR camera identified 1 area of termite activity on wood (Location 15) (Photograph 2) and 2 other termite-activity areas were associated with shelter tubes at Locations 0 & 40.

The moisture readings obtained on the wooden floor joists, headers and sill plates indicated elevated moisture in all the wood in the crawlspace. Depending on the type of meter and location readings ranged from 18-30% wood moisture using resistance (surface) meters to 20-30% wood moisture using a meter with insertion pins (subsurface). The resistance/surface moisture meters provided readings of 20-50% when placed on the surface of the cinder block foundation while one pin-type meter registered 100% on the block when pins were placed against the surface of that material.

The Termatrac T3i microwave motion detector identified notable movement in the shelter tubes at locations 0 and 20 as well as in the beams and sill plate at locations 5 and 15 but not 25 or 30. No live termites were observed at any location despite destructively sampling a 1-2 inch section of shelter tube at locations 0, 20 and 40 (Location 40 was on the north wall but not indicated in Figure 1). There was no destructive sampling of any of the wood supports on this inspection.

SPF foam was applied to the shelter tubes at locations 0 and 20 and on the sill, joist header and beams at locations 5, 15, 25 and 30 (Photograph 1; Figure 1). Two types of SPF were applied at each location, closed cell SPF at 2-3 inches and open cell SPF at 6-8 inches thick.

Inspection notes after SPF application; 17 July:

The number of red arrows placed on the exposed wood by all 5 inspectors was 39 the day after SPF application (Table 2). None of the visual inspections provided evidence of termite activity on the SPF (Table 2). The only device that detected termites through the SPF was the Termatrac T3i microwave motion detector which identified 6 locations (red arrows placed) on the SPF (Table 2). The Termatrac T3i identified movement in shelter tubes at 5 areas including Locations 0 and 20 as well as the beams and sill plate at Locations 5, 15 and 30… but not 25 (Table 1 & 2).

Surface temperatures on the block wall and structural lumber varied by 1.9 degrees Celsius (3.6 ^{0}F) and on foam by 0.9 degrees Celsius with no pattern related to signs of termite activity (Table 1). There were no areas of termite activity identified by the IR cameras on SPF or exposed wood or block.

Moisture readings obtained on the foundation wall, floor joists, headers and sill wood provided the same range of values, by device, measured on inspections conducted the previous day, July 16 (Table 1). Moisture readings on the SPF surface with resistance meters was zero while the pin meters ranged from 2-4% on the surface but registered 0-8% when pins were inserted into either the open- or closed-cell foam. The Termatrac T3i measures of moisture on foam varied from 4-11% with no identifiable pattern related to areas of termite activity.

No live termites were observed at any location and the sections of shelter tubes at locations 0, 20 and 40 that were broken during the previous inspection, on day earlier, had not been repaired. There was no destructive sampling on this inspection.

Inspection notes one-month after SPF application; 15 August:

Inspections aimed at determining termite activity were not recorded during the August visit to the crawlspace due to time constraints and the assumption that those results would be similar to the previous two inspections. Initial visual inspections did not reveal signs of termite activity on the foam but as SPF removal progressed (Photograph 3) it was observed that one area of closed cell foam (at Location 5) on the interface of the sill plate and foundation wall showed signs of termite activity (Photograph 4). When SPF was removed from the block covering the shelter tubes at locations 0 and 20 there were live termites in the shelter tubes but no evidence of termites leaving the shelter tubes and entering the foam. Termites did, however, tunnel into the foam on the beams, joist header and sill at locations 5 and 15 and but not areas 25 or 30 (Photograph 3). There were hundreds of live termites in the foam removed from the aforementioned areas and live termites also were observed in the sill and beams at areas 5 and 15 by destructive sampling and with the borescope (Photograph 5).

Surface temperatures on wood varied by 1.9 degrees Celsius and on foam 0.9 degrees Celsius with no pattern related to signs of termite activity (Table 1).

The range of moisture readings on wood were within the range of values from one month earlier for each of the different devices. The one exception was the Termatrac readings that were, across all locations, higher than in the previous month. The moisture readings on the block were essentially within the same range within a device but showed more variability compared to the previous month with the Termatrac T3i and Delmhorst being higher while the Tramex provided lower values. All devices recorded significantly higher wood moisture content in the joists and joist header that had been under the SPF except the Termatrac which provided lower wood moisture content in those areas (Table 1).

Moisture readings were taken on the area of visible termite activity in the SPF at location 15 and the only device that provided a different reading was the Termatrac T3i that showed 9-15% on the foam next to the area of visible activity and 17-23% on top of that location (Photograph 6).

In addition, we used a XLVU Videoprobe borescope to verify termite activity in the wood behind Loctions 5 and 15 as well as demonstrate that this device could also distinguish between infested and not-infested foam (Photograph 5).

Summary:

This SPF/termite-detection demonstration aimed to examine the ability of pest management professionals, experienced in termite inspections, to identify an active termite infestation in the same crawlspace before and after application of SPF insulation. The site was a crawlspace with a moisture problem as evidenced by the wood % moisture recorded with all moisture meters used by the inspectors (Table 1).

The results from the visual inspections included the obvious, intuitive, observation that visual inspection was prevented following application of SPF to either the wood or hollow cinderblock construction materials (Table 2). Visual inspections are subjective, and inevitability, grounded in the experience of the individual inspector and circumstances at the time and place of the inspection. This point is evident in the summary of the number of red arrows placed by each inspector on the first two inspection dates (Table 2). The number of points identified (with red arrows) using visual search between inspectors indicating evidence of termite activity clearly underscores the aforementioned subjectivity. The fact that three experienced termite inspectors went to the same crawlspace and identify three different number of ‘active locations’ indicates the experiential nature of reporting termite activity using visual inspection. The number of different locations identified by each inspector could have been a result of the fact that evidence of termite activity was widespread in that crawlspace (Photographs 1 & 2). The purpose of an inspection is typically to justify an intervention and one inspector could have placed 3 arrows in an area (split hairs) where the next inspector would have placed 1 because those locations all indicated need for intervention within a section of sill or joist.

Temperature readings taken on the surfaces in the crawlspace displayed surprising similarity regardless of substrate with never more than a ±2 degrees Celsius difference between the wood, block or foam surface temperatures (Table 1). The fact that those temperature differences were within the range of detection for both IR cameras used in this demonstration and it is therefore not surprising those devices were not able to detect the presence of termites with or without a covering of SPF.

An equally interesting, but less obvious, result involved the moisture meters which provided a wide range of values at the same locations (Table 1) indicative of the relative nature of measurements taken by these instruments, depending on the device and technology used to translate electrical conductivity to a number representing percent moisture. All moisture meters with the exception of the Termatrac T3i were consistent with the surface-type meters generally providing no readings on the foam surface while the pin-type moisture meters provided low readings (0-8% moisture) when inserted into the foam. The Termatrac T3i moisture readings ranged from 4-11% the day after SPF application to 0-26% one month later (Table 1).

The conclusion we were able to reach, given the parameters that defined this demonstration project is that the devices employed by the participants were unable to identify any consistent indication of termite infestation on the wood or block and certainly not *through* the SPF insulation. Additional research under varying conditions should be conducted to see how these same or other termite detection devices perform. The Termatrac T3i was the only device to provide moisture readings (17-23%) on the area of closed cell SPF with visual confirmation of termite activity that was different from the surrounding foam (14-15%) (Photograph 6).

The Termatrac T3i using the microwave motion detector provided evidence of termite activity with and without the foam (Table 1). Confirmation of termite activity was confined to the last (August) inspections when destructive sampling was conducted. There were no live termites found during the July inspections when shelter tubes at Locations 0 & 20% were broken nor where those sections of shelter tube repaired (after SPF application) the following day. However, one month after SPF application (August inspection) thousands of termites were observed in the foam and in pieces of wood destructively sampled with a chisel and the borescope as well as in shelter tubes at Locations 0 & 20 (Photographs 3- 5). Destructive sampling using the borescope provided evidence that by drilling ¼-inch holes into SPF one can determine if termites are present (Photograph 5).

Postscript and Conclusions:

Renovation of the crawlspace used in this demonstration began on 6 September 2019. The sill plate, joist header, floor joists and flooring were removed from the foundation walls above the crawlspace entry and halfway down the length of the southern-most wall of the crawl. The renovation exposed the foundation wall behind the joist header and sill plate above Locations 0, and 5 mentioned in the report. An examination of the exposed elements of the foundation provided substantial evidence that this infestation was initiated in the sill and joist headers in the southeast corner of the crawlspace. The amount of termite feeding activity observed in the joist header, sill and floor joists (Photograph Supplement 1) in that area displayed a pattern showing more wood removed from structural lumber closer to the SE corner of the crawlspace.

Subterranean termite structural infestations can be influenced by numerous factors including the construction practices employed – especially the elements of the foundation - as well as the surrounding landscape. This particular infestation was most likely exacerbated by the limited potential for air exchange in the crawlspace. This ~ 300 square-ft section of the structure contained two vents (12 X 8-in.), both in the north wall, coupled with no vapor barrier on the dirt floor of the space (it should be noted that during the September renovations it was discovered that there was a concrete slab floor in the crawlspace… under about 4 inches of soil). The higher- than-normal % wood moisture (The author defines 'normal' structural lumber % moisture to be 9-12% for this part of North Georgia) in the lumber of the crawlspace measured using moisture meters affirmed this point as did the observations of mold made by all inspectors conducting a visual search.

Inspection of any structure for subterranean termite activity is essentially a snap-shot in time of conditions observed during a site visit and the information recorded during this demonstration illustrates that point. The findings reported from a termite inspection are influenced by a number of factors including the type of equipment employed during the inspection. The variability reported within a single technique or piece of equipment between inspection dates shows that termite inspections can agree on the presence of termite activity although the data used to come to that conclusion might be disparate.

A visual inspection was sufficient to identify signs of a termite infestation and moisture management issues in this crawlspace. Verification of an active termite infestation and moisture problems required additional techniques and equipment. The industry standard of a visual inspection along with probing and sounding (i.e. destructive sampling) to verify an active infestation was not conducted until the third (August) inspection. The various moisture meters, indicated on the first and subsequent inspections, conditions of elevated wood moisture which would be conducive to maintaining a subterranean termite infestation. However, the moisture meters alone could not verify areas of active termite infestation. The technique employed (as per the protocol requirement of minimal disturbance) to verify termite activity during the first inspection – a visual inspection after exposing a small section of several of the numerous shelter tubes in this crawlspace - did not provide evidence of active termites. Subterranean termite activity was only confirmed during the August inspection using destructive sampling.

There were two non-destructive termite inspection technologies used during the inspections. The homogeneity of surface temperatures on all the substrates (wood, block or SPF) did not allow for a clear, definitive identification of termite activity using an IR camera. The Termatrac T3i microwave motion detector did indicate an active infestation at a number of Locations on all three inspections on all substrates examined – shelter tube on hollow block, structural wood, and SPF. Those indications of activity were verified during the August destructive sampling inspection.

The veracity of using visual inspection along with probing to identify an active subterranean termite structural infestation was confirmed by this demonstration project. The project also illustrated that SPF foam applied to structural lumber prevented a visual inspection of termite activity. The utility of moisture meters and IR cameras in identifying termite activity with or without SPF was not confirmed. The microwave motion detection device, Termatrac T3i, demonstrated the ability to detect termite activity in structural lumber with and without a covering of SPF. There are, however, practical limitations to conducting a termite inspection using the Termatrac T3i because it can detect motion in a relatively small (4 inches squared) area. Restricting the collection of termite inspection data to the scale of 4 inches^2 would require hours to complete a full inspection of the 300 ft^2 crawlspace used in this demonstration. The utility of using a device with such a small inspection 'window' complicates conducting a full termite inspection due, in part, to the increased time spent on site.

Acknowledgements. The author extends his sincere thanks all the professionals who donated their time, equipment and expertise during this demonstration. The project could not have been conducting without their generosity and I am indebted and deeply appreciative of their sacrifice. The participants included: Rick Bell, Arrow Exterminators; Brian Forschler, University of Georgia; Heath Knudsen and David Eubanks, Flexible Pest Services; Ed Freytag, New Orleans Mosquito and Termite Control Board; Rick Wakenigg, Termatrac LLC; Josh Nichols and Ryan Drueke and Josh Nichol, Foam South insulators.

Figure 1. Diagram of the crawlspace from the building floor plan with blue lines delimiting the interior foundation walls that define the crawl, green lines approximate distances (in feet) of the crawlspace foundation and the red line indicates the location of doorway providing access to the crawlspace. The Location numbers discussed in the report are posted in white boxes in red font with Locations O and 20 on the hollow block wall in the south east and southwest corners, respectively, and Locations 5, 15, 25, and 30 on the joists and joist headers on the south and west walls, respectively.

Photograph 1. Images of the locations discussed in the report where SPF was applied.
A. Locations 0 (not identified with a number; in the corner) and 5.
B. Locations 15, 20, 25, 30.

A.

B.

Photograph 2. Image of the IR camera screen (Flir E6) indicating an area determined to show termite activity during the first inspection (July, 17) and a visual image of the same area indicated by the red box (right).

Photograph 3. Images of termite activity in the SPF observed during the August inspection from the joists and joist header by Location 5.

Picture 4. Images of the area in the SPF at Location 5 that provided visible evidence of termite activity on surface of SPF… left (outlined by the red box) and that same area exposed during foam removal.

Photograph 5. Images from the borescope showing SPF without (left) and with (right) termite activity.

Photograph 6. Image of the Termatrac T3i percent moisture readings on closed-cell foam at Location 5 on the block in an area with (left) and without (right) termite activity.

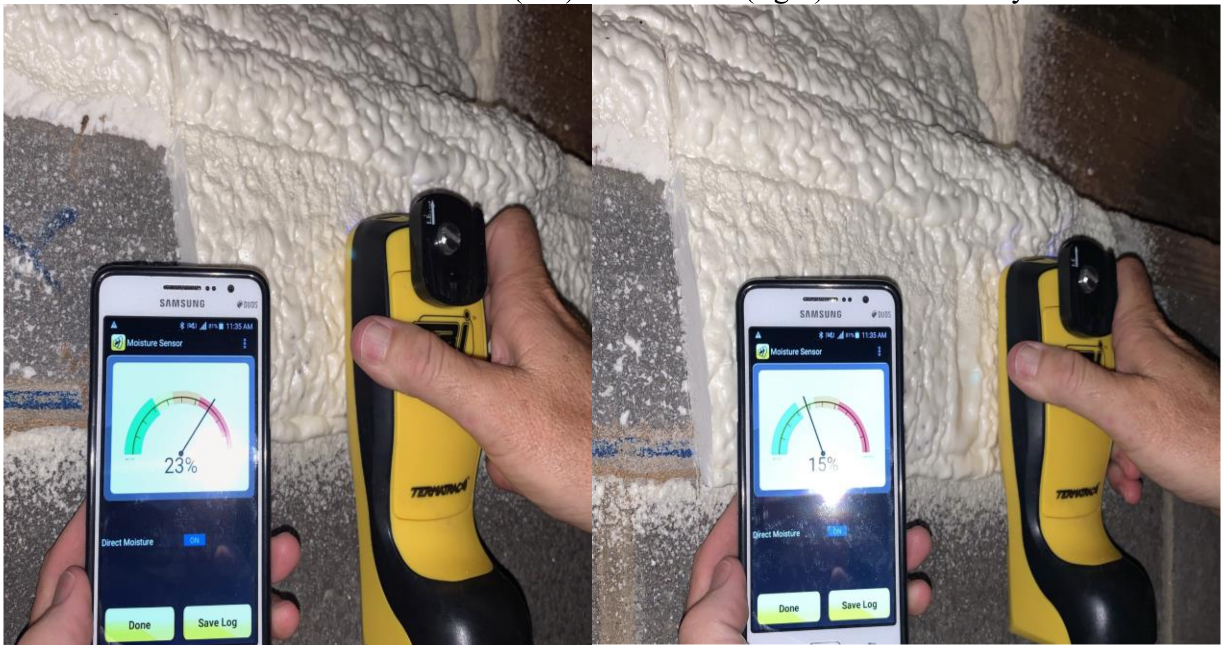


Table 1. The record of data collected in the crawlspace by date, instrument and location. A single number indicates the 2-3 readings within 1-ft^2 were consistent while a range is a record of the high and low reading for that instrument at that location. NA indicates "Not Applicable".

A. Readings taken July 16, 2019 prior to application of foam.

	Location Zero (on block)		**Location 5 (on wood beam)**		**Location 5 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	NA	26	NA	20	NA	20
Protimeter	NA	30	NA	20	NA	24
Protimeter 2	NA	100	NA	18-20	NA	25-30
Tramex	NA	20+	NA	20+	NA	20+
Ryobi	NA	50	NA	30	NA	22
Termatrac T3i	NA	25-26	NA	19	NA	25
Laser temp ^{o}C	NA	27.2	NA	26.6	NA	26.5
Termatrac T3i motion detector	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

	Location 20 (on block)		**Location 15 (on wood beam)**		**Location 15 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	NA	20	NA	20	NA	20
Protimeter	NA	17	NA	22	NA	24
Protimeter 2	NA	100	NA	18-20	NA	25-30
Tramex	NA	20+	NA	20+	NA	20+
Ryobi	NA	33	NA	26	NA	34
Termatrac T3i	NA	25	NA	18	NA	24
Laser temp ^{o}C	NA	26.3	NA	26.8	NA	26.4
Termatrac T3i motion detector	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

B. Readings taken July 17, 2019 one day after application of foam.

	Location Zero (on block)		**Location 5 (on wood beam)**		**Location 5 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	26	0	20	0	20
Protimeter	1	100	2-4	19-22	0-2	24
Protimeter 2	4-6	68	4-6	18-20	4-6	17-20
tramex	0	20+	0	20+	0	20+
Ryobi	0	50	0	30	0	22
Termatrac T3i	4-11	25-26	4-11	19	4-11	25
Laser temp °C	26.7	25.9	26.4	26.8	26.5	26.4
Termatrac T3i motion detection	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

	Location 20 (on block)		**Location 15 (on wood beam)**		**Location 15 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	20	0	20	0	20
Protimeter	3-6	17	3-6	22	3-6	24
Protimeter 2	4	100	4-8	18	4-8	25-30
tramex	0	20+	0	20+	0	20+
Ryobi	0	33	0	26	0	34
Termatrac T3i	4-11	25	4-11	18	4-11	24
Laser temp °C	26.5	26.4	26.5	26.5	26.4	26.5
Termatrac T3i motion detection	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

C. Readings taken August 15, 2019 one month after application of foam prior to foam removal.

	Location Zero (on block)		Location 5 (on wood beam)		Location 5 (on wood sill)	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	30+	0	20	0	24
Protimeter	0	14-17	2	20	0	24
tramex	0	17.5	0	20+	0	20+
Ryobi	8-16	33	12	26	14	34
Termatrac T3i	14-20	30+	7-26	30+	12-20	30+
Laser temp ºC	26.5-27	26.7	27.8	28.2	27.1	27.4
Termatrac T3i motion detector	Termatrac found movement through foam and on tube. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling	

	Location 20 (on block)		Location 15 (on wood beam)		Location 15 (on wood sill)	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	24	0	20	0	24
Protimeter	0	15-18	0	20	0	22
tramex	0	18	0	20+	0	20+
Ryobi	0	51	16	24	0	32-34
Termatrac T3i	9-15	30+	0-16	30+	14	30+
Laser temp ºC	27/26.5	27.3	26.9	26.8	27	26.3
Termatrac T3i motion detector	Termatrac found movement through foam and on tube. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling	

D. Readings taken August 15, 2019 one month after application and *after* SPF removal.

	Location Zero (on block)		**Location 5 (on wood beam)**		**Location 5 (on wood sill)**	
Meter type	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**
Delmhorst	NA	30+	28	20	30+	24
Protimeter	NA	14-17	32	20	30	24
tramex	NA	17.5	20+	20+	20+	20+
Ryobi	NA	33	100	26	100	34
Termatrac T3i	NA	29-30+	18	28-30+	23	30+
Laser temp ^{o}C	NA	26.7	27.4	28.2	26.8	27.4

	Location 20 (on block)		**Location 15 (on wood beam)**		**Location 15 (on wood sill)**	
Meter type	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**
Delmhorst	NA	24	28	20	30+	24
Protimeter	NA	15-18	28	22	50	24
tramex	NA	18	20+	20+	20+	20+
Ryobi	NA	51	100	24	100	32-34
Termatrac T3i	NA	30+	27	30+	25	30+
Laser temp ^{o}C	NA	27.3	26.3	26.8	26.2	26.3

Table 2. Summary of locations (indicated by placement of ‘red arrows’) associated with observation of termite activity by inspection date and inspector/method.

Device/method used to identify termite activity by Inspector	Number of red arrows (signs of termite activity)		
	July 16 Before SPF application	July 17 No SPF	 On SPF
Visual; Inspector #1	14	14	0
Visual/ IR Camera; Inspector #2	3	0	0
Termatrac T3i; Inspector #3	6	11	6
Visual; Inspector #4	5	5	0
Visual; Inspector #5	10	9	0

Appendix 1.

Photograph 1. Images taken during the September 6th, 2019 renovations showing the termite activity, by the red arrows, along the block foundation wall behind the joist header in the southeast corner of crawlspace at locations 0 and 5. The infestation likely accessed the structural lumber from the expansion joint between the slab and block wall (green arrow).

Photograph 2. Pictures of the floor joists between Locations 10 & 15 exposed during renovations conducted 6 September 2019. Pictures of each joist are arranged, left-to-right, by proximity to the joist header (on the left in this image) along the south wall of the crawlspace.

Spray Foam Insulation & Pest Management

The Georgia Structural Pest Control Commission (SPCC) serves the public by adopting regulations and policy to protect the health, safety and welfare of the citizens of Georgia. As part of their mission, the SPCC works with GDA to educate the public about structural pest management. This document was created to provide a background on spray foam insulation and issues related to pest management.

Reference – Polyurethane Spray Foam Insulation (PSFI)

The following is important information for Georgia consumers related to ***Polyurethane Spray Foam Insulation.***

The Georgia Department of Agriculture ***does not*** regulate Polyurethane Spray Foam Applicators, but is responsible for regulating the Pest Management industry in Georgia. The Pest Management industry has noticed an increase in PSFI installations in the State of Georgia during routine inspections for wood destroying organisms and have brought this to the attention of the SPCC. This publication is an effort to inform consumers how PSFI products may adversely impact the ability to inspect for and control termites, carpenter ants, wood boring beetles, and other pests including rats and mice.

If you are considering the installation of PSFI or have already installed this product, we urge you to read the information below to understand the issues surrounding the unintended consequences associated with trying to make your home more energy efficient. The Georgia Department of Agriculture recommends that you contact your local county extension office and several Pest Management Professionals to fully understand how these products could affect your home's protection from pests. It is also very important to know if a polystyrene spray foam installation will impact your existing termite warranty.

Background:

Polyurethane spray foam insulation is an alternative to traditional building insulation such as fiberglass. It is a two-component mixture composed of isocyanate and polyol resin which comes together at the tip of application tool to form an expanding foam. The foam can be sprayed on to/into/under any number of construction features to provide insulation for a building.

Advantages/Disadvantages

There are reported advantages and disadvantages of PSFI insulation by the industry. Advantages include energy cost savings and disadvantages include higher installation cost and hidden water leaks. The SPCC also notes that PSFI prevents comprehensive performance of inspections for wood destroying organisms and creates possible conditions that may invalidate your termite warranty. The last two disadvantages are notes because spray foam insulation can hide evidence of pest activity. For a full list of advantages and disadvantaged visit https://www.greeninsulationtechnologies.com/advantages-disadvantages-foam.php\

Polystyrene Spray Foam Insulation, Termites and Other Pests

Insect and rodent pests such as termites, carpenter ants and rats can easily chew through spray foam insulation which also provides insulation benefits to those pest populations. The presence of such pests within or behind the PSFI makes visual inspection and control problematic, if not impossible.

Polystyrene spray foam insulation impairs the ability of pest management inspectors from performing a visual inspection for evidence of a pest infestation, intrusion or damage. There are currently no inspection tools that can overcome how PSFI prevents visual inspection for pests.

Georgia Structural Pest Control regulations require pest management inspectors to determine the presence or previous presence of infestations and report these findings for Official Wood Infestation Inspection Reports and related control warranties. These inspections will include a visual inspection and the sounding and/or probing of accessible areas.

Polystyrene Spray Foam Insulation and Fumigation

Research has been conducted on PSFI to determine if other chemicals damage the integrity of the foam insulation. Research is, however, lacking on how fumigation gasses interact with polystyrene spray foam insulation. The result is that there are no scientific studies that provide information on using fumigation to control pests found to be infesting building materials covered with PSFI. There also are no established post-fumigation, re-entry or re-occupancy times or post-occupancy ventilation needs.

Spray Foam and Termite Warranties:

Pest Management companies typically include language in their contracts that the installation of products that prevent visual inspection may negatively affect or void a termite warranty. The SPCC recommends homeowners contact their Pest Management provider or consult with one for a review of how installation of PSFI could impact their pest control contract.

Spray Foam Insulation & Termites publication by the American Chemistry Council (ACC) and Spray Polyurethane Foam Alliance (SPFA)
https://polyurethane.americanchemistry.com/Spray-Foam-Insulation-and-Termites.pdf

This publication does reference, on page 13, that Georgia has modified the model energy code to include a termite inspection strip above and below the foundation wall to expose the sill plate and lower band/rim joist for visual inspection. The SPCC has concerns about the general use and practicality of the inspection equipment referenced in Chapter II. Termite Inspection and Treatment. The SPCC Rules call for a visual inspection for wood destroying pests and the utility of using thermal imaging, moisture meters, microwave motion detection, gas or acoustic emissions, or trained dogs for detecting a pest infestation through PSFI have not been adequately tested. The following image shows installation of SPFI in a Georgia home that does not include the required termite inspection strip.

American Chemistry Council | Spray Foam Coalition
SPFA Spray Polyurethane Foam Alliance | Foam • It • Right | PCP Professional Certification Program
GEORGIA CHEMISTRY COUNCIL

September 22, 2020

Gregori Anderson
Chairman
State Codes Advisory Committee
Georgia Department of Committee Affairs
60 Executive Park South, NE
Atlanta, GA 30329

Ted Miltiades
Director
State Codes Advisory Committee
Georgia Department of Committee Affairs
60 Executive Park South, NE
Atlanta, GA 30329

Dear Mr. Anderson and Mr. Miltiades,

On January 30, 2020, the Georgia Department of Community Affairs State Code Advisory Committee (Committee) discussed two proposals associated with the use of spray polyurethane foam (SPF) insulation at the framing foundation interface (FFI). The proposal from the Georgia Structural Pest Control Commission (Commission) sought to eliminate the use of SPF and other high-performance insulations at the FFI. The proposal from the Spray Polyurethane Foam Alliance (SPFA) seek to expand the existing termite requirements in the International Residential Code section 318.4. At the request of the Spray Foam Coalition (SFC) and SPFA, the Committee recommended GSPCC and the SPF industry work together to develop a mutually acceptable solution to protect Georgia consumers.

On June 9, 2020, the GSPCC hosted a meeting with the SPF industry. The SPF industry explained that consumer protection is not limited to preventing termite damage. From our perspective, consumer protection must include minimizing termite damage, reducing energy use, and protecting against unwanted air leakage and moisture intrusion. Uncontrolled air and moisture can result in mold, mildew, wood decay and poor indoor air quality. We suggested that these needs must be balanced to protect consumers. In a letter following the meeting, the SPF industry suggested the following starting point for a compromise solution:

New Construction

- Apply spray foam to the FFI leaving the front face of the sill plate exposed with an inspection strip at the top of the foundation wall
- Require a combination of termite barriers, treated wood sills, and soil treatment for all new wood frame construction
    - Possible exception for finishes on finished basement walls when treated wood materials or metal studs/furring are used for attachment of finishes to the interior side of the basement wall
- Use alternative inspection technology
- Use destructive sampling (with patch and replace) where infestations are suspected
- Proactive use of termiticide (in accordance with the FIFRA label) and bait stations

Existing Construction

- Apply spray foam to the FFI leaving the front face of the sill plate exposed with an inspection strip at the top of the foundation wall
- When sill plates are of untreated wood, the wood shall be inspected and surface treated with a termite treatment suitable for interior use (e.g., borate, etc.) prior to the retrofit insulation work regardless of the insulation and air-barrier materials and approaches used at the FFI
- Use alternative inspection technology

- Use destructive sampling (with patch and replace) where infestations are suspected
- Proactive use of termiticide (in accordance with the FIFRA label) and bait stations

These suggestions are a significant compromise from the SPF industry. Best practice for the use of SPF at the FFI is to cover the foundation wall, sill plate and rim joist with SPF. For unvented crawlspaces, section 402.2.11 of the Georgia Energy Code requires a 3-inch termite inspection strip at the top of the foundation walls. Section 318.4 of the Georgia Residential Code requires a 6 inch clearance between foam plastics installed on foundation walls above grade and exposed earth, which allows for termite inspections. The SPF industry's suggestion expands the inspection strip to the top of the foundation wall to leave the front of the sill plate exposed and adds a termite barrier for new construction. To access the rim joist and other structural elements, termites will need to first move through the sill plate. Leaving the sill plate exposed will allow for visual termite inspections, while balancing energy efficiency and limiting moisture intrusion in a manner that protects Georgia consumers. Pest management professionals can then use alternative inspection technology and destructive sampling through the SPF to confirm termite activity.

On September 14, 2020, the GSPCC informed the SPF industry that it is not willing to consider our suggestions or further collaborate on this issue. GSPCC provided no technical justification or response to our suggestions. It is clear their position on collaboration is nothing short of acceptance of their original proposal, which leaves Georgia consumers vulnerable to energy loss, air leaks, and moisture intrusion. The SPF industry is disappointed in this outcome. We strongly believe that moving and expanding the termite inspection strip is a reasonable and fair first step to address GSPCC's concerns.

Fully eliminating the use of SPF and other high-performance insulations at the FFI will negatively impact home energy efficiency and Georgia consumers. SPF and some other high-performance insulations are air-impermeable. The Committee has already affirmed the need for air-tight buildings. When adopting the 2015 International Energy Conservation Code, the Committee adopted a mandatory air-tightness of 5 ACH_{50} for one and two family dwelling units.[1] Georgia homebuilders need all the energy efficiency tools, including the use of air-impermeable insulation at the FFI, in their portfolio to comply with these new air-tightness requirements. Eliminating the use of SPF at the FFI will make it more difficult for builders to comply with the air-tightness requirements and will not protect Georgia consumers.

The SPF industry has taken the concerns raised by GSPCC and the pest management industry seriously. We have continued to refine the original SPFA proposal. Additionally, it appears that Georgia has separate termite requirements in section 318.4 of the Georgia Residential Code and section R402.2.11 of the Georgia Energy Code. Our new proposal will help streamline and clarify these requirements. We would appreciate guidance from the Committee as to how we can submit an updated proposal for consideration.

Sincerely,

Stephen Wieroniey
Director
Spray Foam Coalition

Rick Duncan
Executive Director
SPFA

Wes Robinson
Executive Director
Georgia Chemistry Council

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[1] Georgia State Supplements and Amendments to the 2015 International Energy Conservation Code R402.4.1.2

American Chemistry Council | Spray Foam Coalition

SPRAY POLYURETHANE FOAM ALLIANCE
SPFA
FOAM•IT•RIGHT®
PCP
PROFESSIONAL CERTIFICATION PROGRAM

February 4, 2020

Chris Gorecki
Rollins Inc.
170 Piedmont Road, NE
Atlanta, GA 30324

Re: Termite Inspection at the Framing Foundation Interface

Dear Mr. Gorecki:

The spray polyurethane foam (SPF) industry, represented by the American Chemistry Council's Spray Foam Coalition (SFC) and the Spray Polyurethane Foam Alliance (SPFA) would like to make a formal request to coordinate with the Georgia Structural Pest Control Commission (GSPCC), National Pest Management Association (NPMA), and Georgia Pest Control Association (GPCA) to review existing code requirements for the use of high-performance insulation at the framing foundation interface to ensure pest management professionals can conduct termite inspections.

On January 30, 2020, SPFA and GSPCC presented code change proposals to the Georgia Code Advisory Council (GCAC) to restructure the current requirements for the use of high-performance insulation at the framing foundation interface. SPFA's proposal sought to cost-effectively maximize the benefit of high-performance insulation and pest management services for homeowners in Georgia. The proposal sealed the foundation wall and band joist to maximize energy efficiency and to remain consistent with existing code and commonly accepted practices. The SPFA proposal left the sill plate and the top three inches of the foundation wall exposed for termite inspection. SFC and SPFA developed this design solution after meeting with the pest management industry in Athens, GA on January 7, 2019, in an effort to respond to their need to conduct termite inspections. In contrast, the GSPCC proposal sought to eliminate the use of high-performance insulation at the framing foundation interface and at the top and bottom of the foundation wall to allow for termite inspection. At the recommendation of SFC and SPFA, the GCAC requested our two industries work together to develop a mutually acceptable solution.

Consumer demands, regulation, and building science are driving the use of high-performance insulation at the framing foundation interface. Modern consumers understand that improvements in energy efficiency can help lower monthly energy usage, improve indoor comfort and air quality, and even reduce the prevalence of moisture and pest damage by controlling the air flow and temperature in this critical area of a home. The International Energy Conservation Code (IECC) is requiring construction that limits the air leakage rate of homes. Georgia recently adopted the 2015 IECC, which limits air leakage to 3 or 5 air changes per hour. Finally, building scientists support the use of air impermeable insulation, like spray polyurethane foam (SPF), to improve energy efficiency and control the flow of moisture laden air in humid environments. One of the simplest methods to meet these demands is to insulate and seal the framing foundation interface with SPF, which helps to protect homes from exfiltration of conditioned air and infiltration of outdoor air and moisture intrusion.

Many construction practices may limit the ability to conduct a visual termite inspection[1] including, but not limited to, finished basements and homes with brick façades. The pest management industry has demonstrated that it can currently warranty and inspect homes with these construction designs without changes to existing code requirements while still protecting consumers. With that understanding, the SPF industry believes our two industries can work together to develop a solution that protects consumers from termite infestations and allows use of high performance insulation products that can insulate and seal the framing foundation interface.

SFC and SPFA would like to work directly with GSPCC, NPMA, and GPCA to develop a solution that protects Georgia consumers. The SPF industry would like to discuss solutions that allow for termite inspection, leverage the use of termiticide products, promote the use of advanced termite inspection tools, maximize energy efficiency, and provide clear requirements for builders, SPF applicators, and pest management professionals.

We have reached out to you as the chairman of the GSPCC. We look forward to your participation as a representative of GSPCC, Rollins Inc., and the Orkin Pest Control Company.

Stephen Wieroniey

Stephen

Director
Spray Foam Coalition

Kurt Riesenberg

Executive Director
Spray Polyurethane Foam Alliance

CC: Gregori Anderson, Chairman GCAC
Jim Fredericks, NPMA
Derrick Lastinger, GSPCC
Ted Miltiades, Georgia DCA
Connie Rogers, GPCA

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[1] https://npmapestworld.org/default/assets/File/Resource%20Center/ConsumerAlert_SprayFoam_v2.pdf

Georgia Structural Pest Control Commission

September 14, 2020

Stephen Wieroniey
Director
Spray Foam Coalition

Kurt Riesenberg
Executive director
Spray Polyurethane Foam Alliance

RE: Termite Inspection at the Framing Foundation Interface (FFI) / GA Building Code Proposal

Dear Mr. Wieroniey and Riesenberg:

The Georgia Structural Pest Control Commission (GSPCC) appreciates the Spray Foam Coalition (SFC) and Spray Polyurethane Foam Alliance's (SPFA) time and willingness to discuss the impasse that exists related to the Commission's proposed Georgia building code change, specifically concerns related to the ability to provide Georgians with a termite inspection at the framing and foundation interface once a spray polyurethane foam application is applied in this area.

The GSPCC has taken the approach to find a workable solution that provides Georgians with the ability to reasonably take advantage of services for protecting their most valuable asset from termite infestations and the insulating properties of spray polyurethane foam.

The GSPCC met to discuss your presentation and the communication you provided on June 25, 2020. The GSPCC was unanimous in their opinion that, unfortunately after a substantial amount of time and effort to find common ground, it is clear we are no closer to resolving this situation and protecting Georgians on this issue.

The GSPCC will be contacting the Georgia Department of Community Affairs Building Code Committee to reaffirm the proposal previously presented and determine next steps in moving forward with the GSPCC proposed Building Code changes.

Sincerely,

Chris Gorecki
Chairman, Georgia Structural Pest Control Commission

CC: Commissioner Christopher Nunn, DCA
Commissioner Gary W. Black, GDA
Derrick Lastinger, Vice Chairman GSPCC
Mr. Jeff Bodine Sinyard, GSPCC
Ms. Kim Bragg, GSPCC
Mr. Greg Holley, GSPCC
Ms. Christy Kuriatnyk, GSPCC
Dr. Brian Forschler Ph.D., GSPCC
Mr. Gregori Anderson, Chairman SCAC
Mr. Ted Miltiades, Georgia DCA

Georgia Structural Pest Control Commission

September 14, 2020

Mr. Ted Miltiades
Georgia Department of Community Affairs
Director, Office of Construction Codes and Industrialized Buildings

Mr. Gregori Anderson
State Codes Advisory Committee Chairman

Dear Mr. Anderson and Miltiades:

The Georgia Structural Pest Control Commission (GSPCC) presented information in support of a Code Amendment for R402.2.9 during the DCA building codes committee meeting, February 11, 2020. This proposed code change referenced the framing and foundation interface for basement and crawl space construction, specifically related to termite inspections and spray polyurethane foam applications.

The direction from the committee was for the GSPCC and the Spray Foam Coalition (SFC) and Spray Polyurethane Foam Alliance's (SPFA) to work out a resolution together and present it back to the committee. Representatives from all parties met on June 25, 2020 to discuss the impasse that exists related to the Commission's proposed Georgia building code change, specifically concerns related to the ability to provide Georgians with a termite inspection at the framing and foundation interface once a spray polyurethane foam application is applied in this area.

The GSPCC has taken the approach to find a workable solution that provides Georgians with the ability to reasonably take advantage of services for protecting their most valuable asset from termite infestations and for the insulating properties of spray polyurethane foam. Unfortunately, after a substantial amount of time and effort to find common ground, it is clear we are no closer to resolving this situation and protecting Georgians on this issue.

I respectfully request information on the next steps to move forward with the GSPCC's proposed code amendment.

Sincerely,

Christopher A. Gorecki
Chairman, Georgia Structural Pest Control Commission

CC:
Commissioner Christopher Nunn, DCA
Commissioner Gary W. Black, GDA
Derrick Lastinger, Vice Chairman GSPCC
Mr. Jeff Bodine Sinyard, GSPCC
Ms. Kim Bragg, GSPCC
Mr. Greg Holley, GSPCC
Ms. Christy Kuriatnyk, GSPCC
Dr. Brian Forschler Ph.D., GSPCC

American Chemistry Council | Spray Foam Coalition

SPFA FOAM•IT•RIGHT PCP

June 25, 2020

Chris Gorecki
Chairman
Georgia Structural Pest Control Commission
Georgia Department of Agriculture
19 M.L.K. Jr Drive SW
Atlanta, GA 30334

Re: Termite Inspection at the Framing Foundation Interface

Dear Mr. Gorecki:

The Spray Foam Coalition (SFC) and Spray Polyurethane Foam Alliance (SPFA) thank you and the Georgia Structural Pest Control Commission (GSPCC) for hosting a discussion to address concerns related to termite inspections at the framing foundation interface (FFI). SFC and SPFA support clarifying requirements for the use of high performance insulation at the FFI in the Georgia State Minimum Standard Building Code (Code) to ensure builders, consumers, spray foam applicators, and pest management professionals understand what application practices are acceptable and to protect consumers from termites and other wood destroying organisms.

SFC and SPFA believe that working with the GSPCC, we can develop a consensus solution that protects consumers and allows for the use of high performance insulation and termite inspections at the FFI.

Many construction practices limit the ability to visually inspect for termites without impacting consumer protections from termite damage. The pest management industry can rise to the challenge and implement a variety of solutions that allow for termite inspection, testing, control and warranties in these areas.

SFC and SPFA believe that consumer protection must include minimizing termite damage, reducing energy use, and protecting against moisture intrusion and air leakage, and these needs must be balanced to protect consumers. Uncontrolled air leakage and moisture intrusion negatively impact energy efficiency, building durability, indoor air quality, and create conditions that invite wood destroying organisms. Eliminating the use of high-performance insulation and air sealing at the FFI is contrary to generally accepted building science principles related to heat transfer and moisture control and will lead to unintended consequences. Consumers and builders need to be able to select high performance insulation to seal crawlspaces to protect their homes against moisture, meet the Code requirements, help control stack effect,[1] and make their homes more comfortable

Recently, the GSPCC completed a study with the University of Georgia that showed that alternative inspection technology and destructive sampling can identify termite activity. The study states:

> *The microwave motion detection device, Termatrac T3i, demonstrated the ability to detect termite activity in structural lumber with and without a covering of SPF*

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[1] Stack Effect (or chimney effect) is the movement of air into and out of buildings through chimneys, flue-gas stacks, or other openings, driven by air buoyancy. Buoyancy occurs due to a difference in indoor-to-outdoor air density resulting from temperature and moisture differences.

> *Destructive sampling using the borescope provided evidence that by drilling ¼-inch holes into SPF one can determine if termites are present.*

Based on these conclusions, GSPCC should promote these practices to improve consumer protections rather than proposing to eliminate the use of SPF, a proven solution for Georgia residents. SFC and SPFA understand that the small size of the current inspection area of many microwave motion detection devices may limit the ability to quickly conduct a termite inspection. However, a quick termite inspection may not present the best solution to protect consumers. Further, we acknowledge there may be concerns with patching and repairing SPF after destructive sampling. We are committed to help develop the appropriate education and tools to implement this solution. Simply put, as construction practices change to improve building performance, termite inspection practices must also evolve.

In general, building codes do not rely on a single form of protection, and the solution for termite control should be no different. No single solution to termite inspections at the FFI can completely protect consumers. We recommend any consensus solution leverage visual inspection, proactive pest management treatments, termite barriers (for new construction), destructive sampling (with patch and replace), bait stations, and advanced inspection technologies.

Visual Inspection

Hidden pathways for termites have *always* existed in homes. Hidden pathways may exist either on the exterior, interior, or somewhere in the middle of all types of foundation and above-grade structure interfaces (*i.e.* basements, crawlspaces, and slabs-on-grade).[2] Hidden pathways can also be formed by other essential parts of buildings (*i.e.* electrical work and plumbing). SPF does not present a unique, insurmountable challenge.

Further, visual inspection is limited and only 33% effective in preventing termite damage. Relying on visual inspection, even without the presence of high performance insulation, was found to be largely an ineffective means (67% of the time) of addressing termite infestation and damage issues.[3] In *Termite Control Services: Information for the Georgia Property Owner*, Suiter and Forschler state:

> *Non-visual inspections offer alternative means for visual termite inspections for inaccessible areas. When users are properly trained, non-visual inspections such as IR, motion detectors, moisture meters and trained dogs can provide additional means to detect termites where visual inspections are not possible.*

Ultimately, relying primarily on visual inspection is preventing the pest management industry from fully addressing modern construction practices to protect consumers.

Consumer Protection and SPF

SFC and SPFA agree with GSPCC that protecting consumers' homes must be the principal focus for any solution to termite inspections at the FFI. Achieving consumer protection is not an off/on switch. Building science is a complicated balance of multiple variables that contribute to durable and resilient homes. Any solution that protects consumers must also balance termite inspection, energy efficiency, and sound building science**.**

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[2] Protection of Wood-Frame Homes from Subterranean Termites: Evaluation of Building Code Provisions & Recommended Improvements

[3] Termite Survey and Hazard Mapping. Cookson and Trajstam. 2002.

Homeowners are generally selecting SPF as a primary component to create an unvented or encapsulated crawlspace. Unvented crawlspaces are formed by insulating and air sealing the crawlspace with a water-resistant, air impermeable, material, like closed-cell SPF. SPF is an ideal tool for unvented crawlspaces because it can insulate, air seal, and control moisture at the FFI without additional products. Eliminating the use of SPF on the FFI undermines the benefit of the use of SPF in crawlspaces.

Unvented crawlspaces protect consumers. Creating an unvented crawlspace is the one of the most practical applications to effectively bring ductwork and HVAC equipment located in the crawlspace into conditioned space in both new and existing homes. Ductwork and HVAC equipment inside the conditioned space can save between 11 and 15% on cooling energy use in hot-humid climates.[4] Sealing the FFI with high performance insulation helps control stack effect, reducing infiltration of moisture-laden air at the FFI. This, in turn, reduces dehumidification needs during the cooling season and greatly reduces the potential for condensation on concealed wood framing. Allowing condensation to form on the framing will result in mold, mildew and poor indoor air quality, and can ultimately lead to conditions ideal for wood-destroying organisms, including termites, that lead to rot and decay of the home's structure.

GSPCC Code Change Proposal

The GSPCC proposal seeks to eliminate high performance insulation from the FFI. From a building science perspective, the GSPCC's proposal is deficient and will lead to unintended consequences. The proposal does not provide for an adequate internal air barrier to control winter time moisture – leading to rot and decay**.** Further, the proposal does not require an adequate air barrier. The Georgia State Minimum Standard Building Code limits air leakage to 5 ACH_{50}. To meet this standard, builders will need to seal the FFI, leveraging high performance insulation to limit air leakage.

Finally, the Code sets the minimum requirements for building in the State. Eliminating the use of high performance insulation at the FFI limits consumer choice and the ability to exceed the current requirements.

SPFA Code Change Proposal – Joint SPFA / SFC Video on Proposal

One of the most effective means to create an unvented crawlspace is to apply a continuous layer of closed-cell SPF (ccSPF) from the subfloor above to the interior grade of the crawlspace wall. Best practices for unvented crawlspaces include insulating and air sealing the entire FFI and inside of the foundation wall with a continuous layer of ccSPF, using a vapor barrier on the floor of the crawlspace.

SPFA's proposal includes an uninsulated inspection strip at the top of the foundation wall and leaves the front face of the sill plate exposed for visual inspection. SPFA's proposal provides a compromise to the best practices for encapsulated crawlspaces by leaving the sill plate exposed for visual inspection and sealing the gap between the sill plate and foundation using other sealants. Termite damage to the sill plate will demonstrate the onset of a subterranean termite infestation. If termites are visually detected in the sill plate, non-visual inspection techniques or destructive sampling can be applied in adjacent areas of the FFI to detect additional damage.

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[4] Beal, D., J. McIlvaine, K. Fonorow, and E. Martin. 2011. Summary of Interior Ducts in New Construction, Including an Efficient, Affordable Method to Install Fur-Down Interior Ducts. Prepared for the U.S. Department of Energy.

The SPFA proposal not only improves energy efficiency compared to the GSPCC proposal, it also helps balance moisture intrusion and condensation from infiltration of hot-humid air during the summer. Further, the SPFA proposal works on new construction and retrofit, and it is compliant with inspection gaps implemented in other southeastern states. This proposal could serve as the basis for best practices for unvented crawlspaces in other states.

Based on the previous discussion with the GSPCC, we have developed some additional considerations for a compromise solution, which are included below.

Use of Exterior Air Barriers on the FFI

During the June 9 meeting, members of the GSPCC suggested that air sealing of the FFI can be achieved by installation of an air barrier material or system from the exterior side of the building**.** This design is problematic for nearly all types of residential construction because the air barrier or sheathing must be continuously sealed to the foundation. Importantly, it is not a practical solution for retrofit, without conducting extensive renovations. It also creates yet another pathway hidden behind the barrier for termites to enter the structure.

To air seal the exterior of the FFI, water resistant barriers (WRBs) or air barriers are adhered to the outside of the building. The products will need to be taped, sealed, and permanently installed to create a continuous air barrier. Using an external barrier essentially replicates the same problem for exterior visual inspection and creates more hidden pathways.

Applying an air barrier, like SPF, to the interior side of the FFI is less complex, more practical, more effective, more energy efficient, and more durable (*e.g.* the air barrier is protected from the elements). Therefore, in terms of protecting consumers, air sealing the internal side of the FFI is a more effective solution.

Potential Compromises

SFC and SPFA believe a new proposal could protect consumers and provide a solution for termite inspections at the FFI. We believe the use of termite barriers in combination with the requirements for an uninsulated inspection strip may provide a starting point for a compromise solution. Because termite barriers force termites to come out into areas for visual inspection, the use of termite barriers will provide additional opportunity for visual inspection at the FFI – although this solution is most useful for new construction.

We acknowledge that different solutions need to be developed for new construction and retrofit.

New Construction

- Apply spray foam to the FFI leaving the front face of the sill plate exposed with an inspection strip at the top of the foundation wall
- Require a combination of termite barriers, treated wood sills, and soil treatment for all new wood frame construction
    - Possible exception for finishes on finished basement walls when treated wood materials or metal studs/furring are used for attachment of finishes to the interior side of the basement wall
- Use alternative inspection technology
- Use destructive sampling (with patch and replace) where infestations are suspected
- Proactive use of termiticide (in accordance with the FIFRA label) and bait stations

Existing Construction

- Apply spray foam to the FFI leaving the front face of the sill plate exposed with an inspection strip at the top of the foundation wall
- When sill plates are of untreated wood, the wood shall be surface treated with a termite treatment suitable for interior use (e.g., borate, etc.) prior to the retrofit insulation work regardless of the insulation and air-barrier materials and approaches used at the FFI
- Use alternative inspection technology
- Use destructive sampling (with patch and replace) where infestations are suspected
- Proactive use of termiticide (in accordance with the FIFRA label) and bait stations

SFC and SPFA would be happy to answer questions or further discuss this compromise solution before its approval by GSPCC.

Sincerely,

Stephen Wieroniey

Stephen

Director
Spray Foam Coalition

Kurt Riesenberg

Executive Director
Spray Polyurethane Foam Alliance

CC: Derrick Lastinger, Vice Chairman GSPCC
Greg Holley, GSPCC
Kim Bragg, GSPCC
Brian T. Forschler, Ph.D., GSPCC
Jeff Bodine Sinyard, GSPCC
Christy Kuriatnyk, GSPCC
Gregori Anderson, Chairman GCAC
Ted Miltiades, Georgia DCA

House Bill 777 (AS PASSED HOUSE AND SENATE)

By: Representatives Corbett of the 174th, Burns of the 159th, McCall of the 33rd, England of the 116th, Smith of the 70th, and others

A BILL TO BE ENTITLED
AN ACT

To amend Chapter 2 of Title 8 of the Official Code of Georgia Annotated, relating to standards and requirements for construction, alteration, etc., of buildings and other structures, so as to direct the Department of Community Affairs to undertake a review of the 2021 edition of the International Building Code so as to consider amending the state minimum standard codes to allow tall mass timber construction types; to provide a date by which said review is to be completed; to provide for related matters; to repeal conflicting laws; and for other purposes.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF GEORGIA:

SECTION 1.

Chapter 2 of Title 8 of the Official Code of Georgia Annotated, relating to standards and requirements for construction, alteration, etc., of buildings and other structures, is amended by revising Code Section 8-2-23, relating to amendment and revision of codes generally and installation of high-efficiency cooling towers, by adding a new subsection to read as follows:

"(d)(1) On or after July 1, 2020, the department shall undertake a review of the tall mass timber provisions of the 2021 International Building Code, approved by the International Code Council, for the purpose of considering whether the department, with the approval of the board, shall amend the Georgia state minimum standard codes to include provisions for tall mass timber as contained in the 2021 International Building Code for construction types IV-A, IV-B, and IV-C.

(2) The department shall complete the review provided for in paragraph (1) of this subsection before July 1, 2021."

SECTION 2.

All laws and parts of laws in conflict with this Act are repealed.

GEORGIA ASSOCIATION OF FIRE CHIEFS
P.O. Box 105377
Atlanta, GA 30348

October 20, 2020

Christopher Nunn, Commissioner
Georgia Department of Community Affairs
60 Executive Park South, NE
Atlanta, Georgia 30329

Dear Commissioner Nunn,

The Georgia Association of Fire Chief's alone with the Georgia State Firefighters Association have been in discussion with Andres Villegas with the Georgia Forestry Association about HB 777 the tall mass timber construction bill that has been assigned to the Department of Community Affairs to undertake a review of the 2021 edition of the International Building Codes for a recommendation on amending the state standard code to allow tall mass timber construction.

We are aware that a committee will be formed in the near future to undertake this study and prepare a recommendation for the state. We would like to ask that the Georgia Association of Fire Chief's be allowed to have a seat at the table so that we may be able to share our thoughts and gather information through out this process. Our goal is not to have any negative issues concerning this study, but to work together so the Fire Service, Timber Industry and the State all unite to keep Georgia moving forward to a bright future.

Please feel free to contact me if you have any questions and on behalf of the Georgia Fire Service thank you.

Respectfully,

Charles Wasdin
President, Georgia Association of Fire Chief's

GFA
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FORESTRY
ASSOCIATION

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P.O. BOX 1217
FORSYTH, GA 31029

August 3, 2020

Mr. Christopher Nunn
Commissioner
Georgia Department of Community Affairs (DCA)
60 Executive Park South NE
Atlanta, GA 30329

Commissioner Nunn:

We write to you today to express our enthusiasm for the passage of House Bill 777, which was signed by Governor Kemp on June 29.

As you know, this legislation directs the Department of Community Affairs (DCA) to undertake a review of the mass timber provisions of the 2021 International Building Code, which outline a safe and tested process for the construction of mass timber structures up to 18 stories tall. Several states in the Pacific Northwest have already incorporated these changes into their state building codes, and we are excited for the prospect of Georgia being the next mass timber friendly state.

Mass timber presents the State of Georgia with such a wonderful and unique opportunity—one that forges a link between rural economies, urban growth, and sustainable development. Mass timber provides an alternative to carbon-intensive building materials, sequesters carbon during the lifetime of the structure, and provides an aesthetically pleasing and innovative way to develop our cities—all while creating a new source of demand from Georgia's sustainable forest products supply chain which impacts rural and urban communities alike. With 22 million acres of private working forests and $36 billion in economic output, Georgia is the #1 forestry state in the nation.

As a group that is passionate and excited about this opportunity for Georgia, **we would like to engage with you on a monthly basis (10-minute call) to check into the status of the DCA's review of these mass timber building codes.**

Thank you for your consideration and for your service to the State of Georgia.

Sincerely,

Andres Villegas
President & CEO
Georgia Forestry Association

Lisa Bianchi-Fossati
Southface Institute

Dr. Puneet Dwivedi
UGA Warnell School of Forestry & Natural Resources

John Heagy
Hines

Bruce Luxmoore
Interfor US South

Deron Davis
The Nature Conservancy, GA

Leah Dixon
Georgia Conservancy

Dr. Russell Gentry
Georgia Institute of Technology

Bill de St. Aubin
The Sizemore Group

LET'S GROW

ICC Ad Hoc Committee on Tall Wood Buildings (TWB) – Complete Approved Changes

International Code Council (ICC) 2018 Group A and 2019 B Cycles

The ICC Ad Hoc Committee on Tall Wood Buildings (TWB) was created by the ICC Board of Directors to explore the science of tall mass timber buildings and develop code change proposals for the ICC process as appropriate. Committee research and activity, including testing, began in 2015.

Group A: For the 2018 code change cycle, the TWB submitted 14 proposals which were considered by the code development committees and the membership at the Committee Action Hearing in Columbus, OH in April and the Public Comment Hearing in Richmond, VA, in October. Final action was determined by the Online Governmental Consensus Vote which concluded in December 2018. All the TWB Group A changes were approved, and the results are shown below.

Group B: For the 2019 code change cycle, the TWB submitted 3 proposals which were considered by the code development committees and the membership at the Committee Action Hearing in Albuquerque, NM in April/May and the Public Comment Hearing in Las Vegas, NV, in October. Final action was determined by the Online Governmental Consensus Vote which concluded in December 2019. All the TWB Group B changes were approved, and the results are shown below

The compiled list below follow a recommended order of reading to understand the full scope and content of the changes. The complete text of the changes and applicable results from the ICC published monographs are included, following the order of the list below. These changes will be incorporated into the 2021 editions of the International Building Code and the International Fire Code.

Group A:

G108-18 – AM - Main proposal describing new mass timber construction types and requirements

FS5-18 – AS - Determining contribution of noncombustible materials to fire resistance by testing

FS81-18 – AM - Prescriptive method for using noncombustible materials to achieve fire resistance

FS6-18 – AMPC-1 - Sealing of adjoining mass timber elements

FS73-18 – AS - Mass timber as acceptable fire blocking

G28-18 – AS - Redundant water supply for tall mass timber buildings

F88-18 – AS - Provisions requiring owner to maintain building for fire resistance

F266-18 – AMPC-1 - Fire safety during construction

G75-18 – AM - Allowable height in feet

G80-18 – AS - Allowable height in stories

G84-18 – AS - Allowable areas

G146-18 – AS - Assigning the designation “HT” to existing Type IV requirements in Chapter 31

G152-18 – AS - Assigning the designation “HT” to existing Type IV requirements in Appendix D

G89-18 – AM - Minimum noncombustible protection for fire barriers

Group B:

S170-19 -- AS - Fire resistance of connections

S100-19 -- AS - Special inspection provisions

ADM35-19 -- AS - Inspection of connection protection

G108-18

G108-18 Final Action: Approved as Modified by Committee

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]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT	1	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 ≤ X < 10	IA, IVA Others	3 2	2 1	11
10 ≤ X < 30	IA, IB, IVA, IVB IIB, VB Others	2 1 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.

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.

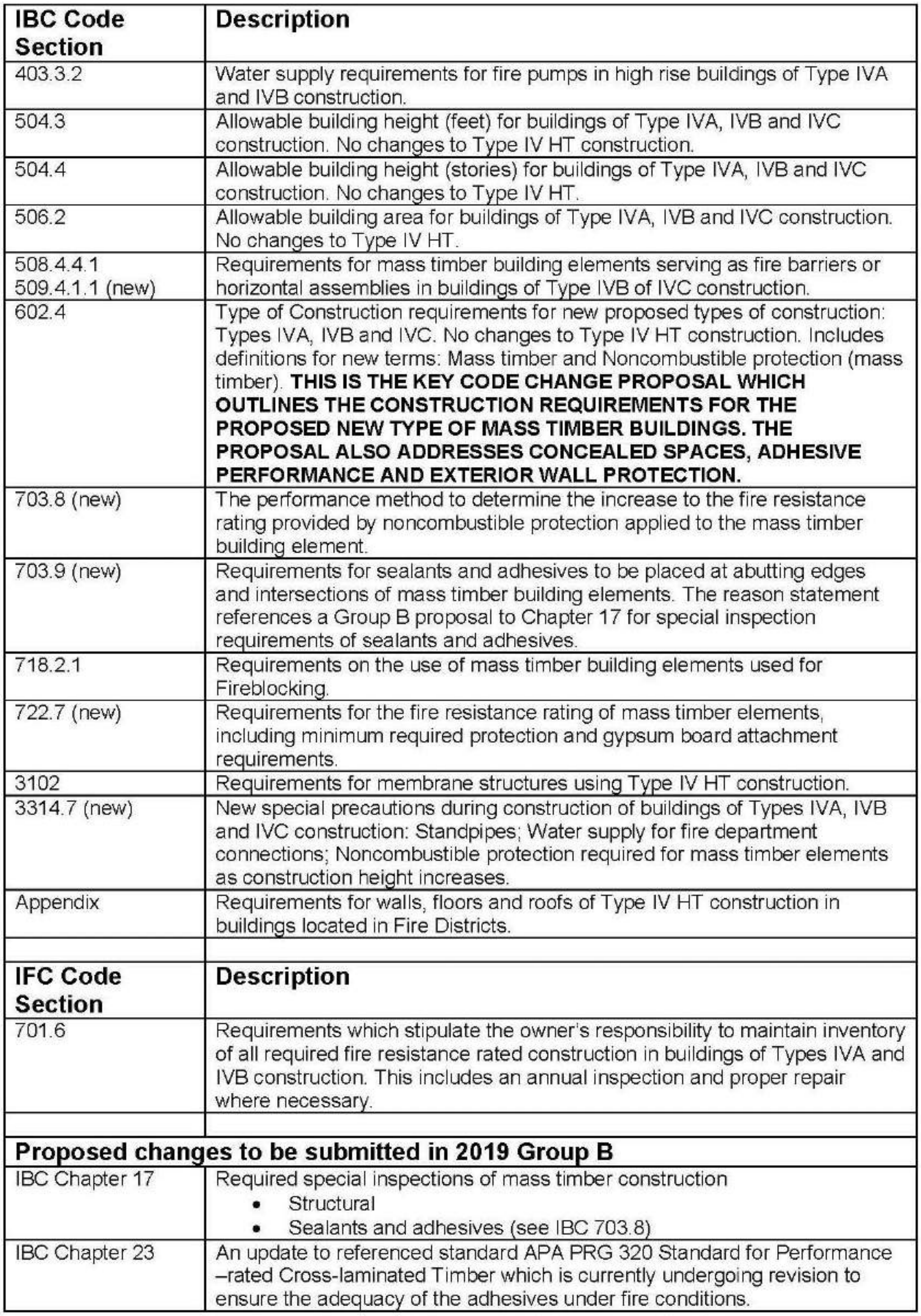
Type IV-B allows some exposed wood surfaces of the ceiling, the walls or columns and beams. The amount of exposed surface permitted to be installed, as well as the required separation between unprotected portions, is clearly specified to limit the contribution of the structure in an interior fire. For 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 Final Action: Approved as Modified by Committee

FS5-18

FS5-18 Final Action: Approved as Submitted

IBC: 703.8

Proposed Change as Submitted

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

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

2018 International Building Code

Add new text as follows

703.8 Determination of noncombustible protection time contribution. . The time, in minutes, contributed to the fire resistance rating by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E 119 or UL 263. The test assemblies shall be identical in construction, loading, and materials, other than the noncombustible protection. The two test assemblies shall be tested to the same criteria of structural failure.

1. Test Assembly 1 shall be without protection.
2. Test Assembly 2 shall include the representative noncombustible protection. The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

The noncombustible protection time contribution shall be determined by subtracting the fire resistance time, in minutes, of Test Assembly 1 from the fire resistance time, in minutes, of Test Assembly 2.

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 determined that the fire resistance rating of mass timber structural elements, embodied in a series of proposals including this one, shall consist of the inherent fire resistance rating of the mass timber and the additional fire resistance rating of the *Noncombustible Protection* described in new definitions proposals. The TWB determined that at least 2/3 of the required fire resistance rating should come from the *Noncombustible Protection.* The TWB decided to provide both a performance path, as embodied in this proposal, and a prescriptive path, embodied in another proposal for Section 722.7.

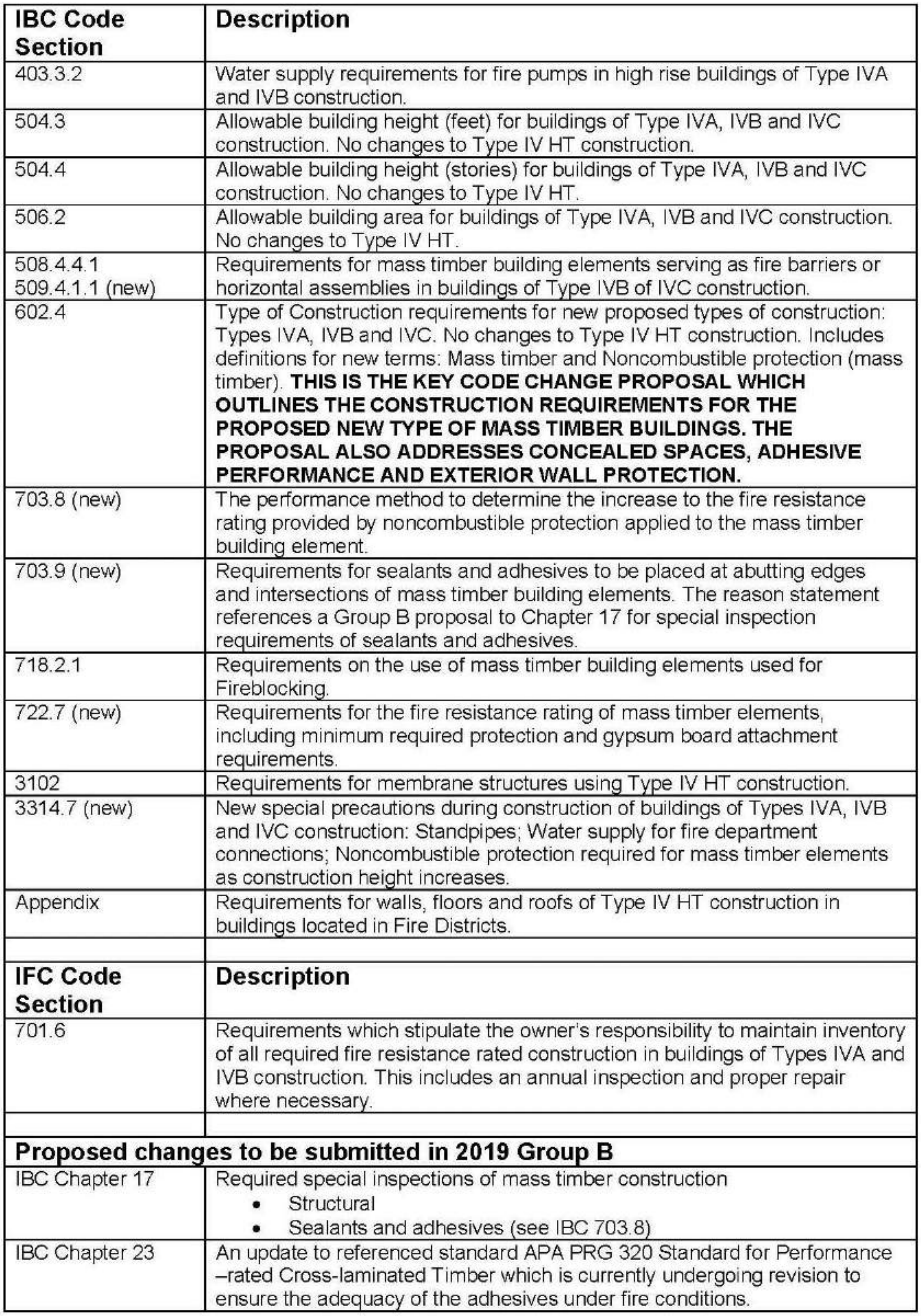
This proposal constitutes the performance path for determining the contribution of noncombustible protection for mass timber elements. The proposal outlines a protocol to accomplish this. This proposal should be considered as a companion proposal to the proposals creating new types of mass timber construction in Section 602.4 and the code proposal in Section 722.7. The proposed new Section 602.4 requires the use of noncombustible protection on most mass timber elements in most of the proposed new types of construction.

This proposal, new section 703.8, is created to provide the method by which any material not contained in the prescriptive Table in Section 722.7 may be tested to show the time, in minutes, which it contributes as *noncombustible protection*. This procedure is representative of the procedure used in the past to determine the protection times for various membranes in Section 722.6 Component Additive Method for wood construction. It is neither new nor ambiguous in its use. Recent testing by AWC confirms the values derived from historic testing. A report is available at the following link: http://bit.ly/WFC-firetestofGWBonCLT . This link was confirmed active on 12/27/17.

This procedure should not be confused with “membrane protection” which is based on temperature rise on the unexposed side of a membrane attached to construction elements. Noncombustible construction is, instead, noncombustible material meeting the requirements of Section 703.5. Its contribution to the fire resistance rating of any building element is determined by this proposed new section. Simply put, it is determined by measuring the fire resistance time, in minutes and determined by structural failure, of a mass timber building element and then conducting a second test measuring the fire resistance time, in minutes and determined by structural failure, of the identical mass timber element with identical load, construction and condition, but with the proposed noncombustible protection applied to it. The difference in time between the two samples is the contribution, in minutes, of the noncombustible protection.

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
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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**
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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:

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

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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.

FS5-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The proponents have done their homework. This is how heavy timber should be done. The western fire test validated this approach and that should be taken into consideration. (Vote: 14-0)

Assembly Action: **None**

FS5-18 Final Action: Approved as Submitted

FS81-18 Final Action: Approved as Modified by Committee

FS81-18

IBC: 722.7, 722.7.1, Table TABLE 722.7.1(1), Table TABLE 722.7.1(2), 722.7.2, 722.7.2.1, 722.7.2.2

Proposed Change as Submitted

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

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

2018 International Building Code

Add new text as follows

722.7 Fire resistance rating of mass timber. The required fire resistance of mass timber elements in Section 602.4 shall be determined in accordance with Section 703.2 or Section 703.3. The fire resistance rating of building elements shall be as required in Tables 601 and 602 and as specified elsewhere in this code. The fire resistance rating of the mass timber elements shall consist of the fire resistance of the unprotected element added to the protection time of the noncombustible protection.

722.7.1 Minimum required protection. Where required by Sections 602.4.1 through 602.4.3, noncombustible protection shall be provided for mass timber building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established in accordance with Section 703.8. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement when installed and fastened in accordance with Section 722.7.2.

TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL

Required Fire Resistance Rating of Building Element per Tables 601 and 602 (hours)	Minimum Protection Required from Noncombustible Protection (minutes)
1	40
2	80
3 or more	120

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

Noncombustible Protection	Protection Contribution (minutes)
$^{1}/_{2}$ inch Type X Gypsum Board	30
$^{5}/_{8}$ inch Type X Gypsum Board	40

722.7.2 Installation of gypsum board noncombustible protection. Gypsum board complying with Table 722.7.1(2) shall be installed in accordance with this section.

722.7.2.1 Interior surfaces. Layers of Type X gypsum board serving as noncombustible protection for interior surfaces of wall and ceiling assemblies determined in accordance with Table 722.7.1(1) shall be installed in accordance with the following:

1. Each layer shall be attached with Type S drywall screws of sufficient length to penetrate the mass timber at least 1 inch when driven flush with the paper surface of the gypsum board.

Exception: The third layer, where determined necessary by Section 722.7, shall be permitted to be attached with1 inch #6 Type S drywall screws to furring channels in accordance with ASTM C645.

2. Screws for attaching the base layer shall be 12 inches on center in both directions.
3. Screws for each layer after the base layer shall be 12 inches on center in both directions and offset from the screws of the previous layers by 4 inches in both directions.
4. All panel edges of any layer shall be offset 18 inches from those of the previous layer.
5. All panel edges shall be attached with screws sized and offset as in items 1 through 4 above and placed at least 1 inch but not more than 2 inches from the panel edge.
6. All panels installed at wall-to-ceiling intersections shall be installed such that ceiling panels are installed first and the wall panels are installed after the ceiling panel has been installed and is fitted tight to the ceiling panel. Where multiple layers are required, each layer shall repeat this process.
7. All panels installed at a wall-to-wall intersection shall be installed such that the panels covering an exterior wall or a wall with a greater fire resistance rating shall be installed first and the panels covering the other wall shall be fitted tight to the panel covering the first wall. Where multiple layers are required, each layer shall repeat this process.
8. Panel edges of the face layer shall be taped and finished with joint compound. Fastener heads shall be covered with joint compound.
9. Panel edges protecting mass timber elements adjacent to unprotected mass timber elements in accordance with Section 602.4.2.2 shall be covered with 1-1/4 inch metal corner bead and finished with joint compound.

722.7.2.2 Exterior surfaces. Layers of Type X gypsum board serving as noncombustible protection for the outside of the exterior heavy timber walls determined in accordance with Table 722.7.1(1) shall be fastened 12 inches on center each way and 6 inches on center at all joints or ends. All panel edges shall be attached with fasteners located at least 1inch but not more than 2 inches from the panel edge. Fasteners shall comply with one of the following:

1. Galvanized nails of minimum 12 Gage with a 7/16 inch head of sufficient length to penetrate the mass timber a minimum of 1 inch.
2. Screws which comply with ASTM C1002 (Type S, Type W, or Type G) of sufficient length to penetrate the mass timber a minimum of 1 inch.

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.
Typically, mass timber elements will be large due to structural requirements. In addition, CLT panels typically are utilized in odd number laminations. This typically results in excess capacity which means better fire endurance. Thus, mass timber elements are conservative in their fire resistance rating. Furthermore, the TWB decided to provide both a prescriptive path, as embodied in this proposal, and a performance path, embodied in another proposal.

This proposal outlines a method to calculate the fire resistance rating of a protected wood element by adding the fire resistance rating of the unprotected wood member together with the protection time provided by the noncombustible protection applied to the exposed wood.

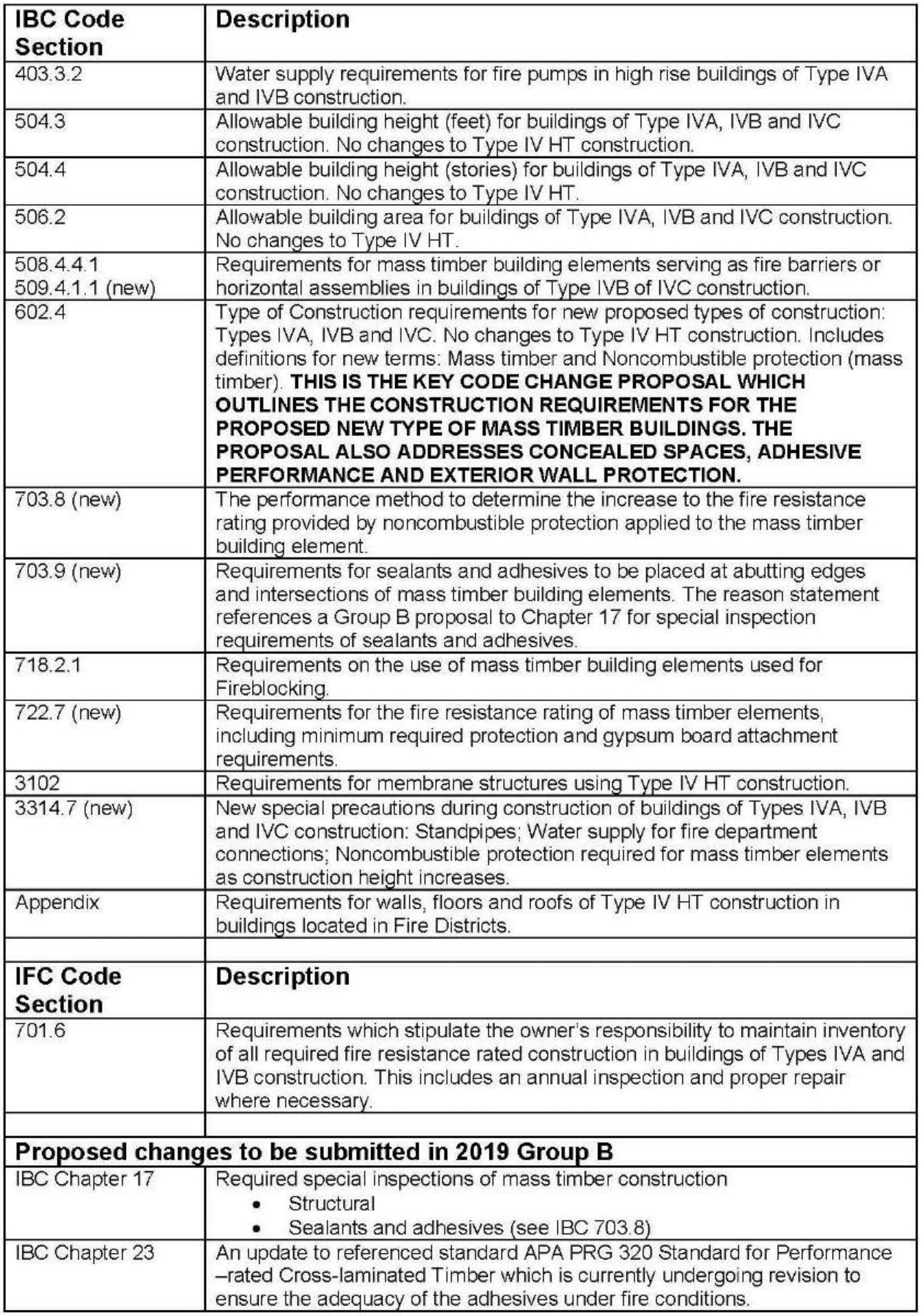
This proposal should be considered as a companion proposal to the proposals creating new types of mass timber construction in Section 602.4 and the code proposal for Section 703.8 outlining a testing protocol to determine the contribution of noncombustible protection. This code proposal allows the user to select a prescriptive solution utilizing Type X gypsum wall board, which is deemed to comply with the basic requirements of this section and those of the proposed Section 602.4. Since this is a prescriptive solution, conditions of use such as attachment, finishing and edge treatment when bordering exposed mass timber areas, are also included in this section.

A proposal in Section 703.8 both forms the performance path for this determination and is the basis by which the contribution of the *Noncombustible Protection* to the fire resistance rating is determined. Testing of beams, columns, walls and ceiling panels has been used to establish the values found in table 722.7.1(b) for 1/2-inch Type X and 5/8-inch Type X gypsum board as well. Recent testing by AWC confirms the values derived from historic testing. A report is available at the following link: http://bit.ly/WFC-firetestofGWBonCLT . This link was confirmed active on 12/27/17.

Tests proposed in Section 703.8 may be used in the future to justify additional materials added to this table and should not be confused with “membrane protection” which is based on temperature rise on the unexposed side of a membrane attached to construction elements. Noncombustible construction is, instead, noncombustible material meeting the requirements of Section 703.5. Its contribution to the fire resistance rating of any building element is determined by this proposed new section. Simply put, it is determined by measuring the fire resistance time in minutes to the point of structural failure of a mass timber building element and then conducting a second test measuring the fire resistance time in minutes taken to the same point of structural failure. Each test is to be conducted with identical mass timber element with identical load, construction and condition, but with the proposed noncombustible protection applied to the second assembly. The difference in time between the two samples is the contribution, in minutes, of the noncombustible protection.

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 referenced standards, ASTM C645 and ASTM C1002, are currently referenced in 2018 I-codes.

FS81-18

Public Hearing Results

Committee Action: As Modified

Committee Modification: In the column of TABLE 722.7.1(2) that addresses 1/2 inch Type X Gypsum Board, change the protection contribution value (in minutes) to 25 instead of 30.

Committee Reason: The modification coordinates well with the existing language in the code. The committee recommends approval based upon the proponent's reason statement. (Vote: 14-0)

Assembly Action: None

FS81-18 Final Action: Approved as Modified by Committee

FS6-18

Final Action: Approved as Modified by Public Comment 1

IBC: 703.9 (New), Chapter 35

Proposed Change as Submitted

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

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

2018 International Building Code

Add new text as follows

703.9 Sealing of adjacent mass timber elements. In buildings of Type IVA, IVB, and IVC construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire resistance-rated
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire resistance-rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Exception: Where sealant or adhesive is not a required component of a fire resistance-rated assembly.

Add new standard(s) follows

ASTM

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

D3498-03(2011):

Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

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.
Mass timber has inherent properties of fire resistance, serving both to provide structural fire resistance and to safeguard against the spread of fire and smoke within a building or the spread of fire between structures.

When mass timber panels are connected together, fire tests have demonstrated that it is important for the abutting edges and intersections in the plane of and between the different planes of panels that form a separation to be sealed. The structures tested as part of the fire tests supporting this submittal were constructed with this sealing.

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

http://bit.ly/ATF-firetestreport

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

The US CLT manual recommends a bead of construction adhesive. Construction adhesive or other sealant can be used to prevent air flow. When a wall or horizontal assembly serves as the separation between two atmospheres, a fire creates differential pressure where heated gasses raise the pressure and work to drive fire and hot gasses through the structure. Voids that are not properly sealed can serve as a conduit for air movement during a fire, so abutting edges and intersections are recommended to be sealed.

Periodic special inspections during construction are required to make sure it is clear that the appropriate sealant or adhesive is used and to establish inspections to verify for ongoing quality control. However, Chapter 17 is a Group B topic. It will be taken up then. It is shown below for clarity and to emphasize the importance the TWB places on proper application of sealants and adhesives in mass timber construction.

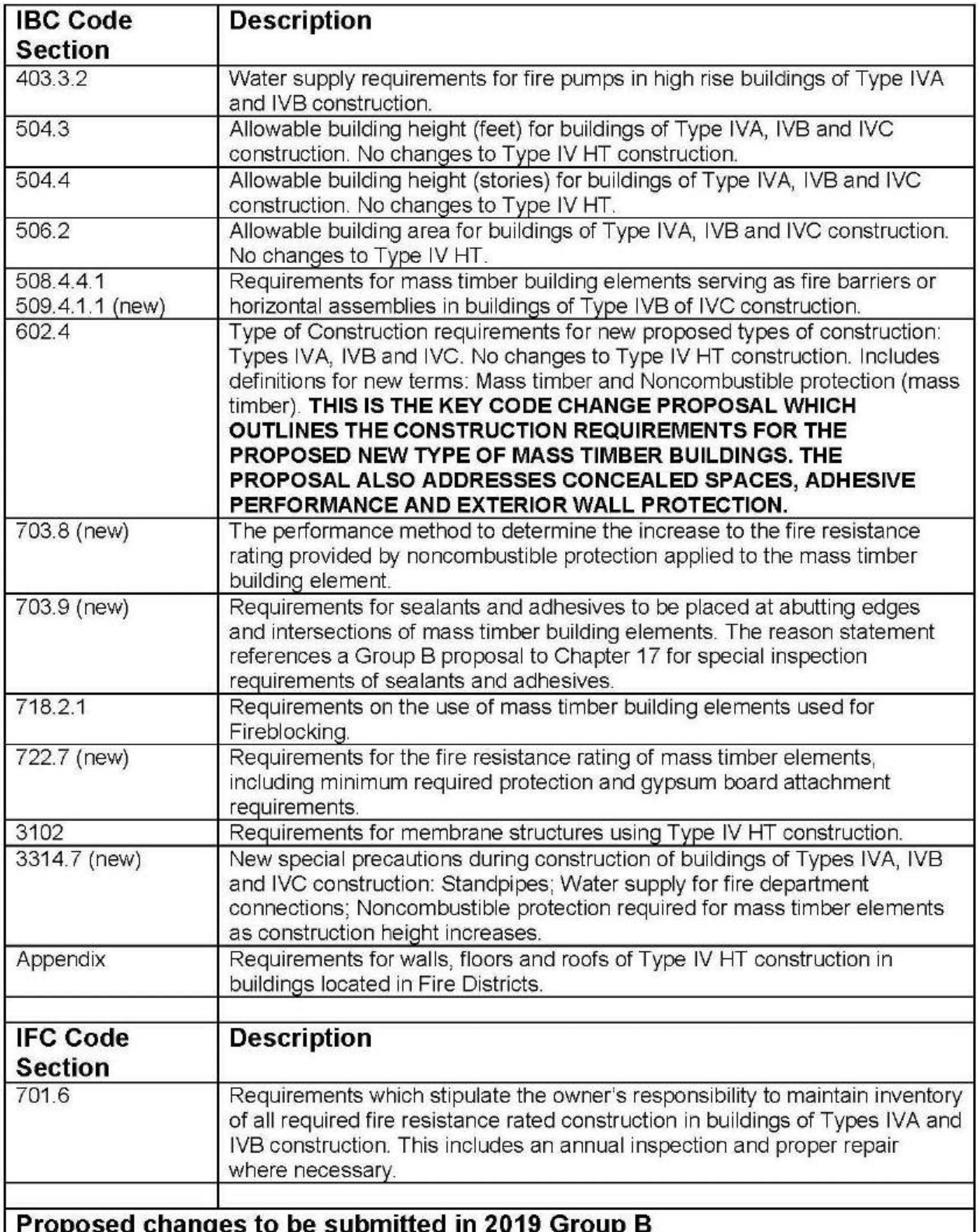
1705.19 Sealing of Mass Timber. Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.9 is applied to mass timber building elements as designated in the approved construction documents.

Some panels are manufactured under proprietary processes to ensure there are no voids at these intersections. Where this proprietary process is incorporated and tested, there is no requirement for sealant or adhesive and an exception is provided for this instance. Where the sealant is not required and is not specifically excluded it is still considered to be a good practice covered by this section.

This code change proposal does not apply to “joints” as defined in Section 202 of the IBC as joints have their own requirements for the placement and inspection of fire resistant joint systems in IBC Section 715. Joints are defined as having an opening that is designed to accommodate building tolerances or to allow independent movement. Panels and members that are connected together as covered by this code change proposal do not meet the definition of a joint since they are rigidly connected and do not have an opening.

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
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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.
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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.
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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: A review of the standard proposed for inclusion in the code, ASTM D3498-03(2011), 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.

FS6-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is necessary to maintain the integrity of the system. It was suggested that a public comment related to the proposed modification may be in order. (Vote: 14-0)

Assembly Action: **None**

FS6-18 Final Action: Approved as Modified by Public Comment 1

FS6-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen DiGiovanni, representing Ad Hoc Committee for Tall Wood Buildings (sdigiovanni@clarkcountynv.gov)requests As Modified by This Public Comment.

Further modify as follows:

2018 International Building Code

703.9 Sealing of adjacent mass timber elements. In buildings of Type IVA, IVB, and IVC construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire resistance-rated
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire resistance-rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

> **Exception:** ~~Where sealant or adhesive is not~~ Sealants or adhesives need not be provided where they are not a required component of a tested fire resistance-rated assembly.

1705.19 **Sealing of mass timber** Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.9 is applied to mass timber building elements as designated in the approved construction documents.

Commenter's Reason: There are two changes proposed. The first change is to the exception for proposed Section 703.9. The original wording of the exception was not clear as to whether it exempted sealants from meeting the ASTM standards, or whether it was intended to exempt the sealant altogether. This exception is expanded to clarify that sealants and adhesives are not required where voids are a part of a tested fire assembly, when such assembly is tested without the use of sealants and adhesives in the void space. The second change adds a special inspection requirement to address sealants and adhesives that are a part of the required design. There is a need to ensure that the details of construction are adhered to, and the special inspection is seen as a means to ensure that these construction details are adequately emphasized during the construction process. This change was proposed as a modification during code hearings and ruled out of order at that time, and in doing so the committee suggested that the appropriate path for adding the special inspection requirement was to submit 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 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.

FS73-18

FS73-18 Final Action: Approved as Submitted

IBC: 718.2.1

Proposed Change as Submitted

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

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

2018 International Building Code

Revise as follows

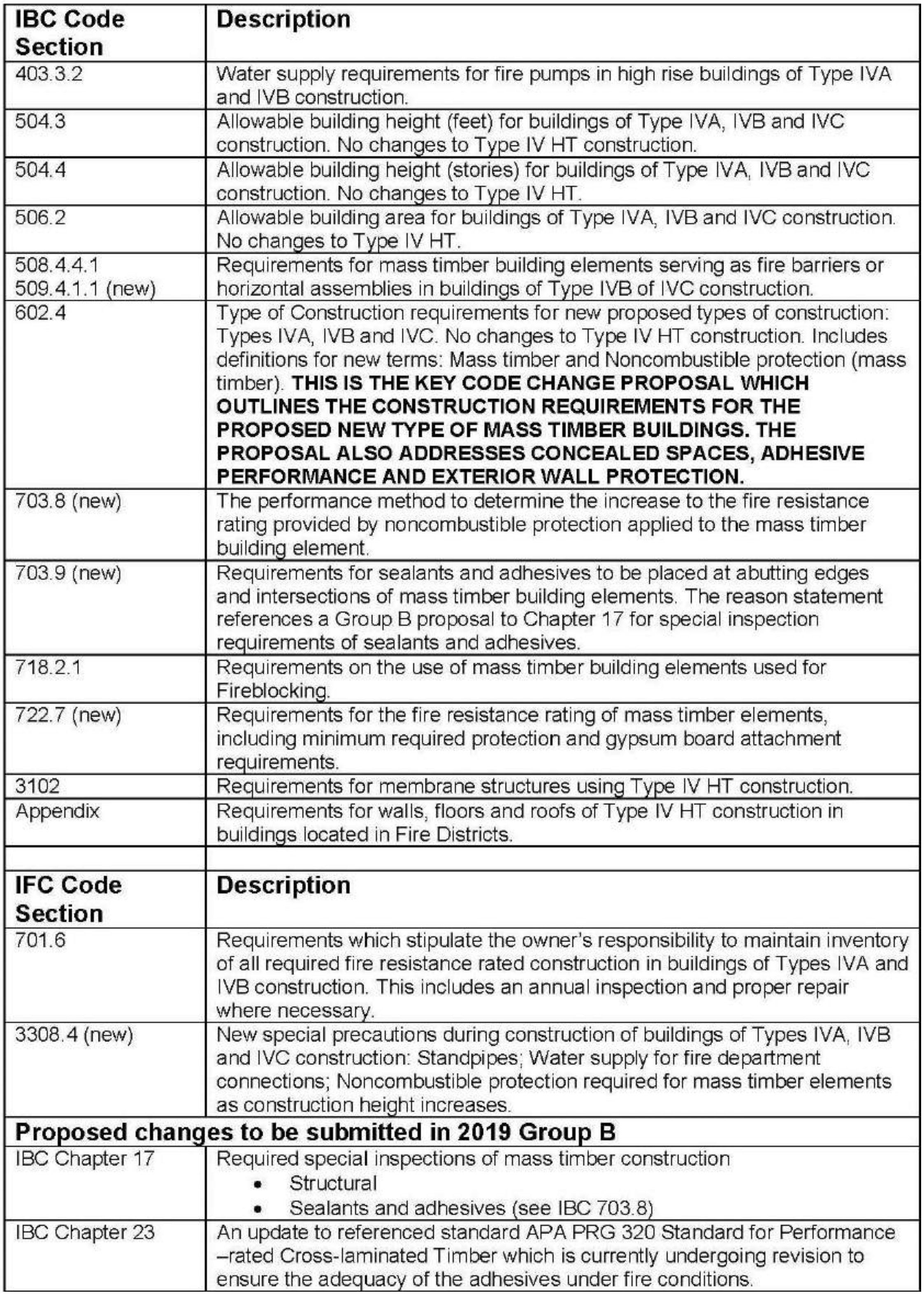
718.2.1 Fireblocking materials. *Fireblocking* shall consist of the following materials:

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25 mm) nominal lumber with broken lap joints.
3. One thickness of 0.719-inch (18.3 mm) wood structural panels with joints backed by 0.719-inch (18.3 mm) wood structural panels.
4. One thickness of 0.75-inch (19.1 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-fourth-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool, mineral fiber or other *approved* materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested for the specific application.
9. Mass timber complying with Section 2304.11.

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

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.



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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.
3308.4 (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.
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)
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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.

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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.

FS73-18

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Mass timber is acceptable for fire blocking given the other materials on the list. (Vote: 14-0)

Assembly Action: **None**

FS73-18 Final Action: Approved as Submitted

G28-18

G28-18 Final Action: Approved as Submitted

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.

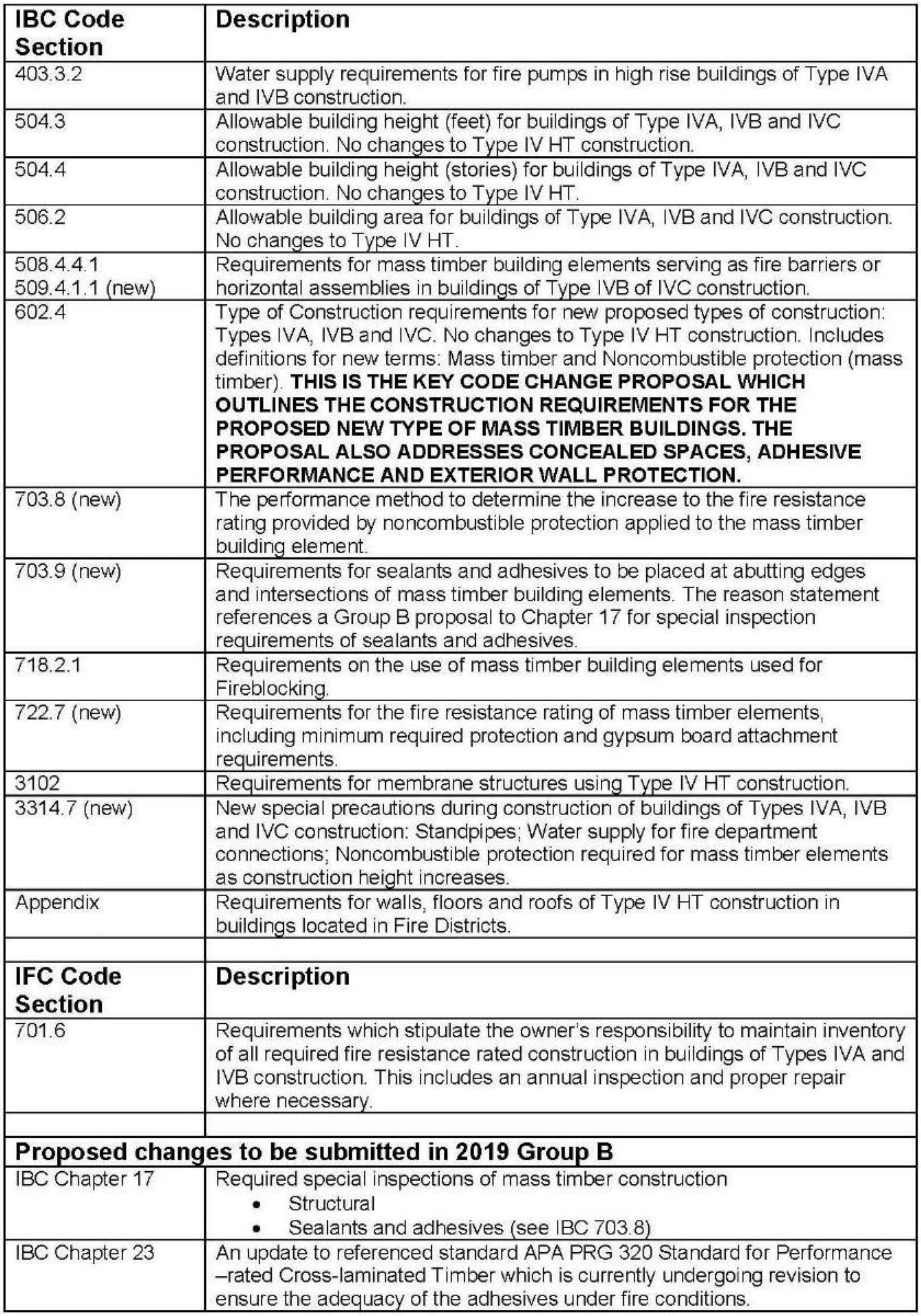
The Code Technology Committee, in response to the events of September 11, 2001, submitted proposals for water supply to super high-rise buildings of 420' and higher. This requirement was adopted due to the recognized importance of insuring a continuous water supply to the active fire protection systems 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:

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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 Final Action: Approved as Submitted

F88-18

F88-18 Final Action: Approved as Submitted

IFC: 701.6

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

2018 International Fire Code

Revise as follows:

701.6 Owner's responsibility. The owner shall maintain an inventory of all required *fire-resistance-rated* construction, construction installed to resist the passage of smoke and the construction included in Sections 703 through 707 and Sections 602.4.1 and 602.4.2 of the International Building Code. Such construction shall be visually inspected by the *owner* annually and properly repaired, restored or replaced where damaged, altered, breached or penetrated. Records of inspections and repairs shall be maintained. Where concealed, such elements shall not be required to be visually inspected by the *owner* unless the concealed space is accessible by the removal or movement of a panel, access door, ceiling tile or similar movable entry to the space.

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. One of the basic requirements incorporated into these proposed increased heights and areas is the added active and passive protection features to these structures.

Specific to this code change proposal, in the related code change proposals for Type IV-A and Type IV-B, mass timber walls and ceilings, except where permitted, will be required to meet a fire-resistance performance with a specified amount provided with gypsum board or its equivalent.

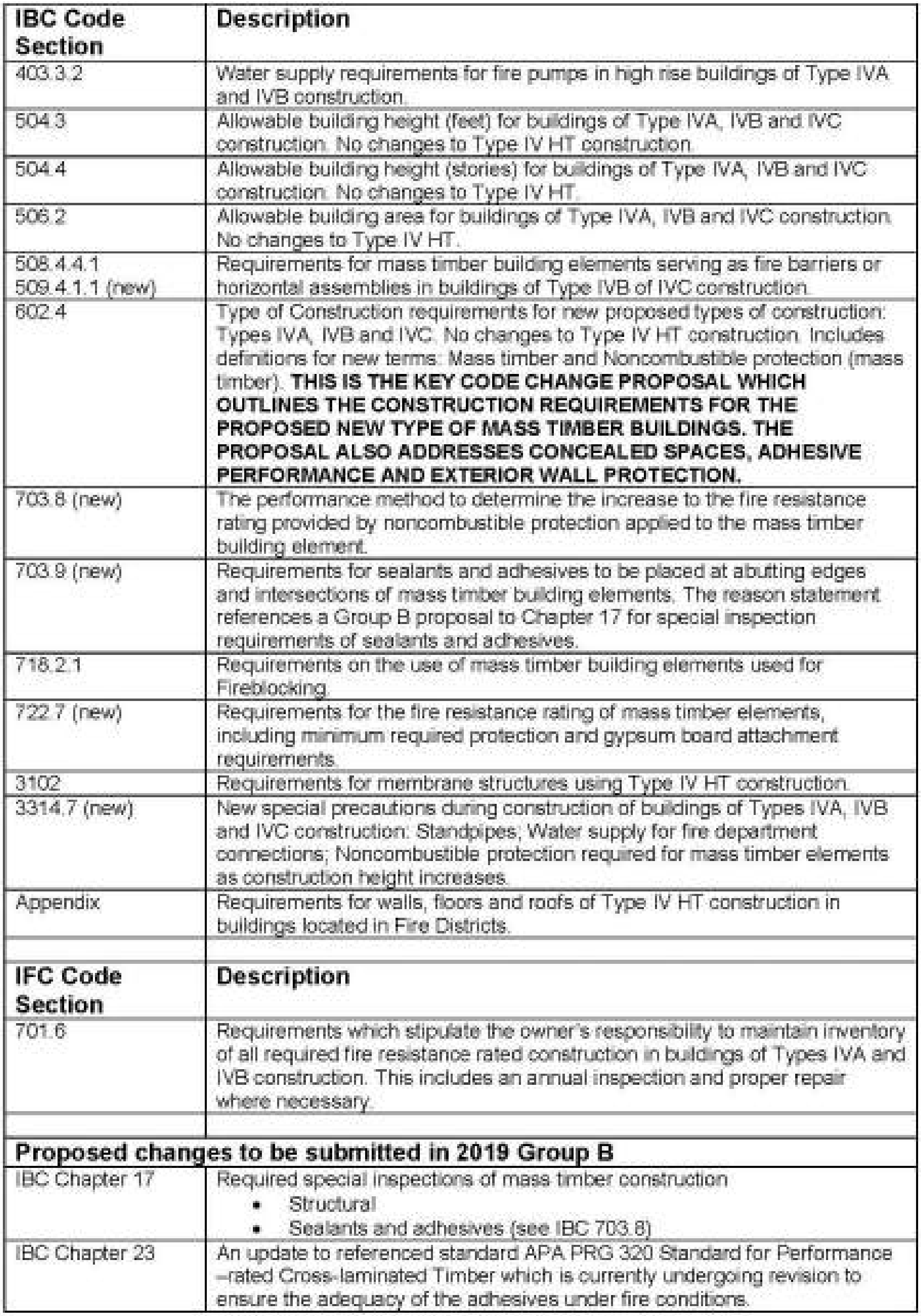
The greater permitted heights and areas are being proposed based on the requirement of this added level of passive protection. It would seem obvious that we should incorporate a methodology to insure this passive protection remains in place.

This is not an undue burden to the building owner or management. Section 701.6 of the International Fire Code permits these inspections to be done by current building staff. Local jurisdictions may or may not require the annual inspection to be reported. The managing authority simply must keep a record of such inspections and take steps to correct any deficiencies identified.

Some have suggested that we do not require other types of construction to inspect the gypsum board annually to insure it has not been compromised. Other forms of construction do not contribute to the fuel load in the manner mass timber construction potentially will do. If we are going to permit mass timber construction to greater heights than previously permitted it means we are relying on the performance of active and passive protection to protect the occupants of the building in the event of a fire. We currently require the active protection to be inspected for performance it is time we require the same for the passive.

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
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IFC Code Section	**Description**
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Proposed changes to be submitted in 2019 Group B	
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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.

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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.

Internal ID: 962

F88-18 Final Action: Approved as Submitted

F88-18

Committee Action: **Approved as Submitted**

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

Assembly Motion: **NONE**

F266-18

F266-18 Final Action: Approved as Modified by Public Comment 1

IFC: 3308.4

Proposed Change as Submitted

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

2018 International Fire Code

3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction. Buildings of Types IV-A, IV-B, and IV-C construction designed to be greater than six stories above grade plane shall comply with the following requirements during construction unless otherwise approved by the fire code official.

1. Standpipes shall be provided in accordance with Section 3313.
2. A water supply for fire department operations, as approved by the fire chief.
3. Where building construction exceeds six stories above grade plane, at least one layer of noncombustible protection where required by Section 602.4 of the International Building Code shall be installed on all building elements more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor levels.
4. Where building construction exceeds six stories above grade plane required exterior wall coverings shall be installed on all floor levels more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor level.
   Exception: Shafts and vertical exit enclosures.

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 has developed a number of proposals to potentially increase the permitted height and area for Type IV structures, specifically mass timber buildings adding additional Types IV-A, IV-B & IV-C. 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 goal of this proposal is to provide guidance and requirements for when this combustible building is most vulnerable, while under construction prior to fire protection systems have been installed.

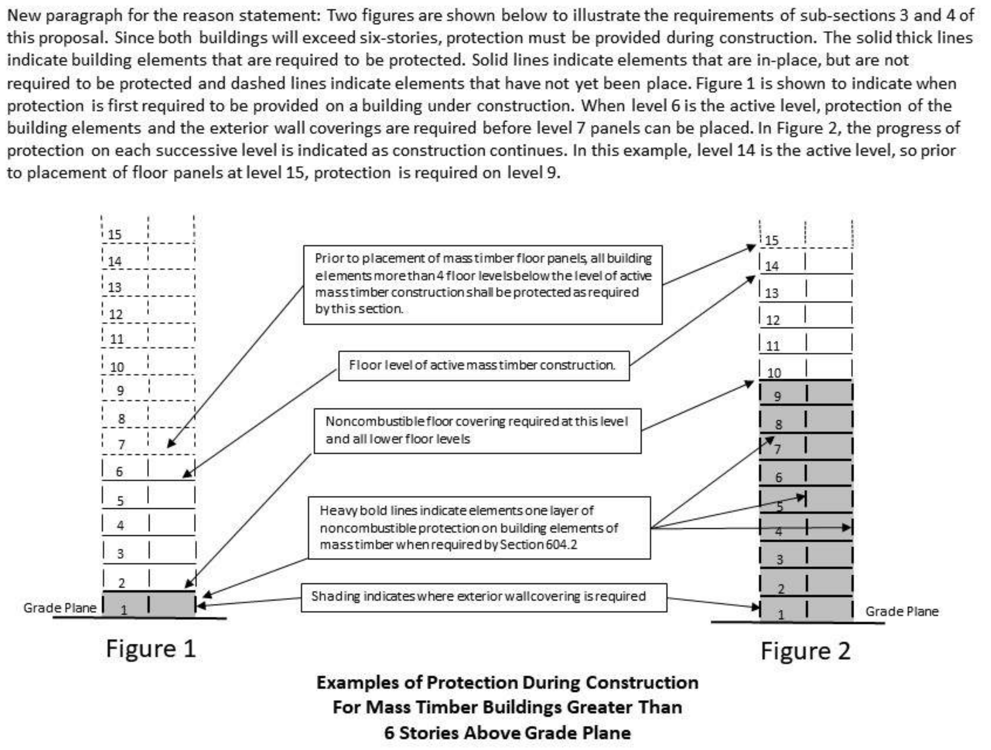
Over the recent years we have experienced a number of fires while combustible buildings have been under construction. It is understood the vast majority of these fires did occur in structures of light-frame structural wood members which present a significant fire hazard when exposed. Even with this fact we cannot simply ignore the potential risk of fire in combustible construction simply due to the size of the timber element and the potentially longer period of time for ignition as the potentially fuel load of a mass timber building can be substantial.

The TWB had a great deal of discussion regarding the proposed requirements regarding water supply to the buildings of combustible construction sites. On one hand, there was a desire to establish a minimum water flow of 250 gpm with a minimum pressure. But the counter discussion identified that these combustible building construction sites may have various degrees of hazards on the site and was not restrictive to just the structure. Mass timber construction typically proceeds with little stored combustible material on the site, mass timber is generally installed as it arrives. Thus, there may be more or fewer site hazards than on a typical construction site utilizing combustible materials. Moreover, protection of the installed material must occur before the project moves above certain specified numbers of levels. This is very different from conventional construction processes.

With this understanding, the TWB is proposing project developers meet and confer with the local fire service to establish the fire department’s response needs, in terms of water flow and pressure, for the specific building, while under construction, and job site.

While sub-sections 1 and 2 apply to the delivery of water to the job site, and/or structure, sub-sections 3 and 4 are specific to the passive protection related to the structure. Due to the proposed increased heights and areas, the TWB felt it was important to require interior and exterior passive protection as the construction progressed. This would insure the lower portions of the combustible structure had redundant, active and passive, protection as greater heights were added.

Two figures are shown below to illustrate the requirements of sub-sections 3 and 4 of this proposal. Since both buildings will exceed six-stories, protection must be provided during construction. The solid thick lines indicate building elements that are required to be protected. Solid thin lines indicate elements that are in-place, but are not required to be protected and dashed lines indicate elements that have not yet been placed. Figure 1 is shown to illustrate when protection is first required on a building under construction. When level 6 is the active level of mass timber construction, protection of the building elements and the exterior wall coverings are required before level 7 panels can be placed. In Figure 2, the progress of protection on each successive level is indicated as construction continues. In this example, level 14 is the active level of mass timber construction, so prior to placement of floor panels at level 15, protection is required on level 9.



New paragraph for the reason statement: Two figures are shown below to illustrate the requirements of sub-sections 3 and 4 of this proposal. Since both buildings will exceed six-stories, protection must be provided during construction. The solid thick lines indicate building elements that are required to be protected. Solid lines indicate elements that are in-place, but are not required to be protected and dashed lines indicate elements that have not yet been place. Figure 1 is shown to indicate when protection is first required to be provided on a building under construction. When level 6 is the active level, protection of the building elements and the exterior wall coverings are required before level 7 panels can be placed. In Figure 2, the progress of protection on each successive level is indicated as construction continues. In this example, level 14 is the active level, so prior to placement of floor panels at level 15, protection is required on level 9.

Prior to placement of mass timber floor panels, all building elements more than 4 floor levels below the level of active mass timber construction shall be protected as required by this section.

Floor level of active mass timber construction.

Noncombustible floor covering required at this level and all lower floor levels

Heavy bold lines indicate elements one layer of noncombustible protection on building elements of mass timber when required by Section 604.2

Shading indicates where exterior wallcovering is required

Figure 1

Figure 2

Examples of Protection During Construction For Mass Timber Buildings Greater Than 6 Stories Above Grade Plane

The TWB strongly feels these code change proposals should be adopted as a whole package. By adopting a few of the code change proposals without the complete package potentially ignores the details required to insure these proposed projects are designed, built and maintained properly now and in the future. **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.

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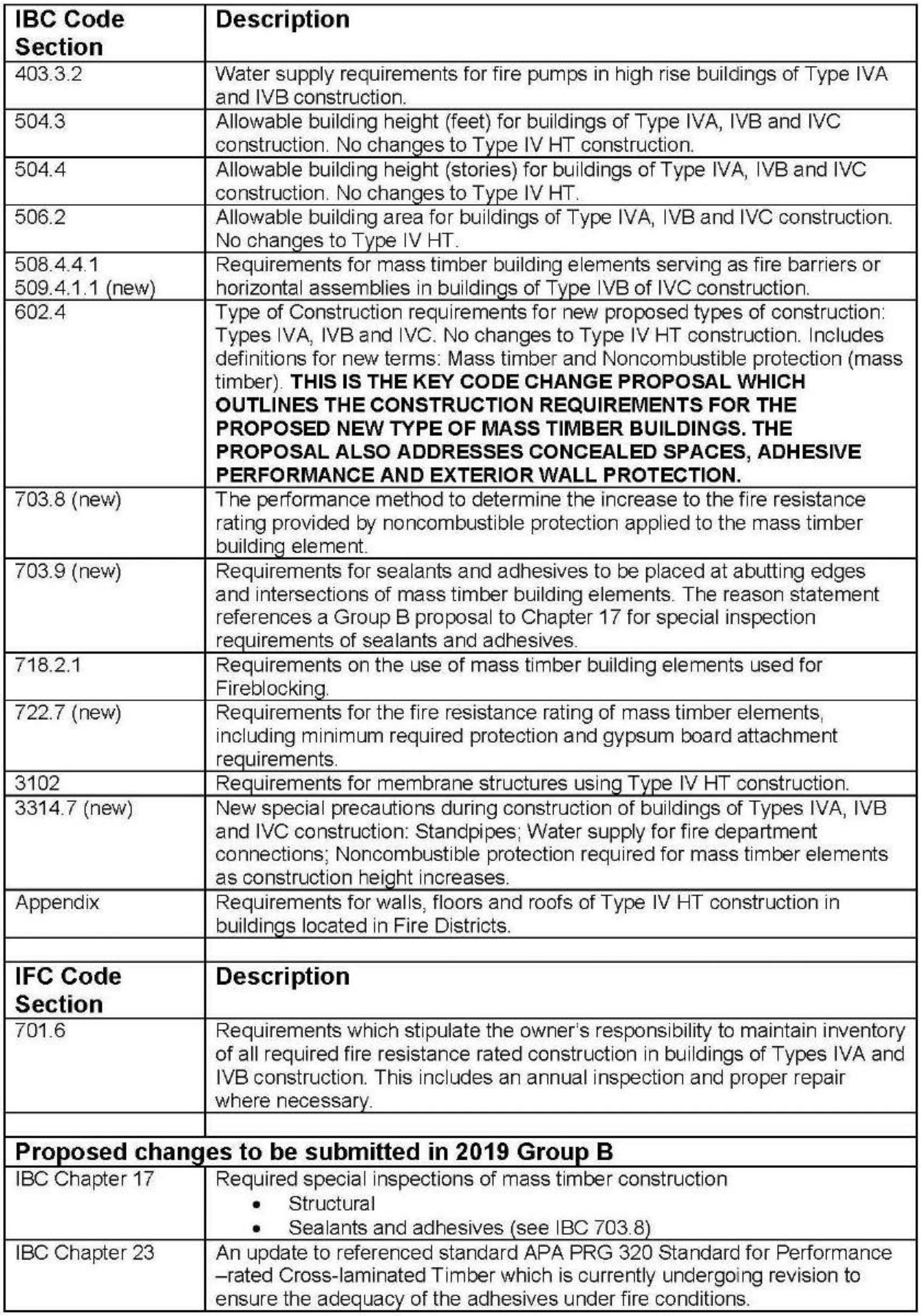

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In addition, fire tests designed to simulate the three new construction types (Types IVA, IVB and IVC) in the ad hoc committee proposals were conducted at the Alcohol Tobacco and Firearms test lab facility. The TWB was involved in the design of the 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.

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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.

F266-18

Public Hearing Results

Committee Action: **As Modified**

Committee Modification: 3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction. Buildings of Types IV-A, IV-B, and IV-C construction designed to be greater than six stories above grade plane shall comply with the following requirements during construction unless otherwise approved by the fire code official.

1. Standpipes shall be provided in accordance with Section 3313.

2. A water supply for fire department operations, as approved by the fire chief.

3. Where building construction exceeds six stories above grade plane, at least one layer of noncombustible protection where required by Section 602.4 of the International Building Code shall be installed on all building elements more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor levels.

Exception: Shafts and vertical exit enclosures shall not be considered a part of the active mass timber construction.

4. Where building construction exceeds six stories above grade plane required exterior wall coverings shall be installed on all floor levels more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor level.

Exception: Shafts and vertical exit enclosures shall not be considered a part of the active mass timber construction.

Committee Reason: This proposal was approved as part of the tall wood building proposals and provides the necessary construction fire safety related provisions. The modification merely makes it clear as to how the exceptions are to apply. The intention is that they only affect items 3 and 4. Shafts and vertical exit enclosures are not constructed with CLT and are not considered when reviewing the progress of construction. (Vote: 13-0)

Assembly Action: **None**

F266-18 Final Action: Approved as Modified by Public Comment 1

F266-18

Individual Consideration Agenda

Public Comment 1:

Proponent: Stephen DiGiovanni, representing Ad Hoc Committee for Tall Wood Buildings (sdigiovanni@clarkcountynv.gov)requests As Modified by This Public Comment.

Modify as follows:

2018 International Fire Code

3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction. Buildings of Types IV-A, IV-B, and IV-C construction designed to be greater than six stories above grade plane shall comply with the following requirements during construction unless otherwise approved by the fire code official.

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4. Where building construction exceeds six stories above grade plane required exterior wall coverings shall be installed on all floor levels more than 4 floor levels, including mezzanines, below active mass timber construction before erecting additional floor level.

    Exception: Shafts and vertical exit enclosures shall not be considered a part of the active mass timber construction.

Commenter's Reason: The original code change proposal was approved by the committee. However, during committee discussions, there was concern that Item 2, which discusses the water supply required for fire department operations during construction, should require also approval by the fire code official. There is concern that, with the many various ways that jurisdictions administer the fire code, not including the fire code official could be make the review and approval process awkward in some instances. This Public Comment simply adds the fire code official to Item 2, to satisfy this concern.

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.

G75-18

G75-18 Final Action: Approved as Modified by Committee

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

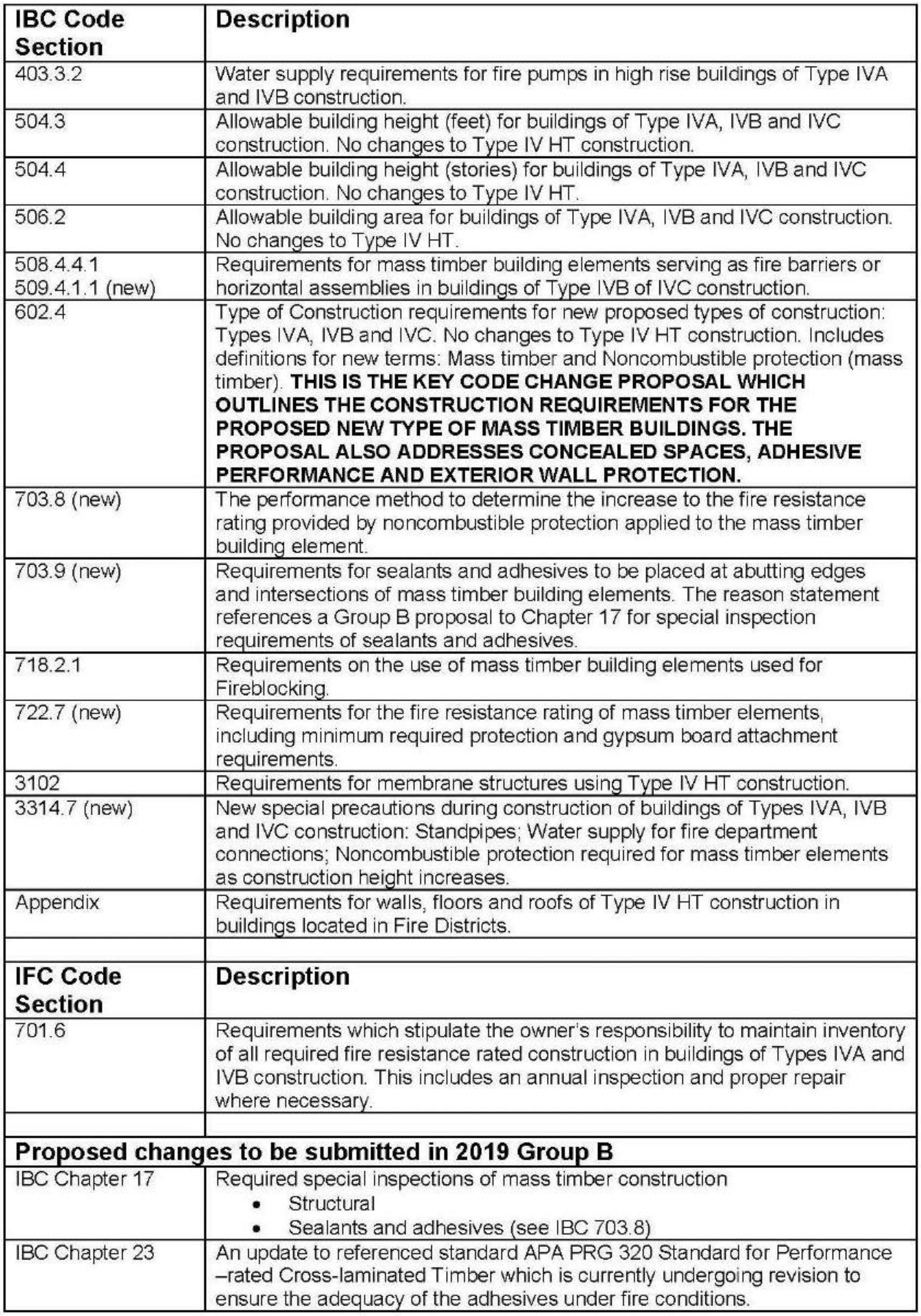
For instance, for Groups H-1, H-2, H-3, and H-5, while the table allows 160 feet for Type I-B construction, the Committee proposed a height of 90 feet for Type IV-B construction, and is using a multiplier of 1.33 to propose a height for Type IV-A construction of 120 feet height, intentionally made equal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

FLOOR MODIFICATION

G75-18-DIGIOVANNI-1

Proponent of Floor Modification: Stephen DiGiovanni, representing ICC Ad Hoc Committee on Tall Wood Buildings (TWB)

2018 International Building Code

Modify proposal as follows:

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANEa

Portions of table not shown remain unchanged.

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**
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

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.

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**

Final Action: Approved as Modified by Committee. See errata published by ICC in following pages regarding the Committee modification.

2018 – 2019 ICC CODE DEVELOPMENT CYCLE

UPDATES TO THE 2018 REPORT OF THE COMMITTEE ACTION HEARINGS
TO THE INTERNATIONAL CODES
GROUP A

Updated 6/18/2018
Updated 8/9/2019
Updated 9/4/2019
Updated 12/9/2019

The following is a compilation of errata discovered since the posting of the Report of the Committee Action Hearing results on May 30, 2018

INTERNATIONAL BUILDING CODE – GENERAL

Added 8/9/2019

G75-18: In Table 504.3, the value for I-4 occupancy, sprinkler protected buildings 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.

G75-18

Committee Action: **Approved as Modified**

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

OCCUPANCY CLASSIFICATION		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	270	180	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	85	85	70	60

Assembly Action: **None**

G80-18 Final Action: Approved as Submitted

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:

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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

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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

G80-18 Final Action: Approved as Submitted

G84-18 Final Action: Approved as Submitted

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

B		108,000	72,000	45,000	36,000	18,000	9,000
		432,000	288,000	180,000	144,000	72,000	36,000
		324,000	216,000	135,000	108,000	54,000	27,000
E		76,500	51,000	31,875	25,500	18,500	9,500
		306,000	204,000	127,500	102,000	74,000	38,000
		229,500	153,000	95,625	76,500	55,500	28,500
F-1		100,500	67,000	41,875	33,500	14,000	8,500
		402,000	268,000	167,500	134,000	56,000	34,000
		301,500	201,000	125,625	100,500	42,000	25,500
F-2		151,500	101,000	63,125	50,500	21,000	13,000
		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
H-4		72,000	54,000	40,500	36,000	18,000	6,500
		288,000	216,000	162,000	144,000	72,000	26,000
		216,000	162,000	121,500	108,000	54,000	19,500
H-5		72,000	54,000	40,500	36,000	18,000	9,000
		288,000	216,000	162,000	144,000	72,000	36,000
		216,000	162,000	121,500	108000	54,000	27,000
I-1		54,000	36,000	18,000	18,000	10,500	4,500
		216,000	144,000	72,000	72,000	42,000	18,000
		162,000	108,000	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

S-1		76,500	51,000	31,875	25,500	14,000	9,000
		306,000	204,000	127,500	102,000	56,000	36,000
		229,500	153,000	95,625	76,500	42,000	27,000
S-2		115,500	77,000	48,125	38,500	21,000	13,500
		462,000	308,000	192,500	154,000	84,000	54,000
		346,500	231,000	144,375	115,500	63,000	40,500
U		54,000	36,000	22,500	18,000	9,000	5,500
		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.

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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.

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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.

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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.

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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.
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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.

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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

G84-18 Final Action: Approved as Submitted

G146-18 Final Action: Approved as Submitted

G146-18

IBC: 3102.3, 3102.6.1.1

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

2018 International Building Code

Revise as follows:

3102.3 Type of construction. Noncombustible membrane structures shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an *approved* membrane in accordance with Section 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an *approved* membrane in accordance with Section 3102.3.1 shall be classified as Type IV-HT construction. Other membrane structures shall be classified as Type V construction.

> **Exception:** Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

3102.6.1.1 Membrane. A membrane meeting the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 shall be permitted to be used as the roof or as a skylight on buildings of Type IIB, III, IV-HT and V construction, provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

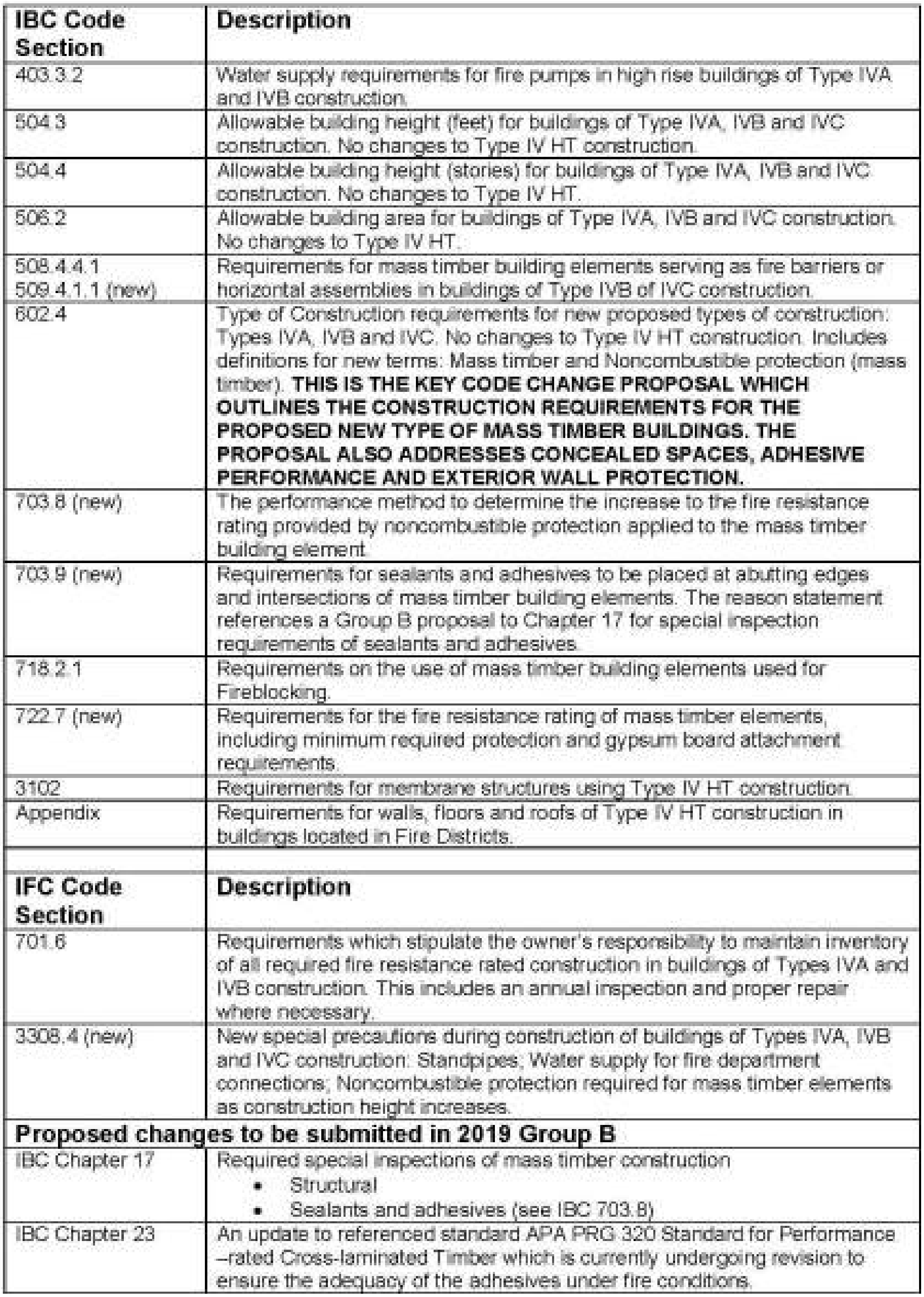
Reason:

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 will result in consistency with the purpose and scope which was to leave intact the current Type IV heavy timber provisions. The HT category was created to differentiate the three (3) new categories of “mass timber”, where HT represents the long established heavy timber category that has been in the ICC family of codes, and the predecessor legacy codes, for decades.

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.
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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.
3308.4 (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.
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.

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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.

Internal ID: 949

G146-18 Final Action: Approved as Submitted

G146-18

Committee Action: **Approved as Submitted**

Committee Reason: This is a necessary change for correlation based on previous committee actions on the tall wood provisions. (Vote: 14-0)

Assembly Motion: **NONE**

G152-18 Final Action: Approved as Submitted

G152-18

IBC: D102.2.5

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

2018 International Building Code

Revise as follows:

D102.2.5 Structural fire rating. Walls, floors, roofs and their supporting structural members shall be not less than 1-hour fire-resistance-rated construction.

Exceptions:

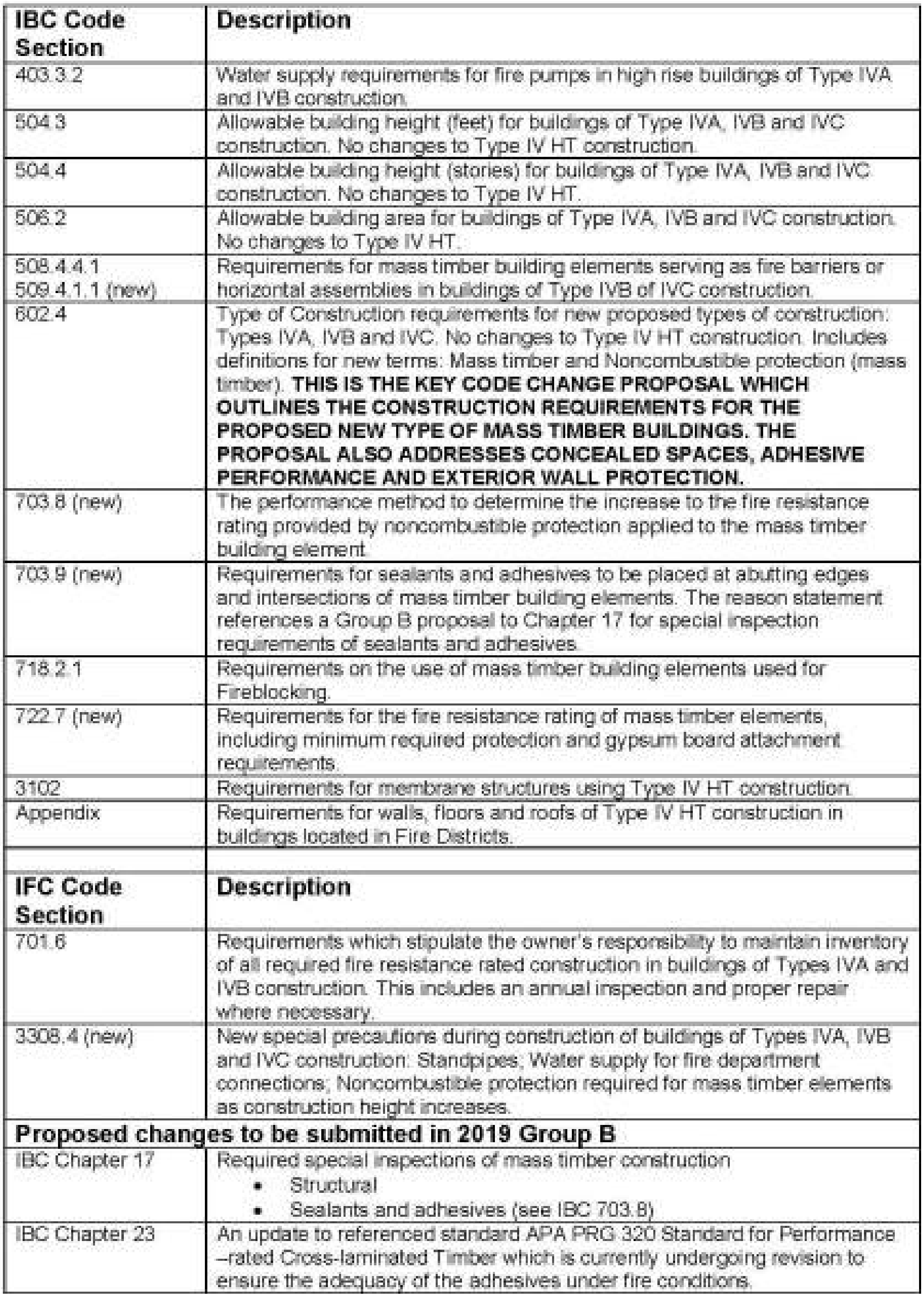
1. Buildings of Type IV-HT construction.
2. Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
3. Automobile parking structures.
4. Buildings surrounded on all sides by a permanently open space of not less than 30 feet (9144 mm).
5. Partitions complying with Section 603.1, Item 11.

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 will result in consistency with the purpose and scope which was to leave intact the current Type IV heavy timber provisions. The HT category was created to differentiate the three (3) new categories of “mass timber”, where HT represents the long established heavy timber category that has been in the ICC family of codes, and the predecessor legacy codes for decades.

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
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Proposed changes to be submitted in 2019 Group B	
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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.

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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.

Internal ID: 951

G152-18 Final Action: Approved as Submitted

Note: G152-18 did not appear in the Report of the Committee Action Hearing published by ICC, apparently an unintentional omission. Consequently the committee comments are not included here. Final Action was published as AS.

G89-18

G89-18 Final Action: Approved as Modified by Committee

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. 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.

Add new text as follows

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.

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.

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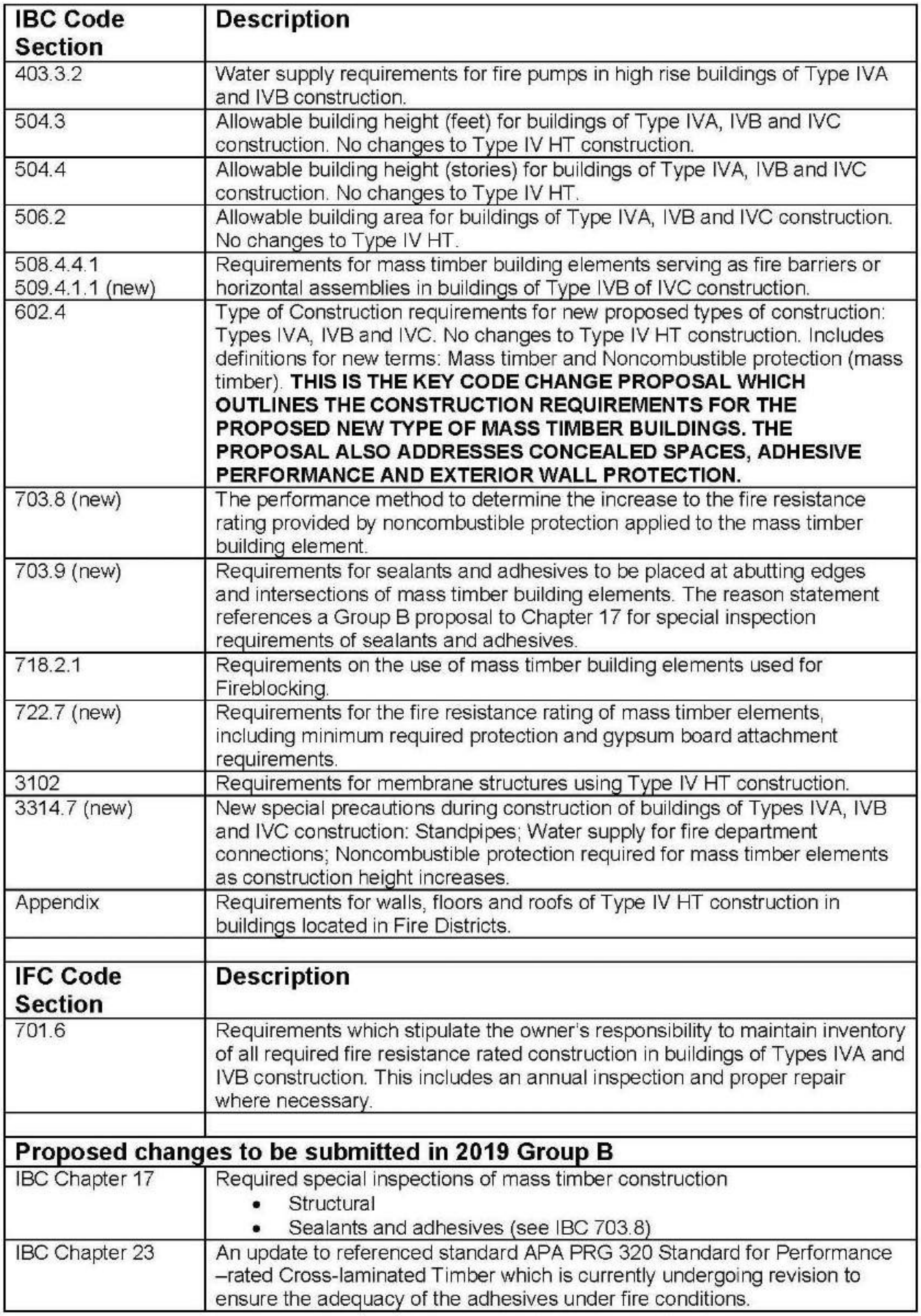

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Cost Impact: The code change proposal will not increase or decrease the cost of construction
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G89-18

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 Final Action: Approved as Modified by Committee

S170-19 final action: Approved as Submitted

S170-19

IBC: 2304.10.1 (New)

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

2018 International Building Code

Add new text as follows:

2304.10.1 Connection fire resistance rating. Fire resistance ratings for connections in Type IV-A, IV-B, or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C), and a maximum temperature rise of 325°F (181°C), for a time corresponding to the required fire resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners, and portions of wood members included in the structural design of the connection.

Reason: IBC Sections 704.2 and 704.3 require connections of columns and other primary structural members to be protected with materials that have the required fire-resistance rating. This proposed change provides two options for demonstrating compliance with this requirement for connections in Types IV-A, IV-B and IV-C construction: a testing option and a calculation option.
Types IV-A, IV-B and IV-C construction utilize mass timber elements that have inherent fire resistance. The new provisions which added these construction types have explicit fire-resistance ratings and protection requirements. Option 1 allows connections that are part of a successful ASTM E119 fire resistance test to be considered acceptable evidence of meeting the requirements of Sections 704.2 and 704.3.

Some connections used in Types IV-A, IV-B and IV-C construction are not part of the mass timber element or assembly testing. For those connections, an engineering analysis is required. Analysis procedures have been developed that allow the protection of these connections to be designed based on test results of E119 fire tests from protection configurations using the wood member outside of the connection, additional wood cover, and/or gypsum board. The analysis procedures must demonstrate that the protection will limit the temperature rise at any portion of the connection, including the metal connector, the connection fasteners, and portions of the wood member that are necessary for the structural design of the connection. The average temperature rise limit of 250°F (139°C) and maximum temperature rise limit of 325°F (181°C) represent the fire separation and thermal protection requirements for wall and floor assemblies tested per ASTM E119 and ensure that the connection retains most of its initial strength throughout the fire-resistance rating time. Please note the Celsius values in parentheses are for temperature rise calculated as the difference between the final temperature and the initial temperature, not a direct conversion of a Fahrenheit temperature.

IBC 722 permits structural fire-resistance ratings of wood members to be determined using Chapter 16 of the National Design Specification® (NDS®) for Wood Construction. Where a wood connection is required to be fire-resistance rated, NDS Section 16.3 requires all components of the wood connection, including the steel connector, the connection fasteners, and the wood needed in the structural design of the connection, to be protected for the required fire-resistance rating time. NDS permits the connection to be protected by wood, gypsum board or other approved materials. AWC publication Technical Report 10: Calculating the Fire Resistance of Wood Members and Assemblies (https://www.awc.org/codes-standards/publications/tr10), which is referenced in the NDS Commentary to Chapter 16, has been specifically updated to provide guidance on and examples of connection designs meeting the requirements of IBC 704 and NDS 16.3.

The Ad Hoc Committee for Tall Wood Buildings (AHC-TWB) was created by the ICC Board of Directors to explore the building science of tall wood buildings with the scope to investigate the feasibility of and take action on developing code changes for these buildings. Members of the AHC-TWB were appointed by the ICC Board of Directors. Since its creation in January 2016, the AHC-TWB has held 8 open meetings and numerous Work Group conference calls. Four Work Groups were established to address over 80 issues and concerns and review over 60 code proposals for consideration by the AHC-TWB. Members of the Work Groups included AHC-TWB members and other interested parties. Related documentation and reports are posted on the AHC-TWB website at https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Since all the code proposals related to Mass Timber products are to address new types of building construction, in theory this will not increase the cost of construction, but rather provides design options not currently provided for in the code. The committee took great care to not change the requirements of the pre-existing construction types, and our changes do not increase the cost of construction using those pre-existing construction types.

Proposal # 4369

S170-19

S170-19

Committee Action: **As Submitted**

Committee Reason: The proposal provides the connection fire testing updates per the TWB ad hoc committee. (Vote: 14-0)

Assembly Motion: **None**

S170-19

S100-19 Final Action: Approved as Submitted

S100-19

IBC: 1705.5.3 (New), TABLE 1705.5.3 (New)

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

2018 International Building Code

Add new text as follows:

1705.5.3 Mass timber construction. *Special inspections* of Mass Timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION

Type	**Continuous Special Inspection**	**Periodic Special Inspection**
1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		X
2. Inspect erection of mass timber construction		X
3. Inspection of connections where installation methods are required to meet design loads		
3.1. Threaded fasteners		
3.1.1. Verify use of proper installation equipment.		X
3.1.2. Verify use of pre-drilled holes where required.		X
3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.		X
3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads	X	
3.3. Adhesive anchors not defined in 3.2.		X
3.4. Bolted connections		X
3.5. Concealed connections		X

Reason: This proposal adds special inspection provisions to Section 1705 for mass timber. This new and unique type of construction requires a level of inspection consistent with other large buildings and unique applications where milestone inspections by the jurisdictional inspectors are not rigorous enough to ensure a level of quality control or quality assurance of the construction process. The proposed special inspections are similar to what is required for other prefabricated systems such as pre-cast concrete and structural steel.
Special Inspection is the monitoring of materials, installation, fabrication, erection and placement of components and connections that require special expertise that are critical to the integrity of the building structure. The special inspectors are required to ensure compliance with the approved construction documents and referenced standards. The program allows jurisdictions to have access to highly specialized and trained inspectors. Some special inspection activities require construction activities to be continuously inspected; which would be logistically difficult for a typical building inspection program. Special inspection is a vital part of the compliance path for successful and compliant building projects constructed under the International Building Code.

The specific elements requiring special inspection are:

1. Periodic inspection of the connection of mass timber elements to wood foundation elements. These connections are critical to transfer loads from the mass timber elements to the piles, particularly for lateral loading. The connections to concrete foundations are addressed in Table 1705.3, Item #3.
2. Periodic inspection of erection of mass timber elements. Similar to pre-cast concrete (Table 1705.3, Item #10), tall wood buildings utilizing pre-fabricated elements needs to have verification that the correct elements are placed in the right location in accordance with the design drawings.
3. Inspection of specialized connections.

Connections between mass timber products that utilized threaded, bolted, or concealed connections are considered periodic in a similar manner that concrete special inspections are required in Table 1705.3. The strength of many connection designs is predicated on specific screw lengths and installation angles. Bolted connections require specific diameters, and for lag bolts, specific lengths. Concealed connectors, many of which are proprietary, must be installed correctly for structural performance. Most of these cannot be verified by the jurisdictional inspector, so special inspections are required.

Adhesive anchorage installed in horizontal or upwardly inclined positions resisting tension loads shall be continuously inspected, again similar to Table 1705.3, Item 4a. This is required because of issues with creep of the adhesives under long-term tension loading discussed in previous code change cycles. However, once again similar to the requirements for precast concrete, all other adhesive anchors need only be inspected periodically (ref. Table 1705.3, Item 4b).

If there are other unusual items not covered in the proposed table, the existing text in Section 1705.1.1 gives the building official the authority to require special inspections for those unusual items. The same section also says the building official can require special inspections where manufacturers' installation instructions prescribe requirements not contained in the code. For example, field-glued mass timber beam or panel splices, while currently rare in North America, may become more prevalent in the future. This is not an item that is covered in the proposed Table 1705.5. While the AHC-TWB is not aware of any of those types of splices that are not currently proprietary, Section 1705.1.1 would allow the building official to require special inspections for either proprietary or non-proprietary field-glued splices. Note that many design engineers will also specify the need for special inspections for unusual conditions in their structural notes in the construction documents, or in the statement of special inspections (see Sections 1704.2.3 and 1704.3).

No changes are being proposed to address fabrication of mass timber structural elements. Mass timber structural assembled in a fabricator shop should be addressed by sections 1704.2.5 and 1704.2.5.1 of the current codes regarding fabrication

The Ad Hoc Committee for Tall Wood Buildings (AHC-TWB) was created by the ICC Board of Directors to explore the building science of tall wood buildings with the scope to investigate the feasibility of and take action on developing code changes for these buildings. Members of the AHC-TWB were appointed by the ICC Board of Directors. Since its creation in January, 2016, the AHC-TWB has held 8 open meetings and numerous Work Group conference calls. Four Work Groups were established to address over 80 issues and concerns and review over 60 code proposals for consideration by the AHC-TWB. Members of the Work Groups included AHC-TWB members and other interested parties. Related documentation and reports are posted on the AHC-TWB website at https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/.

Cost Impact: The code change proposal will increase the cost of construction
Since all the code proposals related to Mass Timber products are to address new types of building construction, in theory this will not increase the cost of construction, but rather provides design options not currently provided for in the code. The committee took great care to not change the requirements of the pre-existing construction types, and our changes do not increase the cost of construction using those pre-existing construction types. However, based on a typically residential or office building of typical floor plates an estimate of Special Inspection costs would range from $1,000 to $2,000 per floor. Another approach to the cost of special inspection is a percentage of total construction costs; for typical pre-fabricated construction elements the cost of special inspection can range between 0.15% to 0.30%, depending on labor cost and complexities of the construction in the building. These estimates are based on responses to surveys of special inspection agencies in the Seattle and Las Vegas areas.

Proposal # 4364

S100-19

S100-19

Committee Action: **As Submitted**

Committee Reason: This proposal adds special inspection provisions to Section 1705 for mass timber consistent with the findings of the Tall Wood Ad Hoc Committee and consistent with the Group A actions. This new and unique type of construction requires a level of inspection consistent with other large buildings and unique applications where milestone inspections by the jurisdictional inspectors are not rigorous enough to ensure a level of quality control or quality assurance of the construction process. The proposed special inspections are similar to what is required for other prefabricated systems such as pre-cast concrete and structural steel.
(Vote: 13-1)

Assembly Motion: **None**

ADM35-19

ADM35-19 Final Action: Approved as Submitted

IBC®: 110.3.5 (New)

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

2018 International Building Code

Add new text as follows:

110.3.5 Type IV-A, IV-B, and IV-C connection protection inspection. In buildings of Type IV-A, IV-B, and IV-C Construction, where connection fire resistance ratings are provided by wood cover calculated to meet the requirements of Section 2304.10.1, inspection of the wood cover shall be made after the cover is installed, but before any other coverings or finishes are installed.

Reason: The TWB determined that the proper construction of the fire resistance rating of mass timber structural elements was important enough, as demonstrated in a series of TWB proposals including this one, to warrant a specific requirement to inspect mass timber connections. The proposal complements the other code change submissions (e.g. Chapters, 7 “Fire and Smoke Protection Features”, 17 “Special Inspections and Tests”, and 23 “Wood”), and recognizes that building officials have the ability to inspect the protection of connections as part of the normal permit inspection process (e.g. footing and foundations, slabs, framing, etc.). The TWB, following input by code officials, did not feel this provision warranted being incorporated into Chapter 17 “Special Inspections and Tests” as this field inspection process did not require any special expertise for inspection nor tools for testing that were outside the capabilities of building officials today. However, the TWB did believe that some form of inspection should take place since the connections of the structural members, and their protection to achieve a fire resistance rating, represent a significant component to the entire design of mass timber buildings.
The Ad Hoc Committee for Tall Wood Buildings (AHC-TWB) was created by the ICC Board of Directors to explore the building science of tall wood buildings with the scope to investigate the feasibility of and take action on developing code changes for these buildings. Members of the AHC-TWB were appointed by the ICC Board of Directors. Since its creation in January, 2016, the AHC-TWB has held multiple open meetings and numerous Work Group conference calls. Related documentation and reports of the TWB are posted on the AHC-TWB website at https://www.iccsafe.org/codes-tech-support/cs/icc-ad-hoc-committee-on-tall-wood-buildings/.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Since all of the code proposals related to Mass Timber products are to address new types of building construction, in theory this will not increase the cost of construction, but rather provides design options not currently provided for in the code. The committee took great care to not change the requirements of the pre-existing construction types, and our changes do not increase the cost of construction using those pre-existing construction types.

Proposal # 4362

ADM35-19

ADM35-19

Committee Action: **As Submitted**

Committee Reason: The committee stated that the reason for the approval was based on the proponent's reason statement. It was specifically stated that the new section was important for the safety of structures and that its addition is absolutely necessary for the use of these new types of building construction. (Vote: 13-0)

Assembly Motion: **None**

ADM35-19

STATE OF GEORGIA
DEPARTMENT OF AGRICULTURE

Gary W. Black
COMMISSIONER

January 21, 2021

Commissioner Christopher Nunn
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, GA 30329

Dear Commissioner Nunn,

I hope this letter finds you well! Please consider the following information regarding spray foam as this process moves forward within our two departments. Many good people have worked to bring this issue to a positive resolve for consumers in Georgia. Thank you for taking the time to review this information.

It is my understanding that The Georgia Structural Pest Control Commission (GA SPCC) has provided the Georgia Department of Community Affairs with a code amendment for section R402.2.9 referencing specifically, the foundation and framing interface of crawl space and basement construction. The focus of the proposed change is to ensure this area is air sealed and insulated in such a way to allow pest management companies to visibly see and inspect the wood in this area. In most cases when spray foam is being applied this area it is being air sealed and insulated by covering it completely with spray foam insulation, leaving no way to visibly see and inspect the area for termites. With this in mind, hundreds to thousands of homes will ultimately lose their termite guarantees and coverages, that have been protecting Georgians homes for over 70 years.

I have been aware of how spray foam insulation can impact the ability to inspect for termites in a structure since 2018 and feel that changes must be made to help protect homeowners in Georgia. Subterranean termites cost U.S. homeowners billions of dollars a year for termite control and damage repair. The threat to homes and other structures by subterranean termites is greater in the Southeast, and Georgia lies in the middle of what is commonly referred to as the "termite belt". The most important component of any pest management program is the inspection, and pest management professionals must be able to visibly see areas of the structure where termites are most likely to be present. When these areas are not visible, live termites and evidence of their presence may remain undetected and could ultimately void pest control contracts.

The GA SPCC's proposal allows for homeowners in Georgia to take advantage of the energy efficiencies, spray foam provides and protect their home from termite damage. I fully support the recommended changes and thank you for your time and consideration.

Respectfully,

Gary W. Black
Commissioner

CC: Mr. Ted Miltiades, Georgia Department of Community Affairs
Mr. Gregori Anderson, Chairman State Codes Advisory Committee
Mr. Daniel Baiamonte, State Codes Advisory Committee
Mr. Bill Chambless, State Codes Advisory Committee
Mr. Mike DeLaigle, State Codes Advisory Committee
Mr. Bill Duck, State Codes Advisory Committee
Mr. Stan Everett, State Codes Advisory Committee
Mr. Dwayne Garriss, State Codes Advisory Committee
Mr. William Guinade, State Codes Advisory Committee
Mr. James Martin, State Codes Advisory Committee
Mr. John Hutton, State Codes Advisory Committee
Mr. Robert Maddox, State Codes Advisory Committee
Mr. Windell Peters, State Codes Advisory Committee
Ms. Elaine Powers, State Codes Advisory Committee
Mr. Bob Qurnell, State Codes Advisory Committee
Mr. Maurice Redmond, State Codes Advisory Committee
Mr. Vance Robinson, State Codes Advisory Committee
Mr. Joel Rodriguez, State Codes Advisory Committee
Mr. Chad Shaw, State Codes Advisory Committee
Mr. Ryan Taylor, State Codes Advisory Committee
Mr. Jerry Wainright, State Codes Advisory Committee
Mr. Tim Williams, State Codes Advisory Committee
Mr. Derrick Lastinger, Georgia Department of Agriculture

Hi Paul,

Thanks for sharing this information!

We don't have anything published yet, but what we did for the 2018 Virginia USBC was add the following code section:

602.1.2 Alternative Provisions. As an alternative to the construction types defined in 602.2 through 602.5, buildings and structures erected or to be erected, altered or extended in height or area may be classified as construction type IV-A, IV-B or IV-C in accordance with Chapter 6 of the 2021 International Building Code. Buildings and structures classified as IV-A, IV-B or IV-C shall comply with all provisions of the 2021 International Building Code and 2021 International Fire Code specific to mass timber and the construction type of the building or structure, as well as all other applicable provisions of this code, including provisions for buildings of Type IV construction.

We are working with ICC now to develop the 2018 Virginia code books and will add the following note right after the new section 602.1.2 in the 2018 Virginia Construction Code:

DHCD Note: See the Supplemental Mass Timber Information – 2021 I-Code Provisions for Mass Timber, for 2021 IBC and 2021 IFC requirements specific to mass timber construction.

...and we will also be adding the attached "Supplemental Mass Timber Information" to the ICC printed 2018 Virginia Construction Code, between the appendices and Index. We pulled the text for the supplement straight from the 2021 IBC.

Sincerely,

JEFF BROWN, MCP, CBO, CFM
Director of State Building Codes Office
Virginia Department of Housing and Community Development (DHCD)
804.371.7161
jeff.brown@dhcd.virginia.gov

SUPPLEMENTAL USBC INFORMATION

Add Supplemental Mass Timber Information after Appendices/before Index to read:

SUPPLEMENTAL MASS TIMBER INFORMATION
2021 I-Code Provisions for Mass Timber

(The information in this supplement is informative and is not part of this code.)

This supplement has been provided as a reference when classifying a building or structure as construction type IV-A, IV-B or IV-C in accordance with Section 602.1.2 of this code. While every effort has been made to include all 2021 IBC and 2021 IFC code sections that contain provisions specific to mass timber construction, there may be other 2021 I-Code sections that are applicable to mass timber construction. Refer to the 2021 IBC and the 2021 IFC for the complete mass timber provisions when utilizing the alternative provisions of Section 602.1.1. The code sections referenced within the 2021 I-Codes Mass Timber code sections and found throughout this supplement, should be considered references to the 2021 I-Codes Sections. The 2021 I-Codes are available for free viewing here: https://codes.iccsafe.org/codes/i-codes

2021 IBC Mass Timber Provisions

Chapter 2 Definitions

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 703.6, designed to increase the fire-resistance rating and delay the combustion of mass timber.

SECONDARY STRUCTURAL MEMBERS. The following structural members shall be considered secondary members and not part of the primary structural frame:

1. Structural members not having direct connections to the columns.
2. Members of the floor construction and roof construction not having direct connections to the columns.
3. Bracing members that are not designated as part of a primary structural frame or bearing wall.

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, 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.
3.

Chapter 4 Special Detailed Requirements Based on Occupancy and Use

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 (36 576 mm) 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.

Chapter 5 General Building Heights and Areas

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

OCCUPANCY CLASSIFICATION	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	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	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.

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	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-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	4	2	1
	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

(*continued*)

TABLE 504.4—continued
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	See Footnotes	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
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	4	4	4	10	7	5	5	4	2
S-2	NS	UL	11	5	3	4	3	4	4	4	5	4	2
	S	UL	12	6	4	5	4	12	8	5	6	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

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.

TABLE 506.2

ALLOWABLE AREA FACTOR (*At* = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1												
	SM												
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500
F-1	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41,875	33,500	14,000	8,500
	S1	UL	UL	100,000	62,000	76,000	48,000	402,000	268,000	167,500	134,000	56,000	34,000
	SM	UL	UL	75,000	46,500	57,000	36,000	301,500	201,000	125,625	100,500	42,000	25,500
F-2	NS	UL	UL	37,500	23,000	28,500	18,000	151,500	101,000	63,125	50,500	21,000	13,000
	S1	UL	UL	150,000	92,000	114,000	72,000	606,000	404,000	252,500	202,000	84,000	52,000
	SM	UL	UL	112,500	69,000	85,500	54,000	454,500	303,000	189,375	151,500	63,000	39,000
H-1	NS[c]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	NP
	S1												
H-2	NS[c]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	3,000
	S1												
	SM												
H-3	NS[c]	UL	60,000	26,500	14,000	17,500	13,000	25,500	25,500	25,500	25,500	10,000	5,000
	S1												
	SM												
H-4	NS[c, d]	UL	UL	37,500	17,500	28,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500
	S1	UL	UL	150,000	70,000	114,000	70,000	288,000	216,000	162,000	144,000	72,000	26,000
	SM	UL	UL	112,500	52,500	85,500	52,500	216,000	162,000	121,500	108,000	54,000	19,500
H-5	NS[c, d]	UL	UL	37,500	23,000	28,500	19,000	72,000	54,000	40,500	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	288,000	216,000	162,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	216,000	162,000	121,500	108000	54,000	27,000

(continued)

TABLE 506.2—continued
ALLOWABLE AREA FACTOR (At = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
I-1	NS[d, e]	UL	55,000	19,000	10,000	16,500	10,000	54,000	36,000	18,000	18,000	10,500	4,500
	S1	UL	220,000	76,000	40,000	66,000	40,000	216,000	144,000	72,000	72,000	42,000	18,000
	SM	UL	165,000	57,000	30,000	49,500	30,000	162,000	108,000	54,000	54,000	31,500	13,500
I-2	NS[d, f]	UL	UL	15,000	11,000	12,000	NP	36,000	24,000	12,000	12,000	9,500	NP
	S1	UL	UL	60,000	44,000	48,000	NP	144,000	96,000	48,000	48,000	38,000	NP
	SM	UL	UL	45,000	33,000	36,000	NP	108,000	72,000	36,000	36,000	28,500	NP
I-3	NS[d, e]	UL	UL	15,000	10,000	10,500	7,500	36,000	24,000	12,000	12,000	7,500	5,000
	S1	UL	UL	60,000	40,000	42,000	30,000	144,000	96,000	48,000	48,000	30,000	20,000
	SM	UL	UL	45,000	30,000	31,500	22,500	108,000	72,000	36,000	36,000	22,500	15,000
I-4	NS[d, g]	UL	60,500	26,500	13,000	23,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000
	S1	UL	121,000	106,000	52,000	94,000	52,000	306,000	204,000	102,000	102,000	74,000	36,000
	SM	UL	181,500	79,500	39,000	70,500	39,000	229,500	153,000	76,500	76,500	55,500	27,000
M	NS	UL	UL	21,500	12,500	18,500	12,500	61,500	41,000	26,625	20,500	14,000	9,000
	S1	UL	UL	86,000	50,000	74,000	50,000	246,000	164,000	102,500	82,000	56,000	36,000
	SM	UL	UL	64,500	37,500	55,500	37,500	184,500	123,000	76,875	61,500	42,000	27,000
R-1[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-2[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-3[h]	NS[d]	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S13D												
	S13R												
	S1												
	SM												
R-4[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13D												
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
S-1	NS	UL	48,000	26,000	17,500	26,000	17,500	76,500	51,000	31,875	25,500	14,000	9,000
	S1	UL	192,000	104,000	70,000	104,000	70,000	306,000	204,000	127,500	102,000	56,000	36,000
	SM	UL	144,000	78,000	52,500	78,000	52,500	229,500	153,000	95,625	76,500	42,000	27,000
S-2	NS	UL	79,000	39,000	26,000	39,000	26,000	115,500	77,000	48,125	38,500	21,000	13,500
	S1	UL	316,000	156,000	104,000	156,000	104,000	462,000	308,000	192,500	154,000	84,000	54,000
	SM	UL	237,000	117,000	78,000	117,000	78,000	346,500	231,000	144,375	115,500	63,000	40,500
U	NS[i]	UL	35,500	19,000	8,500	14,000	8,500	54,000	36,000	22,500	18,000	9,000	5,500
	S1	UL	142,000	76,000	34,000	56,000	34,000	216,000	144,000	90,000	72,000	36,000	22,000
	SM	UL	106,500	57,000	25,500	42,000	25,500	162,000	108,000	67,500	54,000	27,000	16,500

TABLE 506.2—continued

ALLOWABLE AREA FACTOR (*At* = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

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 area 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.

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 gypsum board that is not less than 1/2 inch (12.7 mm) in thickness 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 509.1 specifies a fire-resistance-rated separation, mass timber elements serving as fire barriers or horizontal assemblies 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 gypsum board that is not less than 1/2 inch (12.7 mm) in thickness 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.

Chapter 6 Types of Construction

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. 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 703.6 and comply with Section 722.7.
Cross-laminated timber shall be labeled as conforming to ANSI/APA PRG 320 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 nonloadbearing 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, IV-B, and IV-C construction with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department access, up to and including 12 stories or 180 feet (54 864 mm) 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 (54864 mm) above grade plane, interior exit and elevator hoistway enclosures shall be constructed of noncombustible materials.

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.

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 specified in Table 722.7.1(1). 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/m2, a total heat release of less than 20 MJ/m2 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 E84 or UL 723. The ASTM E1354 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/m2.

602.4.1.2 Interior protection. Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.3.

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), but not less than 80 minutes. The use of materials and their respective protection contributions specified in Table 722.7.1(2) 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 1 inch (25 mm) 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.

602.4.1.4 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 Section 602.4.1.2.

602.4.1.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and 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.

602.4.2.1 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 specified in Table 722.7.1(1). 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/m2, a total heat release of less than 20 MJ/m2 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 E84 or UL 723.

The ASTM E1354 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/m2.

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 703.3.

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 specified 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. Interior faces of mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected in accordance with Section 602.4.2.2.1.

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 and walls complying with one of the following:
    - 1.1. Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20 percent of the floor area in any dwelling unit or fire area.
    - 1.2. Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40 percent of the floor area in any dwelling unit or fire area.
    - 1.3. 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.
2. Mass timber columns and beams that 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.

$$(U_{tc}/U_{ac}) + (U_{tw}/U_{aw}) \leq 1 \qquad \text{(Equation 6-1)}$$

where:

U_{tc} = Total unprotected mass timber ceiling areas.

U_{ac} = Allowable unprotected mass timber ceiling area conforming to Exception 1.1 of Section 602.4.2.2.2.

U_{tw} = Total unprotected mass timber wall areas.

U_{aw}= Allowable unprotected mass timber wall area conforming to Exception 1.2 of Section 602.4.2.2.2.

602.4.2.2.4 Separation distance between unprotected mass timber elements. In each dwelling unit or fire area, unprotected portions of mass timber walls and ceilings shall be not less than 15 feet (4572 mm) 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 1 inch (25 mm) 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 Section 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 Sections 713 and 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.

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 Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water-resistive barriers having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 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 E84 or UL 723. The ASTM E1354 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 Roof coverings. 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 specified in Table 722.7.1(1).

602.4.3.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and 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 specified in Table 722.7.1(1), on both the inside of the shaft and the outside of the shaft.

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, c]	1[b, c]	0[c]	1[b, c]	0	3[a]	2[a]	2[a]	HT	1[b, c]	0
Bearing walls												
Exterior[e, f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
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 structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1½[b]	1[b, c]	1[b, c]	0[c]	1[b, c]	0	1½	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 for roof construction, including primary structural frame members, 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 705.5).

f. Not less than the fire-resistance rating as referenced in Section 704.10.

g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.

Chapter 7 Fire and Smoke Protection Features

703.6 Determination of noncombustible protection time contribution. The time, in minutes, contributed to the fire-resistance rating by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E119 or UL 263. The test assemblies shall be identical in construction, loading and materials, other than the noncombustible protection. The two test assemblies shall be tested to the same criteria of structural failure with the following conditions:

1. Test Assembly 1 shall be without protection.
2. Test Assembly 2 shall include the representative noncombustible protection. The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

The noncombustible protection time contribution shall be determined by subtracting the fire-resistance time, in minutes, of Test Assembly 1 from the fire-resistance time, in minutes, of Test Assembly 2.

703.7 Sealing of adjacent mass timber elements. In buildings of Types IV-A, IV-B and IV-C construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Exception: Sealants or adhesives need not be provided where they are not a required component of a tested fire-resistance-rated assembly.

704.4 Protection of secondary structural members. Secondary structural members that are required to have protection to achieve a fire-resistance rating shall be protected by individual encasement protection.

718.2.1 Fireblocking materials. Fireblocking shall consist of the following materials:

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25 mm) nominal lumber with broken lap joints.
3. One thickness of 0.719-inch (18.3 mm) wood structural panels with joints backed by 0.719-inch (18.3 mm) wood structural panels.
4. One thickness of 0.75-inch (19.1 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-fourth-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool, mineral fiber or other approved materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.
9. Mass timber complying with Section 2304.11.

722.7 Fire-resistance rating for mass timber. The required fire resistance of mass timber elements in Section 602.4 shall be determined in accordance with Section 703.2. The fire-resistance rating of building elements shall be as required in Tables 601 and 705.5 and as specified elsewhere in this code. The fire-resistance rating of the mass timber elements shall consist of the fire resistance of the unprotected element added to the protection time of the noncombustible protection.

722.7.1 Minimum required protection. Where required by Sections 602.4.1 through 602.4.3, noncombustible protection shall be provided for mass timber building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the noncombustible protection of mass timber building elements, components or assemblies, shall be established in accordance with Section 703.6. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement where installed and fastened in accordance with Section 722.7.2.

722.7.2 Installation of gypsum board noncombustible protection. Gypsum board complying with Table 722.7.1(2) shall be installed in accordance with this section.

722.7.2.1 Interior surfaces. Layers of Type X gypsum board serving as noncombustible protection for interior surfaces of wall and ceiling assemblies determined in accordance with Table 722.7.1(1) shall be installed in accordance with the following:

1. Each layer shall be attached with Type S drywall screws of sufficient length to penetrate the mass timber at least 1 inch (25 mm) when driven flush with the paper surface of the gypsum board.

Exception: The third layer, where determined necessary by Section 722.7, shall be permitted to be attached with 1-inch (25 mm) No. 6 Type S drywall screws to furring channels in accordance with AISI S220.

2. Screws for attaching the base layer shall be 12 inches (305 mm) on center in both directions.
3. Screws for each layer after the base layer shall be 12 inches (305 mm) on center in both directions and offset from the screws of the previous layers by 4 inches (102 mm) in both directions.
4. All panel edges of any layer shall be offset 18 inches (457 mm) from those of the previous layer.
5. All panel edges shall be attached with screws sized and offset as in Items 1 through 4 and placed at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge.
6. All panels installed at wall-to-ceiling intersections shall be installed such that ceiling panels are installed first and the wall panels are installed after the ceiling panel has been installed and is fitted tight to the ceiling panel. Where multiple layers are required, each layer shall repeat this process.
7. All panels installed at a wall-to-wall intersection shall be installed such that the panels covering an exterior wall or a wall with a greater fire-resistance rating shall be installed first and the panels covering the other wall shall be fitted tight to the panel covering the first wall. Where multiple layers are required, each layer shall repeat this process.
8. Panel edges of the face layer shall be taped and finished with joint compound. Fastener heads shall be covered with joint compound.
9. Panel edges protecting mass timber elements adjacent to unprotected mass timber elements in accordance with Section 602.4.2.2 shall be covered with 11/4-inch (32 mm) metal corner bead and finished with joint compound.

722.7.2.2 Exterior surfaces. Layers of Type X gypsum board serving as noncombustible protection for the outside of the exterior mass timber walls determined in accordance with Table 722.7.1(1) shall be fastened 12 inches (305 mm) on center each way and 6 inches (152 mm) on center at all joints or ends. All panel edges shall be attached with fasteners located at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge. Fasteners shall comply with one of the following:

1. Galvanized nails of minimum 12 gage with a 7/16-inch (11 mm) head of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).
2. Screws that comply with ASTM C1002 (Type S, W or G) of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).

TABLE 705.5
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, d, g]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[e]	OCCUPANCY GROUP F-1, M, S-1[f]	OCCUPANCY GROUP A, B, E, F-2, I, R[i], S-2, U[h]
X < 5[b]	All	3	2	1
5 ≤ X < 10	IA, IVA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB, IVA, IVB	2	1	1[c]
	IIB, VB	1	0	0
	Others	1	1	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 wall 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.

TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL

REQUIRED FIRE-RESISTANCE RATING OF BUILDING ELEMENT PER TABLE 601 AND TABLE 705.5 (hours)	MINIMUM PROTECTION REQUIRED FROM NONCOMBUSTIBLE PROTECTION (minutes)
1	40
2	80
3 or more	120

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

NONCOMBUSTIBLE PROTECTION	PROTECTION CONTRIBUTION (minutes)
1/2-inch Type X gypsum board	25
5/8-inch Type X gypsum board	40

Chapter 17

1705.5.3 Mass timber construction. Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

1705.20 Sealing of mass timber. Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to mass timber building elements as designated in the approved construction documents.

TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION

TYPE			CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		—	X
2.	Inspect erection of mass timber construction.		—	X
3.	Inspection of connections where installation methods are required to meet design loads.			
	Threaded fasteners	Verify use of proper installation equipment.	—	X
		Verify use of pre-drilled holes where required.	—	X
		Inspect screws, including diameter, length, head type, spacing, installation angle and depth.	—	X
	Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.		X	—
	Adhesive anchors not defined in preceding cell.		—	X
	Bolted connections.		—	X
	Concealed connections.		—	X

Chapter 23 Wood

2304.10.1 Connection fire-resistance rating. Fire-resistance ratings for connections in Type IV-A, IV-B, or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C), and a maximum temperature rise of 325°F (181°C), for a time corresponding to the required fire-resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners, and portions of wood members included in the structural design of the connection.

Chapter 33 Safeguards During Construction

3313.1 Where required (water supply for fire protection). An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 3313.2 through 3313.5.

> Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

3313.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

3313.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

3313.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

3313.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

3313.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

3313.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 3313, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

3314.1 Fire watch during combustible construction. A fire watch shall be provided during nonworking hours for construction that exceeds 40 feet (12192 mm) in height above the lowest adjacent grade at any point along the building perimeter, for new multistory construction with an aggregate area exceeding 50,000 square feet (4645 m^2) per story or as required by the fire code official.

Chapter 35 Referenced Standards

ANSI/APA PRG 320—2019: Standard for Performance-rated Cross-laminated Timber; referenced in Sections 602.4 & 2303.1.4.

ASTM D3498—03(2011): Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems; referenced in Section 703.7.

2021 IFC Mass Timber Provisions

Chapter 7 Fire and Smoke Protection Features

701.6 Owner's responsibility. The owner shall maintain an inventory of all required fire-resistance-rated construction, construction installed to resist the passage of smoke and the construction included in Sections 703 through 707 and Section 602.4.1 and 602.4.2 of the International Building Code. Such construction shall be visually inspected by the owner annually and properly repaired, restored or replaced where damaged, altered, breached or penetrated. Records of inspections and repairs shall be maintained. Where concealed, such elements shall not be required to be visually inspected by the owner unless the concealed space is accessible by the removal or movement of a panel, access door, ceiling tile or similar movable entry to the space.

Chapter 9 Fire Protection and Life Safety Systems

914.3.1.2 Water supply to required fire pumps. In all buildings that are more than 420 feet in building height, and buildings of Type IV-A and IV-B 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.

Chapter 33 Fire Safety During Construction and Demolition

3303.5 Fire safety requirements for buildings of Types IVA, IV-B and IV-C construction. Buildings of Types IV-A, IV-B and IV-C construction designed to be greater than six stories above grade plane shall comply with the following requirements during construction unless otherwise approved by the fire code official:

1. Standpipes shall be provided in accordance with Section 3313.
2. A water supply for fire department operations, as approved by the fire code official and the fire chief.
3. Where building construction exceeds six stories above grade plane and noncombustible protection is required by Section 602.4 of the International Building Code, at least one layer of noncombustible protection shall be installed on all building elements on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

   Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.
4. Where building construction exceeds six stories above grade plane, required exterior wall coverings shall be installed on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

   Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.

3313.1 When required (water supply for fire protection). An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, upon commencement of vertical combustible construction, and upon installation of a standpipe system in buildings under construction, in accordance with Sections
3313.2 through 3313.5.

Exception: The fire code official is authorized to reduce the fireflow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

3313.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gpm shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

3313.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

3313.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet from property lot lines, and an adjacent property has an existing structure or otherwise can be constructed upon, the water supply shall provide either a minimum of 500 gpm, or the entire fire flow required for the building when constructed, whichever is greater.

3313.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet up to 60 feet from property lot lines, and an adjacent property has an existing structure or otherwise can be constructed upon, the water supply shall provide a minimum of 500 gpm, or 50 percent of the fire flow required for the building when constructed, whichever is greater.

3313.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet or greater from a property lot line, a water supply of 500 gpm shall be provided.

3313.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 3313, a water supply providing a minimum flow of 500 gpm shall be provided. The fire hydrant used for this water supply shall be located within 100 feet of the Fire Department Connection supplying the standpipe.

Proposal to incorporate the tall mass timber provisions of the 2021 International Building Code (IBC) into the 2018 IBC by means of an appendix, for use in Georgia

Add new text as follows:

602.1.2 Alternative mass timber provisions. As an alternative to the construction types defined in 602.2 through 602.5, buildings and structures erected or to be erected, altered or extended in height or area may be classified as construction Type IV-A, IV-B or IV-C in accordance with Appendix P. Buildings and structures classified as IV-A, IV-B, and IV-C shall comply with the provisions of Appendix P, as well as all other applicable provisions of this code, including provisions for buildings of Type IV construction.

Add new text as follows:

IBC APPENDIX P
TALL MASS TIMBER BUILDINGS

P101
GENERAL

P101.1 Purpose. The purpose of this appendix is to provide criteria for three new mass timber construction types: Type IV-A, Type IV-B, and Type IV-C. These building types expand the allowable use of mass timber construction to larger areas and greater heights than allowed for Type IV-HT construction.

P101.2 Scope. The provisions in this appendix are in addition to or replace the sections in the 2018 International Building Code where Types IV-A, IV-B, and IV-C construction are used. Where building Types IV-A, IV-B, or IV-C are not used, this appendix does not apply.

P102
AMENDMENTS TO THE 2018 INTERNATIONAL BUILDING CODE

CHAPTER 1
SCOPE AND ADMINISTRATION

Add new text as follows:

110.3.5 Type IV-A, IV-B and IV-C connection protection inspection. In buildings of Type IV-A IV-B and IV-C Construction where connection fire resistance ratings are provided by wood cover calculated to meet the requirements of Section 2304.10.1 inspection of the wood *cover* shall be made after the cover is installed but before any other coverings or finishes are installed.

CHAPTER 2
DEFINITIONS

Add new text 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:

[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.

CHAPTER 4
SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

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 IV-A and IV-B 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.

CHAPTER 5
GENERAL BUILDING HEIGHT AND AREAS

Revise as follows:

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

OCCUPANCY CLASSIFICATION	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	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	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 heights in the 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.

Revise as follows:

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	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-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	4	2	1
	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

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.

Revise as follows:

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												
	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-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1												
	SM												
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500
F-1	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41.875	33,500	14,000	8,500
	S1	UL	UL	100,000	62,000	76,000	48,000	402,000	268,000	167,500	134,000	56,000	34,000
	SM	UL	UL	75,000	46,500	57,000	36,000	301,500	201,000	125,625	100,500	42,000	25,500
F-2	NS	UL	UL	37,500	23,000	28,500	18,000	151,500	101,000	63,125	50,500	21,000	13,000
	S1	UL	UL	150,000	92,000	114,000	72,000	606,000	404,000	252,500	202,000	84,000	52,000
	SM	UL	UL	112,500	69,000	85,500	54,000	454,500	303,000	189,375	151,500	63,000	39,000
H-1	NS[c]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	NP
	S1												
H-2	NS[c]	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	3,000
	S1												

	SM												
H-3	NS[c]	UL	60,000	26,500	14,000	17,500	13,000	25,500	25,500	25,500	25,500	10,000	5,000
	S1												
	SM												
H-4	NS[c,d]	UL	UL	37,500	17,500	28,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500
	S1	UL	UL	150,000	70,000	114,000	70,000	288,000	216,000	162,000	144,000	72,000	26,000
	SM	UL	UL	112,500	52,500	85,500	52,500	216,000	162,000	121,500	108,000	54,000	19,500
H-5	NS[c,d]	UL	UL	37,500	23,000	28,500	19,000	72,000	54,000	40,500	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	288,000	216,000	162,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	216,000	162,000	121,500	108,000	54,000	27,000
I-1	NS[d,e]	UL	55,000	19,000	10,000	16,500	10,000	54,000	36,000	18,000	18,000	10,500	4,500
	S1	UL	220,000	76,000	40,000	66,000	40,000	216,000	144,000	72,000	72,000	42,000	18,000
	SM	UL	165,000	57,000	30,000	49,500	30,000	162,000	108,000	54,000	54,000	31,500	13,500
I-2	NS[d,f]	UL	UL	15,000	11,000	12,000	NP	36,000	24,000	12,000	12,000	9,500	NP
	S1	UL	UL	60,000	44,000	48,000	NP	144,000	96,000	48,000	48,000	38,000	NP
	SM	UL	UL	45,000	33,000	36,000	NP	108,000	72,000	36,000	36,000	28,500	NP
I-3	NS[d,e]	UL	UL	15,000	10,000	10,500	7,500	36,000	24,000	12,000	12,000	7,500	5,000
	S1	UL	UL	45,000	40,000	42,000	30,000	144,000	96,000	48,000	48,000	30,000	20,000
	SM	UL	UL	45,000	30,000	31,500	22,500	108,000	72,000	36,000	36,000	22,500	15,000
I-4	NS[d,g]	UL	60,500	26,500	13,000	23,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000
	S1	UL	121,000	106,000	52,000	94,000	52,000	306,000	204,000	102,000	102,000	74,000	36,000
	SM	UL	181,500	79,500	39,000	70,500	39,000	229,500	153,000	76,500	76,500	55,500	27,000
M	NS	UL	UL	21,500	12,500	18,500	12,500	61,500	41,000	25,625	20,500	14,000	9,000
	S1	UL	UL	86,000	50,000	74,000	50,000	246,000	164,000	102,500	82,000	56,000	36,000
	SM	UL	UL	64,500	37,500	55,500	37,500	184,500	123,000	76,875	61,500	42,000	27,000
R-1[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-2[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-3[h]	NS[d]	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S13D												
	S13R												
	S1												
	SM												
R-4[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13D												
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
S-1	NS	UL	48,000	26,000	17,500	26,000	17,500	76,500	51,000	31,875	25,500	14,000	9,000
	S1	UL	192,000	104,000	70,000	104,000	70,000	306,000	204,000	127,500	102,000	56,000	36,000
	SM	UL	144,000	78,000	52,500	78,000	52,500	229,500	153,000	95,625	76,500	42,000	27,000
S-2	NS	UL	79,000	39,000	26,000	39,000	26,000	115,500	77,000	48,125	38,500	21,000	13,500
	S1	UL	316,000	156,000	104,000	156,000	104,000	462,000	308,000	192,500	154,000	84,000	54,000
	SM	UL	237,000	117,000	78,000	117,000	78,000	346,500	231,000	144,375	115,500	63,000	40,500
U	NS[i]	UL	35,500	19,000	8,500	14,000	8,500	54,000	36,000	22,500	18,000	9,000	5,500
	S1	UL	142,000	76,000	34,000	56,000	34,000	216,000	144,000	90,000	72,000	36,000	22,000
	SM	UL	106,500	57,000	25,500	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.

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. 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 gypsum board that is not less than 12 inch (12.7 mm) in thickness 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.

Add new text as follows:
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 horizontal assemblies 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 gypsum board that is not less than 12 inch (12.7 mm) in thickness 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.

CHAPTER 6
TYPES OF CONSTRUCTION

Delete and substitute 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 Type 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 Section 722.7.

Cross laminated timber shall be labeled as conforming to PRG 320-19 as reference 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 (22 860 mm) above the lowest level of fire department access, up to and including 12 stories or 180 feet (54 864 mm) 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 (54 864 mm) 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 Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 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 of less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 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 mass timber roofs, shall be protected with material 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(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.

602.4.1.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) 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 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.

602.4.2 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 Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 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 E84 or UL 723. The ASTM E1354 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. Interior faces of all mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected in accordance with Section 602.4.2.2.1.

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 and walls complying with one of the following:
    - 1.1 Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20 percent of the floor area in any dwelling unit or fire area.
    - 1.2 Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40 percent of the floor area in any dwelling unit or fire area.
    - 1.3 Unprotected portions of both walls and ceilings of mass timbers, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with Section 602.4.2.2.3.
2. Mass timber columns and beams that 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 Equations 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 Exception 1.1 of Section 602.4.2.2.2.
U_{tw} = Total unprotected mass timber wall areas
U_{aw} = Allowable unprotected mass timber wall area conforming to Exception 1.2 of Section 602.4.2.2.2.

602.4.2.2.4 Separation distance between unprotected mass timber elements. In each dwelling unit or fire area, unprotected portions of mass timber walls and ceilings shall be not less than 15 feet (4572 mm) from unprotected portions of other walls and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls measure horizontally along the floor.

602.4.2.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) 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 Section 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 Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150 kW/m^2, a total heat release of less than 20 MJ/m^2 and an effective heat of combustion of less than 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 E84 or UL 723. The ASTM E1354 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 specified in Table 722.7.1(1).

602.4.3.6 Shafts. Shafts shall be permitted in accordance with Section 713 and 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 specified in Table 722.7.1(1), on both the inside of the shaft and the outside of the shaft.

602.4.4 Type IV-HT. Type IV-HT (Heavy Timber) 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 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 1-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 of the following:

1. Fire-retardant-treated wood sheathing complying with Section 2303.2 and not less than $^{15}/_{32}$ inch (12 mm) thick; or
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]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT	1	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 ½[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1 ½	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 DISTANCE [a,d,g]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[e]	OCCUPANCY GROUP F-1, M, S-1[f]	OCCUPANCY GROUP A, B, E, F-2, I, R[i], S-2, U[h]
X < 5[b]	All	3	2	1

5 ≤ X < 10	IA, IV-A Others	3 2	2 1	1 1
10 ≤ X < 30	IA, IB, IV-A, IV-B IIB, VB Others	2 1 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 hangers, 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.

CHAPTER 7
FIRE AND SMOKE PROTECTION FEATURES

Add new text as follows:

703.8 Determination of noncombustible protection time contribution. The time, in minutes, contributed to the fire resistance rating by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E119 or UL263. The test assemblies shall be identical in construction, loading, and materials, other than the noncombustible protection. The two test assemblies shall be tested to the same criteria of structural failure with the following conditions:

1. Test Assembly 1 shall be without protection.
2. Test Assembly 2 shall include the representative noncombustible protection. The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

The noncombustible protection time contribution shall be determined by subtracting the fire resistance time, in minutes, of Test Assembly 1 from the fire resistance time, in minutes, of Test Assembly 2.

Add new text as follows:
703.9 Sealing of adjacent mass timber elements. In buildings of Type IV-A, IV-B, and IV-C construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Exception: Sealants or adhesives need not be provided where they are not a required component of a tested fire-resistance-rated assembly.

Revise as follows:
718.2.1 Fireblocking materials. Fireblocking shall consists of the following materials:

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25 mm) nominal lumber with broken lap joints.
3. One thickness of 0.719-inch (18.3 mm) wood structural panels with joints backed by 0.719-inch (18.3 mm) wood structural panels.
4. One thickness of 0.75-inch (19.1 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-fourth-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wood, mineral fiber or other approved materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested for the specific application.
9. Mass timber complying with Section 2304.11.

Add new text as follows:
722.7 Fire resistance rating of mass timber. The required fire resistance of mass timber elements in Section 602.4 shall be determined in accordance with Section 703.2 or Section 703.3. The fire resistance rating of building elements shall be as required in Tables 601 and 602 and as specified elsewhere in this code. The fire resistance rating of the mass timber elements shall consist of the fire resistance of the unprotected element added to the protection time of the noncombustible protection.

722.7.1 Minimum required protection. Where required by Sections 602.4.1 through 602.4.3, noncombustible protection shall be provided for mass timber building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established in accordance with

Section 703.8. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement where installed and fastened in accordance with Section 722.7.2.

TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL

REQUIRED FIRE-RESISTANCE RATING OF BUILDING ELEMENT PER TABLE 601 AND TABLE 602 (hours)	MINIMUM PROTECTION REQUIRED FROM NONCOMBUSTIBLE PROTECTION (minutes)
1	40
2	80
3 or more	120

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

NONCOMBUSTIBLE PROTECTION	PROTECTION CONTRIBUTION (minutes)
$^1/_2$-inch Type X gypsum board	25
$^5/_8$-inch Type X gypsum board	40

722.7.2 Installation of gypsum board noncombustible protection. Gypsum board complying with Table 722.7.1(2) shall be installed in accordance with this section.

722.7.2.1 Interior surfaces. Layers of Type X gypsum board serving as noncombustible protection for interior surfaces of wall and ceiling assemblies determined in accordance with Table 722.7.1(1) shall be installed in accordance with the following:

1. Each layer shall be attached with Type S drywall screws of sufficient length to penetrate the mass timber at least 1-inch (25 mm) when driven flush with the paper surface of the gypsum board.

   Exception: The third layer, where determined necessary by Section 722.7, shall be permitted to be attached with 1-inch (25 mm) No. 6 Type S drywall screws to furring channels in accordance with AISI S220.

2. Screws for attaching the base layer shall be 12 inches (305 mm) on center in both directions.
3. Screws for each layer after the base layer shall be 12 inches (305 mm) on center in both directions and offset from the screws of the previous layers by 4 inches (102 mm) in both directions.
4. All panel edges of any layer shall be offset 18 inches (457 mm) from those of the previous layer.
5. All panel edges shall be attached with screws sized and offset as in Items 1 through 4 and placed at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge.
6. All panels installed at wall-to-ceiling intersections shall be installed such that ceiling panels are installed first and the wall panels are installed after the ceiling panel has been installed and is fitted tight to the ceiling panel. Where multiple layers are required, each layer shall repeat this process.

7. All panels installed at a wall-to-wall intersection shall be installed such that the panels covering an exterior wall or a wall with a greater fire resistance rating shall be installed first and the panels covering the other wall shall be fitted tight to the panel covering the first wall. Where multiple layers are required, each layer shall repeat this process.
8. Panel edges of the face layer shall be taped and finished with joint compound. Fastener heads shall be covered with joint compound.
9. Panel edges protecting mass timber elements adjacent to unprotected mass timber elements in accordance with Section 602.4.2.2 shall be covered with 1 ¼-inch (32 mm) metal corner bead and finished with joint compound.

722.7.2.2 Exterior surfaces. Layers of Type X gypsum board serving as noncombustible protection for the outside of the exterior mass timber walls determined in accordance with Table 722.7.1(1) shall be fastened 12 inches (305 mm) on center each way and 6 inches (152 mm) on center at all joints or ends. All panel edges shall be attached with fasteners located at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge. Fasteners shall comply with one of the following:

1. Galvanized nails of minimum 12 gage with a 7/16-inch (11 mm) inch head of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).
2. Screws which comply with ASTM C1002 (Type S, W, or G) of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).

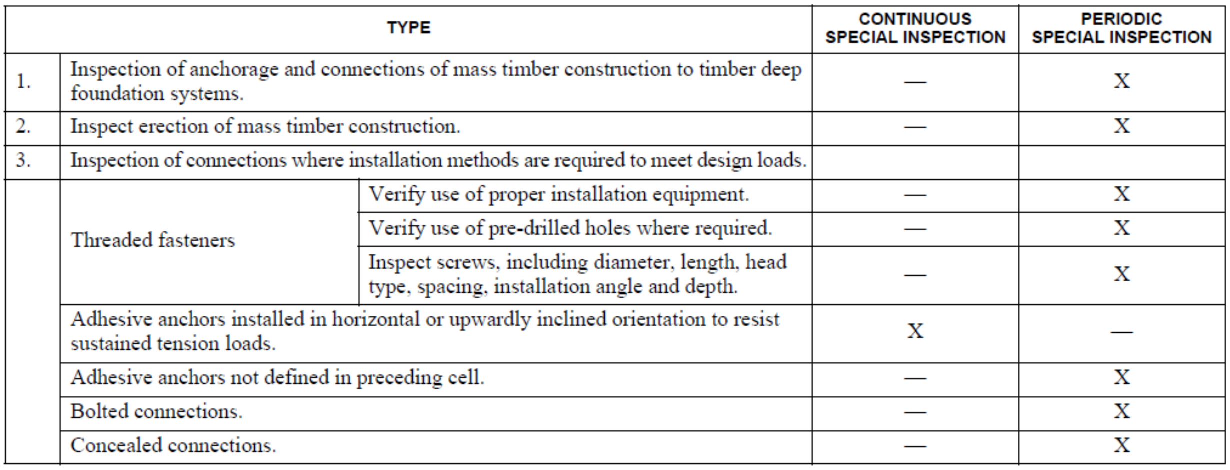
CHAPTER 17
SPECIAL INSPECTIONS AND TESTS

Add new text as follows:

1705.5.3 Mass Timber construction. Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

Add new table as follows:

TABLE 1705.5.3
REQUIRED SPECIAL INSPECTION OF MASS TIMBER CONSTRUCTION



TYPE			CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.		—	X
2.	Inspect erection of mass timber construction.		—	X
3.	Inspection of connections where installation methods are required to meet design loads.			
	Threaded fasteners	Verify use of proper installation equipment.	—	X
		Verify use of pre-drilled holes where required.	—	X
		Inspect screws, including diameter, length, head type, spacing, installation angle and depth.	—	X
	Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.		X	—
	Adhesive anchors not defined in preceding cell.		—	X
	Bolted connections.		—	X
	Concealed connections.		—	X

Add new text as follows:

1705.19 Sealing of mass timber Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.9 is applied to mass timber building elements as designated in the approved construction documents.

CHAPTER 23
WOOD

Add new text as follows:

2304.10.1 Connection fire-resistance rating. Fire resistance ratings for connections in Type IV-A, IV-B, or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139° C), and a maximum temperature rise of 325°F (181° C), for a time corresponding to the required fire resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners, and portions of wood members included in the structural design of the connection.

CHAPTER 31
SPECIAL CONSTRUCTION

Revise as follows:

3102.3 Type of construction. Noncombustible membrane structures shall be classified as Type II B construction. Noncombustible frame or cable-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type II B construction. Heavy timber frame-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IV-HT construction. Other membrane structures shall be classified as Type V construction.

> **Exception:** Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

Revise as follows:

3102.6.1.1 Membrane. A membrane meeting the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 710 shall be permitted to be used as the roof or as a skylight on buildings of Type II B, III, IV-HT and V construction, provided that the membrane is not less than 20 feet (6096 mm) above and floor, balcony or gallery.

CHAPTER 35
REFERENCED STANDARDS

Revise as follows:

APA

APA – Engineered Wood Association
7011 South 19th Street
Tacoma WA 98466-7400

ANSI/APA PRG 320 – ~~17~~19: Standard for Performance-rated Cross-laminated Timber

602.4, 2303.1.4

Add new text as follows:

ASTM

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

D3498—03(2011): Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

703.9

APPENDIX D
FIRE DISTRICTS

Revise as follows:

D102.2.5 Structural fire rating. Walls, floors, roofs and their supporting structural members shall be not less than 1-hour fire-resistance-rated construction.

Exceptions:

1. Buildings of Type IV-HT construction.

2. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Automobile parking structures.
4. Buildings surrounded on all sides by a permanently open space of not less than 30 feet (9144 mm).
5. Partitions complying with Section 603.1, Item 11.

Proposal to incorporate the tall mass timber provisions of the 2021 International Fire Code (IFC) into the 2018 IFC by means of an appendix, for use in Georgia

Add new text as follows:

IFC APPENDIX O
TALL WOOD BUILDINGS

O101
GENERAL

O101.1 Purpose. The purpose of this appendix is to provide criteria for three new mass timber construction types: Type IV-A, Type IV-B, and Type IV-C. These building types expand the allowable use of mass timber construction to larger areas and greater heights than allowed for Type IV-HT construction.

O101.2 Scope. The provisions in this appendix are in addition to or replace the sections in the 2018 International Fire Code where Types IV-A, IV-B, and IV-C construction are used. Where building Types IV-A, IV-B, or IV-C are not used, this appendix does not apply.

O102
AMENDMENTS TO THE 2018 INTERNATIONAL FIRE CODE

CHAPTER 7
FIRE AND SMOKE PROTECTION FEATURES

Revise as follows:

701.6 Owner's responsibility. The owner shall maintain an inventory of all required fire-resistance-rated construction, construction installed to resist the passage of smoke and the construction included in Sections 703 through 707 and Section 602.4.1 and 602.4.2 of the International Building Code. Such construction shall be visually inspected by the owner annually and properly repaired, restored or replaced where damaged, altered, breached or penetrated. Records of inspections and repairs shall be maintained. Where concealed, such elements shall not be required to be visually inspected by the owner unless the concealed space is accessible by the removal or movement of a panel, access door, ceiling tile or similar movable entry to the space.

CHAPTER 9
FIRE PROTECTION AND LIFE SAFETY SYSTEMS

Revise as follows:

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 IV-A and IV-B 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.

CHAPTER 33
FIRE SAFETY DURING CONSTRUCTION AND DEMOLITION

Add a new Section 3308.4 as follows (renumber current Sections 3308.4 through 3308.8 as 3308.5 through 3308.9):

3308.4 Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction. Buildings of Types IV-A, IV-B, and IV-C construction designed to be greater than six stories above grade plane shall comply with the following requirements during construction unless otherwise approved by the fire code official.

1. Standpipes shall be provided in accordance with Section 3313.
2. A water supply for fire department operations, as approved by the fire code official and the fire chief.
3. Where building construction exceeds six stories above grade plane and noncombustible protection is required by Section 602.4 of the International Building Code, at least one layer of noncombustible protection shall be installed on all building elements on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

   Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.
4. Where building construction exceeds six stories above grade plane, required exterior wall coverings shall be installed on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

   Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.

Spray Foam Insulation and Subterranean Termite Inspection Issues

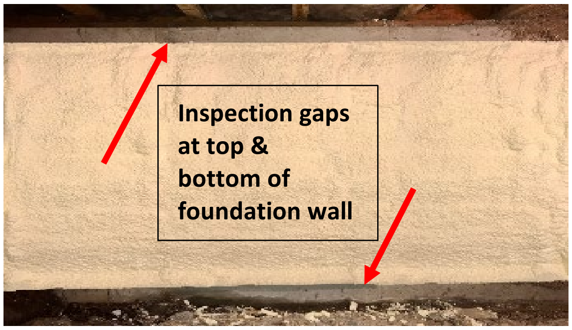
As building performance requirements have steadily increased to provide lower energy consumption, reduced air leakage, improved moisture management and building durability, the use of Spray Polyurethane Foam Insulation, (SPF) has grown significantly. Spray Foam applications to the ***framing and foundation interface area*** (noted below) in crawl space and basement construction are creating serious issues for Georgia homeowners.

These applications adversely impact Georgia homeowner's ability to protect their homes from termite infestations. The proposed code change presented by the Georgia Structural Pest Control Commission (GA SPCC) only references the framing and foundation interface area pictured above and no other changes are being requested.

Termites cause more than $5 billion in structural damage each year in the United States. As part of the termite management process, inspections are performed by trained personnel at various points in the termite management process. The Pest Management Industry is required to conduct inspections under an established regulatory framework, not simply industry standards. Inspections must be performed to identify termite infestations and determine necessary control procedures, as part of periodic, ongoing warranty/bond programs designed to detect and manage termite infestations (and re-infestations) as early as possible, and as part of real estate transfers (many state rules, all HUD/FHA guaranteed loans and many private lenders in most regions of the U.S.). Successful termite inspections to the framing and foundation interface are dependent on having visual access to identify evidence of infestation.

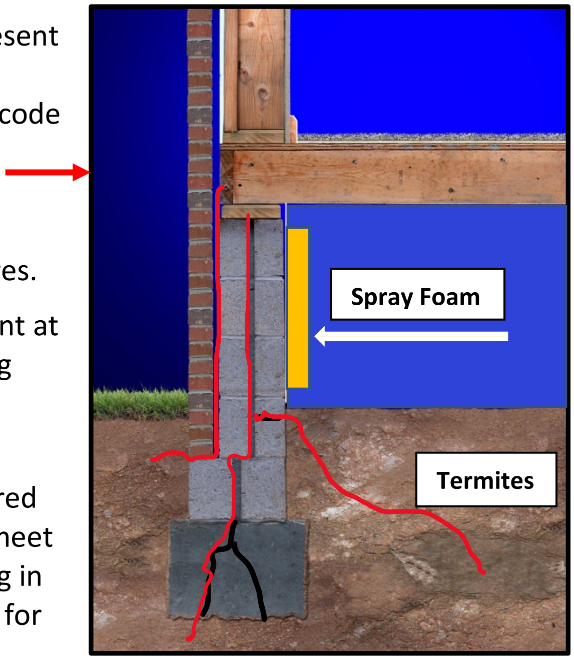
Contrary to statements made by the Spray Foam Industry, there are currently no ***"viable" alternative methods or tools available to perform termite inspections through SPF*** (see attachment "A": "Spray Polyurethane Foam / Termite Detection Demonstration Project" completed by Dr. Brian Forschler, University of Georgia, Athens GA). Additionally, visual inspections are required by some states and mortgage companies. A direct result of this issue has been that homeowners who retrofit their vented crawl spaces to unvented (semi-conditioned) to improve energy and moisture management performance, may be put in a situation that their existing termite bonds or warrantees are cancelled. This is due to the fact that the spray foam was installed according to building code requirements, "to air seal and insulate" the framing and foundation interface, but covering this area with spray foam prevents termite inspectors from detecting subterranean termite infestations. New construction, based on the current building codes for this area, have the same outcome, taking away the pest management industry's ability to inspect this crucial area. A similar product and problem occurred in the 90's with "Rigid Board Insulation". Many, homeowners throughout Georgia and the Southeast U.S. receive serious financial harm due to this product being applied incorrectly (Rigid Board Insulation (Dryvit) having contact with the ground) thus thousands of homeowners suffered due to termites having direct access into the home. Fortunately, the codes were changed and Georgia consumers and all involved were better because of this code change.

Georgia Building codes are one of a few states that require termite ***inspection gaps (no foam)*** at the top and bottom of the foundation walls, and leads the country for acknowledging the ability to conduct an inspection and determine termite activity coming up the ***inside*** crawl space or basement foundation walls, which is paramount to protecting Georgia homeowners.



Despite the well intentioned and useful code, the aforementioned interior foundation inspection gaps represent one of the few remaining areas conducive to termite inspection in modern construction. However, the current code ***does not,*** facilitate detecting termites that enter buildings through cracks in footings, foundation walls voids, mortar joints, exterior cladding over foundation or joints along adjacent concrete walkways, patios, or landscaping features.

Visible inspection from inside the crawlspace and basement at the framing and foundation interface is the ***only*** remaining option to detect if termites have gained access to the structure.

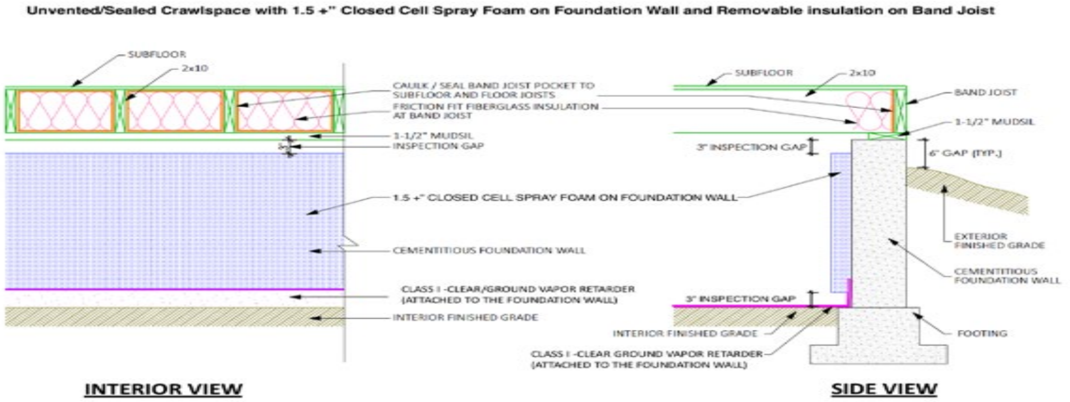


Allowing the framing and foundation interface to be covered with SPF is the easiest way for spray foam applicators to meet the current code requirements of air sealing and insulating in this area, but this practice is creating unnecessary liability for countless Georgia homeowners every day, who stand the chance of severe structural damage caused by termites because the home cannot be inspected in one of the most critical areas. Georgia homeowners may also be at risk when It comes time to sell the home, due to the inability to inspect the structure adequately for wood destroying organisms to satisfy potential buyers and lenders.

Many discussions between pest management professionals and the Spray Polyurethane Foam Alliance (SPFA) have taken place over the past 3 years in an effort to work together to resolve the concerns that raised about the application of spray foam in the framing and foundation interface. What has emerged from those discussions is one constant theme with the SPFA expressing a desire to have the ability to spray polyurethane foam with few to no limitations or liability. The SPFA has identified a number of other stakeholders who need to find alternative solutions to circumvent any culpability for unintended consequences from their business model. SPFA has highlighted the need to cover the framing foundation interface in foam as integral to their desire to reduce energy loss and it is the pest management industry's problem to resolve, with new technology, then the issue was a Georgia homeowner's education/awareness problem, and now their latest proposal is to tell builders how to build a house. SPFA's narrative continues to turn away from the spray foam issue at hand by recommending numerous alternatives that harm the Georgia consumer, homebuilders, the pest control industry, and others. All this while allowing the SPFA industry to continue doing business as usual, in some cases, blowing and going with no future responsibility.

The proposal the SPCC has put forward is not new, it is one of the accepted practices for air sealing and insulating the framing and foundation interface, currently being taught by SOUTHFACE INSTITUTE. Additionally, the GA Energy Code in the Residential Field Guide (page 17) states, ***"the band area of a conditioned crawlspace must be air sealed and insulated. It is <u>strongly recommended</u> that the band area be insulated with a removable insulation product to provide access for pest control inspection".***

We respectfully ask that the above stated code's wording **<u>"strongly recommend"</u>** be considered as follows: ***The band area (framing and foundation interface) of a conditioned crawlspace must be air sealed and insulated. It is <u>required</u> to air seal with caulk or foam at the joints connecting the floor sheathing above and the top of the foundation and be insulated with a removable insulation product to provide access for pest control inspection,*** as seen on the <u>Drawing</u> below.



Requiring that the framing & foundation interface area have removable insulation will offer the solution that allows Georgia's consumers to have both, a much-needed termite guarantee/bond and be able to take advantage of all the benefits of an air sealed crawlspace.

This **<u>SHOULD</u>** be the only solution allowed for protecting Georgia homeowners from additional liability from termite damage. We are asking for the committee's support to **<u>prohibit</u>** the application of spray foam to cover the framing and foundation interface.

Spray Polyurethane Foam / Termite Detection Demonstration Project
(July – August 2019)

Introduction

The Demonstration Project described in this report was an attempt to gather information on the utility of identifying subterranean termite infestations in or on structural components covered with Spray Polyurethane Foam (SPF) insulation. The project was conducted in a crawlspace with an active infestation of the dark southeastern subterranean termite, *Reticultermes virginicus*. The crawlspace had hollow-block foundation walls and piers with wood framing above that which served as the support for the rooms on the first floor of the structure. Initial inspections were conducted on July 16, 2019 using visual search, moisture meters, infrared cameras, a laser thermometer and a microwave motion detector. Five inspectors, identified herein by number (1-5) each used a different approach. Inspector #1 conducted a visual search in conjunction with a moisture meter; #2 used visual inspection and an infrared camera; #3 used visual inspection, a moisture meter and motion detector; #4, moisture meter, borescope and infrared camera; and #5 used visual inspection, moisture meters and an infrared thermometer. Inspectors were given one hour to examine the crawlspace and place laminated cards (red arrow) at locations where they identified termite activity. The distribution of red arrows was recorded by photography after each inspection. Inspectors then agreed to 6 locations where SPF insulation would be applied to the hollow-block foundation wall (two locations) and wooden structural members (four locations) in the crawlspace. The application of SPF at each Location included half of the designated area covered using closed-cell (2-3 inches thick) and the other half open-cell (4-6 inches thick) SPF. The following day, 17 July, the crawlspace was for a second time inspected by the same teams using the same equipment and the number and distribution of red arrows recorded for comparison with the previous inspections. One month after SPF application, 15 August, an additional inspection was conducted by all parties after which destructive sampling was conducted to verify the presence of live termites at all Locations examined in this demonstration project.

Building: River Basin Center, School of Ecology, University of Georgia, Athens, GA 30602
Areas Inspected: Crawlspace in the north east corner of the structure
Site Description: The crawlspace measured 20X20X20X10-ft and was installed during a renovation of the building in 1999 (Figure 1). The crawlspace was defined by hollow block walls approximately 7-ft high with wood framing for the floor with four hollow block piers and one metal pole as supports for the floor in the center of the space. A vapor barrier was placed over the soil floor of the crawlspace on July15, 2019.

Description of equipment used by inspector (number) and equipment (type, model):
All inspectors had at least 20 years' experience conducting termite inspections. The firm that applied SPF has been in business for 5 years and has a A+ BBB rating.

#1, Ryobi, E49MM01 resistance (surface with digital readout in %)) and Protimeter Mini (BLD2001) a pin-type (subsurface with light-up scale in 1% increments from 6-30) moisture meters

#2, Infrared camera, FLIR E6

#3, Termatrac T3i All Sensor 3-n-1 unit with the following functions, Radar Technology confirms movement, Moisture sensors both Direct & Relative using Omni-Directional Technology (digital readout in %) and Thermal Sensor showing changes in surface temperature.

#4, Infrared camera, Protec IT 100; A moisture meter, Protimeter moisture meter system-logging MMS2 (digital readout in %) and a XLVU Videoprobe (a flexible borescope), Baker Hughes Co.

#5, Infrared thermometer, General IRT207, and two moisture meters; Tramex moisture encounter resistance (surface, range in 1% increments on a graph from 10-20%) and Delmhorst Instrument Co. PC-3 pin-type (subsurface, range in 2% increments that light-up display measuring from 8-30%).

Initial Inspection notes, 16 July:
The wooden structural members - joist header, sill plate, joists and cross beams - in the crawlspace provided numerous locations where visual evidence of subterranean termite infestation was clear and obvious. There also were 10 areas with subterranean termite shelter tubes on the exterior surface of the concrete block foundation.

All 5 inspectors collectively placed 38 red arrows in the crawlspace during the initial inspection in the area adjacent to the entryway along 40 feet of foundation wall from the southeast corner to the northwest corner of the crawlspace (Locations 0, 15, 20, 30 and 35 38). The range of arrows placed per inspector was 3 to 14 (Table 2).

Surface temperatures on all substrates – block or wood – did not vary more than 0.9 degrees Celsius (1.6 degrees Fahrenheit) between any of the surfaces in the crawlspace with no pattern related to signs of termite activity. The Flir IR camera identified 1 area of termite activity on wood (Location 15) (Photograph 2) and 2 other termite-activity areas were associated with shelter tubes at Locations 0 & 40.

The moisture readings obtained on the wooden floor joists, headers and sill plates indicated elevated moisture in all the wood in the crawlspace. Depending on the type of meter and location readings ranged from 18-30% wood moisture using resistance (surface) meters to 20-30% wood moisture using a meter with insertion pins (subsurface). The resistance/surface moisture meters provided readings of 20-50% when placed on the surface of the cinder block foundation while one pin-type meter registered 100% on the block when pins were placed against the surface of that material.

The Termatrac T3i microwave motion detector identified notable movement in the shelter tubes at locations 0 and 20 as well as in the beams and sill plate at locations 5 and 15 but not 25 or 30. No live termites were observed at any location despite destructively sampling a 1-2 inch section of shelter tube at locations 0, 20 and 40 (Location 40 was on the north wall but not indicated in Figure 1). There was no destructive sampling of any of the wood supports on this inspection.

SPF foam was applied to the shelter tubes at locations 0 and 20 and on the sill, joist header and beams at locations 5, 15, 25 and 30 (Photograph 1; Figure 1). Two types of SPF were applied at each location, closed cell SPF at 2-3 inches and open cell SPF at 6-8 inches thick.

Inspection notes after SPF application; 17 July:

The number of red arrows placed on the exposed wood by all 5 inspectors was 39 the day after SPF application (Table 2). None of the visual inspections provided evidence of termite activity on the SPF (Table 2). The only device that detected termites through the SPF was the Termatrac T3i microwave motion detector which identified 6 locations (red arrows placed) on the SPF (Table 2). The Termatrac T3i identified movement in shelter tubes at 5 areas including Locations 0 and 20 as well as the beams and sill plate at Locations 5, 15 and 30… but not 25 (Table 1 & 2).

Surface temperatures on the block wall and structural lumber varied by 1.9 degrees Celsius (3.6 ^{0}F) and on foam by 0.9 degrees Celsius with no pattern related to signs of termite activity (Table 1). There were no areas of termite activity identified by the IR cameras on SPF or exposed wood or block.

Moisture readings obtained on the foundation wall, floor joists, headers and sill wood provided the same range of values, by device, measured on inspections conducted the previous day, July 16 (Table 1). Moisture readings on the SPF surface with resistance meters was zero while the pin meters ranged from 2-4% on the surface but registered 0-8% when pins were inserted into either the open- or closed-cell foam. The Termatrac T3i measures of moisture on foam varied from 4-11% with no identifiable pattern related to areas of termite activity.

No live termites were observed at any location and the sections of shelter tubes at locations 0, 20 and 40 that were broken during the previous inspection, on day earlier, had not been repaired. There was no destructive sampling on this inspection.

Inspection notes one-month after SPF application; 15 August:

Inspections aimed at determining termite activity were not recorded during the August visit to the crawlspace due to time constraints and the assumption that those results would be similar to the previous two inspections. Initial visual inspections did not reveal signs of termite activity on the foam but as SPF removal progressed (Photograph 3) it was observed that one area of closed cell foam (at Location 5) on the interface of the sill plate and foundation wall showed signs of termite activity (Photograph 4). When SPF was removed from the block covering the shelter tubes at locations 0 and 20 there were live termites in the shelter tubes but no evidence of termites leaving the shelter tubes and entering the foam. Termites did, however, tunnel into the foam on the beams, joist header and sill at locations 5 and 15 and but not areas 25 or 30 (Photograph 3). There were hundreds of live termites in the foam removed from the aforementioned areas and live termites also were observed in the sill and beams at areas 5 and 15 by destructive sampling and with the borescope (Photograph 5).

Surface temperatures on wood varied by 1.9 degrees Celsius and on foam 0.9 degrees Celsius with no pattern related to signs of termite activity (Table 1).

The range of moisture readings on wood were within the range of values from one month earlier for each of the different devices. The one exception was the Termatrac readings that were, across all locations, higher than in the previous month. The moisture readings on the block were essentially within the same range within a device but showed more variability compared to the previous month with the Termatrac T3i and Delmhorst being higher while the Tramex provided lower values. All devices recorded significantly higher wood moisture content in the joists and joist header that had been under the SPF except the Termatrac which provided lower wood moisture content in those areas (Table 1).

Moisture readings were taken on the area of visible termite activity in the SPF at location 15 and the only device that provided a different reading was the Termatrac T3i that showed 9-15% on the foam next to the area of visible activity and 17-23% on top of that location (Photograph 6).

In addition, we used a XLVU Videoprobe borescope to verify termite activity in the wood behind Loctions 5 and 15 as well as demonstrate that this device could also distinguish between infested and not-infested foam (Photograph 5).

Summary:

This SPF/termite-detection demonstration aimed to examine the ability of pest management professionals, experienced in termite inspections, to identify an active termite infestation in the same crawlspace before and after application of SPF insulation. The site was a crawlspace with a moisture problem as evidenced by the wood % moisture recorded with all moisture meters used by the inspectors (Table 1).

The results from the visual inspections included the obvious, intuitive, observation that visual inspection was prevented following application of SPF to either the wood or hollow cinderblock construction materials (Table 2). Visual inspections are subjective, and inevitability, grounded in the experience of the individual inspector and circumstances at the time and place of the inspection. This point is evident in the summary of the number of red arrows placed by each inspector on the first two inspection dates (Table 2). The number of points identified (with red arrows) using visual search between inspectors indicating evidence of termite activity clearly underscores the aforementioned subjectivity. The fact that three experienced termite inspectors went to the same crawlspace and identify three different number of ‘active locations’ indicates the experiential nature of reporting termite activity using visual inspection. The number of different locations identified by each inspector could have been a result of the fact that evidence of termite activity was widespread in that crawlspace (Photographs 1 & 2). The purpose of an inspection is typically to justify an intervention and one inspector could have placed 3 arrows in an area (split hairs) where the next inspector would have placed 1 because those locations all indicated need for intervention within a section of sill or joist.

Temperature readings taken on the surfaces in the crawlspace displayed surprising similarity regardless of substrate with never more than a ±2 degrees Celsius difference between the wood, block or foam surface temperatures (Table 1). The fact that those temperature differences were within the range of detection for both IR cameras used in this demonstration and it is therefore not surprising those devices were not able to detect the presence of termites with or without a covering of SPF.

An equally interesting, but less obvious, result involved the moisture meters which provided a wide range of values at the same locations (Table 1) indicative of the relative nature of measurements taken by these instruments, depending on the device and technology used to translate electrical conductivity to a number representing percent moisture. All moisture meters with the exception of the Termatrac T3i were consistent with the surface-type meters generally providing no readings on the foam surface while the pin-type moisture meters provided low readings (0-8% moisture) when inserted into the foam. The Termatrac T3i moisture readings ranged from 4-11% the day after SPF application to 0-26% one month later (Table 1).

The conclusion we were able to reach, given the parameters that defined this demonstration project is that the devices employed by the participants were unable to identify any consistent indication of termite infestation on the wood or block and certainly not *through* the SPF insulation. Additional research under varying conditions should be conducted to see how these same or other termite detection devices perform. The Termatrac T3i was the only device to provide moisture readings (17-23%) on the area of closed cell SPF with visual confirmation of termite activity that was different from the surrounding foam (14-15%) (Photograph 6).

The Termatrac T3i using the microwave motion detector provided evidence of termite activity with and without the foam (Table 1). Confirmation of termite activity was confined to the last (August) inspections when destructive sampling was conducted. There were no live termites found during the July inspections when shelter tubes at Locations 0 & 20% were broken nor where those sections of shelter tube repaired (after SPF application) the following day. However, one month after SPF application (August inspection) thousands of termites were observed in the foam and in pieces of wood destructively sampled with a chisel and the borescope as well as in shelter tubes at Locations 0 & 20 (Photographs 3- 5). Destructive sampling using the borescope provided evidence that by drilling ¼-inch holes into SPF one can determine if termites are present (Photograph 5).

Postscript and Conclusions:

Renovation of the crawlspace used in this demonstration began on 6 September 2019. The sill plate, joist header, floor joists and flooring were removed from the foundation walls above the crawlspace entry and halfway down the length of the southern-most wall of the crawl. The renovation exposed the foundation wall behind the joist header and sill plate above Locations 0, and 5 mentioned in the report. An examination of the exposed elements of the foundation provided substantial evidence that this infestation was initiated in the sill and joist headers in the southeast corner of the crawlspace. The amount of termite feeding activity observed in the joist header, sill and floor joists (Photograph Supplement 1) in that area displayed a pattern showing more wood removed from structural lumber closer to the SE corner of the crawlspace.

Subterranean termite structural infestations can be influenced by numerous factors including the construction practices employed – especially the elements of the foundation - as well as the surrounding landscape. This particular infestation was most likely exacerbated by the limited potential for air exchange in the crawlspace. This ~ 300 square-ft section of the structure contained two vents (12 X 8-in.), both in the north wall, coupled with no vapor barrier on the dirt floor of the space (it should be noted that during the September renovations it was discovered that there was a concrete slab floor in the crawlspace… under about 4 inches of soil). The higher- than-normal % wood moisture (The author defines 'normal' structural lumber % moisture to be 9-12% for this part of North Georgia) in the lumber of the crawlspace measured using moisture meters affirmed this point as did the observations of mold made by all inspectors conducting a visual search.

Inspection of any structure for subterranean termite activity is essentially a snap-shot in time of conditions observed during a site visit and the information recorded during this demonstration illustrates that point. The findings reported from a termite inspection are influenced by a number of factors including the type of equipment employed during the inspection. The variability reported within a single technique or piece of equipment between inspection dates shows that termite inspections can agree on the presence of termite activity although the data used to come to that conclusion might be disparate.

A visual inspection was sufficient to identify signs of a termite infestation and moisture management issues in this crawlspace. Verification of an active termite infestation and moisture problems required additional techniques and equipment. The industry standard of a visual inspection along with probing and sounding (i.e. destructive sampling) to verify an active infestation was not conducted until the third (August) inspection. The various moisture meters, indicated on the first and subsequent inspections, conditions of elevated wood moisture which would be conducive to maintaining a subterranean termite infestation. However, the moisture meters alone could not verify areas of active termite infestation. The technique employed (as per the protocol requirement of minimal disturbance) to verify termite activity during the first inspection – a visual inspection after exposing a small section of several of the numerous shelter tubes in this crawlspace - did not provide evidence of active termites. Subterranean termite activity was only confirmed during the August inspection using destructive sampling.

There were two non-destructive termite inspection technologies used during the inspections. The homogeneity of surface temperatures on all the substrates (wood, block or SPF) did not allow for a clear, definitive identification of termite activity using an IR camera. The Termatrac T3i microwave motion detector did indicate an active infestation at a number of Locations on all three inspections on all substrates examined – shelter tube on hollow block, structural wood, and SPF. Those indications of activity were verified during the August destructive sampling inspection.

The veracity of using visual inspection along with probing to identify an active subterranean termite structural infestation was confirmed by this demonstration project. The project also illustrated that SPF foam applied to structural lumber prevented a visual inspection of termite activity. The utility of moisture meters and IR cameras in identifying termite activity with or without SPF was not confirmed. The microwave motion detection device, Termatrac T3i, demonstrated the ability to detect termite activity in structural lumber with and without a covering of SPF. There are, however, practical limitations to conducting a termite inspection using the Termatrac T3i because it can detect motion in a relatively small (4 inches squared) area. Restricting the collection of termite inspection data to the scale of 4 inches^2 would require hours to complete a full inspection of the 300 ft^2 crawlspace used in this demonstration. The utility of using a device with such a small inspection ‘window’ complicates conducting a full termite inspection due, in part, to the increased time spent on site.

Acknowledgements. The author extends his sincere thanks all the professionals who donated their time, equipment and expertise during this demonstration. The project could not have been conducting without their generosity and I am indebted and deeply appreciative of their sacrifice. The participants included: Rick Bell, Arrow Exterminators; Brian Forschler, University of Georgia; Heath Knudsen and David Eubanks, Flexible Pest Services; Ed Freytag, New Orleans Mosquito and Termite Control Board; Rick Wakenigg, Termatrac LLC; Josh Nichols and Ryan Drueke and Josh Nichol, Foam South insulators.

Figure 1. Diagram of the crawlspace from the building floor plan with blue lines delimiting the interior foundation walls that define the crawl, green lines approximate distances (in feet) of the crawlspace foundation and the red line indicates the location of doorway providing access to the crawlspace. The Location numbers discussed in the report are posted in white boxes in red font with Locations O and 20 on the hollow block wall in the south east and southwest corners, respectively, and Locations 5, 15, 25, and 30 on the joists and joist headers on the south and west walls, respectively.

Photograph 1. Images of the locations discussed in the report where SPF was applied.
A. Locations 0 (not identified with a number; in the corner) and 5.
B. Locations 15, 20, 25, 30.

A.

B.

Photograph 2. Image of the IR camera screen (Flir E6) indicating an area determined to show termite activity during the first inspection (July, 17) and a visual image of the same area indicated by the red box (right).

Photograph 3. Images of termite activity in the SPF observed during the August inspection from the joists and joist header by Location 5.

Picture 4. Images of the area in the SPF at Location 5 that provided visible evidence of termite activity on surface of SPF… left (outlined by the red box) and that same area exposed during foam removal.

Photograph 5. Images from the borescope showing SPF without (left) and with (right) termite activity.

Photograph 6. Image of the Termatrac T3i percent moisture readings on closed-cell foam at Location 5 on the block in an area with (left) and without (right) termite activity.

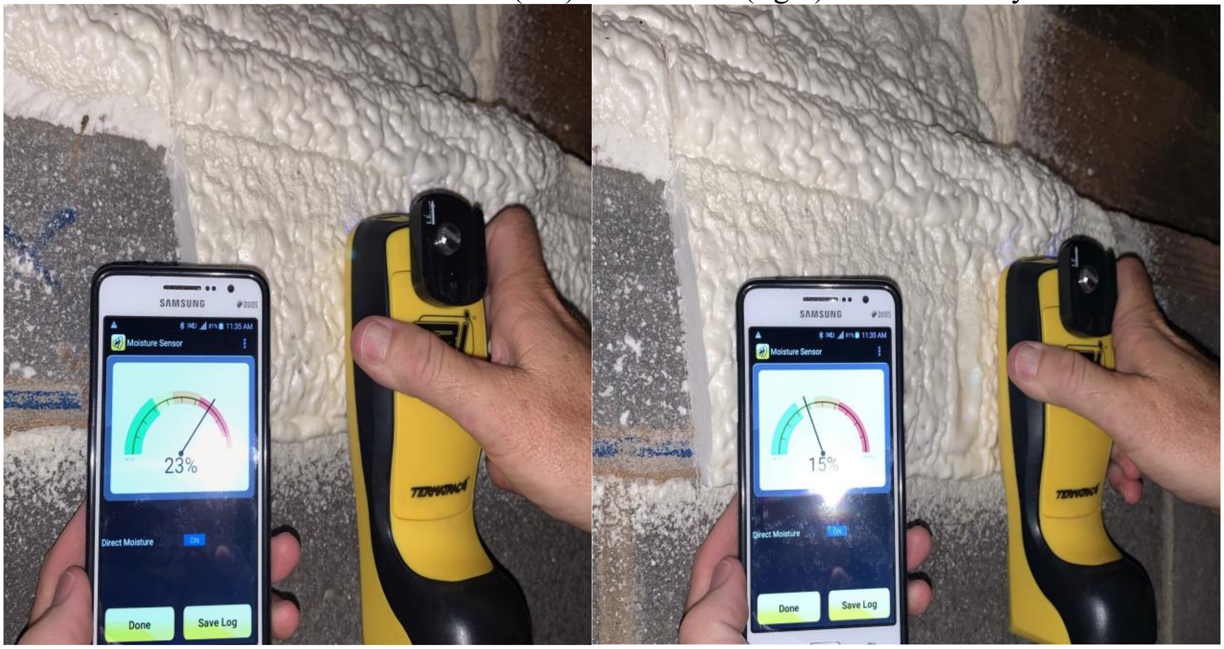


Table 1. The record of data collected in the crawlspace by date, instrument and location. A single number indicates the 2-3 readings within 1-ft^2 were consistent while a range is a record of the high and low reading for that instrument at that location. NA indicates "Not Applicable".

A. Readings taken July 16, 2019 prior to application of foam.

	Location Zero (on block)		**Location 5 (on wood beam)**		**Location 5 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	NA	26	NA	20	NA	20
Protimeter	NA	30	NA	20	NA	24
Protimeter 2	NA	100	NA	18-20	NA	25-30
Tramex	NA	20+	NA	20+	NA	20+
Ryobi	NA	50	NA	30	NA	22
Termatrac T3i	NA	25-26	NA	19	NA	25
Laser temp °C	NA	27.2	NA	26.6	NA	26.5
Termatrac T3i motion detector	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

	Location 20 (on block)		**Location 15 (on wood beam)**		**Location 15 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	NA	20	NA	20	NA	20
Protimeter	NA	17	NA	22	NA	24
Protimeter 2	NA	100	NA	18-20	NA	25-30
Tramex	NA	20+	NA	20+	NA	20+
Ryobi	NA	33	NA	26	NA	34
Termatrac T3i	NA	25	NA	18	NA	24
Laser temp °C	NA	26.3	NA	26.8	NA	26.4
Termatrac T3i motion detector	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

B. Readings taken July 17, 2019 one day after application of foam.

	Location Zero (on block)		**Location 5 (on wood beam)**		**Location 5 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	26	0	20	0	20
Protimeter	1	100	2-4	19-22	0-2	24
Protimeter 2	4-6	68	4-6	18-20	4-6	17-20
tramex	0	20+	0	20+	0	20+
Ryobi	0	50	0	30	0	22
Termatrac T3i	4-11	25-26	4-11	19	4-11	25
Laser temp °C	26.7	25.9	26.4	26.8	26.5	26.4
Termatrac T3i motion detection	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

	Location 20 (on block)		**Location 15 (on wood beam)**		**Location 15 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	20	0	20	0	20
Protimeter	3-6	17	3-6	22	3-6	24
Protimeter 2	4	100	4-8	18	4-8	25-30
tramex	0	20+	0	20+	0	20+
Ryobi	0	33	0	26	0	34
Termatrac T3i	4-11	25	4-11	18	4-11	24
Laser temp °C	26.5	26.4	26.5	26.5	26.4	26.5
Termatrac T3i motion detection	Termatrac found movement on tube but no live termites seen in small section of broken tube		Termatrac found movement but no live termites seen, no destructive sampling		Termatrac found movement but no live termites seen, no destructive sampling	

C. Readings taken August 15, 2019 one month after application of foam prior to foam removal.

	Location Zero (on block)		**Location 5 (on wood beam)**		**Location 5 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	30+	0	20	0	24
Protimeter	0	14-17	2	20	0	24
tramex	0	17.5	0	20+	0	20+
Ryobi	8-16	33	12	26	14	34
Termatrac T3i	14-20	30+	7-26	30+	12-20	30+
Laser temp ºC	26.5-27	26.7	27.8	28.2	27.1	27.4
Termatrac T3i motion detector	Termatrac found movement through foam and on tube. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling	

	Location 20 (on block)		**Location 15 (on wood beam)**		**Location 15 (on wood sill)**	
Meter type	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**	**On SPF**	**w/o SPF**
Delmhorst	0	24	0	20	0	24
Protimeter	0	15-18	0	20	0	22
tramex	0	18	0	20+	0	20+
Ryobi	0	51	16	24	0	32-34
Termatrac T3i	9-15	30+	0-16	30+	14	30+
Laser temp ºC	27/26.5	27.3	26.9	26.8	27	26.3
Termatrac T3i motion detector	Termatrac found movement through foam and on tube. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling		Termatrac found movement through foam. Live termites seen during destructive sampling	

D. Readings taken August 15, 2019 one month after application and *after* SPF removal.

	Location Zero (on block)		**Location 5 (on wood beam)**		**Location 5 (on wood sill)**	
Meter type	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**
Delmhorst	NA	30+	28	20	30+	24
Protimeter	NA	14-17	32	20	30	24
tramex	NA	17.5	20+	20+	20+	20+
Ryobi	NA	33	100	26	100	34
Termatrac T3i	NA	29-30+	18	28-30+	23	30+
Laser temp °C	NA	26.7	27.4	28.2	26.8	27.4

	Location 20 (on block)		**Location 15 (on wood beam)**		**Location 15 (on wood sill)**	
Meter type	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**	**under SPF**	**w/o SPF**
Delmhorst	NA	24	28	20	30+	24
Protimeter	NA	15-18	28	22	50	24
tramex	NA	18	20+	20+	20+	20+
Ryobi	NA	51	100	24	100	32-34
Termatrac T3i	NA	30+	27	30+	25	30+
Laser temp °C	NA	27.3	26.3	26.8	26.2	26.3

Table 2. Summary of locations (indicated by placement of ‘red arrows’) associated with observation of termite activity by inspection date and inspector/method.

Device/method used to identify termite activity by Inspector	Number of red arrows (signs of termite activity)		
	July 16	July 17	
	Before SPF application	No SPF	On SPF
Visual; Inspector #1	14	14	0
Visual/ IR Camera; Inspector #2	3	0	0
Termatrac T3i; Inspector #3	6	11	6
Visual; Inspector #4	5	5	0
Visual; Inspector #5	10	9	0

Appendix 1.

Photograph 1. Images taken during the September 6th, 2019 renovations showing the termite activity, by the red arrows, along the block foundation wall behind the joist header in the southeast corner of crawlspace at locations 0 and 5. The infestation likely accessed the structural lumber from the expansion joint between the slab and block wall (green arrow).

Photograph 2. Pictures of the floor joists between Locations 10 & 15 exposed during renovations conducted 6 September 2019. Pictures of each joist are arranged, left-to-right, by proximity to the joist header (on the left in this image) along the south wall of the crawlspace.

UL 1995 Transition to UL 60335-2-40

NOVEMBER 30
2012

UL 60335-2-40, 1st edition published

- Covers products rated less than 600 Volts.
- Does not include requirements for the use of A2 and A3 (flammable) refrigerants.

JULY 15
2015

UL 1995, 5th edition published

The 5th Edition covers all products..

SEPTEMBER 15
2017

UL 60335-2-40, 2nd edition published

- Includes requirements for air-conditioners rated up to 15kV, partial units, and revised electric heat requirements.
- Includes requirements for the use of A2 and A3 (flammable) refrigerants.

DECEMBER
2018

UL 60335-2-40 3rd edition is out for ballot. This edition contains A2L refrigerant specific requirements. The scope now aligns with UL 1995

FEBRUARY 6
2019

60335-2-40 ballot closes

JULY 31
2019

Existing products impacted by, but do not yet comply with the new Electric Heat Back-up Protection requirements or the Ultraviolet Light (UV) requirements noted in UL 1995, 5th edition must be evaluated for compliance

JANUARY 1
2024

All products shall comply with UL 60335-2-40 3rd edition by January 1, 2024. Today, products may be listed to either UL 1995 or UL 60355-2-40. However, with minimum equipment efficiency changes scheduled for 2023 and 2024, coupled with Low GWP refrigerant requirements expected in several states, all equipment within the scope of UL 1995 shall be retested to the requirements in the 3rd edition UL 60335-2-40

Currently, manufacturers may have UL 1995 Certified products evaluated to UL 60335-2-40. UL 1995 will remain a valid certification standard through January 1, 2024, when it will be effectively obsoleted. At that time, UL 1995 will no longer be used to certify new products.

Empowering Trust™

From: Glass, Robert S.
To: Jim Reynolds; Christian Poulos
Cc: P. E. Julius Ballanco (JBEngineer@aol.com)
Subject: Summary Document of Standards in Effect in ICC Codes
Date: Tuesday, February 23, 2021 6:42:53 PM
Attachments: UL1995to60355_timeline2019_vDIGITAL1-1.pdf

Mr. Reynolds/Mr. Poulos,

As requested, the following outlines the standards that we are addressing in proposals IRC 2202-4 through IRC 2202-9. I have also done the IMC as well for possible use by the PMG Subcommittee.

2018 IRC Sections Referenced

NMX-J-521/2-40-2014/CAN/CSA-22.2 No. 60335-2-40-12/UL 6-335-2-40 M1403.1, M1412.1, M1413.1
ASHRAE 34-2016 M1411.1
CAN/CSA/C22.2 No. 60335-2-40-2012 M1403.1, M1412.1, M1413.1
UL 1995-2011 M1402.1, M1403.1, M1407.1, <1412.1, M1413.1, M2006.1
UL/CSA/ANCE 60335-2-40-2012 M1403.1, M1412.1, M1413.1

2021 IRC Sections Referenced

NMX-J-521/2-40-2014/CAN/CSA-22.2 No. 60335-2-40-12/UL 6-335-2-40 M1403.1, M1412.1, M1413.1
ASHRAE 34-2019 M1411.1
CAN/CSA/C22.2 No. 60335-2-40-2012 M1403.1, M1412.1, M1413.1
UL 1995-2015 M1402.1, M1403.1, M1407.1, M1412.1, M1413.1, M2006.1
UL/CSA/ANCE 60335-2-40-2012 M1402.1, M1403.1, M1412.1, M1413.1, M2006.1

2018 IMC Sections Referenced

ASHRAE 15-2016 1101.6, 1105.8, 1108.1
ASHRAE 34-2016 202, 1102.2.1, 1103.1
UL 1995-2011 908.1, 911.1, 918.1, 918.2, 1101.2

2021 IMC Sections

Referenced

ASHRAE 15-2019	1101.6, 1105.8, 1108.1
ASHRAE 34-2019	202, 1102.2.1, 1103.1
UL 1995-2015	908.1, 911.1, 918.1, 918.2, 1101.2
UL/CSA 60335-2-40-17*	908.1, 916.1, 918.1, 918.2
UL/CSA 60335-2-89-17	1101.2

- The reason given during IMC 2021 development was that UL/CSA 60335-2-40-2019 standard had not been published yet, so they couldn't update the reference to this standard (published in Nov 2019)

Current GA 2020 IRC	**Sections Referenced**
NMX-J-521/2-40-ANCE-2014-CAN/CSA-22.2 No. 60335-2-40-12/UL 60335-2-40	M1403.1, M1412.1, M1413.1
ASHRAE 34-2016	M1411.1
CAN/CSA/C22.2 No. 60335-2-40-2012	M1403.1, M1412.1, M1413.1
UL 1995-2011	M1402.1, M1403.1, M1407.1, M1412.1, M1413.1, M2006.1
UL/CSA/ANCE 60335-2-40-2012	M1402.1, M1412.1, M1413.1

Proposed GA IRC Amendments	**Sections Referenced**
~~NMX-J-521/2-40-ANCE-2014-CAN/CSA-22.2 No. 60335-2-40-12/UL 60335-2-40~~	~~M1403.1, M1412.1, M1413.1~~
ASHRAE 34-~~2016~~ 2019	M1411.1
~~CAN/~~CSA~~/~~C22.2 No. 60335-2-40-~~2012~~ 2019	M1402.1, M1403.1, M1412.1, M1413.1, M2006.1
UL 1995-~~2011~~ 2015	M1402.1, M1403.1, M1407.1, M1412.1, M1413.1, M2006.1
UL/CSA/~~ANCE~~ 60335-2-40-~~2012~~ 2019	M1402.1, M1403.1, M1412.1, M1413.1, M2006.1

Current GA 2020 IMC	**Sections Referenced**
ASHRAE 15-2016	1105.3, 1106.6, 1106.7
ASHRAE 34-2016	202, 1102.2.1, 1103.1

UL 1995-2011	908.1, 911.1, 918.1, 918.2, 1101.2

Proposed GA IMC Amendments	**Sections Referenced**
ASHRAE 15-~~2016~~ 2019	1105.3, 1106.6, 1106.7
ASHRAE 34-~~2016~~ 2019	202, 1102.2.1, 1103.1
CSA C22.2 No. 60335-2-40-2019	9081., 918.1, 918.2, 1101.2
UL 1995-~~2011~~ 2015	908.1, 911.1, 918.1, 918.2, 1101.2
UL 60335-2-40-2019	9081., 911.1, 918.1, 918.2, 1101.2

2020 FL Residential Code	**Sections Referenced**
ASHRAE 34-2019	M1411.1
UL/CSA 60335-2-40-2019	M1403.1, M1412.1, M1413.1
UL 1995-2015	M1402.1, M1403.1, M1407.1, M1412.1, M1413.1

2020 FL Mechanical Code	**Sections Referenced**
ASHRAE 15-2019	1101.6, 1105.8, 1108.1
ASHRAE 34-2019	202, 1102.2.1, 1103.1
UL 1995-2015	908.1, 911.1, 918.1, 918.2, 1101.2
UL/CSA 60335-2-40-2019	

2018 WA State Residential Code	**Sections Referenced**
ASHRAE 34-2019	M1411.1
CAN/CSA/C22.2 No. 60335-2-40-2019	M1403.1, M1412.1, M1413.1
UL 1995-2011	M1402.1, M1403.1, M1407.1, M1412.1, M1413.1, M2006.1
UL/CSA/ANCE 60335-2-40-2019	M1403.1, M1412.1, M1413.1

2018 WA State Mechanical Code	**Sections Referenced**
ASHRAE 15-2019	1101.6, 1105.8, 1108.1
ASHRAE 34-2019	202, 1102.2.1, 1103.1
UL 1995-2011	9081., 911.1, 918.1, 918.2, 1101.2

Proposals have been submitted to ICC for updates to the 2024 IRC in the 2024 Code Cycle as follows:

2024 IRC

~~NMX-J-521/2-40-2014/CAN/CSA-22.2 No. 60335-2-40-12/UL 6-335-2-40~~	~~M1403.1, M1412.1, M1413.1~~
ASHRAE 34-2019	M1411.1
CAN/CSA/C22.2 No. 60335-2-40-~~2012~~ 2019	M1403.1, M1412.1, M1413.1
UL 1995-2015	M1402.1, M1403.1, M1407.1, M1412.1, M1413.1, M2006.1
UL/CSA/ANCE 60335-2-40-~~2012~~ 2019	M1402.1, M1403.1, M1412.1, M1413.1, M2006.1

Proposals have been submitted to ICC for updates to the2024 IMC in the 2024 Code Cycle as follows:

2024 IMC

ASHRAE 15-2019	1101.6, 1105.8, 1108.1
ASHRAE 34-2019	202, 1102.2.1, 1103.1
UL 1995-2015	908.1, 911.1, 918.1, 918.2, 1101.2
UL/CSA 60335-2-40-~~17~~ 2019	908.1, 916.1, 918.1, 918.2
UL/CSA 60335-2-89-~~17~~ 2019	1101.2

Attached is the UL Roadmap document that I discussed also.

The link to the webinar that I referenced is https://www.youtube.com/watch?v=PSqGp4ai4jY&feature=youtu.be

Please let me know if you have need for any more information.

Regards,

Robert

Robert Glass

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American Chemistry Council | Spray Foam Coalition

SPFA
SPRAY POLYURETHANE FOAM ALLIANCE

April 5, 2021

Joel Rodriquez
Chairman
2022 Energy, Residential and Building Amendments Subcommittee
State Code Advisory Council
Georgia Department of Community Affairs
60 Executive Park South, NE
Atlanta, GA 30329

RE: Changes to Termite Protection Requirements (IRC R318 and R402.2.11)

The American Chemistry Council's Center for the Polyurethanes Industry Spray Foam Coalition[1] and the Spray Polyurethane Foam Alliance[2] (collectively, the spray foam industry) appreciate the opportunity to provide additional background on the proposed changes to IRC sections R318 and R402.2.11 to the Energy, Residential and Building Amendments Subcommittee (Subcommittee).

Background:
Builders can implement strategies to reduce risk of termite infestations, but full prevention is not feasible. The Subcommittee should focus on termite strategies that increase the opportunity to visually identify termite infestation before significant damage occurs. The spray foam industry is striving to take a truly pro-active and "integrated" pest management approach which recognizes in heavy termite infestation probability areas that no one measure is sufficient. We believe the Subcommittee must consider an approach that implements multiple measures to avoid and mitigate serious termite infestations.

The use of spray foam, and other high-performance insulation products, on the framing foundation interface (FFI) can positively impact energy efficiency, structural resilience, and moisture control. Despite concerns that multi-purpose, energy efficient products cannot work with traditional pest control methods, the spray foam industry believes that consumers can be protected by both. Traditional visual inspection of the FFI is a practical solution in existing homes, but solely relying on visual inspections when better integrated solutions exist leaves consumers vulnerable to uncontrolled termite infestations potentially jeopardizing the single most important purchase of their life—their home. The spray foam industry has developed an alternative solution for termite controls in the FFI that leverages termite barriers, preservative-treated lumber, and limited/targeted use of termiticide to protect indoor air quality and provide the earliest possible warnings of termite infestations such that measures can be implemented to prevent severe infestations.

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[1] The Spray Foam Coalition (SFC) champions the use of spray polyurethane foam in North America by promoting its energy efficiency, performance, economic benefits, and contributions to sustainability. The SFC provides a forum to conduct research, to advocate for science-based public policy, excellence in safety, stewardship, training, and to advance technical knowledge.

[2] Founded in 1987, the Spray Polyurethane Foam Alliance (SPFA) is the voice, and educational and technical resource for the spray polyurethane foam industry. The Alliance is a 501(c)(6) trade association comprised of contractors, manufacturers, and distributors of polyurethane foam, related equipment, and protective coatings, inspections, surface preparations, and other services. SPFA supports the best practices and the growth of the industry through a number of core initiatives, including educational programs and events; a Professional Certification Program; technical services and publications; federal and state advocacy; and networking opportunities.

Sealing a crawlspace with air impermeable insulation, such as spray foam, improves the overall energy performance, comfort, and air quality of a house. Sealing the crawlspace effectively controls air leakage – the natural process of by which moisture laden air is drawn through leakage paths like the FFI and exiting through other gaps and openings. The U.S. Department of Energy estimates that 56% of the energy used in a home goes to heating and cooling[3], however, as much as 40% of a building's HVAC energy is lost due to uncontrolled air leakage.[4] Stopping air leakage, with products like spray foam, effectively reduces the loss of conditioned air. Fully air sealing the thermal envelope and leveraging controlled ventilation of a home can save homeowners up to 30% from their HVAC energy bill per year.[5]

In addition to energy savings, reducing air infiltration at the FFI is important for moisture control, especially in hot-humid climates. Stack-effect, wind, and unbalanced ventilation drive air leakage. Humid air can condense on interstitial surfaces such as framing and sheathing materials resulting in mold, mildew, and rot. These conditions create uncomfortable living environments, lead to poor indoor air quality, are ideal for termites (and other wood-destroying organisms) and can lead to structural deterioration. Homeowners must have a variety of tools, including spray foam, available to protect their homes and promote healthy indoor air.

The spray foam industry believes the application of spray foam is both desirable and feasible at the FFI and proper construction methods can enhance visual inspections of the key areas and greatly increase their effectiveness. The spray foam industry has developed a design solution that allows for visual inspection for termites at the FFI, while allowing homeowners to seal the FFI to protect against moisture damage and lower their energy usage. This solution balances energy efficiency with the needs of pest management professions, while protecting consumers from termites, air leakage, and moisture intrusion, leading to a better indoor environment.

The pest management industry is proposing to only allow the use of removable batt insulation in the FFI. This is problematic for several reasons: 1) the spray foam industry's solution provide for visual inspections and options for builders – including removable insulation when certain conditions are not met, 2) pest management professionals (PMPs) are not trained insulation installers. It will be difficult to ensure that the batt insulation will be properly reinstalled after each annual termite inspection and it is likely that it will become damaged (*i.e.* the removal insulation can become compressed, distorted, or separated during each removal and replacement cycle and as batts are manipulated the potential increases they can simply drop out of the joist cavity) 2) many hidden pathways still exist in wall and floor assemblies allowing termite infestations to proceed unless proper control measures are installed at the time of construction, and 3) batt insulation alone does not provide moisture protection or air sealing.

Furthermore, insulation inspections take place on an infrequent basis. Homeowners rarely enter their crawlspaces and it is unlikely they will ensure the batt insulation is properly re-installed after each removal and is functioning properly. Allowing the use of spray foam, and other high performance insulations, will provide greater a likelihood on the insulation functioning properly throughout the life of the home.

A key requirement of the Georgia's termite protections should be the installation of a sealed termite shield or barrier that extends through all layers of the foundation wall at a location that is at least 6" above grade and below the lowest location of untreated wood framing.

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[3] https://www.energy.gov/energysaver/heat-and-cool

[4] https://www.energystar.gov/ia/home_improvement/home_sealing/AirSealingFS_2005.pdf

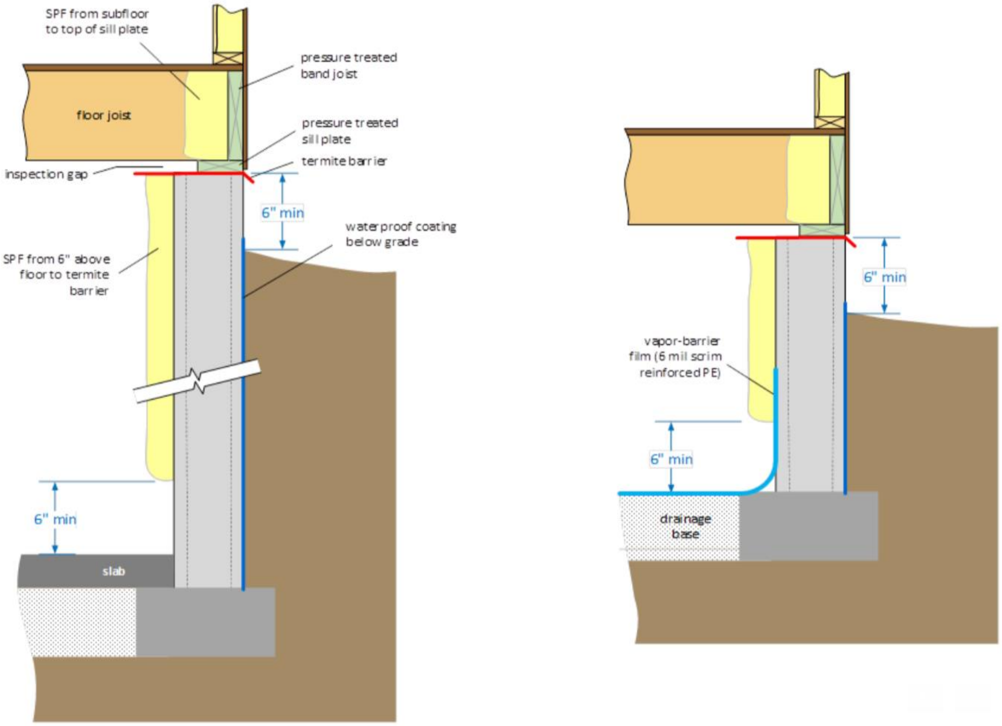
[5] https://www.energy.gov/eere/why-energy-efficiency-upgrades

This measure will help minimize or eliminate the hidden pathways through which termites evade detection. This should be a key starting point to help ensure termite attack is detected at an early stage—*the barrier helps force termites out of hidden pathways to become visible at an early stage*. It also helps minimize the need for chemical re-treatment to control termites because infestations can be pinpointed at an earlier stage. However, it is best used in combination with targeted approved chemical soil treatments or bait systems as commonly required to secure a home mortgage.

Overall, we believe that an integrated approach, combining the benefits of termite shields or barriers with other measures, should be a minimum requirement for Georgia's termite protection requirements. Please see our original proposal for the exact suggestions.

Figure 1 shows what a conditioned basement or crawlspace would look like using the default requirement in Georgia (showing use of spray foam because of its air sealing and moisture control properties, but the same termite control details would apply for any insulation strategy and air sealing strategy).

Figure 1: Spray foam installed in a conditioned crawlspaces



The spray foam industry believes that this termite-resistant foundation construction practice (including integrated use of a termite shield, treated lumber, and use of soil chemical treatment or bait system) is the minimum acceptable practice necessary to protect against termites in regions with very heavy termite infestation probability. Termites have posed significant problems for homes with or without foundation insulation and, even without foundation insulation present, inspections for termites have been found to be only 33% effective because hidden pathways exist in essentially all foundation constructions. However, we do include recognition of a commonly accepted practice for cases, such as existing construction, where it may not be practical to retrofit a termite shield or treat existing lumber. This practice is not considered as effective as the proposed integrated solution and is needed only because existing homes typically have not included termite shields to improve visual inspection effectiveness.

Consumer Protection:
Homes are generally the most valuable assets a person can own. Ensuring homes are protected is one of the major responsibilities of the building and construction sector. Building homes that are durable, comfortable, and energy-efficient is important. Using principles of building science, achieving these goals requires a reasonable balance of several attributes. In the context of sealing the framing foundation interface, there are three key protections: 1) structural features of the home, 2) energy performance, and 3) indoor air quality and occupant comfort.

In terms of consumer protection, the reduction of costly damage from subterranean termites is obviously important. However, preventing moisture damage, while meeting more stringent energy performance, and indoor air quality, is at least equally important. Achieving both creates residential housing stock that is energy efficient and resilient—two factors that contribute to sustainable housing.

Energy Efficiency and Crawlspaces:
Insulation and air barriers protect consumers by saving on energy usage and controlling the flow of moisture laden air, promoting the durability of the building. High performance insulation products, like spray foam, allow consumers to insulate and air seal their homes with minimal need for additional measures. According to 2009 data from the EIA, the average annual energy cost is $2,067 for Georgia homes, where 41% of this energy is used for heating and cooling using mostly electricity and natural gas. This includes mostly existing homes with a HERS score of about 140. Estimated energy costs for a new home built to the 2006 IECC standard (HERS/ERI of 100) will be about $1,476, and an energy-efficient home built to the 2018 IECC standard with a HERS/ERI of 60 will have annual energy costs of $885. The net annual savings from an energy-efficient new home to a home built to 2018 IECC standards is about $591[6]. Using spray foam, homes can often exceed the prescriptive air tightness requirements and homeowners often see additional savings.

Most energy efficient homes require improved enclosures, using increased levels of high-performance insulation and fenestration coupled with reduced air leakage on the order of 1.0-1.5 ACH_{50}, up to 5 times lower than that required by the current Georgia airtightness requirements. Improved enclosures can account for a significant reduction in HVAC energy costs and are a key component of energy-efficient homes. They can also provide a means to better control indoor humidity and moisture levels by minimizing uncontrolled humid air leakage, allowing properly designed HVAC systems to better do their job.

Two of the most critical areas for air sealing a home are at the ceiling or roof assembly of the top floor and where the framing meets the foundation. This is because of air leakage which occurs in all buildings regardless of climate, location or orientation. Minimizing air leakage is critically important to controlling comfort, energy efficiency, moisture control, noise, dust and many other problems. Sealing the FFI with spray foam, as well as the ceiling and roof penetrations, effectively minimizes air leakage and can significantly reduce energy usage.

Additionally, stringent codes and above-code programs are critical to ensuring that new homes not only save energy but also reduce use of non-renewable fossil fuels and minimize carbon impact on the environment. Current energy codes require energy efficient enclosures that are well insulated and properly sealed against unwanted air leakage. A carefully designed strategy of insulation and air sealing coupled with pest control can help achieve these important objectives.

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[6] https://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/ga.pdf

Termite Damage and Prevention:
Homeowners want to ensure that their largest single investment will not be destroyed by wood-destroying organisms such as subterranean termites. The annual cost for termite damage repair in the US is approximately $1B[7] to $5B[8] and the average repair cost per house is $600[9] to $3,000[2], according to various pest management contractors in Georgia.

Termite damage can range from aesthetic damage to walls, carpeting or furniture, up to structural damage to wall, floor, roof, and ceiling assemblies. While structural damage can be detected before collapse of the building, repairs will often be significant. Structural repair costs from termite damage are typically not covered by homeowner's insurance policies.

Home buyers typically require termite inspections to obtain mortgage financing. There are three major factors that PMPs use to protect homeowners: Inspection, Preventive Treatment, and Passive or Reactive Treatment:

- **Inspections** for subterranean termite infestation start with an inspection of the foundation walls for mud tubes and entry points and the onset of termite damage to the sill plate (the foundation-framing interface). Some PMPs augment visual inspection with other non-visual inspections that include infrared cameras to search for heat generated by active termites, motion detection/acoustic emission to audibly detect termite activity and moisture meters to search for construction materials with high moisture content conducive to termite activity. A recent study by the University of Georgia demonstrated that motion detection/acoustic emission devices effectively detected termite activity.[10]
- **Preventive treatment** for subterranean termites typically uses regular application of termiticide into the soil adjacent to the foundation and/or application of termiticide into the foundation wall or on the wood in contact with the foundation. Termiticides kill termites on contact, including foraging termites and termites living inside the underground colony. Termiticide treatments need to be regularly refreshed to assure efficacy.
- **Passive or Reactive treatment** for subterranean termites uses bait stations installed in the ground around the perimeter of the foundation. These bait stations contain termiticide-treated food sources which are carried back to the underground colony by foraging termites.

Some PMPs use a preventive approach that relies heavily on regular application of termiticide adjacent to or inside the foundation. These PMPs inject termiticide into the ground or foundation every few years. The efficacy of this generally more costly approach is high and is less reliant on regular visual inspections.

Other PMPs use a passive or reactive approach that relies on more frequent and thorough visual inspections performed every 6 to 12 months. If a termite infestation is detected, they then treat the home with less costly installation of bait stations and, in some cases, with termiticide treatment.

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[7] https://secure.caes.uga.edu/extension/publications/files/pdf/B%201241_5.PDF UGA Extension report 2017 (Forschler)

[8] https://www.orkin.com/termites/facts/statistics

[9] https://www.bredapest.com/news/the-cost-of-repairing-termite-damage-ga

[10] http://agr.georgia.gov/Data/Sites/1/media/ag_plantindustry/structural_pest_control/structural_pest_control_commission/files/Spray-Polyurethane-Foam-Termite-Detection-Demo-Project.pdf

Limitations on Visual Termite Inspections:
The utility of visual inspections, without the use of termite barriers, is limited. A 2002 study by Cookson and Trajstam found[11]:

- Visual inspection is only 33% effective in preventing termite damage. Relying on visual inspection, even without the presence of foam sheathing, was found to be largely an ineffective means (67% of the time) of addressing termite infestation and damage issues.
- Chemical treatment is 96% effective in preventing termite infestation and damage.
- There should be an emphasis on treatment and protective practices, such as termite shields, for improving inspection success while also mitigating vulnerability to termite infestation.

According to the *Termite Control Services: Information for the Georgia Property* Owner by Dr. Brian Forschler:

> *Since much of the wood in a structure is hidden from view, visual inspections for subterranean termites are cursory at best. Many construction types provide only a limited view of the multitude of areas termites might use to gain entry into a structure.*

These three factors should all be part of consumer protection. Relying on inspections and post-infestation treatment limits the effectiveness of termite prevention.

Termite Barriers Improve Visual Inspections:
Termite barriers are essentially pieces of metal flashing or membranes that are installed between layers of the foundation. Their purpose is to prevent direct termite access to wood within the structure. The metal layer forces the termites out of hidden pathways, forcing them around the barrier and into an area for visual inspections. Termite barriers are a tool for increasing the effectiveness of visual inspection, they are not meant to completely mitigate termite risk. Properly installed termite shields are one of the most effective control measures because they make it much easier to detect termite infestations by forcing any invading termites to build mud shelter tubes around the termite shield where they are easier to detect during routine inspections. This results in more timely and effective treatment.

Figure 2 shows how termites might enter a condition crawlspace and how termite shields increase the opportunity to visual identify a termite infestation in the interior *and* exterior of a home.

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[11] Termite Survey and Hazard Mapping. Cookson and Trajstam. 2002.

Figure 2: Termite Pathways with Barrier

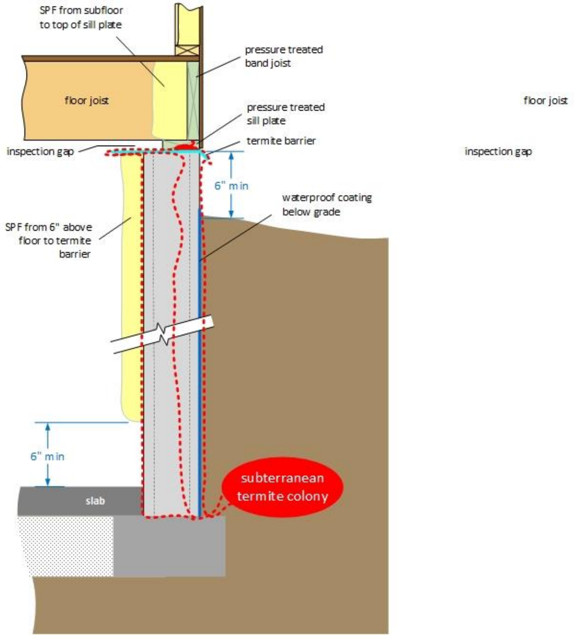
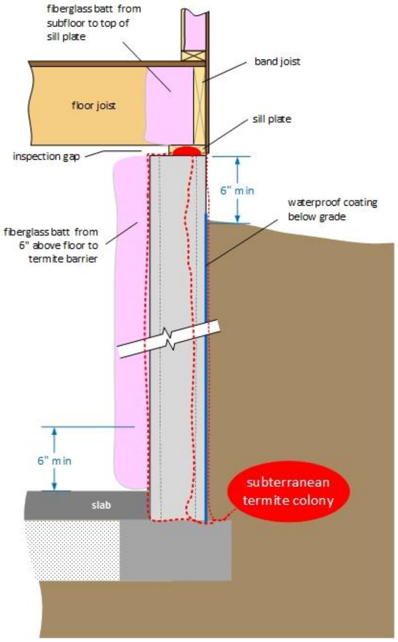


Figure 3: Termite Pathways without Barrier



Moisture Damage and Prevention:

Properly insulated and sealed homes with controlled ventilation not only save energy, but dramatically reduce the infiltration of hot, humid air during summer months. Infiltration of hot-humid air at the foundation can condense on wood framing, providing idea conditions for a range of wood-destroying organisms, such as: (1) potentially toxic mold and mildew that negatively impact indoor air quality and occupant health, and (2) added moisture to structural wood framing that actually attract subterranean termites and reduce building durability.

Air impermeable insulations, like closed-cell spray foam (ccSPF) or rigid foam board, retard the flow of vapor. At 1.5" ccSPF has an R-Value of 10 and is listed as a Class II vapor retarder. In a basement or crawlspace wall or band joist, this is a huge advantage in the winter. A relative humidity of 25% at 70 degrees results in a dew point of 35 degrees. The warmer air is, the more moisture air can hold.

In winter, condensation will occur on cold surfaces. Keeping surfaces temperature above the dew point prevents condensation. When ccSPF is applied to a band joist, the condensing surface is no longer the wood. It is now the interior surface of the ccSPF and it will remain too warm (above dew point) for condensation to occur and it also serves as a vapor retarder because water vapor cannot permeate through ccSPF easily. In a conditioned crawlspace or basement, the interior temperature and all interior surface temperatures will be greater than 30 degrees above the interior dew point minimizing condensation potential and removing a potential moisture source for termites.

Conclusion:
The spray foam industry believes implementing these changes to Georgia's Residential Code will protect consumers, decrease homeowner risk associated with termites, improve indoor air quality while balancing the energy savings of foam plastic insulations. By encouraging homeowners and builders to thoughtfully plan and design buildings that will be durable and resilient, housing stock will be improved and important investments will be protected.

If you have any questions, please contact Stephen Wieroniey at 202-249-6617 or stephen_wieroniey@americanchemistry.com or Rick Duncan at 703-222-4269 or rickduncan@sprayfoam.org.

Sincerely,

Stephen

Stephen Wieroniey
Director
Spray Foam Coalition

Rick Duncan
Executive Director
Spray Polyurethane Foam Alliance

Spray Foam Insulation and Subterranean Termite Inspection Issues - April 2021

The Georgia Structural Pest Control Commission (GASPCC) appreciates the opportunity to provide the Energy, Residential and Building Amendments Subcommittee, additional information pertaining to our proposed building code changes.

First and foremost, we strongly reiterate that the application of Spray Polyurethane Foam (SPF) to the framing foundation interface (FFI), ***should not*** be allowed under any situation or circumstances in order to protect Georgians from unnecessary liability, potentially severe structural damage, home resale concerns and expense.

Termites will use spray foam as a bridge to bypass mechanical obstacles and treated wood to gain access to untreated wood in a structure. Spray foam hides, provides protection, and enables termites to move undetected to find and exploit food sources.

Georgia Building codes require treated wood when installed in certain areas of a structure and we strongly support the use of treated wood in areas that are likely to be in contact with soil and/or moisture.

Treated wood is regulated under U.S. EPA pesticide laws and regulations for protecting the wood from wood destroying organisms. That being said, treated lumber ***does not*** offer structural protection from wood-destroying organisms. To make claims of structural protection against termites, the pesticide product (termiticide) must meet strict efficacy standards set by U.S. EPA to be registered for use and be applied by a Georgia Department of Agriculture licensed pest management professional.

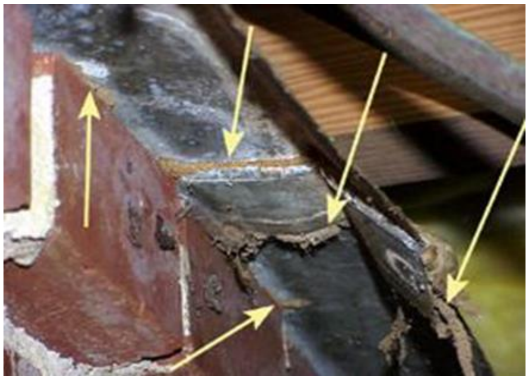
While our focus with this proposed change has been around termite infestations and the application of SPF in the Framing Foundation Interface (FFI), we feel it is also important to inform the committee that under the Georgia Structural Pest Control Regulations, specifically the Wood Destroying Organism (WDO) section, pest management professionals are required by regulation to complete ***visible*** inspections for multiple wood destroying organisms. These include application of all measures for the purpose of controlling termites, powder post beetles, wood boring beetles, wood destroying fungi and any other wood destroying organism in structures and/or adjacent outside areas. Most of these pests infest directly into the wood and do not provide signs like termite tubes and once the wood is covered with SPF detection is virtually impossible.

All these wood destroying organisms are found in Georgia. When untreated or conditions are created, like the application of SPF that hinder the ability to inspect for these organisms, Georgia homeowners will be placed unnecessarily in harm's way with little to no solutions for appropriate early detection and remediation.

The spray foam industry presented some interesting solutions on the admitted concern with inspections in the FFI that has been covered with SPF, and we would like to address some of them.

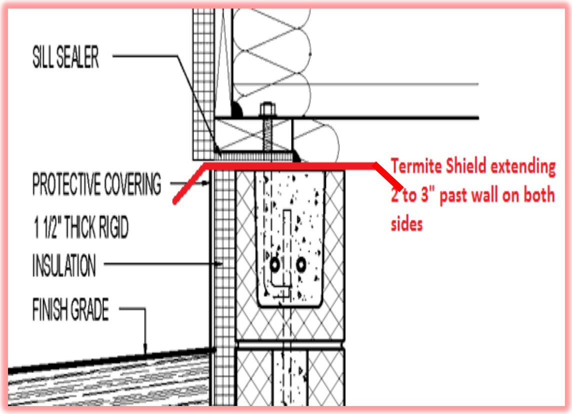
Termite shields:

The SPF proposal is putting an enormous amount of stock in the ability of termite shields to prevent termites from getting into a structure so they can cover the FFI with SPF. With modern day termite control products and treatments, you rarely see termite shields today, unless you are looking at a structure-built decades ago. Metal termite shields were first recommended half a century ago and are no longer recommended by the USDA as the following decades have demonstrated, such devices, ***do not stop*** termite movement along foundation walls and piers to the wooden parts of the structure. The shields are rarely installed in modern construction because they are difficult to install properly (i.e., not soldered/sealed properly), can be damaged while finishing new construction or deteriorate over time, causing cracks or gaps thereby allowing termites to reach wooden construction features. Additionally, because it is required to secure the sill plate to the foundation, the shields need to accommodate a bolt or sill plate straps to pass through further compromising their effectiveness in stopping or revealing termite infestations.



As a reminder, termites can access a structure through a 1/64" gap.

Metal termite shielding, should extend at least **two inches out** and **two inches down** at a **45° angle** from the foundation wall. As shown in the drawing to the right, this means the termite shield must extend out over the outside foundation wall 2 – 3 inches, being visible beyond the outer most building components on the exterior of the structure (i.e., siding, brick and stone veneers, etc.).



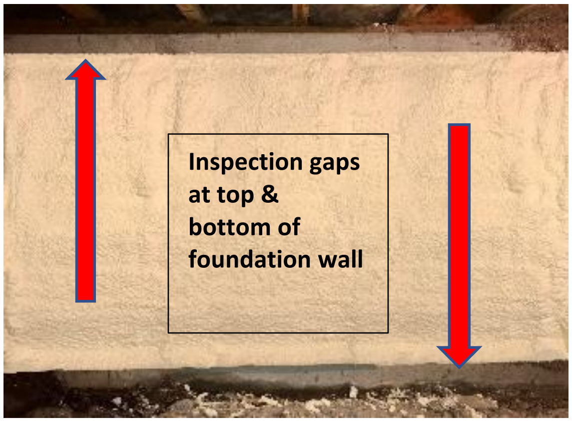
This requirement presents a less than appealing aesthetic look on the exterior of the home and requires additional craftsmanship, labor, equipment, and product cost to builders, making homes less affordable to hundreds of consumers. Most importantly, such shields are compromised and ***not visible*** if the structure has porches, sidewalks, or patios adjacent to the structure. These inaccessible areas are highly termite vulnerable places on a structure and conducive to hidden termite infestation.

In the picture to the right, you can see that the termite shield extends over the ***inside*** and outside of the foundation wall. You can also see that the ***outside*** foundation wall will be completely hidden behind added brick or stone veneer sitting on the ledge below (arrow), providing hidden access for termite entry on the exterior foundation walls. In this situation, SPF's proposal would allow the FFI to be covered with spray foam and the homeowner will pay the price of having an invisible infestation persist for years before detection.

There are many ways to secure the sill plate to the foundation. The picture ***above*** shows anchor bolts (circled) being used to secure the sill plate to the foundation. The bolts must pass through a termite shield creating the need to seal each bolt. In this situation, given that even a 1/64th inch gap would compromise the "shield". The attention required as to the details of a sealing application and maintaining the integrity of the "shield" are obvious reasons why this methodology is no longer recommended after decades of less-than-satisfactory experience.

As I mentioned the sill plate can also be secured to the foundation by using a variety of types of foundation straps. The picture to the right shows one type of sill plate straps / anchors in use, yet there are many varieties and designs in the marketplace. These straps / anchors are imbedded into the foundation making it extremely difficult, if not impossible to install a termite shield and be able to seal it as required around each strap.

Foundation Inspection Gaps



Current Georgia Building codes require termite ***inspection gaps (no foam)*** at the top and bottom of the foundation walls, and that code leads the country for acknowledging that conducting an inspection to determine termite activity coming up the ***inside*** crawl space or basement foundation walls is paramount to protecting Georgia homeowners. The proposed changes from SPF proponents seems to eliminate these important inspection gaps by striking section R402.2.11 and this would be a giant step backwards.

Moisture

Moisture has been continuously stated by SPF proponents as a major concern with the GASPCC proposal, but they have provided no information on how SPF interacts with moisture. The same properties that permit SPF to exclude moisture from external sources, would hold moisture against wood components if there is a leak or faulty construction, consistent with the problems identified with a similar product and problem in the 90's, "Rigid Board Insulation or *DRYVIT*". This has already been experienced, as the UGA SPF Demonstration Project showed higher wood moisture content in wood that was behind or under spray foam after the foam was removed. Wood decay fungus grows and damages wood when the wood moisture exceeds 22%.

In the two pictures below, you can see common moisture situations that occur at the FFI when drainage on the exterior of the home is not moving water way from the structure.

How much unseen damage will occur and how long will it take for it to be visible if this area is covered with spray foam?

One thing is the homeowner will be the one stuck with any remediation problem!

Inspections

It is important to remember that wood destroying organism inspections are defined in the GASPCC rules as a visual inspection that includes sounding and probing of structural members for subterranean termites that eat wood undetected from the inside out. The structural integrity of wood members must be sounded and probed to determine the extent of activity or damage. Additionally, the industry utilizes multiple technologies to aid in the detection and identifying the extent of activity or damage in a structure. This is contrary to SPF proponents' outrageous comments that these technologies are not used by the pest management industry, and practitioners are either completely unaware or refuse to admit the potential of utilizing these tools.

SPF proponents also continue to put forward a narrative about termites ***"posing significant concerns with or without spray foam and inspections for termites being only 33% effective because of hidden pathways that exist in structure".*** The pest management industry fully understands the limitations we have with the amount of a structure that is visible, but unlike SPF proponents the pest management industry continuously adapts and offers consumers in Georgia termite protection with highly effective treatments and inspections by skilled, knowledgeable and state licensed individuals. In addition, homeowners are protected by licensed and regulated pest management companies who offer warranties on the work provided, and protection against future infestations. SPF proponent's narrative on the state of the pest management industry is disingenuous and misinformed as they propose to cover, without assuming any responsibility, the ***most important area*** for WDO inspections afforded within a structure, the framing foundation interface.

Conclusion

Spray foam proponents continue to state that the pest management industry should get with modern times and technology, while recommending ineffective, arcane, decades old technology such as termite shields and, deflecting the issue to home builders in their latest proposal.

The pest management industry has been patient, professional and accommodating throughout this code recommendation process, but the approaches being taken by the SPF proponents is unabashedly self-centric and does nothing to resolve the concerns raised.

The latest SPF proponent's proposal is another attempt in their consistent approach taken throughout this entire process, which deflects responsibility and liability so they can simply continue to do what they have been doing with no recourse or concern for Georgia homeowners.

Proposed change

The proposal the SPCC has put forward is not new, it is one of the accepted practices for air sealing and insulating the framing and foundation interface, currently being taught by SOUTHFACE INSTITUTE. Additionally, the GA Energy Code in the Residential Field Guide (page 17) states, ***"the band area of a conditioned crawlspace must be air sealed and insulated. It is strongly recommended that the band area be insulated with a removable insulation product to provide access for pest control inspection".***

We respectfully reiterate that the code's wording be modified as follows:

"The band area (framing and foundation interface) of a conditioned crawlspace must be air sealed and insulated. It is required to air seal with caulk or foam at the joints connecting the floor sheathing above and the top of the foundation and be insulated with a removable insulation product to provide access for pest control inspections."

Mr. Ted Miltiades, Director
Office of Construction Codes and Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

12 April 2021

Mr. Miltiades:

I am writing in support of Georgia's adoption of the 2018 International Existing Building Code (IEBC). As an architect who primarily works with adaptive use and historic preservation projects, I see a need for flexible building codes that address specific needs of existing buildings, as the IEBC provides.

Practicing in Georgia since 1991, I have worked with the adaptive use and rehabilitation of existing buildings large and small; in big cities and rural settings; for public and private owners; and to house a variety of functions. I believe the additional flexibility given to reviewing authorities by the IEBC will encourage even more reuse of our existing and historic buildings.

Thank you again for considering the benefits that could result if the IEBC is adopted as mandatory by the State of Georgia.

Sincerely,

Thomas F. Little

Thomas F. Little, AIA
Thomas Little Architect
145 15th Street NE
#1205
Atlanta, Georgia 30309
404-783-6211

MACON-BIBB COUNTY
Building & Fire Safety
200 Cherry Street, Suite 202
Macon, GA 31201
Office: (478) 803-0466 ● Email: buildingpermits@maconbibb.us

April 13, 2021

Georgia Department of Community Affairs
Office of Construction Codes & Industrialized Buildings
Attn.: Mr. Ted Miltiades, Director
60 Executive Park South NE
Atlanta, GA 30329

Re.: Support of 2018 International Existing Building Code as a statewide mandatory code

Director Miltiades,

As the Chief Building Official for Macon-Bibb County, our community faces a challenge that is systemic across the United States that is specific to communities having older existing buildings. These structures, when left unused become a blight on the community and a drain on our local resources.

The prescriptive based design option found within the model codes does not offer a clear path or process to allow these buildings to be recommissioned for the benefit of the community. Which is way you see large areas of older municipalities with vacant and vandalized buildings that are not contributing to the tax base, while creating safety issues for the public and first responders.

Over the past year, under my leadership of the Building & Fire Safety office we have addressed our community's aging building stock through the recognition of the International Existing Building Code as an alternate method of design. This requires that the registered design professional petitions the Chief Building Official for recognition and use of the International Existing Building Code for the duration of a specific project.

As proponents for the use of the International Existing Building Code as a statewide mandatory code, our office supports the Department of Community Affairs' recognition of this code for that purpose. As a mandatory code, if will allow our property owners, registered designers, and the regulatory communities a clear pathway and ability to cohesively solve the blight within our county. While making these existing buildings safer for the occupants, the public at large, and first responders.

If you have any questions or concerns, please feel free to contact me directly at (404) 938-3422, or via email at dwilkins@maconbibb.us.

Sincerely,

Don Wilkins, C.B.O., C.F.M., M.C.P.
Chief Building Official

bTbB inc.
ARCHITECTS | PLANNERS

April 12, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Subject: Adoption of 2018 International Existing Building Code (2018 IEBC)

Dear Mr. Miltiades:

As an Architect who works extensively with building renovations of both a historic and non-historic nature, I constantly balance the desire to maintain existing buildings with my professional duty to ensure they meet requirements to protect the Health, Safety and Welfare of the public. From my experience, renovating existing buildings provides several key advantages, as follows:

- Preservation – the rich Architectural history of Georgia's cities deserves to be carried forward for a new generation to experience. The 2018 IEBC provides creative solutions for design professionals to align the intent of the code with the heart of the built environment.
- Sustainability – through the reuse of these structures, the embodied energy inherent from their initial construction allows for less output from today's burdened infrastructure.
- Affordability – Georgia's robust Historic Buildings and Low-Income Tax Credit programs provide monetary incentives to renovate our historic buildings instead of allowing them become dilapidated, and the provisions of the 2018 IEBC provide the mechanism to warrant their success.

Thank you for your consideration of this vital change to our state building code.

Sincerely,

William A. Stanford II, AIA + LEED Green Associate

WAS/prs

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Atlanta, GA 30303
404.522.8888 T
404.521.6204 F

www.ssoe-sw.com

April 12, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

RE: Adoption of 2021 IEBC Amendment

Dear Ted:

SSOE | Stevens & Wilkinson has been involved in the renovation of historic buildings throughout the State of Georgia for a wide variety of clients ranging from the USG Board of Regent, and private, universities and colleges; the Department of Natural Resources; the Georgia Building Authority; State Property Office; and other institutional, nonprofit and for-profit business and property owners.

We believe in the sustainable mission of renovation projects and appreciate the environmental impact of building conservation. We believe that historic structures are a crucial component to any community either in their original use or re-purposed to satisfy other needs. Conservation and reuse of existing building stock not only reduces the community's carbon footprint but improves the quality of life and promotes community identity.

We have found that having IEBC to rely on in our work for renovation projects, in downtown Atlanta for example, advantageous for all parties involved. The IEBC code is written in concert with the IBC which is very helpful, especially for renovation projects of historic buildings that have a change of occupancy classification or changed to mixed use occupancy. The IEBC facilitates discussions with permitting and code enforcement officials. We support this proposed change from permissive to adopted with Georgia amendments.

Should you have any questions, please contact me directly at 404-797-0747 or tdolson@stevens-wilkinson.com. Thank you for your consideration of this request.

Sincerely,
SSOE | S&W

Todd Dolson, AIA
Principal

cc: Jimmy Reynolds, DCA

Mrs. Kelly Albrecht, AIA
771 Broad Street, Suite 200
Augusta, GA 30901

April 13, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Dear Mr. Miltiades,

I am writing this letter in support of adopting the 2018 IEBC with Georgia amendments as a mandatory code. As Georgia's second oldest city, Augusta is home to many historical buildings, and we are advocates of the preservation necessary to maintain our rich culture and history.

This code amendment will help to facilitate the renovation of historic buildings by providing architects and design professionals with the tools needed to clearly address issues arising during the design process. The flexibility and coordination that passing this amendment as code provides is a huge benefit to encouraging the reuse of buildings, of which the urban fabric of our downtown depends on heavily. Many of our existing buildings downtown currently remain vacant, because of the inflexibility of renovating the spaces.

The potential for historic tax credits will also hold much leverage with our clients, and to help encourage the reuse of buildings. Augusta has so much potential to make our city thrive through our existing buildings; to boost our economy, our culture, and our character. I would kindly request that you consider adopting this code amendment as mandatory code.

Sincerely,

Kelly Albrecht

Kelly Albrecht, AIA
AIA Augusta

Mrs. Kelly Albrecht, AIA
771 Broad Street, Suite 200
Augusta, GA 30901

April 13, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Dear Mr. Miltiades,

I am writing this letter in support of adopting the 2018 IEBC with Georgia amendments as a mandatory code. As Georgia's second oldest city, Augusta is home to many historical buildings, and we are advocates of the preservation necessary to maintain our rich culture and history.

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The potential for historic tax credits will also hold much leverage with our clients, and to help encourage the reuse of buildings. Augusta has so much potential to make our city thrive through our existing buildings; to boost our economy, our culture, and our character. I would kindly request that you consider adopting this code amendment as mandatory code.

Sincerely,

Kelly Albrecht

Kelly Albrecht, AIA
AIA Augusta

Altman + Barrett Architects

P.O. Box 665 Hahira, GA 31632
117 W. Main Street Hahira, GA 31632
Phone: 229-585-9018

www.altmanbarrettarchitects.com
mail@altmanbarrettarchitects.com

Walter Altman, AIA, Principal
Keith Barrett, AIA, Principal

April 13, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

RE: Adoption of 2021 IEBC Amendment

Dear Mr. Miltiades:

Over the past decade Altman + Barrett Architects has had the opportunity to build an extensive portfolio of projects pertaining to historic design and preservation. A large part of our designs are based on the standards and rehabilitation guidelines, much of which the IEBC provides.

Restoration of historical structures should be a responsibility for architects, forcing us to be conscious of the surrounding vernacular and our environment. Being LEED Certified, I try to find ways to reduce new material waste, implement existing built components, and promote the heritage of a community by adapting the built environment. In a way, historical preservation and rehabilitation can be seen as a necessary element in the construction industry. The benefits of designing a facility for adaptive reuse, rehabilitation, or preservation are diverse and provide a positive impact on both the community and its environment.

As an architect I heavily rely on codes and manuals for everyday reference. The IEBC is a go to tool for, not only historical preservation, but renovations to any existing facility that were designed before code requirements were introduced. By adopting the Permissive IEBC with all Georgia Amendments, architects and end users can reduce the overall carbon footprint of a community while promoting sustainability and resiliency. As President of Southwest Georgia AIA, I speak for all members in support of adopting the IEBC as the rehabilitation code for existing buildings.

If you have any questions or concerns, please feel free to reach me at 229-585-9018 or email me at kwilkerson@altmanbarrettarchitects.com.

Respectfully submitted,

Kyle Wilkerson, AIA, LEED AP BD+C

cc: Jimmy Reynolds, DCA

HISTORIC
MACON
FOUNDATION

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Dear Mr. Miltiades,

Historic Macon Foundation has been involved in the renovation of historic buildings in Macon since 1964. We employ a full time licensed contractor, building crew and architect and are just launching a Trades Program and community Tool Library to support the work of historic preservation in our community.

We believe in the sustainable mission of renovation projects and appreciate the environmental impact of building conservation. Historic structures are a crucial part of our community either in their original use or re-purposed to satisfy other needs. Conservation and reuse of existing building stock not only reduces the community's carbon footprint but improves the quality of life and promotes community identity. In the current climate of hyper-inflated building material costs for new construction, renovations and adaptive reuse projects will continue to be the most affordable option for many clients. It's our belief that historic preservation work will grow exponentially in the coming months and help keep the construction business viable through these uncertain economic times.

The IEBC code is written in concert with the IBC which is very helpful, especially for renovation projects of historic buildings that have a change of occupancy classification. The IEBC facilitates discussions with permitting and code enforcement officials. We support this proposed change from permissive to adopted with Georgia amendments.

Thank you for your consideration of this request.

Sincerely,

Ethiel Garlington
Executive Director

PO Box 13358
Macon, GA 31208
www.historicmacon.org

AIA
Middle Georgia

April 13, 2021

Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Dear Mr. Miltiades:

I am writing to appeal to the consideration of the 2018 International Existing Building Code by DCA as a mandatory code. Macon and the communities of Middle Georgia have a longstanding history of maintaining their historic structures which provide cultural significance, context and pride. Numerous examples of success stories from our membership's respective portfolios are recognized statewide, nationally and internationally for their contribution to the historic landscape.

As with any worthy endeavor, the completion of these projects have their own unique sets of challenges. Our membership believes that relief from these hurdles to successful projects is possible through the adoption of the 2018 IEBC which allows for more flexible, creative and sustainable outcomes to generally prohibitive code provisions. Additionally, the framework of this prescriptive code enhances relationships from the design, construction and code enforcement communities through fostering a "teamwork" attitude.

Finally, consider that the state of Georgia has adopted the Life Safety Code 101 alongside the IBC. The LSC 101 code contains separate chapters for Existing and New Occupancies. These companion chapters are written to work with each other in each published edition of the code. Similarly, the IBC and IEBC are written to work alongside one another. The use of the 2012 IBC to address the existing structures is akin to using the New Occupancy chapters of 2018 LSC 101 with Existing Occupancy chapters of 2012 LSC 101. This approach does not seem seasonable and neither does the use of 2018 IBC for new construction with 2012 IBC for existing facilities.

Considering all of the above, the Executive Board of AIA Middle Georgia requests that DCA approve the adoption of the 2018 IEBC as a model code for Georgia. Thanks in advance, for your consideration.

Sincerely,

Wood III

Joseph C. Wood III, AIA
2021 AIA Middle Georgia President

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IA INTERIOR ARCHITECTS GLOBAL ALLIANCE

April 13, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Re: 2018 IEBC – Mandatory Code

Dear Ted:

It is my understanding that the 2018 IEBC proposed Amendments will be coming up for vote tomorrow by the GA Department of Community Affairs (DCA). I wanted to send you a quick note asking you to consider passing the proposed amendment submitted by the American Institute of Architects (AIA), Georgia Association *advocating for the adoption or the 2018 IEBC with Amendments as a mandatory code in Georgia.*

I am a Georgia licensed Architect with a primary focus on interior planning/development within existing office buildings. This amendment would have definite benefits to any architect/designer providing services within the Commercial Building realm and offers the following benefits:

- Levels the playing field throughout the State where all jurisdictions would be applying the same codes to existing buildings.
- Provides additional guidance where renovations are provided in buildings and help cap the total level of upgrades required to make the building compliant with *current* adopted codes that are cost prohibitive or impossible to provide:
    - Major structural upgrades due to updated seismic codes
    - Upgrades to existing plumbing counts in multi-story office buildings due to current occupancy calculations and updated plumbing codes.
    - Upgrades to existing building architecture where existing life safety requirements are not possible (separation of exit stairs, travel distances, etc.) as the buildings were designed to previous model building codes.

The IEBC provides a level of clarity to all Architects and Interior Designers regarding existing buildings and the necessary levels of sustainability, historic preservation, accessibility, feasibility of construction, etc. that must be provided within any project in an existing building.

Thank you for your consideration.

Regards,
INTERIOR ARCHITECTS, INC.
Mark Schroeder, AIA
Technical Director

AIA
Savannah

C. Adam Drummond, Assoc. AIA
Advocacy Director, AIA Savannah
222 East Bay Street
Savannah, GA 31401
270.991.0705
Adam@a101.design
4/13/2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Dear Mr. Miltiades

I am writing today on behalf of the American Institute of Architects Savannah to express our support for proposed amendment Item Number IEBC-2022-10. *The 2018 International Existing Building Code (IEBC) with Georgia amendments* has been adopted by the Georgia DCA as a permissive code. We propose adopting the 2018 IEBC with Georgia amendments as a mandatory code.

The 2018 IEBC would allow architectural professionals more options and clarity when working with both clients and building officials when improving the overall safety of an existing structure. Being able to sustain a local building increases the general wellbeing of properties users while establishing resiliency in the community.

For an owner of an existing building, any flexibility in retrofitting a building instead of constructing a new structure encourages finical investment to revitalize established properties. This allows for cost-effective business creation and growth, lowers costs to existing utility and infrastructure use, and improves the ability to generate local tax revenue.

We ask the committee to make the 2018 IEBC with Georgia amendments a mandatory code. This change will be beneficial to existing residential, commercial, educational, and industrial buildings in both rural and urban environments.

Sincerely,

C. Adam Drummond, Assoc. AIA
Advocacy Director, AIA Savannah

HISTORIC
SAVANNAH
FOUNDATION

321 E. York Street
P. O. Box 1733
Savannah, GA 31402-1733
P: 912.233.7787 F: 912.233.7706

April 13, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, GA 30329

Dear Mr. Miltiades,

On behalf of Historic Savannah Foundation, I am writing in support of the AIA, Georgia Association initiative to update the International Existing Building Codes with the Department of Community Affairs.

As one of the one of the most respected preservation foundations in the country Historic Savannah Foundation wholeheartedly supports the use and reuse of existing buildings.

We strongly support this amendment for the following reasons:

- Reuse of existing buildings protects the cultural and architectural heritage of Savannah. They can enrich our neighborhoods and communities; and preserve our history.
- Reuse of existing buildings can help Savannah meet our affordable housing needs; this is a critical issue not only for Savannah but for the entire state of Georgia.
- Reused buildings are significantly more sustainable than new buildings.

Thank you for the consideration.
Sincerely,

Susan Adler, MA
CEO & President
Historic Savannah Foundation

cc: Mr. David Southerland
Mr. Jimmy Reynolds

BUILDING SCIENCES
COLUMN


Joseph W. Lstiburek

Dirty Harry Does Insulation[*]

A Good Insulation Always Knows Its Limitations

BY JOSEPH W. LSTIBUREK, PH.D., P.ENG., FELLOW ASHRAE

After all these decades, thermal performance should be pretty non-controversial. How complicated can it be to insulate a building and make it airtight? The physics is pretty straightforward. But then you get sales people and marketing people involved, and the physics gets twisted and people get annoyed.[†] For the record I like all insulations—yup, all of them. I think they are all good, but they all have limitations.

What is nice about where we are right now, after all these decades, is that we have performance requirements specified in the Model Codes for thermal resistance for roofs, walls and foundations, and we have airtightness performance requirements specified in the Model Codes for air barrier materials, air barrier assemblies and air barrier enclosures.[‡] We also have airtightness performance requirements for duct distribution systems in the Model Codes. Buildings are required to be airtight and are tested for compliance.[§] Ducts are required to be airtight and are air tested for compliance.[#] In terms of insulations and insulation systems, install them correctly, and they provide the thermal resistance expected. Let me repeat that. Install them correctly, and they work.

Here is something that should be obvious. It is a very, very bad idea to try to trade off thermal resistance for increased airtightness because the Model Code minimum airtightness is already so low. Let me repeat. It does not matter because we are already so "tight." We build tight—and sometimes ventilate right ("Unintended Consequences Suck," *ASHRAE Journal*, June 2013 and "Deal with Manure & Then Don't Suck," *ASHRAE Journal*, July 2013).

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[*] "Dirty" Harry Callahan. "A good man always know his limitations." "Magnum Force," 1973, Clint Eastwood as Harry Callahan.

[†] In the 1990s I developed the technology behind unvented and conditioned roof assemblies using spray polyurethane foam (SPF) with help from the U.S. Department of Energy's "Building America Program" and got it accepted by the Model Codes and managed to irritate the manufacturers of fiberglass, cellulose and mineral wool insulation. Then in the mid-2000s I developed the technology behind unvented and conditioned roof assemblies using fiberglass, cellulose and mineral wool with help from the U.S. Department of Energy's "Building America Program" and got it accepted by the Model Codes and managed to irritate the manufacturers of spray polyurethane foam (SPF) insulation.

PHOTO 1 Foil-Faced Polyisocyanurate Boards. The rigid insulation boards are installed on the exterior of framing with their joints taped/sealed and act as the water control layer, air control layer, vapor control layer and thermal control layer—all four control layers.

PHOTO 2 Extruded Polystyrene (XPS) Boards. The rigid insulation boards are installed on the exterior of framing with their joints taped/sealed and act as the water control layer, air control layer, vapor control layer and thermal control layer—all four control layers.

PHOTO 3 Mineral Wool Board Insulation. The insulation boards installed on the exterior of framing can act as the thermal control layer, but they need to be coupled with a water control layer, air control layer and vapor control layer. Mineral wool board insulation can do only one of the control layers.

Here is another thing that is obvious. Some insulations can also act as air control layers (aka air barriers), in addition to acting as thermal control layers. It gets even more interesting. Some can also act as vapor control layers—or not—and some can also act as water control layers (aka water resistive barriers [WRBs] or drainage planes). Some can act as all of the above. Some can't. Let's look at a bunch of common insulations and see what they can do—and what they can't do.

Foil-faced polyisocyanurate boards installed on the exterior of framing with their joints taped/sealed can act as the water control layer, air control layer, vapor control layer and thermal control layer—all four control layers (*Photo 1*). So can extruded polystyrene (XPS) boards (*Photo 2*).

Mineral wool board insulation installed on the exterior of framing can act as the thermal control layer, but it needs to be coupled with a water control layer, air control layer and vapor control layer (*Photo 3*). It can do only one of the control layers ("Hot and Wet But Dry," *ASHRAE Journal*, June 2016).

Let's look at structural insulated panels (SIPs). They can act as the air control layer, vapor control layer and

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[‡] These requirements came from my work also through the U.S. Department of Energy's "Building America Program." Air impermeable insulation is 0.02 $L/s{\cdot}m^2$ at 75 Pa (.004 cfm/ft^2 at 0.01 psi)—basically the leakage through gypsum board (aka "drywall"). Air barrier enclosures for buildings are 2.00 $L/s{\cdot}m^2$ at 75 Pa (0.4 cfm/ft^2 at 0.01 psi)—see "Understanding Air Barriers," *ASHRAE Journal*, July 2005. Residentially, the Model Codes call out 3 ach at 50 Pa (0.007 psi) for houses constructed in cold and mixed climates and 5 ach at 50 Pa (0.007 psi) for houses constructed in hot climates. The reason for the difference between the climates is that in cold and mixed climates we have basements–great places for ductwork and mechanical systems. Where we have slabs with vented attics and vented crawlspaces with vented attics with ductwork and mechanical systems in them, it is not easy to get to 3 ach at 50 Pa (0.007 psi). Hence, the "push" to unvented and conditioned roof assemblies and unvented and conditioned attics and crawlspaces—easy to get to 3 ach at 50 Pa (0.007 psi). The problem is not leaky ducts, but all those penetrations the ducts and boots go through.

[§] It is amazing when you think about this: in the 1980s and 1990s, houses were 5 ach at 50 Pa (0.007 psi) to 15 ach at 50 Pa, and now they are at 3 ach at 50 Pa to 5 ach at 50 Pa.

[#] It is even more amazing that in the 1980s and 1990s, ductwork leakage was typically between 10% and 30% at 25 Pa (0.004 psi), and now it is typically between 3% and 5% at 25 Pa.

Joseph W. Lstiburek, Ph.D., P.Eng., is a principal of Building Science Corporation in Westford, Mass. Visit www.buildingscience.com.

PHOTO 4 Structural Insulated Panels (SIPs). They can act as the air control layer, vapor control layer and thermal control layer, but not the water control layer. They need to have a water control layer installed on their exterior.

PHOTO 5 Insulated Concrete Forms (ICFs). They can act as the air control layer, vapor control layer and thermal control layer. They need to have a water control layer installed on their exterior or a cladding such as polymer-based stucco directly attached to their exterior face, creating a barrier wall mass assembly.

PHOTO 6 Spray Polyurethane Foam. When you spray closed-cell, high-density spray polyurethane foam (ccSPF) on the exterior of gypsum sheathing or plywood or OSB, it can act as the water control layer, air control layer, vapor control layer and thermal control layer—all four control layers.

PHOTO 7 Spray Polyurethane Foam Roofing. A fluid-applied roofing membrane can be applied directly to the ccSPF. The Louisiana Superdome was successfully repaired with this approach after Hurricane Katrina.

thermal control layer (*Photo 4*). They need to have a water control layer installed on their exterior.

How about insulated concrete forms (ICFs)? They can act as the air control layer, vapor control layer and thermal control layer (*Photo 5*). They need to have a water control layer installed on their exterior or a cladding such as polymer-based stucco directly attached to their exterior face, creating a barrier wall mass assembly ("High-Rise Igloos," *ASHRAE Journal*, April 2009).

Now let's look at spray polyurethane foam. When you spray closed-cell, high-density spray polyurethane foam (ccSPF) on the exterior of gypsum sheathing or plywood or OSB, it can act as the water control layer, air control layer, vapor control layer and thermal control layer (*Photo 6*)—all four control layers ("Exterior Spray Foam," *ASHRAE Journal*, November 2010). Works for roofs as well—a fluid-applied roofing membrane can be applied directly to the ccSPF. The Louisiana Superdome was successfully repaired with this approach after Hurricane Katrina (*Photo 7*) ("How Not to Build Roofs," *ASHRAE Journal*, March 2008).

Open-cell, low-density spray foam

PHOTO 8 Open-Cell Spray Polyurethane Foam (ocSPF). When you spray ocSPF into wall cavities from the interior, the ocSPF can act as the air control layer and thermal control layer. It can't act as the vapor control layer. It is too vapor open. This is an issue when you spray ocSPF on the underside of roof/attic assemblies, and you can end up with problems ("Ping Pong Water and the Chemical Engineer," *ASHRAE Journal*, October 2016).

(ocSPF), if applied on the exterior of wall assemblies, can't act as the water control layer. A fluid-applied water control layer needs to be applied over its exterior surface.

When you spray ccSPF into wall cavities from the interior, the ccSPF can act as the air control layer, vapor control layer and thermal control layer ("Interior Spray Foam," *ASHRAE Journal*, February 2020). When you spray ocSPF into wall cavities from the interior, the ocSPF can act as the air control layer and thermal control layer. It can't act as the vapor control layer. It is too vapor open. This is an issue when you spray ocSPF on the underside of roof/attic assemblies (*Photo 8*), and you can end up with problems ("Ping Pong Water and the Chemical Engineer," *ASHRAE Journal*, October 2016). Water vapor from the interior passes up through the ocSPF and is stored in the wood-based roof sheathing—and then driven out by solar radiation. In and then out, in and then out—a "ping" followed by a "pong," leading to an increase in moisture accumulating at the ridge (*Figure 1*), requiring a means of moisture removal—either air supply and return from the house or a dehumidifier.

Note that this also happens with fiberglass, mineral wool and cellulose (*Photo 9*). All of these insulations also require either air supply and return from the house coupled with a vapor diffusion port or a dehumidifier ("Venting Vapor," *ASHRAE Journal*, August 2015). Further note that none of this is an issue with ccSPF. Let me repeat. None of this is an issue with ccSPF because it is not vapor "open."

On to fiberglass and mineral wool batts installed in wall cavities, roof cavities, on the ceilings of attics or on the underside of roof/attic sheathing. They obviously can't act as the water control layer, the air control layer or the vapor control layer. They can act as the thermal control layer if airflow through them is limited or controlled (*Photo 10* and *Photo 11*). We learned this with our "Thermal Metric Project."[1] In fact, the Thermal Metric Project showed that all cavity insulations functioned if they were combined with air control layers and if convection was controlled (*Figure 2*).

FIGURE 1 "Ping Pong Water." Water vapor from the interior passes up through the ocSPF and is stored in the wood-based roof sheathing—and then driven out by solar radiation. In and then out, in and then out—a "ping" followed by a "pong," leading to an increase in moisture accumulating at the ridge, requiring a means of moisture removal—either air supply and return from the house or a dehumidifier.

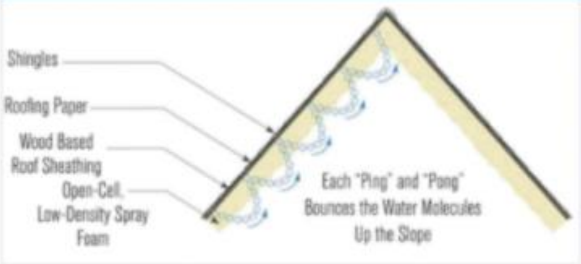


PHOTO 9 Fiberglass and Mineral Wool and Cellulose Underside Roof Deck Insulation. Water vapor from the interior passes up through the vapor open insulation and is stored in the wood-based roof sheathing—and then driven out by solar radiation. In and then out, in and then out—a "ping" followed by a "pong," leading to an increase in moisture accumulating at the ridge, requiring a means of moisture removal—either air supply and return from the house coupled with a vapor diffusion port or a dehumidifier.

Let me be specific and obvious. If batts are installed and fitted "tightly" without voids, they work ("WUFI: Barking Up the Wrong Tree?," *ASHRAE Journal*, October 2015). Additionally, in roof/attic applications windwashing must be controlled ("Bobby Darin and Thermal Performance," *ASHRAE Journal*, October 2012).

How about cellulose—the netted and damp spray kind? They can only act as the thermal control layer (*Photo 12*). They can't act as the air control layer—despite what folks say ("Don't be Dense With Insulation," *ASHRAE Journal*, August 2010). Same with netted blown fiberglass.

What else do we want to look at? Lot's of stuff, but one more biggie—fire. Lots of insulations burn, and lots do not. Those that do not can be made to work ("Rain Screens, Claddings, and Continuous Insulation: Great Fire of London," *ASHRAE Journal*, August 2017). What about embodied energy, carbon footprint, global warming potential? Ah, save that for another day.[II]

Now to sales people and marketing people. I got this argument years ago—and thought we crushed it—but alas, no. Here goes the argument: "If I make my house airtight, I don't need as much insulation." Or "my insulation is so good it makes the house airtight, so I don't need as much insulation."

This argument typically comes from people whose insulation is more expensive than their competitors—so to compete on a cost basis, they want to reduce the amount of insulation. With today's levels of airtightness and duct tightness, you can't reduce thermal insulation and expect the house to perform the same.

The first time I dealt with this was in Florida when I was using low-density spray polyurethane foam to create conditioned attics. Yes, the entire house became more airtight. Yeah! The roof deck/insulation layer became the air barrier and was connected to the top of the walls. But you could also get to the house being more airtight by taping/sealing the joints of the plywood or OSB roof sheathing and installing sealed wood blocking between the rafter tails or the roof trusses. You did not need spray foam to get

PHOTO 10 Fiberglass and Mineral Wool Batts. When they are installed in wall cavities, roof cavities, on the ceilings of attics or on the underside of roof/attic sheathing, they can't act as the water control layer, the air control layer or the vapor control layer. They can act as the thermal control layer if airflow through them is limited or controlled.

FIGURE 2 Cavity Insulation Airflow Pathways. There are 12 possible airflow pathways that can reduce the thermal resistance of cavity insulations. Cavity insulations can act as effective thermal control layers. The Thermal Metric Project[1] showed that all cavity insulations functioned if they were combined with air control layers and if convection was controlled. Let me be specific and obvious. If batts are installed and fitted "tightly" without voids, they work.

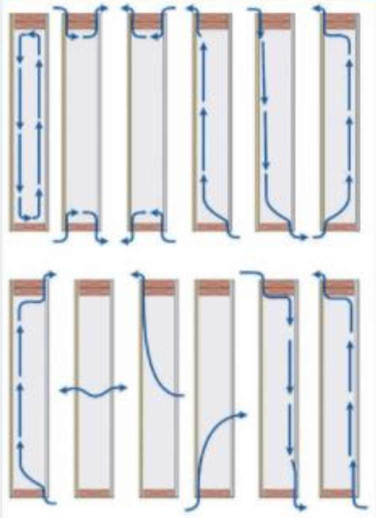
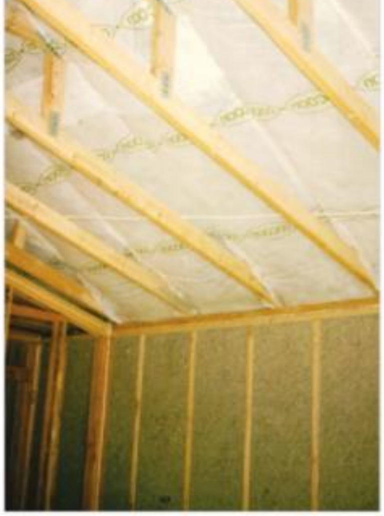


PHOTO 11 Faced Insulation Batts. Airflow and convection can be effectively controlled by facers adhered to batt insulation. Note that faced insulation batts should have the facers installed to the face of the stud framing, not inset stapled. Inset stapling creates voids and air channels that can lead to convective loops and a loss of thermal resistance.

PHOTO 12 Netted and Damp Spray Cellulose. They can only act as the thermal control layer. They can't act as the air control layer or the vapor control layer. Same with netted blown fiberglass.



the airtightness. We showed this with fiberglass and mineral wool insulation ("Venting Vapor," *ASHRAE Journal*, August 2015 and "Conditioned Unvented Attics & Unconditioned Unvented Attics," *ASHRAE Journal*, June 2020).

Foam sales people and marketing people forget one of the code arguments against unvented conditioned attics—when you move the thermal layer from the ceiling to the underside of the roof, the surface area of heat gain/heat loss goes up 30% to 40%.** I had to argue aggressively to not have spray foam roofs penalized because of the increase in surface area. Remember the big issue was leaky ductwork in vented attics. By moving the insulation layer to the underside of the roof deck, I argued that the ducts were now "inside," and if they now leaked it wouldn't matter.

The counter code argument was, "Who cares? We can make ductwork tight, so it does not leak." Yes. True. Ouch. Ducts today are tight wherever they are. (We were here before, "Cool Hand Luke Meets Attics," *ASHRAE Journal*, April 2014.) But I won the battle by saying even tight R-6 ducts were pretty bad in a vented attic when they are above all that R-30 ceiling insulation (now it is R-38 and going up) exposed to all that radiation exchange from the underside of the roof deck. If I could just keep to R-30 on the underside of the roof deck and not be made to increase the thermal resistance of that layer, the increase in surface area of heat gain/heat loss would be compensated for by the way more effective thermal performance of the ductwork that was no longer exposed to the radiation exchange.

The next battle was from attic vent people who argued that vented attics and vented roofs were more energy efficient because all that airflow from the outside would cool the underside of the roof deck. Turned out that was not the case, because for the airflow to be effective, it had to be well coupled to the underside of the roof deck. The airflow was not sufficient to compensate for the radiation exchange between the underside of the roof deck and the top of the insulation layer on the ceiling.

I need to repeat once again that it was lucky to just break even thermally with unvented conditioned attics compared to vented unconditioned attics in the code arena. So now I chuckle in amazement when I hear the current argument: "If I use spray foam on the underside of the roof deck, the increase in airtightness is so significant I can, therefore, reduce the minimum Model Code thermal resistance roof insulation R-value by 20% or 30%."

Let me go back to the beginning. Again, it is a very, very bad idea to try to trade off thermal resistance for increased airtightness because the Model Code minimum airtightness is already so low. Let me repeat. Again, it does not matter because we are already so "tight."

And guess what? Let's say the argument works. Guess what comes next? We already have manufacturers of solar panels, battery storage and high efficiency geothermal systems saying, "Who cares about thermal resistance and airtightness if you use our stuff? We can trade off building enclosure efficiency with solar collectors and conditioning system efficiency improvements. We don't need all that airtightness and thermal insulation."

Sales people and marketing people who sell and market thermal insulation. Be careful what you wish for.

References

1. BSC. 2013. "The Thermal Metric Project." Building Science Corporation. https://www.buildingscience.com/project/thermal-metric-project ■

**It's this Pythagoras and hypotenuse thing.

Building Unvented Attic Assemblies Using Fiber Glass and Mineral Wool

The 2018 version of the International Residential Code (IRC) contains a new alternate compliance path that allows unvented attics to be built using air-permeable insulation (fiber glass and mineral wool) on the underside of the roof deck. Currently the code only allows this practice in Climate Zones 1, 2 and 3 (see map below). The North American Insulation Manufacturers Association is sponsoring research with the Department of Energy to verify the practice can also be used in Climate Zones 4 and 5.

To use fiber glass and mineral wool in unvented attics, the IRC requires 4 basic requirements. These include the roof has the following:

1. A “vapor diffusion port”
2. A moderate slope - greater than or equal to 3:12,
3. No items like blocking prevent the flow of moisture to the port, and
4. Conditioned air is supplied to the attic space.

A **“vapor diffusion port”** is similar to a standard roof or ridge vent except instead of venting hot air from the attic, it prevents air from moving into or out of the attic - but does allow water vapor to leave the attic. One way of building the port is to use typical house wrap in combination with a ridge vent or other roof vents. The area of the port must be at least 1/600th of the ceiling area (Note: example calculation 1 below) and the lowest part of the port must be within 12 inches of the peak of the roof. Although not required by the code, in order to improve the performance of the system, the area of the vapor diffusion port(s) should be as evenly distributed over the roof area as possible.

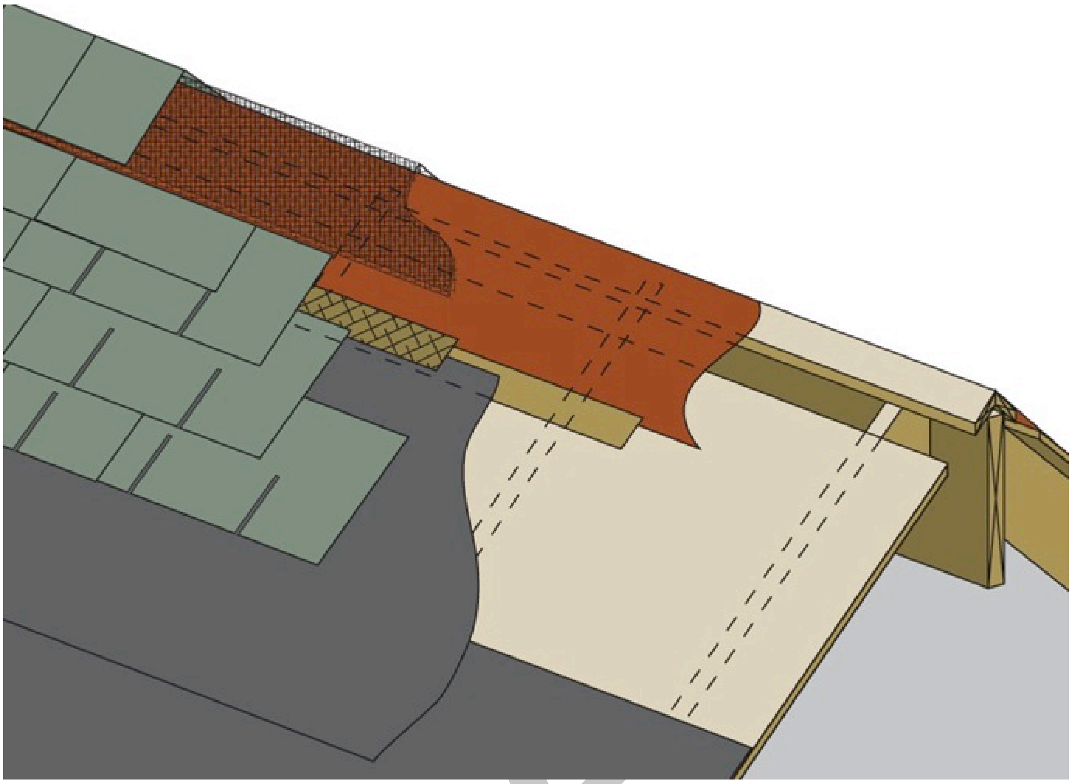
The roof slope must be at least 3:12 because flat or low-slope roofs don’t readily vent moisture. Also, there cannot be obstructions within the insulation (such as blocking between roof trusses) closer than 2 inches to the roof sheathing because this may obstruct water vapor movement within the insulation from easily moving to the vapor diffusion port.

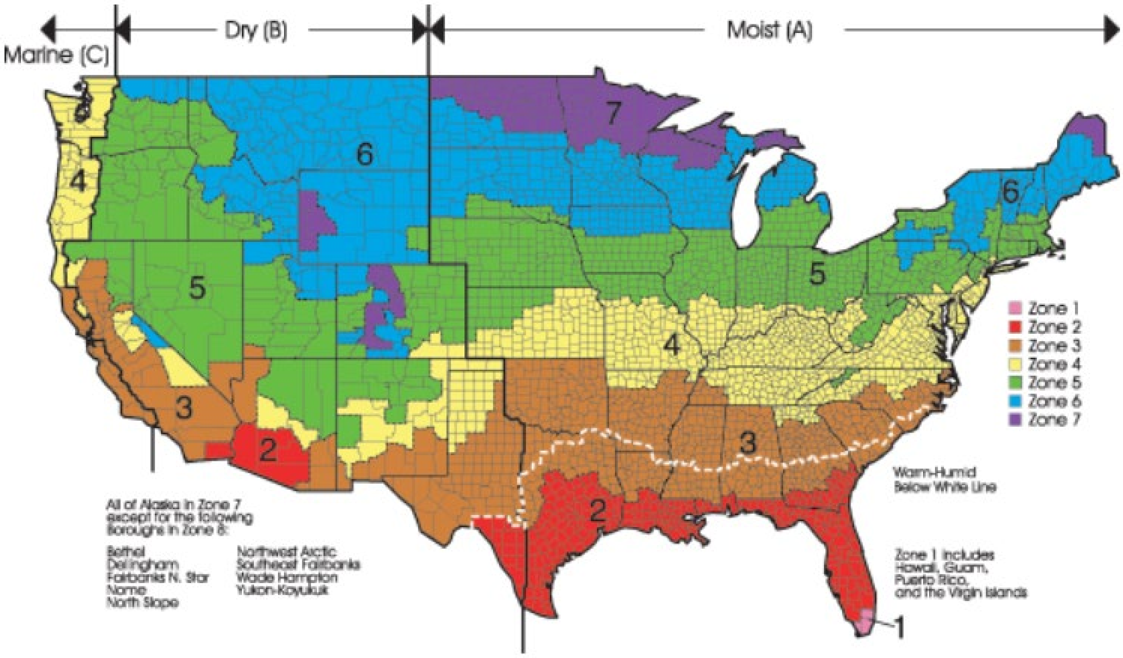
Finally, **the IRC requires at least 50 cubic feet per minute of conditioned for each 1000 square feet of ceiling area be supplied to the unvented attic space** (Note: example calculation #2 below). This helps assure humid air that may be in the attic is diluted and lessens the chance of any condensation issues. All unvented attics are intended to be conditioned as they are a part of the home and this provision in the IRC ensures that this is happening. The home’s standard HVAC system can provide this conditioned air and the air does not need to be continuously supplied. Although this adds additional volume to the home, this practice is not an energy penalty as it improves air tightness and provides better humidity control.

NOTE: This is a summary of the International Residential Code requirements when using air-permeable insulation (fiber glass and mineral wool) in unvented attic applications. For the detailed code requirements refer to section “R806.5 Unvented attic assemblies and unvented enclosed rafter assemblies” in the 2018 International Residential Code.

Calculation 1 – A home with 3500 square feet of ceiling area requires a vapor diffusion port at least 5.83 ft^2 or 840 in^2 (6” x 11’ 8”) (3500/600 = 5.83 ft^2 or 5.83 x 144 = 840 in^2

Calculation 2 – A home with 3500 square feet of ceiling area requires 175 CFM of conditioned air (3500/1000x50=175 CFM)





Analysis – Countering Spray Foam Insulation Reductions

Overview

This document outlines the trade-off paths that already exist with the IECC that permit the reduction in R-value at the roof deck, while making up for these losses through efficiency improvements elsewhere in the home.

IECC Performance Path (R405) Comparison

The trade-off of insulation at the roof deck is permitted under the Performance Path of the code and can be traded off against improvements to the thermal envelope R-values, duct leakage, and whole home infiltration.

Proposed trade-off not viable. Table 1 below displays the results of the proposed trade-off from R-38 down to R-20 and the improved air infiltration rate from 5 ACH50 to 3 ACH50. This proposed trade-off is not permitted under the performance path as it is not energy equivalent to the code minimum home. Even if you were to reduce the air leakage value down to passive house levels of 0.6 ACH50, it does not attain code compliance as it does not make up the energy efficiency lost by reducing the attic insulation at the roof deck.

Options are readily available in current code. Table 1 also outlines several options for complying with the Performance Path while moving the R-value down to R-20. As an example, Option 1 includes basic improvements such as moving from R-13 to R-15 wall insulation and up to R-30 floor insulation as simple trade-offs for moving down to R-20 at the roof deck. These are not the only options available under the Performance Path – combinations of improvements to wall and floor insulation and measured duct leakage are also possible.

Table 1 – Performance Path Trade-off Comparison for Sealed Attics

	GA Code Minimum	R-20 at Roof Deck 3ACH50	R-20 at Roof Deck 0.6ACH50	R-20 at Roof Deck + R405 Option 1	R-20 at Roof Deck + R405 Option 2	R-20 at Roof Deck + R405 Option 3
Wall R-value	13	13	13	15	15	15
Ceiling R-value	38	20	20	20	20	20
Window U-factor	0.35	0.35	0.35	0.35	0.28	0.35
Floor R-value	19	19	19	30	19	19
ACH50	5	3	0.6	5	5	2.5
Energy Budget	548	557	550	547	546	547
R405 Compliant?	-	NO	NO	YES	YES	YES

*Smaller energy budget values indicate a more efficient home – energy budget values must be the same or less than the code minimum energy budget.

Analysis – Countering Spray Foam Insulation Reductions

IECC Prescriptive Path Total UA (R402.15) Comparison

The trade down to R-20 in lieu of R-38 at the roof deck is permitted under the Total UA compliance option. However, this reduction needs to be made up for elsewhere in the thermal envelope. Changes to whole home infiltration are not permitted to be used in the Total UA approach, and therefore insulation levels in walls or floors, or the performance of windows must be improved to make up for the loss in efficiency from reducing the attic insulation. Table 2 below outlines the two paths for compliance out of an innumerable combination of options for builders that wish to install R-20 at the roof deck.

Table 2 – Total UA Trade-off Comparison for Sealed Attics

	GA Code Minimum	R-20 at Roof Deck	R-20 at Roof Deck + UA Option 1	R-20 at Roof Deck + UA Option 2
Wall R-value	13	13	15	15
Ceiling R-value	38	20	20	20
Window U-factor	0.35	0.35	0.35	0.28
Floor R-value	19	19	30	19
Total UA	470.5	500.1	470.2	463
R402.1.5 Complaint?	-	NO	YES	YES

*Smaller Total UA values indicate a more efficient the thermal envelope – Total UA values must be the same or less than the code minimum Total UA.

Analytical Assumptions

Home prototype. DOE prototypical home. 2 stories, 2376 sqft, 15% window to floor area, basement foundation. For more information visit: https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology

Georgia Code. https://www.dca.ga.gov/sites/default/files/iecc2020_gaamendments_revised03082018.pdf

Location. Located in Atlanta GA IECC Climate Zone 3A

Software. REM/Rate v16.0

AIA Atlanta

Sent via email to ted.miltiades@dca.ga.gov and jim.reynolds@dca.ga.gov with hard copy to follow via U.S.P.S.

April 12, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Re: Georgia IEBC Code

Dear Mr. Miltiades:

Please accept this letter of support of the AIA Georgia proposed amendment to update the state's minimum mandatory building codes from the 2012 IEBC to the 2018 IEBC standard.

The AIA Atlanta chapter represents more than 1,800 architecture professionals in the state, including some of the most active and credentialed firms working on historic preservation, affordable housing, green and sustainable design, and place-centered planning projects. We firmly believe that abandoning the 2012 IEBC, which offers only limited creative solutions for updating and adapting existing buildings, and moving to the current 2018 IEBC platform, is an enormous net positive for owners, communities, and citizens. Moreover, the wider range of options offered to design professionals, building code officials, and owners provides support for all of the key issues mentioned above.

We encourage the State Codes Advisory Committee and the Department of Community Affairs to quickly adopt this amendment, provide our architects and building code officials the most advanced tools to address the challenges of preserving our old building stock, while still ensuring that it can meet the needs of today's citizens, companies, and communities.

Please let me know if you have any questions. Thank you for your time and attention.

Sincerely,

Jennifer Ingram

Jennier Ingram AIA, Chair of Local Advocacy
American Institute of Architects, Atlanta Chapter

cc: David Southerland, Executive Director of AIA Georgia

AIA Atlanta
50 Hurt Plaza, Suite 109
Atlanta, GA 30303

T (404) 222 0099

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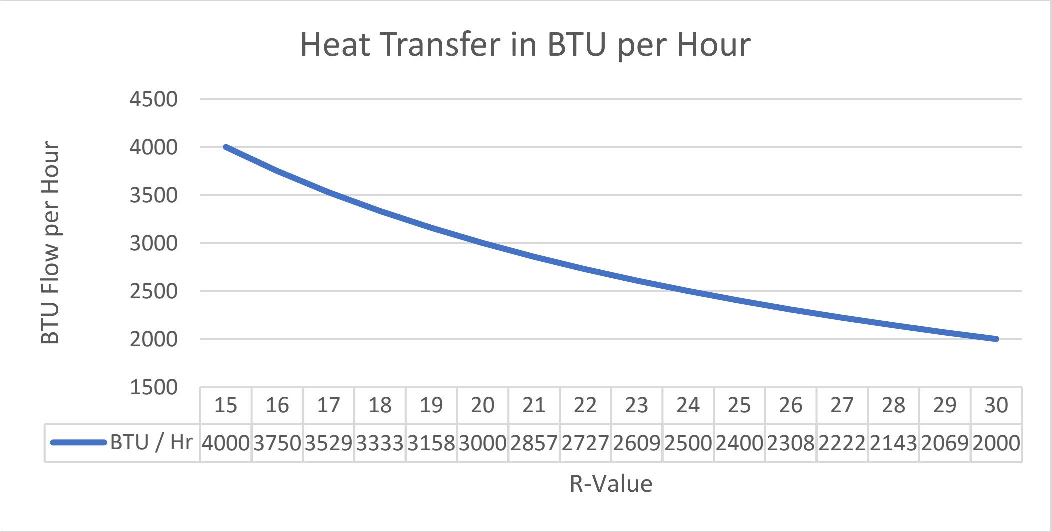
I am Robert De Vries, Director of Product Support and Development for Nu Wool Co. Inc., a manufacturer and distributor of Nu Wool Cellulose and Nu Seal polyurethane spray foam. I have assembled the following information over my concern as to how fragile the thermal boundary may become if the current proposal is accepted.

The point of this exercise is to illustrate how weak the thermal envelope can become when we cut it too thin. There are significant differences between walls and ceilings and each needs to be addressed with the assemblies' practical limitations in mind. Primary to this is the ability to cost effectively add more insulation in an attic. Couple this with the attic being as much as 50% (or more) of the thermal envelope it simply doesn't make sense to "value engineer" this portion of the home.

Specifically in the code proposal #1, IECC /IRC Section 402 / N1102 sets the R-Value at 20. Just a 5% (less than ¼" of closed cell foam) negative deviation in thickness equals a 5% increase in thermal load.

Below is a graphical representation of heat flow. It is a simple model based on the equation:
$Q=A * \Delta T / R$
Q is heat flow per hour in BTU's
A is the square foot area of the assembly
ΔT is the temperature difference between conditions in Fahrenheit
R is the thermal resistance of the assembly in R-Value units

In this case an area of 1,000 sq' with a 60°F differential and R-Values ranging from 15-30 are shown.
The following conclusions can be made from the data:
Heat transfer is not a linear function.
A loss of one R from 20 to 19 represents a 5.3% increase in BTU load while that same loss from R-30 to R29 is only 3.5%



A 60°F delta T may seem excessive one must remember that the roof shingles get very hot due to radiant energy and there is no benefit of ventilation. Below is a chart showing shingle temperatures for a vented and unvented assembly from the Florida Solar Energy Center. This is not for the discussion of shingle durability but rather to illustrate how hot the roof deck gets. Given the current information by climate scientists one could argue this is only going to get worse.

While the preceding chart applies to all thermal insulation there is a concern specific to closed cell plastic foam. Due to the gas used to achieve higher R-Values than materials that use ambient air as the prime insulator (fibrous insulation) there is a change over time in the R-Value. This is known as Long Term Thermal Resistance (LTTR). Foam plastic undergoes a rapid aging test in an attempt to predict this but studies are still being conducted. Some studies show the LTTR could dimmish by as much as 5%-10% in a decade. Consequently a 10% drop equates to almost the same amount of BTU increase.

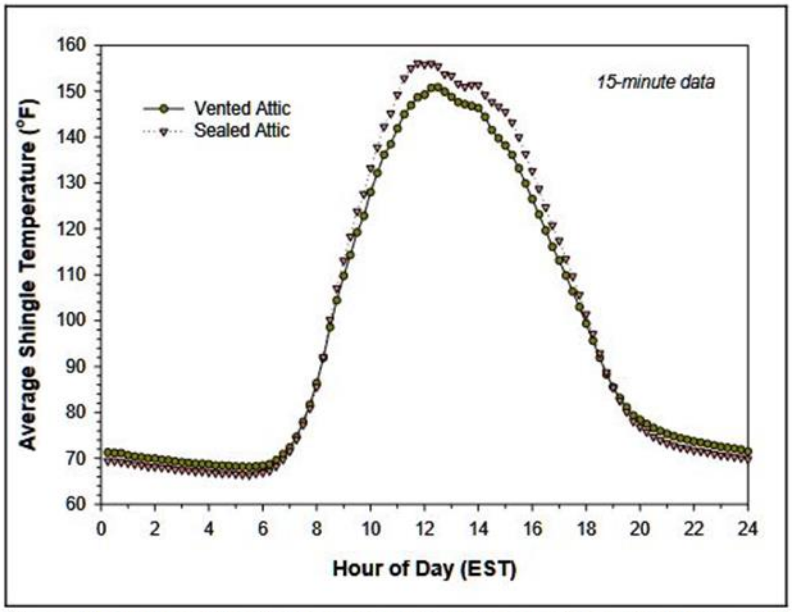


Figure 11. Data on 15-minute average shingle temperatures at FRF over the summer of 2000 in Cocoa, Florida.

From: Phelps, George
To: Jim Reynolds
Subject: EcoBatt Integrated Roof Deck (IRD) | Knauf Insulation
Date: Wednesday, April 14, 2021 1:43:36 PM

Jimmy ,
This is a link to our roof deck insulation system so you can see how it works.
Thanks,
George
703/321-6813

https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.knaufnorthamerica.com%2Fen-us%2Fproducts%2Fbatts-insulation%2Fecobatt-integrated-roof-deck&data=04%7C01%7CJim.Reynolds%40dca.ga.gov%7Cf6fc74ca39034ba7f91c08d8ff6cd162%7Cdc9db449fad64fcd899014394088d4ec%7C1%7C0%7C637540190154212022%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=Vr%2Fgmv42zkLudLavYsQQsntHM3C7w6Hw7QTuabp6d%2F4%3D&reserved=0

Sent from my iPhone

Comments on Georgia Proposed Amendment IECC/IRC 2022-1

Issue Summary

As Georgia has embraced the beneifits of energy efficient homes and an energy code that requires ceiling R-values improve to R-38 and R-49, one manufacturer in the polyurethane spray foam industry is advocating for carve-outs that permit lower R-values when using spray foam in below roof deck attic applications. These proposals are often accompanied by measures like increased ACH50 requirements that are intended to mitigate the reduction in R-value but are not energy equivalent or based on sound building science.

Points

1) **No insulation type is inherently more energy efficient – R-value is R-value.** A recent study by Building Science Corporation (2015) funded by manufacturers across the insulation industry (including spray foam manufacturers) showed that any insulation type, if properly installed with an air barrier, performs to the labeled R-value regardless of material type. https://www.buildingscience.com/documents/special/thermal-metric-documents/thermal-metric-summary-report

2) **Trade-off paths already exists.** The IECC performance path (R405) and Total UA alternative (R402.1.5) within the code already give builders the option to reduce R-value at the roof deck if energy savings are made up for elsewhere in the home (e.g. improved air leakage, duct leakage, or insulation elsewhere).

3) **Trade-offs of thermal performance for reduced air leakage are not equivalent.** Proposals often cite a Building Science Corporation (BSC) study from 1999. This BSC study was published prior to the creation and widespread adoption of the IECC, which includes stringent air leakage testing and duct leakage testing targets that did not exist at the time of the BSC study. The code already mandates stringent air tightness targets. Trade offs against thermal performance to meet these targets result in a less energy efficient home. https://www.buildingscience.com/documents/reports/rr-9904-unvented-cathedralized-attics-where-we-ve-been-and-where-we-re-going/view

4) **It's a bad idea to trade off thermal performance for envelope tightness.** One of the nations leading building scientist, Dr. Joseph Lstiburek wrote an article for the Building Science Column in the April 2021 Issue of the ASHRAE Journal titled "A Good Insulation Always Knows Its Limitations". The article outlines all insulation and their properties. The article states that it is a very bad idea to trade off any thermal resistance with air leakage. He states that air leakage is so tight in modern codes that it is irrelevant to trade any thermal resistance against it. He goes on to state that trading off any thermal resistance against air leakage, or duct leakage is a bad idea, the home will not perform the same if done so. While Georgia has amended their air leakage to 5 ACH50, this is still considered extremely tight compared to older homes. https://technologyportal.ashrae.org/Journal/ArticleDetail/2292

5) **Energy Codes should not be designed to show favor on one manufacturer**. This proposal carves out a prescriptive alternative for one insulation manufacturer. The codes should no shape out paths that favor one product over another. ICC notoriously has rejected proposals based on these reasons.

Georgia REALTORS®

6065 Barfield Road NE ● Atlanta, Georgia 30328-4402 ● p: (770) 451-1831 ● f: (770) 458-6992 ● toll free: (866) 280-0576 ● www.garealtor.com

April 27, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Re: Structural Pest Control Commission Proposed Amendment

Dear Mr. Miltiades:

For over 100 years, the Georgia REALTORS® have served as the voice of real estate and homeownership in our great state. With that voice we have and continue to advocate for sound policies that protect the homeowners of Georgia.

The Structural Pest Control Commission has proposed an amendment to the building code regarding spray-foam insulation. This proposal would establish a protocol through which pest control inspections would be able to more readily identify emerging infestations, or offer a report of the absence of infestation, without obfuscation of the insulation. As the ability to identify and treat the home for pests is a critical component to homeownership, this matter is of great interest to our association. Thus, on behalf of 49,000 Georgia REALTORS®, we feel that this proposal is in the best interest of the homeowner and support the adoption of this amendment by the Energy, Residential, and Building Amendments Subcommittee at its May 4, 2021, meeting.

For the Georgia REALTORS®,

Dorrie G. Love

Dorrie Love, 2021 President

Certified Pest Control Operators Association of Georgia
"Promoting Professionalism for the Pest Control Industry"
PO Box 490164 / Lawrenceville, GA 30049
t: 770-338-1050 / f: 770-338-2090

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

RE: **Energy, Residential, Building Amendments Subcommittee – Proposed Georgia Structural Pest Control Commission Amendments**

Dear Mr. Miltiades,

The Certified Pest Control Operators Association of Georgia (CPCO of GA) currently has more than 425 pest management companies who are active members in the state-wide association. Our membership represents sole proprietors, small-medium businesses and some larger corporate affiliates totaling over 2500 licensed operators and technicians.

The pest management industry is a major contributor to the economy and is critical for health and welfare of our citizens. As an essential workforce who protects people's largest asset (their home) and helps maintain sanitary conditions both residentially and commercially, our licensed professionals must be able to accomplish these tasks free from barriers that obstruct their ability to do a thorough and adequate inspection for consumers.

CPCO of GA's mission statement is "To Promote Professionalism for the Pest Control Industry". Pest management professionals (PMPs) in GA are proud to have an excellent working relationship with the Georgia Department of Agriculture's Structural Pest Division as the regulatory arm for the industry. Our state has been a noted national forerunner for guidance when issues arise in the industry. Many other states have developed policies and procedures from GA's efforts to put quality decisions into action.

CPCO of Georgia supports the proposed amendments put forward by the Georgia Structural Pest Control Commission as they are needed to ensure the protection of Georgia consumers and their property from Wood Destroying Organisms. Thank you for your consideration of these amendments as they will have a great impact on our state's citizens and PMPs.

Sincerely,

Glenda Lehmberg

Glenda Lehmberg
Executive Director
CPCO of GA

Georgia
Pest Control
Association

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

RE: **Energy, Residential, Building Amendments Subcommittee – Proposed Georgia Structural Pest Control Commission Amendments**

Dear Mr. Miltiades,

The Georgia Pest Control Association (GPCA) was established in 1950 with 16 members. Currently more than 650 pest management companies are active members in the state-wide association. The GPCA represents 85% of the individual pest management operators in the state, accounting for over 9,800 state licensed and regulated professionals.

The pest management industry has a significant economic impact on our state and is charged with the protection of health, safety, and property for Georgia consumers. We are a major employer in the State and an integral part of school operations, commercial establishments, and home management. GPCA is understandably proud of its long, rich history as a partner with the consumers, and law-markers of Georgia.

We started out with leaders focused on professionalism and it remains our focus to this day.

The GPCA supports the proposed amendments put forward by the Georgia Structural Pest Control Commission as they are needed to ensure the protection of Georgia consumers and their property from Wood Destroying Organisms.

Garry Adams
Chairman of the Board

Brantley Russell
President

Cliff Baird
Vice President

Glen Ramsey
Secretary/Treasurer

C Rogers

Connie Rogers
Executive Director

2034 BEAVER RUIN ROAD – NORCROSS, GA 30071 – PHONE (770) 417-1881 – FAX (770) 417-1419 – GPCA.ORG

NPMA
National Pest Management Association
Our Mission is Your Protection

April 29, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Re: Energy, Residential, Building Amendments Subcommittee – Proposed Georgia Structural Pest Control Commission Amendments

Dear Mr. Miltiades:

The National Pest Management Association (NPMA), the only national trade group representing the structural pest management industry, would like to voice our support for the code amendments proposed by the Georgia Structural Pest Control Commission (GASPCC).

NPMA, a non-profit organization with more than 5,000 U.S. based pest management companies which account for about 90% of the $9.4 billion U.S. structural pest control market, was established in 1933 to support the pest management industry. More than 80% of the industry is made up of small businesses, many of them with five employees or less. Across the country, termites cause more than $5 billion in damage annually. NPMA's member companies provide termite control services for countless commercial, residential, and institutional settings.

NPMA supports the amendments proposed by the GASPCC. The proposed amendment ensures that the foundation/framing interface remains uncovered and allows pest management professionals the opportunity to visually inspect this crucial area. Our organization opposes code change recommendations that would result in covering these critical construction elements. By maintaining visual access in the manner proposed by the GSPCC, opportunities for early detection of subterranean termite infestation will be preserved, thereby safeguarding the structural integrity of Georgia buildings, and protecting consumers from costly termite damage and repairs.

Sincerely,

Jim Fredericks, PhD, BCE
VP, Technical & Regulatory Affairs
National Pest Management Association
jfredericks@pestworld.org

R806.5 Unvented attic and unvented enclosed rafter assembles

5. 2 In Climate Zones 1,2 and 3, air-permeable insulation installed in unvented *attics* shall meet the following requirements.

5.2.1 An approved vapor *diffusion port* shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.

5.2.2. The port area shall be greater than or equal to 1:150 of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirements.

5.2.3 The vapor-permeable membrane in the *vapor diffusion port* shall have a vapor permeance rating of great than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.

5.2.4 The *vapor diffusion port* shall serve as an air barrier between the *attic* and the exterior of the building.

5.2.5. The *vapor diffusion port* shall protect the *attic* against the entrance of rain or snow.

5.2.6 Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (51 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.

5.2.7 The roof slope shall be greater than or equal to 3:12 (vertical/horizontal)

5.2.8 Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing.

5.2.9 *Air-impermeable insulation,* if any, shall be directly above or below the structural roof sheathing and is not required to meet the R-value in Table 806.5. Where directly below the structural roof sheathing, there shall be no space between the *air-impermeable insulation* and air-permeable insulation.

5.2.10 The air shall be supplied to a flow rate greater than or equal to 50 CFM (23.6 L/s) per 1,000 square feet (93 m^2) of ceiling. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating.

Reason Statement:

The 2018 IRC introduced unvented attics and unvented enclosed rafter assemblies using only air permeable insulation as an acceptable construction method as long as certain criteria and guidelines are followed. One of the key guidelines in using air permeable insulation in an unvented attic is the addition of a vapor diffusion port, this port constructability is similar to the addition of a ridge vent in traditional roof assemblies. This system has been studied, researched and vetted for many years and has been proven to be successful.

Advantages:

- **Airtightness.** a house that has a conditioned unvented attic can be significantly more airtight than houses without it thus making it more energy efficient. Even though the model code has requirements for duct tightness levels the ductwork and air handlers are often leaky. Often the ductwork and/or the air handlers are located in the attic, if the attic is conditioned the leaks will not have a big energy penalty, if the attic is unconditioned and vented the leaks from these systems can result in a pressure difference causing more infiltration into the home. Figure 1, below outlines this issue.

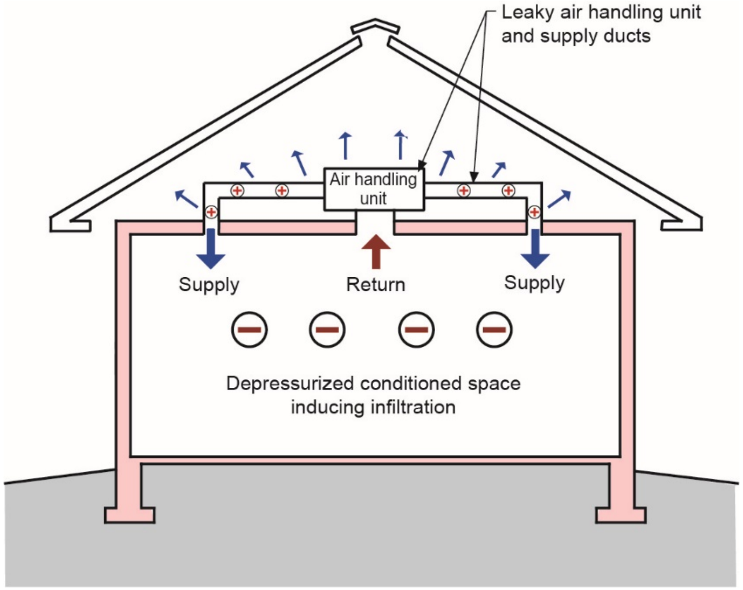


Figure 1. (Lstiburek, J.W.)

- **Fire Protection.** Unvented attics can provide other benefits as well including helping to reduce the spread of fires. This is particularly true for areas where buildings are close to one another, typically fires start in neighboring buildings due to debris getting sucked into the house via attics vents, if there are no vents it can significantly reduce the fire risk.
- **Wind Uplift.** Other benefits come in areas of the country where there is a high wind potential, mostly the coastal areas. High wind events can cause the soffit vents to

breakdown and create significant uplift on the roof assemblies which can cause damage to the roof assembly and rest of the dwelling.

- **Moisture Control in Humid Climates.** The traditional way of thinking is that vented attics help to alleviate moisture issues and this may be true in certain climate zones. In a hot humid climate having a vented attic will cause moisture problems, it will bring the hot humid air from outside the home into the attic which causes ductwork to sweat which in turn can cause moisture and mold growth on sheathing and framing. The alternative is unvented attics, these attics have shown to have some moisture concerns as well near the ridge, however, the introduction of vapor diffusion ports has shown to significantly reduce the moisture build up in these area to help to alleviate moisture build up. The difference in moisture is shown below.

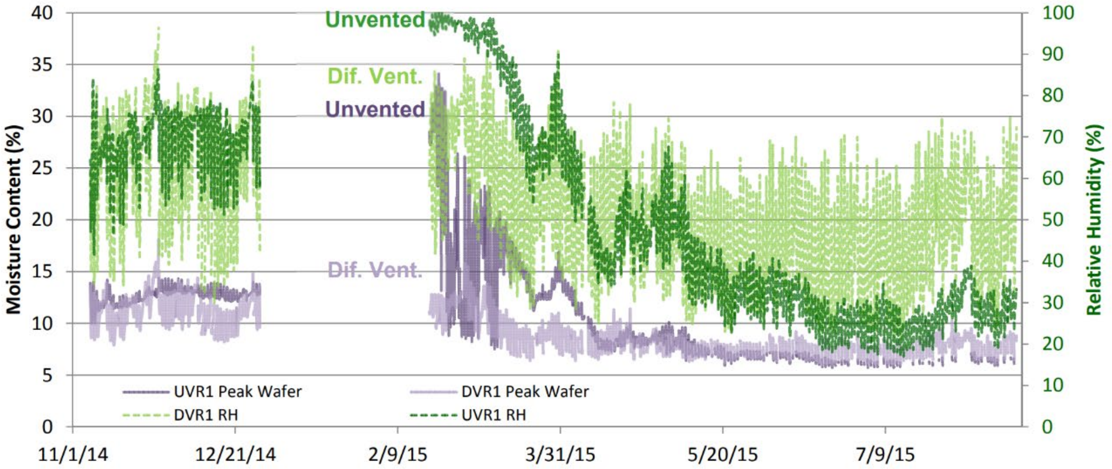


Figure 2. (Ueno, K and Lstiburek, J.W)

- **Cost Effectiveness.** *Description on how using air-permeable insulation to construct a home with a conditioned attic is a low cost pathway for builders*

References:

1. Lstiburek, J.W.; Venting vapor, ASHRAE Journal, July 2015.
2. Ueno, K and Lstiburek, J.W.; Building America Report: Field testing of an unvented roof with fibrous insulaiton, tiles, and vapor diffusion venting, Building Science Corporation, November 2015.

Table R402.1.6

MINIMUM INSULATION R-VALUES FOR ENVELOPE COMPONENTS WHEN TRADE OFFS ARE USED

Climate Zone	Wood[a] Framed Walls	Mass[a.b] Wall	Attic[a,c] Kneewall	Basement Wall[a]	Crawl Wall[a]	Floor Over Unheated Spaces	Ceilings with Attic Space	Unvented Attics Air-Impermeable Insulation[c,d,e]	Unvented Attics Air-permeable Insulation[c,d,e]
2	13	4	18	0	0	13	30	20	20
3	13	5	18	5	5	13	30	20	20
4	13	6	18	5	5	13	30	20	20

[a] Weather-stripped hinged vertical doors (minimum R-5 insulation or maximum U-0.20), weather-stripped hatches/scuttle hole covers (minimum R-19 insulation or maximum U-0.050), or weather-stripped and disappearing/pull-down stairs (minimum R-5 or maximum U-0.020) shall be deemed to meet the minimum insulation R-values of the corresponding envelope element.

[b] Any mass wall (masonry, CMU, etc.)

[c] Attic kneewall for the purpose of this code is defined as any vertical or near vertical wall in the building envelope that has conditioned space on one side and attic space on the other side.

Exception: When the building roofline is insulated, the former kneewall is classified as an interior wall.

[d] Examples of air-impermeable insulation include spray foam and rigid board. Examples of air-permeable insulation include fiberglass batt and cellulose. See ‘Roofline Installed Options’ in Appendix RA, of these Georgia State Supplements and Amendments for details.

e. Unvented attics shall meet the following requirements:

1. The house shall attain a blower door test result <3ACH50
2. The house shall require a whole house mechanical ventilation system that does not solely rely on a negative pressure strategy (must be positive, balanced or hybrid)
3. All ducts and air handling equipment shall be located completely inside the building thermal envelope and a portion of the ductwork and or air handler must be located within the unvented attic space.
4. Unvented attics using air-permeable insulation shall be in compliance with Item 5.2 of Section R806.5

Building
Science
Corporation

April 28, 2021

Joel Rodriguez
Chairman
2022 Energy, Residential and Building Amendments Subcommittee
State Code Advisory Council
Georgia Department of Community Affairs
60 Executive Park South, NE
Atlanta, GA 30329

RE: Termite Inspections at the Framing Foundation Interface

Dear Chairman Rodriquez,

Building Science Corporation is a building science consulting firm with clients throughout North America. Our focus is preventing and resolving problems relating to building design, construction and operation. We are internationally recognized for our expertise in moisture dynamics, indoor air quality, and building failure forensic investigations. We have posted hundreds of papers on building performance on our website: www.buildingscience.com

Building Science Corp has reviewed the two proposals submitted to the Georgia State Code Advisory Council on termite inspection at the framing foundation interface. Building Science Corp supports the Spray Foam Coalition's proposed amendments to Georgia Building Code Section R318 and Section R402.2.11. This proposal will maximize flexibility for builders, ensure builders have the tools to meet the Georgia air-tightness requirements, and protect consumers from termites, energy loss, and moisture issues.

The use of air impermeable insulation at the framing foundation interface will help control stack effect, wind and minimize concealed condensation issues. In our opinion, these are as important as maintaining an accessible rim/band joist area because they contribute to rotting and deterioration that is very problematic at the framing foundation interface.

Building Science Corp believes that spray foam can be used in a manner that protects Georgia homeowners if the following three conditions are met:

1. The framing foundation interface is constructed with treated lumber
2. The front face of the sill-plate is left exposed
3. A termite shield is in place

The Spray Foam Coalition proposal creates a small group of houses where the GSPCC can gain experience with alternate means of inspecting foundations in houses where the framing foundation interface is not as vulnerable as it is in today's houses. Note that it is an option. Also note that the above termite control measures are not required in all houses.

A complete ban on spray foam in the framing foundation interface will undermine the best building science and impact the ability for builders to comply the Georgia Building Code. We believe this is a prudent path forward that addresses termite control.

I am happy to respond to questions. I can be reached at: (978) 852-5232 or joe@buildingscience.com

Yours truly,

Joseph Lstiburek, Ph.D., P.Eng.
Principal, Building Science Corporation

SECTION R318 PROTECTION AGAINST SUBTERRANEAN TERMITES

R318.1 Subterranean termite control methods.

In areas subject to damage from termites as indicated by Table R301.2(1), protection shall be by one, or a combination, of the following methods:

1. Chemical termiticide treatment in accordance with Section R318.2.
2. Termite-baiting system installed and maintained in accordance with the *label*.
3. Pressure-preservative-treated wood in accordance with the provisions of Section R317.1.
4. Naturally durable termite-resistant wood.
5. Physical barriers in accordance with Section R318.3 and used in locations as specified in Section R317.1.
6. Cold-formed steel framing in accordance with Sections R505.2.1 and R603.2.1.

R318.2 Chemical termiticide treatment.

Chemical termiticide treatment shall include soil treatment, ~~or~~ field-applied, or factory applied wood treatment. The concentration, rate of application and method of treatment of the chemical termiticide shall be in strict accordance with the termiticide label and manufacturer’s instructions.

R318.3 Barriers.

Approved physical barriers, such as metal or plastic sheeting or composite sheeting or collars specifically designed for termite prevention, shall be located below the lowest point of untreated wood materials in the structure. Such materials shall be installed in a manner that provides a continuous barrier, extending through all layers of the wall, to force termites to pass around the barrier or shield thereby becoming visible to prevent termites from entering the structure without detection by visual inspection. ~~installed in a manner to prevent termites from entering the structure. Shields placed on top of an exterior foundation wall shall be used only if in combination with another method of protection.~~

R318.4 Foam plastic protection.

Where insulation is used below grade or is concealed underneath the foundation or slab on grade floor, the insulation material shall be protected against termite damage by treating the adjacent soil in accordance with R318.1.1 or by use of an approved termite-resistant insulation material.

R318.4(a) Foam plastics without advanced termite protection.

Without the use of the advanced termite protections outlined in section R318.4(b), foam plastic cannot be installed in the framing foundation interface. Foam plastics can be installed on the foundation wall using the following criteria:

1. The clearance between foam plastics on the foundation wall installed above grade and exposed earth shall be not less than 3 inches (76 mm).
2. The clearance between foam plastics and the top of the foundation wall shall not be less than 3 inches (76 mm).
3. Insulation installed in the framing foundation interface shall be removable.
4. The framing foundation interface shall be air sealed by other means.

R318.4(b) Foam plastics installed with advanced termite protection.

Foam plastic insulation can be installed to the foundation wall and framing foundation interface if foundation construction meets the following criteria:

1. The clearance between foam plastics on the foundation wall installed above grade and exposed earth shall be not less than 3 inches (76 mm).
2. A termite barrier or shield that shall extend continuously through the foundation and through the insulation in accordance with Section R318.1.2.

3. The sill plate and rim/header joist shall be preservative treated in accordance with Section R317 or shall have a field-applied treatment in accordance with R318.1.1.
4. The interior edge of the sill plate shall remain exposed for visual inspection.
5. Foam installers shall provide a certificate mounted in a conspicuous location demonstrating that construction and insulation installation complies with this section.

~~In areas where the probability of termite infestation is "very heavy" as indicated in Figure R301.2(7), extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be not less than 6 inches (152 mm).~~

Exceptions:

1.Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure-preservative-treated wood.

~~2.Where in addition to the requirements of Section R318.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is used.~~

2.~~3~~. On the interior side of basement walls.

R402.2.11 Crawl space walls.

As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to within 9 inches (229 mm) of the finished interior grade adjacent to the foundation wall. ~~A 3-inch (76 mm) inspection/view strip immediately below the floor joists shall be provided to permit inspections for termites.~~ Exposed earth in unvented crawl space foundations shall be covered with a continuous Class 1 vapor retarder in accordance with the International Building Code. All joints of the vapor retarder shall overlap by 6 inches (152 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall. Insulation shall be installed in accordance with the termite provisions in R318.

Building
Performance
Institute, Inc.

STANDARDS | CERTIFICATIONS | RATING SYSTEMS | BPI GOLDSTAR CONTRACTORS

April 30th, 2021

Rick Duncan – Executive Director
Spray Polyurethane Foam Alliance
11 Hope Road, Suite 111 #308
Stafford, VA 22554

Dear Rick:

The Building Performance Institute supports the proposed optional amendment by the Spray Polyurethane Foam (SPF) Industry for insulating and air sealing the foundation-framing interface (FFI) when a pre- or post-construction termite barrier (shied) is also installed.

Builders and contractors need to have options to meet strict mandates of the International Energy Conservation Code and above code requirements of local, state, federal, and utility energy efficiency (EE) and weatherization programs. The SPF Industry proposed optional amendment provides an alternative method for insulting and air sealing the FFI to builders and contractors options that will help program administrators reach goals in the reduction of greenhouse gases and energy usage.

BPI sets national standards for improving comfort and energy efficiency for creating and maintaining safe and healthy home environments. From these standards, BPI develops professional certifications for home contractors to ensure quality service and workmanship. BPI is a national 501(c)(3) nonprofit organization.

Sincerely,

Larry Zarker

Larry Zarker
Chief Executive Officer

Building Performance Institute Saratoga Technology + Energy Park
107 Hermes Road, Suite 210 | Malta, NY 12020 | Phone: (518) 899-2727 or (877) 274-1274 | Fax: (518) 899-1622 or (866) 777-1274
✉ info@bpi.org Twitter: _BPI_ Facebook: BuildingPerformanceInstitute **bpi.org**

Georgia Department of Community Affairs

Code Amendment

Revised Code Amendment Proposal

Proponent: Georgia Structural Pest Control Commission

Date: April 24, 2021

Email: SPCC@agr.georgia.gov

Address: 19 Martin Luther King Jr. DR., S.W. Atlanta, Georgia 30334

Telephone Number: 404-656-3641 **Fax Number:** 404-463-6671

Add new section to:

Georgia State Amendments to the International Energy Conservation Code – 2015 edition

R402.2.11 - **Crawl Space Walls**

Propose to add - R402.2.11(1):

To read as:

"Insulation provided at the interior rim joist area shall be removable to allow access for pest control inspections."

Add new section to:

Body of the International Energy Conservation Code

R402.2.9 - **Basement Walls**

Propose to add - R402.2.9(1):

To read as:

"Insulation provided at the interior rim joist area shall be removable to allow access for pest control inspections."

CI1Y OF DAWSON

101 South Main Street
Post Office Box 190
Dawson, Georgia 39842
Phone 229-995-4444
Fax 229-995-3713
Email: dawsoncityhall@cityofdawson.org

MAYOR
Robert Aaron
CITY MANAGER
William "Tracy" Hester

April 30, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Re: Georgia IEBC Code

Dear Mr. Miltiades

On behalf of myself as a Building official, Building Contractor, City Manager for the City of Dawson Ga. and past member of the State Codes Advisory Board I would like to submit this letter of support for the proposed amendments to the 2018 IEBC Standards.

My past experiences with the noted professions above have given me a unique perspective in to this matter related to termite protection and energy conservation, as with the old drivit system we have all seen the effects of not being able to inspect and even treat infestation. I served on a sub-committee several years ago that addressed this concern and the results of our efforts has a proven tract record. When given a way and means to the termite professionals to inspect and treat an effected area, the potential to alleviate a termite infestation is very positive. Energy conservation is certainly at the top of the construction industry and homeowners list these days but we **can-not** overlook the facts that proven methods of construction in certain areas still have a place no matter the convenience or ability to make our homes and businesses energy compliant.

I encourage the State Codes Advisory Committee and the Department od Community Affairs to adopt the proposed amendment. I feel the benefits of inspection ports by the means proposed accomplishes both the protection needed to prevent termite infestation and energy conservation.

Please contact me if you have questions or concerns and thanks you for your consideration of my support.

Sincerely,

William Tracy Hester, ICC CBO CM

City Attorney - Tommy Coleman
Council Members
*Melissa Marsholl- Ward I * George E. Wilson - Ward 2 * Sandra Walker- Ward 3*
*john Harris - Ward 4 * Sandra Bowens. - Ward 5 * Iri Deen Pittman - Ward 6*

April 30,2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

RE: Proposed Amendment to adopt the IEBC
as a mandatory Code for the State of Georgia.

Dear Mr. Miltiades,

I wanted to send you this letter on behalf of the Georgia State Inspectors Association to show our support for the proposed amendment to make the IEBC a mandatory code for the State of Georgia. I have discussed this with the GSIA Board, and we are in favor of this adoption.

Please let me know if you have any questions for me or if I can be of any additional assistance.

Respectfully,

Duane Helton
City of Woodstock
Building Official

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM

ITEM NO: ____________ (DCA USE ONLY) PAGE 1 OF 2

CODE: IECC / IRC SECTION: R402 / N1102

PROPONENT: David Goulding, Ensign Building Solutions; Joel Rodriguez, Gwinnett County; Lucas Lauritzen, Meritage Homes; Randy Nicklas, Icynene-Lapolla; Mike Barcik, Southface Institute; Phil Brown, Compton Sales DATE: 12/14/2020

EMAIL: David@ensignbuildingsolutions.com; Joel.Rodriguez@gwinnettcounty.com; Lucas.Lauritzen@meritagehomes.com; rnicklas@icynene-lapolla.com; mikeb@southface.org; pbrown@comptonsales.com

ADDRESS: 1479 Ventura Dr. Ste A, Cumming, GA 30040

TELEPHONE NUMBER: (770) 205-9891 FAX NUMBER: ( ) -

CHECK ONE:

☐ Revise section to read as follows:

x Add new section to read as follows:

☐ Delete section and substitute the following:

☐ Delete without substitution:

~~LINE THROUGH MATERIAL TO BE DELETED:~~ UNDERLINE MATERIAL TO BE ADDED

☐ Approve ☐ Approve as amended (DCA STAFF ONLY) ☐ Disapprove ☐ Withdrawn

DESCRIPTION:

Add new Section R402.1.2.1

R402.1.2.1 (N1102.1.2.1) Semi-conditioned attics. Where table N1102.1.2 (R402.1.2) requires R-38 or Table N1102.1.4 (R402.1.4) requires a U-factor of 0.030, an air impermeable insulation installed to the underside or directly above the roof deck with a U-factor of 0.05 or R-value of R-20 shall be deemed equivalent to the provisions in N1102.2.1 (R402.2.1), with the following requirements:

1. The house shall attain a blower door test result < 3 ACH50
2. The house shall require a whole house mechanical ventilation system that does not solely rely on a negative pressure strategy (must be positive, balanced or hybrid)
3. If not already covered by the R-20 depth of the air-impermeable insulation, the exposed portion of the roof rafters shall be wrapped (covered) by minimum R-3 unless directly covered by drywall / finished ceiling.

DESCRIPTION:
Add new Section R402.1.2.1

R402.1.2.1 (N1102.1.2.1) Semi-conditioned attics. Where table N1102.1.2 (R402.1.2) requires R-38 or Table N1102.1.4 (R402.1.4) requires a U-factor of 0.030, an air impermeable insulation installed to the underside or directly above the roof deck with a U-factor of 0.05 or R-value of R-20 shall be deemed equivalent to the provisions in N1102.2.1 (R402.2.1), with the following requirements:

1. The house shall attain a blower door test result < 3 ACH50
2. The house shall require a whole house mechanical ventilation system that does not solely rely on a negative pressure strategy (must be positive, balanced or hybrid)
3. If not already covered by the R-20 depth of the air-impermeable insulation, the exposed portion of the roof rafters shall be wrapped (covered) by minimum R-3 unless directly covered by drywall / finished ceiling.

REASON/INTENT:
This new section will allow easier compliance for designers and builders to provide a cost- and performance-effective assembly. The tighter blower door requirement (< 3ACH50) and whole house mechanical ventilation, along with wrapping rafters to reduce thermal bridging will provide energy savings and assure code compliant indoor air quality. This proposed amendment will eliminate the additional expense for builders of running a computer simulation program to allow for R-value trade-offs for the roof assembly. Note: The R-20 roof (air impermeable) insulation has a long record of successful performance in Georgia.

FINANCIAL IMPACT OF PROPOSED AMENDMENT:
This will reduce the overall cost of design and construction for Georgia homeowners and provide effective optimal insulation values.

GEORGIA DEPARTMENT OF COMMUNITY AFFAIRS

CODE AMENDMENT FORM INSTRUCTION SHEET

1. Do not complete the line entitled “Item No.______”.
2. Use a separate form for each proposed code amendment.
3. “Sheet ____ of _____” indicates the number of sheets for each individual proposed code amendment, not the number of sheets for all the amendments submitted.
4. Identify the code and code section that is the subject of the proposed amendment.
5. The proponent’s name, address, telephone number and fax number must be filled out completely.

6. Be sure to indicate the type of recommended action in the space referred to as “Check One”.

7. If the proposed amendment revises the language of the code section, deletes the entire code section, or deletes the entire code section and offers substitute language, include the language of the present code section and line through the language to be deleted and underline the language of the proposed amendment.

8. Under the “Reason” section, provide the reasoning behind the proposed code amendment. The reason should be clear and concise. Test reports, standards or other supporting information and documentation may be submitted with the proposed amendment and must be attached to the amendment form.

9. **A Statement of Financial Impact must accompany all proposed code amendments.** The statement should be clear and concise. Test reports, standards or other supporting information and documentation may be submitted with the proposed amendment and must be attached to the amendment form.

10. **All proposed amendments must be typed and completed in full and the original submitted to the Codes and Industrialized Buildings Section of the Department of Community Affairs NO LATER THAN DECEMBER 15TH.** The proposed code change shall be submitted for review to the State Codes Advisory Committee at their quarterly meeting in January. An incomplete form will be sent back to the proponent for completion. An amendment submitted after the submittal deadline date will be returned to the proponent.

11. The proponent will be notified when the proposed amendment will be considered by the State Codes Advisory Committee.

12. Information concerning submittal of code amendments, including deadline dates for submittal, can be obtained by contacting the Codes and Industrialized Buildings Section at (404) 679-3118. All proposed code amendments should be submitted to:

The Department of Community Affairs
Codes and Industrialized Buildings Section
60 Executive Park South, NE
Atlanta, Georgia 30329-2231

Home Energy Rating Certificate

Projected Report

Rating Date: 2019-07-15
Registry ID:
Ekotrope ID: 3LM4EBJ2

HERS® Index Score:

73

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$500

*Relative to an average U.S. home

Home:

, GA

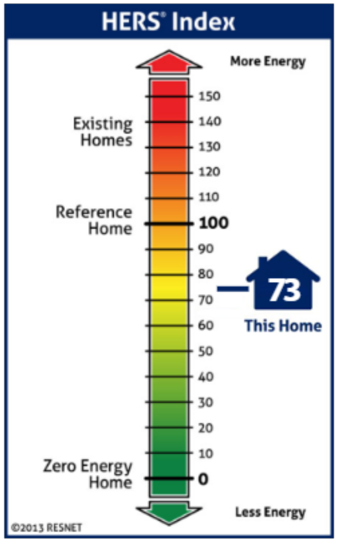
Builder:

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	5.8	$94
Cooling	2.7	$47
Hot Water	23.6	$237
Lights/Appliances	20.3	$314
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**52.4**	**$1,117**

This home meets or exceeds the criteria of the following:

2009 International Energy Conservation Code
2006 International Energy Conservation Code



Home Feature Summary:

Home Type:	Townhouse, inside unit
Model:	Amber
Community:	N/A
Conditioned Floor Area:	1,596 ft^2
Number of Bedrooms:	3
Primary Heating System:	Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System:	Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating:	Water Heater • Natural Gas • 0.64 UEF
House Tightness:	948.6 CFM50 (3.00 ACH50)
Ventilation:	140 CFM • 50 Watts
Duct Leakage to Outside:	0.5 CFM25 / 100 ft^2
Above Grade Walls:	R-13
Ceiling:	Vaulted Roof, R-20
Window Type:	U-Value: 0.35, SHGC: 0.27
Foundation Walls:	N/A

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
241 Pine Street NE
4046042001

National Mortgage Industry HERS Accreditation Registry
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 2:22 PM

Ekotrope RATER - Version:3.2.4.2662
The Energy Rating Disclosure for this home is available from the Approved Rating Provider.
This report does not constitute any warranty or guarantee.

Building Specification Summary

Property
, GA
Model: Amber

Amber - A Slab Mid - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

Building Information

Conditioned Area [ft²]	1,596.00
Conditioned Volume [ft³]	18,971.00
Thermal Boundary Area [ft²]	4,743.90
Number Of Bedrooms	3
Housing Type	Townhouse, inside unit

Rating

HERS Index	73
HERS Index w/o PV	73

Building Shell

Ceiling w/ Attic	None
Vaulted Ceiling	G1 R-20 Foam Roof 2x4 24"oc; U-0.049
Above Grade Walls	G1 R-13 Foam Cement Board; U-0.086
Found. Walls	None
Framed Floors	G1 R-19 Foam 19"OC Crpt Garage; R-19
Slabs	Wood uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.06
Infiltration	948.6 CFM50 (3.00 ACH50)
Duct Lkg to Outside	0.5 CFM25 / 100 ft²
Total Duct Leakage	6 CFM25 / 100 ft² (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	140 CFM • 50 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	709.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Georgia 2020 R405 Performance Compliance

Property
, GA
Model: Amber

Amber - A Slab Mid - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost

Design	**Georgia 2020 Performance**	**As Designed**
Heating	$203	$221
Cooling	$98	$122
Water Heating	$637	$637
SubTotal - Used to determine compliance	**$938**	**$980**
Lights & Appliances	$596	$592
Onsite generation	$0	$0
Total	**$1,534**	**$1,571**

Requirements

⚠	405.3	Performance-based compliance fails by 4.4%	The projected energy bill exceeds that of the Georgia 2020 Performance reference house by $41.66.
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	R405.2	Duct Insulation	

Design fails to meet the performance requirement for Georgia 2020 Performance compliance by 4.4%.

As a 3rd party extension of the code jurisdiction utilizing these reports, I certify that this energy code compliance document has been created in accordance with the requirements of Chapter 4 of the adopted International Energy Conservation Code based on Climate Zone 3. If rating is Projected, I certify that the building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. If rating is Confirmed, I certify that the address referenced above has been inspected/tested and that the mandatory provisions of the IECC have been installed to meet or exceed the intent of the IECC or will be verified as such by another party.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 2:22 PM

Ekotrope RATER - Version 3.2.4.2662

Georgia 2020 Total UA Compliance

Property
, GA
Model: Amber

Amber - A Slab Mid - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Building UA

Elements	**IECC Reference**	**As Designed**
Ceilings	31.3	51.0
Above-Grade Walls	57.0	59.2
Windows, Doors and Skylights	58.8	57.7
Slab Floor:	38.0	38.0
Framed Floors	14.4	13.7
Foundation Walls	0.0	0.0
Rim Joists	3.4	3.1
Overall UA (Design must be equal or lower):	**202.9**	**222.7**

Requirements

⚠	402.1.5	Total UA alternative compliance fails by 9.8%.	Specified envelope UA is 223 BTU / hF. This exceeds the maximum of 203 BTU / hF by 9.8%.
✓	402.3.2 Glazed Fenestration SHGC	Average SHGC: 0.27 Max SHGC: 0.27	
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	403.5.3	Hot water pipe insulation	
✓	403.5.4	Drain Water Heat Recovery Effectiveness	

Design fails to meet the requirement for Georgia 2020 Prescriptive compliance by 9.8%.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 2:22 PM

Georgia 2015 IECC Compliance Report (ERI Pathway) Projected Energy Rating Index Report

Property

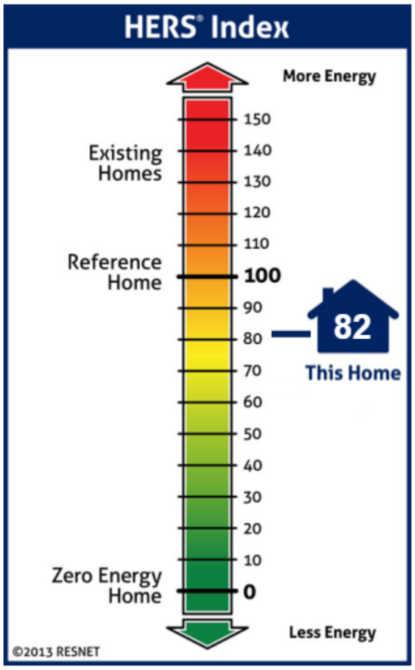
Builder:
Address:, , GA

Organization

Company:Ensign Building Solutions
Phone:
Rater:Matt Wall

Energy Rating Index Information

Projected Rating
Rating No:
Rater ID (RTIN):8094643
Date Rated:2019-07-15



Estimated Annual Energy Consumption*

	Rated Home Calculated Energy Use (MBtu)	Rated Home Cost ($/yr)
Heating	5.8	$94
Cooling	2.7	$47
Water Heating	23.6	$237
Lights & Appliances	20.3	$314
Photovoltaics	0.0	$0
Total	**52.4**	**$1,117**

*Based on standard operating conditions

ERI with PV:82

ERI without PV:82

Annual Estimates

Electric (kWh):7,546.9	CO2 Emissions (Tons):6.7
Natural Gas (Therms):266.3	Energy Savings ($)**:N/A

**Based on the Georgia 2015 IECC Compliance Report (ERI Pathway) Reference design home

Maximum Energy Rating Index:57	This Home's Energy Rating Index:82	FAIL

This home DOES NOT MEET the Energy Rating Index Score requirement of Georgia 2015 IECC Compliance Report (ERI Pathway) for Climate Zone 3. It DOES NOT MEET all of the requirements verified by Ekotrope. Mandatory requirements are summarized on the 2nd page of this report, some of which are not verified by Ekotrope.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 2:22 PM

Rating Provider Data and Seal

Company:Southface Energy Rated Homes
Address:241 Pine Street NE
Phone #:4046042001
Fax #:

NATIONAL MORTGAGE INDUSTRY HERS ACCREDITATION REGISTRY
No. 1998-057

To determine if a provider is properly accredited go to: **www.resnet.us/professional/programs/search_directory**

(Projected. Confirmation required.)

Climate Zone 3	Mandatory Requirements	
Provision Number	**Topic**	**Compliance Decision**
Georgia 2009 IECC Table 402.1.1 or 402.1.3	Building thermal envelope minimum insulation levels and maximum fenestration U-factor and SHGC	PASS
R401.3	Post a permanent certificate listing the level of efficiencies installed in the house	Certificate required for CO
R402.4.1.2	Envelope air leakage maximum leakage rate	PASS
R402.4.1 / Table R402.4.1.1	Comply with air sealing and insulation requirements in Table R402.4.1.1	Checklist required for CO
R402.4.4	Rooms containing fuel-burning appliances	PASS*
R402.5	Maximum fenestration U-factor and SHGC	(U-Factor) PASS
		(SHGC) PASS
R403.1.2	Heat pump controls	PASS*
R406.2	Ducts outside of conditioned space to be insulated to a minimum of R-6.	PASS*
R403.3.2	Duct sealing on all ducts	PASS*
R403.3.3	Duct testing for ducts in unconditioned space	PASS*
R403.3.5	Building cavities not used as ducts.	PASS*
R403.5.1	Heated water circulation and temperature maintenance systems comply	PASS*
R403.5.3	Hot water pipe insulated to R-3	PASS
R403.6	Mechanical ventilation meeting the requirements of the IRC or IMC. Outdoor air and exhaust dampers installed	PASS*
R403.7	ACCA Manual J and S conducted for all heating and cooling systems.	ACCA forms required for permit
R403.8	Systems serving multiple dwelling units to meet the mechanical requirements of IECC commercial code	PASS*
R403.9	Snow melt and ice system controls installed where applicable	PASS*
R403.10	Pools and permanent spa energy consumption meet requirements for heaters, time clocks and covers	PASS*
R403.11	Portable spas meet the requirements of APSP-14.	PASS*
R404.1	High efficacy lights installed in 75% of permanently installed fixtures.	PASS

* This is a projected rating. These items must eventually be field-verified by the Rater, Field Inspector, Code Inspector, or Builder.

Home Energy Rating Certificate

Projected Report

Rating Date: 2019-07-15
Registry ID:
Ekotrope ID: bL7XaNKd

HERS® Index Score:

74

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$489

*Relative to an average U.S. home

Home:

, GA

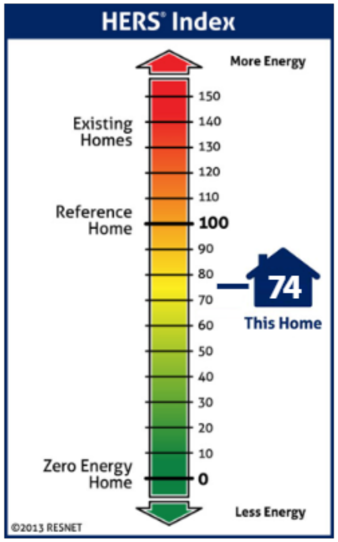
Builder:

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	6.7	$109
Cooling	2.4	$40
Hot Water	23.6	$237
Lights/Appliances	20.3	$313
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**52.9**	**$1,123**

This home meets or exceeds the criteria of the following:

2009 International Energy Conservation Code
2006 International Energy Conservation Code



Home Feature Summary:

Home Type: Townhouse, inside unit
Model: Amber
Community: N/A
Conditioned Floor Area: 1,596 ft^2
Number of Bedrooms: 3
Primary Heating System: Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System: Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating: Water Heater • Natural Gas • 0.64 UEF
House Tightness: 1194.6 CFM50 (5.00 ACH50)
Ventilation: 140 CFM • 49 Watts
Duct Leakage to Outside: 63.84 CFM @ 25Pa (4 / 100 ft^2)
Above Grade Walls: R-13
Ceiling: Attic, R-38
Window Type: U-Value: 0.35, SHGC: 0.27
Foundation Walls: N/A

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
241 Pine Street NE
4046042001

National Mortgage Industry HERS Accreditation Registry
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 2:23 PM

ekotrope

Ekotrope RATER - Version:3.2.4.2662

Building Specification Summary

Property
, GA
Model: Amber

Amber - A Slab Mid LHGar (Code Minimum Comparison)

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

Building Information

Conditioned Area [ft²]	1,596.00
Conditioned Volume [ft³]	14,335.00
Thermal Boundary Area [ft²]	4,226.00
Number Of Bedrooms	3
Housing Type	Townhouse, inside unit

Rating

HERS Index	74
HERS Index w/o PV	74

Building Shell

Ceiling w/ Attic	G1 R-38 Blown 2x8 16"oc, No RB; U-0.027
Vaulted Ceiling	None
Above Grade Walls	G1 R-13 Cement Board; U-0.086
Found. Walls	None
Framed Floors	G1 R-19 19"OC Crpt Garage; R-19
Slabs	Wood uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.07
Infiltration	1194.6 CFM50 (5.00 ACH50)
Duct Lkg to Outside	63.84 CFM @ 25Pa (4 / 100 ft²)
Total Duct Leakage	95.76 CFM @ 25Pa (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	140 CFM • 49 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	709.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Home Energy Rating Certificate

Projected Report

Rating Date: 2019-07-15
Registry ID:
Ekotrope ID: B2608aod

HERS® Index Score:

71

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$564

*Relative to an average U.S. home

Home:

, GA

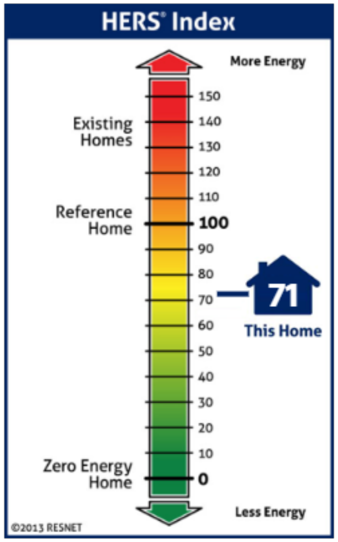
Builder:

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	9.3	$149
Cooling	3.0	$52
Hot Water	23.6	$237
Lights/Appliances	20.3	$312
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**56.3**	**$1,175**

This home meets or exceeds the criteria of the following:

2009 International Energy Conservation Code
2006 International Energy Conservation Code



Home Feature Summary:

Home Type:	Townhouse, end unit
Model:	Amber
Community:	N/A
Conditioned Floor Area:	1,596 ft^2
Number of Bedrooms:	3
Primary Heating System:	Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System:	Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating:	Water Heater • Natural Gas • 0.64 UEF
House Tightness:	3 ACH50
Ventilation:	140 CFM • 50 Watts
Duct Leakage to Outside:	0 CFM @ 25Pa (0 / 100 ft^2)
Above Grade Walls:	R-13
Ceiling:	Vaulted Roof, R-20
Window Type:	U-Value: 0.35, SHGC: 0.27
Foundation Walls:	N/A

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
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National Mortgage Industry HERS Accreditation Registry
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 1:49 PM

ekotrope

Ekotrope RATER - Version:3.2.4.2662
The Energy Rating Disclosure for this home is available from the Approved Rating Provider.
This report does not constitute any warranty or guarantee.

Building Specification Summary

Property
, GA
Model: Amber

Amber - A Slab RE LHGar - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

Building Information

Conditioned Area [ft²]	1,596.00
Conditioned Volume [ft³]	18,971.00
Thermal Boundary Area [ft²]	4,743.90
Number Of Bedrooms	3
Housing Type	Townhouse, end unit

Rating

HERS Index	71
HERS Index w/o PV	71

Building Shell

Ceiling w/ Attic	None
Vaulted Ceiling	G1 R-20 Foam Roof 2x4 24"oc; U-0.049
Above Grade Walls	G1 R-13 Foam Cement Board; U-0.086
Found. Walls	None
Framed Floors	G1 R-19 Foam 19"OC Crpt Garage; R-19
Slabs	Wood uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.07
Infiltration	3 ACH50
Duct Lkg to Outside	0 CFM @ 25Pa (0 / 100 ft²)
Total Duct Leakage	95.76 CFM @ 25Pa (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	140 CFM • 50 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	709.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Georgia 2020 R405 Performance Compliance

Property
, GA
Model: Amber

Amber - A Slab RE LHGar - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost

Design	**Georgia 2020 Performance**	**As Designed**
Heating	$347	$357
Cooling	$122	$141
Water Heating	$637	$637
SubTotal - Used to determine compliance	**$1,106**	**$1,136**
Lights & Appliances	$596	$592
Onsite generation	$0	$0
Total	**$1,701**	**$1,727**

Requirements

⚠	405.3	Performance-based compliance fails by 2.7%	The projected energy bill exceeds that of the Georgia 2020 Performance reference house by $29.79.
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	R405.2	Duct Insulation	

Design fails to meet the performance requirement for Georgia 2020 Performance compliance by 2.7%.

As a 3rd party extension of the code jurisdiction utilizing these reports, I certify that this energy code compliance document has been created in accordance with the requirements of Chapter 4 of the adopted International Energy Conservation Code based on Climate Zone 3. If rating is Projected, I certify that the building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. If rating is Confirmed, I certify that the address referenced above has been inspected/tested and that the mandatory provisions of the IECC have been installed to meet or exceed the intent of the IECC or will be verified as such by another party.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 1:49 PM

Ekotrope RATER - Version 3.2.4.2662

Georgia 2020 Performance compliance results calculated using Ekotrope RATER's energy and code compliance algorithm, including appropriate amendments.
Ekotrope RATER is a RESNET Accredited HERS Rating Tool. All results are based on data entered by Ekotrope users.
Ekotrope disclaims all liability for the information shown on this report.

Georgia 2020 Total UA Compliance

Property
, GA
Model: Amber

Amber - A Slab RE LHGar - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Building UA

Elements	**IECC Reference**	**As Designed**
Ceilings	31.3	51.0
Above-Grade Walls	133.1	132.6
Windows, Doors and Skylights	73.5	72.4
Slab Floor:	54.5	54.5
Framed Floors	14.4	13.7
Foundation Walls	0.0	0.0
Rim Joists	5.7	5.4
Overall UA (Design must be equal or lower):	**312.5**	**329.6**

Requirements

⚠	402.1.5	Total UA alternative compliance fails by 5.5%.	Specified envelope UA is 330 BTU / hF. This exceeds the maximum of 312 BTU / hF by 5.5%.
✓	402.3.2 Glazed Fenestration SHGC	Average SHGC: 0.27 Max SHGC: 0.27	
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	403.5.3	Hot water pipe insulation	
✓	403.5.4	Drain Water Heat Recovery Effectiveness	

Design fails to meet the requirement for Georgia 2020 Prescriptive compliance by 5.5%.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 1:49 PM

Georgia 2015 IECC Compliance Report (ERI Pathway) Projected Energy Rating Index Report

Property

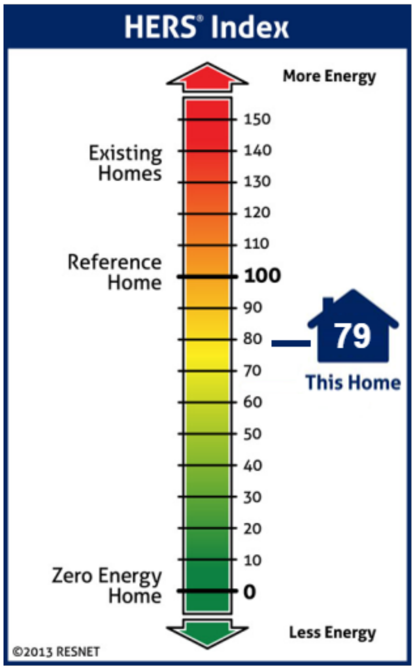
Builder:
Address:, , GA

Organization

Company:Ensign Building Solutions
Phone:
Rater:Matt Wall

Energy Rating Index Information

Projected Rating
Rating No:
Rater ID (RTIN):8094643
Date Rated:2019-07-15



Estimated Annual Energy Consumption*

	Rated Home Calculated Energy Use (MBtu)	Rated Home Cost ($/yr)
Heating	9.3	$149
Cooling	3.0	$52
Water Heating	23.6	$237
Lights & Appliances	20.3	$312
Photovoltaics	0.0	$0
Total	**56.3**	**$1,175**

*Based on standard operating conditions

ERI with PV:79

ERI without PV:79

Annual Estimates

Electric (kWh):8,662.7	CO2 Emissions (Tons):7.5
Natural Gas (Therms):266.9	Energy Savings ($)**:N/A

**Based on the Georgia 2015 IECC Compliance Report (ERI Pathway) Reference design home

Maximum Energy Rating Index:57 | This Home's Energy Rating Index:79 | FAIL

This home DOES NOT MEET the Energy Rating Index Score requirement of Georgia 2015 IECC Compliance Report (ERI Pathway) for Climate Zone 3. It DOES NOT MEET all of the requirements verified by Ekotrope. Mandatory requirements are summarized on the 2nd page of this report, some of which are not verified by Ekotrope.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 1:49 PM

Rating Provider Data and Seal

Company:Southface Energy Rated Homes
Address:241 Pine Street NE
Phone #:4046042001
Fax #:

National Mortgage Industry HERS Accreditation Registry
No. 1998-057

To determine if a provider is properly accredited go to: **www.resnet.us/professional/programs/search_directory**

(Projected. Confirmation required.)

Climate Zone 3	Mandatory Requirements	
Provision Number	**Topic**	**Compliance Decision**
Georgia 2009 IECC Table 402.1.1 or 402.1.3	Building thermal envelope minimum insulation levels and maximum fenestration U-factor and SHGC	PASS
R401.3	Post a permanent certificate listing the level of efficiencies installed in the house	Certificate required for CO
R402.4.1.2	Envelope air leakage maximum leakage rate	PASS
R402.4.1 / Table R402.4.1.1	Comply with air sealing and insulation requirements in Table R402.4.1.1	Checklist required for CO
R402.4.4	Rooms containing fuel-burning appliances	PASS*
R402.5	Maximum fenestration U-factor and SHGC	(U-Factor) PASS
		(SHGC) PASS
R403.1.2	Heat pump controls	PASS*
R406.2	Ducts outside of conditioned space to be insulated to a minimum of R-6.	PASS*
R403.3.2	Duct sealing on all ducts	PASS*
R403.3.3	Duct testing for ducts in unconditioned space	PASS*
R403.3.5	Building cavities not used as ducts.	PASS*
R403.5.1	Heated water circulation and temperature maintenance systems comply	PASS*
R403.5.3	Hot water pipe insulated to R-3	PASS
R403.6	Mechanical ventilation meeting the requirements of the IRC or IMC. Outdoor air and exhaust dampers installed	PASS*
R403.7	ACCA Manual J and S conducted for all heating and cooling systems.	ACCA forms required for permit
R403.8	Systems serving multiple dwelling units to meet the mechanical requirements of IECC commercial code	PASS*
R403.9	Snow melt and ice system controls installed where applicable	PASS*
R403.10	Pools and permanent spa energy consumption meet requirements for heaters, time clocks and covers	PASS*
R403.11	Portable spas meet the requirements of APSP-14.	PASS*
R404.1	High efficacy lights installed in 75% of permanently installed fixtures.	PASS

* This is a projected rating. These items must eventually be field-verified by the Rater, Field Inspector, Code Inspector, or Builder.

Home Energy Rating Certificate

Projected Report

Rating Date: 2019-07-15
Registry ID:
Ekotrope ID: 123qJMDd

HERS® Index Score:

75

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$528

*Relative to an average U.S. home

Home:

, GA

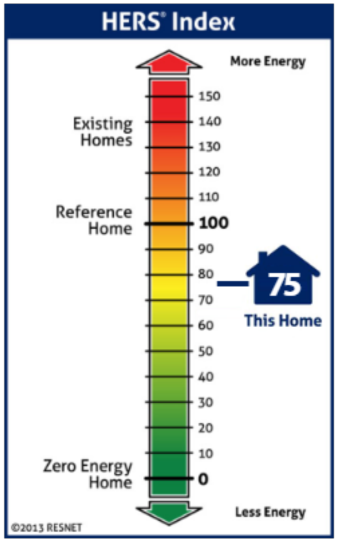
Builder:

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	10.5	$167
Cooling	2.6	$45
Hot Water	23.6	$237
Lights/Appliances	20.3	$311
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**57.1**	**$1,185**

This home meets or exceeds the criteria of the following:

2009 International Energy Conservation Code
2006 International Energy Conservation Code



Home Feature Summary:

Home Type:	Townhouse, end unit
Model:	Amber
Community:	N/A
Conditioned Floor Area:	1,596 ft^2
Number of Bedrooms:	3
Primary Heating System:	Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System:	Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating:	Water Heater • Natural Gas • 0.64 UEF
House Tightness:	5 ACH50
Ventilation:	140 CFM • 49 Watts
Duct Leakage to Outside:	63.84 CFM @ 25Pa (4 / 100 ft^2)
Above Grade Walls:	R-13
Ceiling:	Attic, R-38
Window Type:	U-Value: 0.35, SHGC: 0.27
Foundation Walls:	N/A

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
241 Pine Street NE
4046042001

National Mortgage Industry HERS Accreditation Registry
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 1:50 PM

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Ekotrope RATER - Version:3.2.4.2662

Building Specification Summary

Property
, GA
Model: Amber

Amber - A Slab RE LHGar (Code Minimum Comparison)

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

Building Information

Conditioned Area [ft²]	1,596.00
Conditioned Volume [ft³]	14,335.00
Thermal Boundary Area [ft²]	4,226.00
Number Of Bedrooms	3
Housing Type	Townhouse, end unit

Rating

HERS Index	75
HERS Index w/o PV	75

Building Shell

Ceiling w/ Attic	G1 R-38 Blown 2x6 16"oc, No RB; U-0.027
Vaulted Ceiling	None
Above Grade Walls	G1 R-13 Cement Board; U-0.086
Found. Walls	None
Framed Floors	G1 R-19 19"OC Crpt Garage; R-19
Slabs	Wood uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.09
Infiltration	5 ACH50
Duct Lkg to Outside	63.84 CFM @ 25Pa (4 / 100 ft²)
Total Duct Leakage	95.76 CFM @ 25Pa (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	140 CFM • 49 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	709.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Home Energy Rating Certificate

Projected Report

Rating Date: 2018-10-31
Registry ID:
Ekotrope ID: x25MXKl2

HERS® Index Score:

68 Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$716

*Relative to an average U.S. home

Home:

, GA

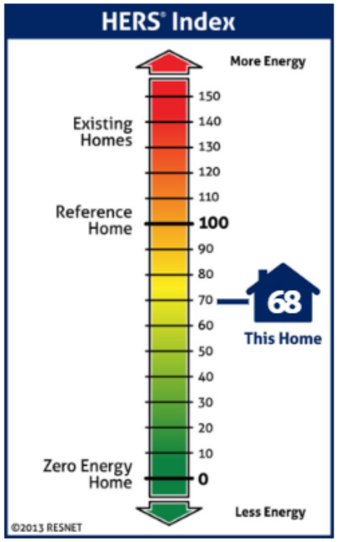
Builder:

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	14.1	$218
Cooling	4.4	$80
Hot Water	25.5	$254
Lights/Appliances	23.9	$377
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**67.7**	**$1,354**

This home meets or exceeds the criteria of the following:

ENERGY STAR v3
2009 International Energy Conservation Code
2006 International Energy Conservation Code



Home Feature Summary:

Home Type:	Single family detached
Model:	Grayson
Community:	N/A
Conditioned Floor Area:	2,099 ft^2
Number of Bedrooms:	4
Primary Heating System:	Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System:	Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating:	Water Heater • Natural Gas • 0.64 UEF
House Tightness:	1458.9 CFM50 (3.00 ACH50)
Ventilation:	142 CFM • 49 Watts
Duct Leakage to Outside:	0 CFM @ 25Pa (0 / 100 ft^2)
Above Grade Walls:	R-13
Ceiling:	Vaulted Roof, R-20
Window Type:	U-Value: 0.35, SHGC: 0.27
Foundation Walls:	N/A

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
241 Pine Street NE
4046042001

National Mortgage Industry HERS Accreditation Registry
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 2:03 PM

ekotrope

Ekotrope RATER - Version:3.2.4.2662
The Energy Rating Disclosure for this home is available from the Approved Rating Provider.

Building Specification Summary

Property , GA Model: Grayson	**Organization** Ensign Building Solutions Matt Wall	**Inspection Status** Results are projected
Grayson - A Slab RHGar - CM, R-20 Roof Deck	**Builder**	

Building Information

Conditioned Area [ft²]	2,099.00
Conditioned Volume [ft³]	29,178.00
Thermal Boundary Area [ft²]	7,063.70
Number Of Bedrooms	4
Housing Type	Single family detached

Rating

HERS Index	68
HERS Index w/o PV	68

Building Shell

Ceiling w/ Attic	None
Vaulted Ceiling	G1 R-20 Foam Roof 2x4 24"oc; U-0.049
Above Grade Walls	G1 R-13 Foam Cement Board; U-0.086
Found. Walls	None
Framed Floors	None
Slabs	Carpet uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.08
Infiltration	1458.9 CFM50 (3.00 ACH50)
Duct Lkg to Outside	0 CFM @ 25Pa (0 / 100 ft²)
Total Duct Leakage	125.94 CFM @ 25Pa (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	142 CFM • 49 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	714.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Georgia 2020 R405 Performance Compliance

Property
, GA
Model: Grayson

Grayson - A Slab RHGar - CM, R-20
Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost

Design	Georgia 2020 Performance	As Designed
Heating	$528	$545
Cooling	$175	$205
Water Heating	$678	$678
SubTotal - Used to determine compliance	**$1,381**	**$1,429**
Lights & Appliances	$704	$698
Onsite generation	$0	$0
Total	**$2,085**	**$2,127**

Requirements

⚠	405.3	Performance-based compliance fails by 3.5%	The projected energy bill exceeds that of the Georgia 2020 Performance reference house by $47.88.
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	R405.2	Duct Insulation	

Design fails to meet the performance requirement for Georgia 2020 Performance compliance by 3.5%.

As a 3rd party extension of the code jurisdiction utilizing these reports, I certify that this energy code compliance document has been created in accordance with the requirements of Chapter 4 of the adopted International Energy Conservation Code based on Climate Zone 3. If rating is Projected, I certify that the building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. If rating is Confirmed, I certify that the address referenced above has been inspected/tested and that the mandatory provisions of the IECC have been installed to meet or exceed the intent of the IECC or will be verified as such by another party.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 2:03 PM

Ekotrope RATER - Version 3.2.4.2662

Georgia 2020 Total UA Compliance

Property
, GA
Model: Grayson

Grayson - A Slab RHGar - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Building UA

Elements	**IECC Reference**	**As Designed**
Ceilings	78.7	128.2
Above-Grade Walls	177.5	170.0
Windows, Doors and Skylights	79.8	77.5
Slab Floor:	133.0	133.0
Framed Floors	0.0	0.0
Foundation Walls	0.0	0.0
Rim Joists	0.0	0.0
Overall UA (Design must be equal or lower):	**469.0**	**508.7**

Requirements

⚠	402.1.5	Total UA alternative compliance fails by 8.5%.	Specified envelope UA is 509 BTU / hF. This exceeds the maximum of 469 BTU / hF by 8.5%.
✓	402.3.2 Glazed Fenestration SHGC	Average SHGC: 0.27 Max SHGC: 0.27	
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	403.5.3	Hot water pipe insulation	
✓	403.5.4	Drain Water Heat Recovery Effectiveness	

Design fails to meet the requirement for Georgia 2020 Prescriptive compliance by 8.5%.

Name: Matt Wall
Organization: Ensign Building Solutions
Signature: Matt Wall
Digitally signed: 4/29/21 at 2:03 PM

Georgia 2015 IECC Compliance Report (ERI Pathway) Projected Energy Rating Index Report

Property

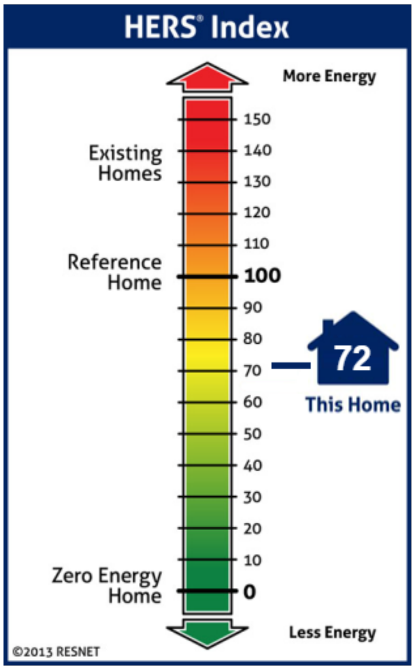
Builder:
Address:, , GA

Organization

Company:Ensign Building Solutions
Phone:
Rater:Matt Wall

Energy Rating Index Information

Projected Rating
Rating No:
Rater ID (RTIN):8094643
Date Rated:2018-10-31



Estimated Annual Energy Consumption*

	Rated Home Calculated Energy Use (MBtu)	Rated Home Cost ($/yr)
Heating	14.1	$218
Cooling	4.4	$80
Water Heating	25.5	$254
Lights & Appliances	23.9	$377
Photovoltaics	0.0	$0
Total	**67.7**	**$1,354**

*Based on standard operating conditions

ERI with PV:72

ERI without PV:72

Annual Estimates

Electric (kWh):11,408.8	CO2 Emissions (Tons):9.5
Natural Gas (Therms):288.0	Energy Savings ($)**:N/A

**Based on the Georgia 2015 IECC Compliance Report (ERI Pathway) Reference design home

Maximum Energy Rating Index:57 | This Home's Energy Rating Index:72 | FAIL

This home DOES NOT MEET the Energy Rating Index Score requirement of Georgia 2015 IECC Compliance Report (ERI Pathway) for Climate Zone 3. It DOES NOT MEET all of the requirements verified by Ekotrope. Mandatory requirements are summarized on the 2nd page of this report, some of which are not verified by Ekotrope.

Name: Matt Wall

Signature: Matt Wall

Organization: Ensign Building Solutions

Digitally signed: 4/29/21 at 2:03 PM

Rating Provider Data and Seal

Company:Southface Energy Rated Homes
Address:241 Pine Street NE
Phone #:4046042001
Fax #:

National Mortgage Industry HERS Accreditation Registry
No. 1998-057

To determine if a provider is properly accredited go to: **www.resnet.us/professional/programs/search_directory**

(Projected. Confirmation required.)

Climate Zone 3	Mandatory Requirements	
Provision Number	**Topic**	**Compliance Decision**
Georgia 2009 IECC Table 402.1.1 or 402.1.3	Building thermal envelope minimum insulation levels and maximum fenestration U-factor and SHGC	PASS
R401.3	Post a permanent certificate listing the level of efficiencies installed in the house	Certificate required for CO
R402.4.1.2	Envelope air leakage maximum leakage rate	PASS
R402.4.1 / Table R402.4.1.1	Comply with air sealing and insulation requirements in Table R402.4.1.1	Checklist required for CO
R402.4.4	Rooms containing fuel-burning appliances	PASS*
R402.5	Maximum fenestration U-factor and SHGC	(U-Factor) PASS
		(SHGC) PASS
R403.1.2	Heat pump controls	PASS*
R406.2	Ducts outside of conditioned space to be insulated to a minimum of R-6.	PASS*
R403.3.2	Duct sealing on all ducts	PASS*
R403.3.3	Duct testing for ducts in unconditioned space	PASS*
R403.3.5	Building cavities not used as ducts.	PASS*
R403.5.1	Heated water circulation and temperature maintenance systems comply	PASS*
R403.5.3	Hot water pipe insulated to R-3	PASS
R403.6	Mechanical ventilation meeting the requirements of the IRC or IMC. Outdoor air and exhaust dampers installed	PASS*
R403.7	ACCA Manual J and S conducted for all heating and cooling systems.	ACCA forms required for permit
R403.8	Systems serving multiple dwelling units to meet the mechanical requirements of IECC commercial code	PASS*
R403.9	Snow melt and ice system controls installed where applicable	PASS*
R403.10	Pools and permanent spa energy consumption meet requirements for heaters, time clocks and covers	PASS*
R403.11	Portable spas meet the requirements of APSP-14.	PASS*
R404.1	High efficacy lights installed in 75% of permanently installed fixtures.	PASS

* This is a projected rating. These items must eventually be field-verified by the Rater, Field Inspector, Code Inspector, or Builder.

Home Energy Rating Certificate
Projected Report

Rating Date: 2018-10-31
Registry ID:
Ekotrope ID: yvP8a5ev

HERS® Index Score:

74 Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$635
*Relative to an average U.S. home

Home:

, GA

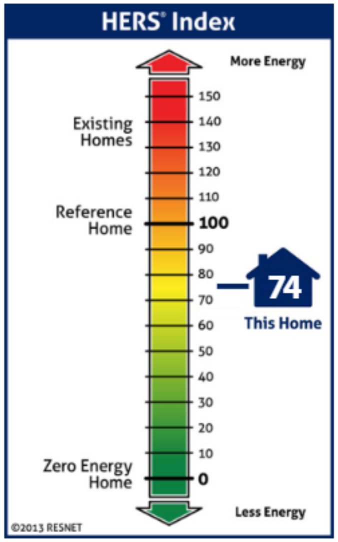
Builder:
Meritage Homes

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	16.2	$249
Cooling	3.6	$66
Hot Water	25.5	$254
Lights/Appliances	23.9	$372
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**69.2**	**$1,365**

This home meets or exceeds the criteria of the following:

2009 International Energy Conservation Code
2006 International Energy Conservation Code



Home Feature Summary:

Home Type: Single family detached
Model: Grayson
Community: N/A
Conditioned Floor Area: 2,099 ft^2
Number of Bedrooms: 4
Primary Heating System: Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System: Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating: Water Heater • Natural Gas • 0.64 UEF
House Tightness: 1574.3 CFM50 (5.00 ACH50)
Ventilation: 142 CFM • 49 Watts
Duct Leakage to Outside: 83.96 CFM @ 25Pa (4 / 100 ft^2)
Above Grade Walls: R-13
Ceiling: Attic, R-38
Window Type: U-Value: 0.35, SHGC: 0.27
Foundation Walls: N/A

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
241 Pine Street NE
4046042001

NATIONAL MORTGAGE INDUSTRY HERS ACCREDITATION REGISTRY
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 2:04 PM

ekotrope

Ekotrope RATER - Version:3.2.4.2662
The Energy Rating Disclosure for this home is available from the Approved Rating Provider.

Building Specification Summary

Property
, GA
Model: Grayson

Grayson - A Slab RHGar (Code Minimum Comparison)

Organization
Ensign Building Solutions
Matt Wall

Builder
Meritage Homes

Inspection Status
Results are projected

Building Information

Conditioned Area [ft²]	2,099.00
Conditioned Volume [ft³]	18,892.00
Thermal Boundary Area [ft²]	6,142.00
Number Of Bedrooms	4
Housing Type	Single family detached

Rating

HERS Index	74
HERS Index w/o PV	74

Building Shell

Ceiling w/ Attic	G1 R-38 Blown 2x6 16"oc, No RB; U-0.027
Vaulted Ceiling	None
Above Grade Walls	G1 R-13 Cement Board; U-0.086
Found. Walls	None
Framed Floors	None
Slabs	Carpet uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.10
Infiltration	1574.3 CFM50 (5.00 ACH50)
Duct Lkg to Outside	83.96 CFM @ 25Pa (4 / 100 ft²)
Total Duct Leakage	125.94 CFM @ 25Pa (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	142 CFM • 49 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	714.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Home Energy Rating Certificate

Projected Report

Rating Date: 2019-01-17
Registry ID:
Ekotrope ID: ILXyxo7d

HERS® Index Score:

69

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$834

*Relative to an average U.S. home

Home:

, GA

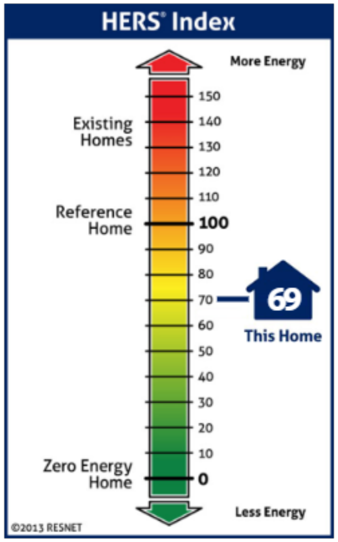
Builder:

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	13.2	$202
Cooling	6.1	$123
Hot Water	27.6	$274
Lights/Appliances	28.6	$468
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**75.4**	**$1,491**

This home meets or exceeds the criteria of the following:

2009 International Energy Conservation Code
2006 International Energy Conservation Code



Home Feature Summary:

Home Type: Single family detached
Model: Savannah
Community: N/A
Conditioned Floor Area: 2,798 ft^2
Number of Bedrooms: 5
Primary Heating System: Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System: Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating: Water Heater • Natural Gas • 0.64 UEF
House Tightness: 1635.4 CFM50 (3.00 ACH50)
Ventilation: 140 CFM • 49 Watts
Duct Leakage to Outside: 0 CFM @ 25Pa (0 / 100 ft^2)
Above Grade Walls: R-13
Ceiling: Vaulted Roof, R-20
Window Type: U-Value: 0.35, SHGC: 0.27
Foundation Walls: N/A

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
241 Pine Street NE
4046042001

NATIONAL MORTGAGE INDUSTRY HERS ACCREDITATION REGISTRY
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 2:13 PM

ekotrope

Ekotrope RATER - Version:3.2.4.2662
The Energy Rating Disclosure for this home is available from the Approved Rating Provider.
This report does not constitute any warranty or guarantee.

Building Specification Summary

Property
, GA
Model: Savannah

Savannah - C Slab LHGar - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

Building Information

Conditioned Area [ft²]	2,798.00
Conditioned Volume [ft³]	32,707.00
Thermal Boundary Area [ft²]	7,185.20
Number Of Bedrooms	5
Housing Type	Single family detached

Rating

HERS Index	69
HERS Index w/o PV	69

Building Shell

Ceiling w/ Attic	None
Vaulted Ceiling	G1 R-20 Foam Roof 2x4 24"oc; U-0.049
Above Grade Walls	G1 R-13 Foam Cement Board; U-0.086
Found. Walls	None
Framed Floors	G1 R-19 19"OC Wood Garage; R-19
Slabs	Uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.11
Infiltration	1635.4 CFM50 (3.00 ACH50)
Duct Lkg to Outside	0 CFM @ 25Pa (0 / 100 ft²)
Total Duct Leakage	167.88 CFM @ 25Pa (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	140 CFM • 49 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	727.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Georgia 2020 R405 Performance Compliance

Property
, GA
Model: Savannah

Savannah - C Slab LHGar - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Annual Energy Cost

Design	Georgia 2020 Performance	As Designed
Heating	$506	$523
Cooling	$253	$279
Water Heating	$731	$731
SubTotal - Used to determine compliance	**$1,490**	**$1,534**
Lights & Appliances	$847	$841
Onsite generation	$0	$0
Total	**$2,337**	**$2,374**

Requirements

⚠	405.3	Performance-based compliance fails by 3.0%	The projected energy bill exceeds that of the Georgia 2020 Performance reference house by $44.07.
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	R405.2	Duct Insulation	

Design fails to meet the performance requirement for Georgia 2020 Performance compliance by 3%.

As a 3rd party extension of the code jurisdiction utilizing these reports, I certify that this energy code compliance document has been created in accordance with the requirements of Chapter 4 of the adopted International Energy Conservation Code based on Climate Zone 3. If rating is Projected, I certify that the building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. If rating is Confirmed, I certify that the address referenced above has been inspected/tested and that the mandatory provisions of the IECC have been installed to meet or exceed the intent of the IECC or will be verified as such by another party.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 2:13 PM

Georgia 2020 Total UA Compliance

Property
, GA
Model: Savannah

Savannah - C Slab LHGar - CM, R-20 Roof Deck

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

This report is based on a proposed design and does not confirm field enforcement of design elements.

Building UA

Elements	**IECC Reference**	**As Designed**
Ceilings	69.3	112.9
Above-Grade Walls	205.0	204.4
Windows, Doors and Skylights	118.0	116.8
Slab Floor:	120.7	120.7
Framed Floors	15.4	15.5
Foundation Walls	0.0	0.0
Rim Joists	6.2	5.8
Overall UA (Design must be equal or lower):	**534.6**	**576.1**

Requirements

⚠	402.1.5	Total UA alternative compliance fails by 7.8%.	Specified envelope UA is 576 BTU / hF. This exceeds the maximum of 535 BTU / hF by 7.8%.
✓	402.3.2 Glazed Fenestration SHGC	Average SHGC: 0.27 Max SHGC: 0.27	
✓	R402.4.1.2	Air Leakage Testing	
✓	R402.5	Area-weighted average fenestration SHGC	
✓	R402.5	Area-weighted average fenestration U-Factor	
✓	R404.1	Lighting Equipment Efficiency	
✓	R403.6.1	Mechanical Ventilation Efficacy	
✓	Mandatory Checklist	Mandatory code requirements that are not checked by Ekotrope must be met.	
ℹ	402.1.6	Minimum insulation values from Table R402.1.6. must be met. Ekotrope does not check this automatically.	
✓	403.1.2	Heat pump supplementary heat	
✓	403.1.2.3	Primary Heat Source	
✓	403.3.4	Duct Leakage	
✓	403.5.3	Hot water pipe insulation	
✓	403.5.4	Drain Water Heat Recovery Effectiveness	

Design fails to meet the requirement for Georgia 2020 Prescriptive compliance by 7.8%.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 2:13 PM

Georgia 2015 IECC Compliance Report (ERI Pathway) Projected Energy Rating Index Report

Property

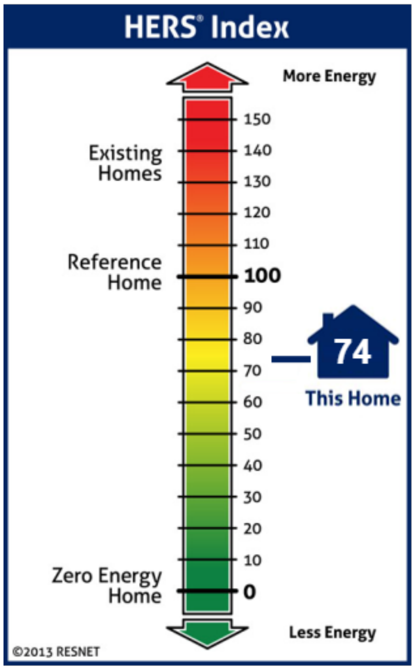
Builder:
Address:, , GA

Organization

Company:Ensign Building Solutions
Phone:
Rater:Matt Wall

Energy Rating Index Information

Projected Rating
Rating No:
Rater ID (RTIN):8094643
Date Rated:2019-01-17



Estimated Annual Energy Consumption*

	Rated Home Calculated Energy Use (MBtu)	Rated Home Cost ($/yr)
Heating	13.2	$202
Cooling	6.1	$123
Water Heating	27.6	$274
Lights & Appliances	28.6	$468
Photovoltaics	0.0	$0
Total	**75.4**	**$1,491**

*Based on standard operating conditions

ERI with PV:74

ERI without PV:74

Annual Estimates

Electric (kWh):12,966.1
Natural Gas (Therms):311.7
CO2 Emissions (Tons):10.7
Energy Savings ($)**:N/A

**Based on the Georgia 2015 IECC Compliance Report (ERI Pathway) Reference design home

Maximum Energy Rating Index:57 This Home's Energy Rating Index:74 FAIL

This home DOES NOT MEET the Energy Rating Index Score requirement of Georgia 2015 IECC Compliance Report (ERI Pathway) for Climate Zone 3. It DOES NOT MEET all of the requirements verified by Ekotrope. Mandatory requirements are summarized on the 2nd page of this report, some of which are not verified by Ekotrope.

Name: Matt Wall
Signature: Matt Wall
Organization: Ensign Building Solutions
Digitally signed: 4/29/21 at 2:13 PM

Rating Provider Data and Seal

Company:Southface Energy Rated Homes
Address:241 Pine Street NE
Phone #:4046042001
Fax #:

National Mortgage Industry HERS Accreditation Registry
No. 1998-057

To determine if a provider is properly accredited go to: **www.resnet.us/professional/programs/search_directory**

(Projected. Confirmation required.)

Climate Zone 3	Mandatory Requirements	
Provision Number	**Topic**	**Compliance Decision**
Georgia 2009 IECC Table 402.1.1 or 402.1.3	Building thermal envelope minimum insulation levels and maximum fenestration U-factor and SHGC	PASS
R401.3	Post a permanent certificate listing the level of efficiencies installed in the house	Certificate required for CO
R402.4.1.2	Envelope air leakage maximum leakage rate	PASS
R402.4.1 / Table R402.4.1.1	Comply with air sealing and insulation requirements in Table R402.4.1.1	Checklist required for CO
R402.4.4	Rooms containing fuel-burning appliances	PASS*
R402.5	Maximum fenestration U-factor and SHGC	(U-Factor) PASS
		(SHGC) PASS
R403.1.2	Heat pump controls	PASS*
R406.2	Ducts outside of conditioned space to be insulated to a minimum of R-6.	PASS*
R403.3.2	Duct sealing on all ducts	PASS*
R403.3.3	Duct testing for ducts in unconditioned space	PASS*
R403.3.5	Building cavities not used as ducts.	PASS*
R403.5.1	Heated water circulation and temperature maintenance systems comply	PASS*
R403.5.3	Hot water pipe insulated to R-3	PASS
R403.6	Mechanical ventilation meeting the requirements of the IRC or IMC. Outdoor air and exhaust dampers installed	PASS*
R403.7	ACCA Manual J and S conducted for all heating and cooling systems.	ACCA forms required for permit
R403.8	Systems serving multiple dwelling units to meet the mechanical requirements of IECC commercial code	PASS*
R403.9	Snow melt and ice system controls installed where applicable	PASS*
R403.10	Pools and permanent spa energy consumption meet requirements for heaters, time clocks and covers	PASS*
R403.11	Portable spas meet the requirements of APSP-14.	PASS*
R404.1	High efficacy lights installed in 75% of permanently installed fixtures.	PASS

* This is a projected rating. These items must eventually be field-verified by the Rater, Field Inspector, Code Inspector, or Builder.

Home Energy Rating Certificate

Projected Report

Rating Date: 2019-01-17
Registry ID:
Ekotrope ID: P2lymrxL

HERS® Index Score:

74

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

$765

*Relative to an average U.S. home

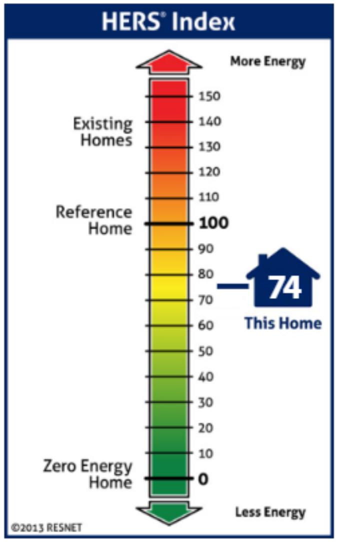
Home:

, GA

Builder:

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	17.5	$264
Cooling	5.2	$104
Hot Water	27.6	$274
Lights/Appliances	28.6	$464
Service Charges		$424
Generation (e.g. Solar)	0.0	$0
Total:	**78.8**	**$1,529**



Home Feature Summary:

Home Type: Single family detached
Model: Savannah
Community: N/A
Conditioned Floor Area: 2,798 ft²
Number of Bedrooms: 5
Primary Heating System: Air Source Heat Pump • Electric • 8.2 HSPF
Primary Cooling System: Air Source Heat Pump • Electric • 14 SEER
Primary Water Heating: Water Heater • Natural Gas • 0.64 UEF
House Tightness: 2162.4 CFM50 (5.00 ACH50)
Ventilation: 140 CFM • 49 Watts
Duct Leakage to Outside: 111.92 CFM @ 25Pa (4 / 100 ft²)
Above Grade Walls: R-13
Ceiling: Attic, R-38
Window Type: U-Value: 0.35, SHGC: 0.27
Foundation Walls: N/A

This home meets or exceeds the criteria of the following:

2009 International Energy Conservation Code
2006 International Energy Conservation Code

Rating Completed by:

Energy Rater: Matt Wall
RESNET ID: 8094643

Rating Company: Ensign Building Solutions
1479 Ventura Drive Ste. A Cumming, GA 30040
770-205-9891

Rating Provider: Southface Energy Rated Homes
241 Pine Street NE
4046042001

NATIONAL MORTGAGE INDUSTRY HERS ACCREDITATION REGISTRY
No. 1998-057

Matt Wall

Matt Wall, Certified Energy Rater
Digitally signed: 4/29/21 at 2:13 PM

ekotrope

Ekotrope RATER - Version:3.2.4.2662
The Energy Rating Disclosure for this home is available from the Approved Rating Provider.
This report does not constitute any warranty or guarantee.

Building Specification Summary

Property
, GA
Model: Savannah

Savannah - C Slab LHGar (Code Minimum Comparison)

Organization
Ensign Building Solutions
Matt Wall

Builder

Inspection Status
Results are projected

Building Information

Conditioned Area [ft²]	2,798.00
Conditioned Volume [ft³]	25,949.00
Thermal Boundary Area [ft²]	6,939.30
Number Of Bedrooms	5
Housing Type	Single family detached

Rating

HERS Index	74
HERS Index w/o PV	74

Building Shell

Ceiling w/ Attic	G1 R-38 Blown 2x8 16"oc, No RB; U-0.027
Vaulted Ceiling	None
Above Grade Walls	G1 R-13 Cement Board; U-0.086
Found. Walls	None
Framed Floors	G1 R-19 19"OC Crpt Garage; R-19
Slabs	Uninsulated; R-0

Windows (largest)	U-Value: 0.35, SHGC: 0.27
Window / Wall Ratio	0.11
Infiltration	2162.4 CFM50 (5.00 ACH50)
Duct Lkg to Outside	111.92 CFM @ 25Pa (4 / 100 ft²)
Total Duct Leakage	167.88 CFM @ 25Pa (Post-Construction)

Mechanical Systems

Heating	Air Source Heat Pump • Electric • 8.2 HSPF
Cooling	Air Source Heat Pump • Electric • 14 SEER
Water Heating	Water Heater • Natural Gas • 0.64 UEF
Programmable Thermostat	Yes
Ventilation System	140 CFM • 49 Watts

Lights and Appliances

Percent Interior LED	90%
Percent Exterior LED	100%
Refrigerator (kWh/yr)	727.0
Dishwasher Efficiency	270 kWh
Ceiling Fan (CFM/Watt)	70.4

Clothes Dryer Fuel	Electric
Clothes Dryer CEF	2.6
Clothes Washer LER (kWh/yr)	704.0
Clothes Washer Capacity	2.9
Range/Oven Fuel	Natural Gas

Proposed Amendment for
Air Impermeable Insulation in Semi-conditioned Attics

Summary:
With respect to the proposed amendment to the 2020 GA energy code, proponents recognize the need for the code to be product agnostic. Revisions to the amendment are included here in. The revisions make reference to installation of air impermeable insulation, but make no reference to specific insulation products; rather, this amendment only addresses the associated R-value requirement (which is already accepted in the GA Energy Code) as well as the need for complete coverage, or quality of installation.

Proponents of this amendment would like to briefly address the need, or the purpose, of this proposal and provide additional supporting documentation.

Purpose:
The current energy code allows buildings to comply either via prescriptive path or performance path. The performance path gives four different options to show compliance, including:

- ERI
- Simulated Performance
- UA Tradeoff
- Rescheck (not a viable compliance option because Rescheck does not account for GA amendments)

The practice of creating semi conditioned attics in lieu of vented attics is becoming more and more common, in large part because of increasing consumer demand and the recognition that this practice results in a more energy efficient home. The benefits of bringing the HVAC system inside the thermal envelope are well documented. The 2020 GA Energy Code does make accommodations for the use of air impermeable insulation installed in the roofline; however, homes built using this insulating method very often do not pass code using the alternative compliance options specifically allowed in the code, even though homes implementing this practice outperform the same house built to the prescriptive energy code requirements.

Supporting Documentation:
Provided as an addendum to this summary are HERS Certificates that may be submitted as evidence to the improved performance of homes that employ the use of air impermeable insulation in the roofline. This energy modeling was produced for both townhomes and SFH, and in every case, reflects a reduced HERS Rating and reduction in annual energy usage. Also provided are sample documents using the currently approved compliance options showing that these homes “fail” to meet the energy code, despite having improved performance.

This amendment provides builders with one additional compliance pathway. Builders are not required to install air impermeable insulation in the roofline, but if they do, they should have a compliance pathway that is simple for them to employ, and equally as simple for code officials to enforce.

BOMA Georgia

BUILDING OWNERS AND
MANAGERS ASSOCIATION
OF GEORGIA
5901-C Peachtree Dunwoody Rd NE, Suite 300
Atlanta, GA 30328
www.BOMAGeorgia.org

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

2018 IEBC – Mandatory Code

Dear Mr. Miltiades,

The Building Owners and Managers Association of Georgia (BOMA Georgia) is writing in support of the proposed amendment submitted by the American Institute of Architects of Georgia (AIA Georgia) that advocates for the adoption of the 2018 IEBC with Amendments as a mandatory code in Georgia.

BOMA Georgia is a trade association representing one of the largest and most revenue-generating industries in the state: commercial real estate. In Georgia, commercial real estate contributes approximately $5 billion to the state's economy; generates nearly $1.5 billion in new taxable personal earnings and supports nearly 50,000 jobs.

This amendment would have definite benefits to the commercial real estate industry. Most notably, these benefits include:

- Clear guidelines for architects and contractors working with building officials to expedite the regular and ongoing construction projects that occur at existing buildings managed commercial real estate management professionals.
- Setting a consistent standard in existing building construction and renovation across jurisdictions in the state. Many of our members manage a portfolio of existing buildings in Georgia. A consistent and mandatory code in Georgia would result in cost and time savings for existing building owners, tenants, and managers.
- The flexibility provided by the IEBC helps encourage the use of existing buildings for businesses and business tenants in Georgia because the reuse of existing buildings is generally more affordable.
- BOMA Georgia members are proponents of green and sustainable solutions and seek ways to increase efficiency and reduce waste. The reuse of buildings is significantly more sustainable than the energy and waste generated during new construction.

It is for these reasons and many more that we encourage the adoption of the 2018 IEBC with Amendments as a mandatory code in Georgia. Thank you for your consideration.

Sincerely,

Gabriel Eckert, FASAE, CAE
CEO, BOMA Georgia

Please submit response to:
Ryan Okey
Department of Pesticide Regulation
511 Westinghouse Road
Pendleton, SC 29670

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Dear Mr. Miltiades,

The Association of Structural Pest Control Regulatory Officials (ASPCRO) has been focusing on structural pest management issues including the inspection and control of termites since 1956. ASPCRO's membership is comprised of state pest control regulatory officials who are responsible for assuring consumer protection related to termite control and prevention. Each state has an agency that regulates pest management companies that provide termite control and many states have specific state regulations on termite inspections.

On behalf of the ASPCRO Board of Directors, I am writing in support of the Georgia Structural Pest Control Commission and Georgia Department of Agriculture's initiative to update the residential building codes with the Georgia Department of Community Affairs.

We strongly support this amendment for the following reasons:

- Termites cause more than $5 billion in damage each year across the United States.
- Visual inspections, provide an accurate, first-line of protection, method of termite detection available to pest management professionals. Georgia, along with a number of other states, has specific laws regarding the performance of termite inspections requiring a visual inspection for evidence of termite infestation when completing the Georgia Wood Infestation Inspection Report.
- The proposed amendment allows for a visible inspection of the foundation and framing interface of a crawl space and basement construction. Visual access to foundation and framing interface is critical for effective subterranean termite inspections.
- The proposed amendment provides the best consumer protection. Visual access affords pest management professionals the best opportunity for early detection of termite infestation reducing the risk of costly damage and repairs.

Thank you for the consideration.

Sincerely,

Ryan Okey
ASPCRO, President
www.ASPCRO.org

cc: Mr. Derrick Lastinger

M1401.2 Access

Heating and cooling equipment and appliances shall be located only in conditioned spaces with respect to building construction and other equipment and appliances to permit maintenance, servicing and replacement. Clearances shall be maintained to permit cleaning of heating and cooling surfaces; replacement of filters, blowers, motors, controls and vent connections; lubrication of moving parts; and adjustments.

Exception: **Access shall not be required for ducts, piping, or other components approved for concealment.**

M1305.1 Appliance Access for Inspection Service, Repair and Replacement

Appliances shall be located to allow for access for inspection, service, repair and replacement without removing permanent construction, other appliances, or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide (762 mm by 762 mm) shall be provided in front of the control side to service an appliance.

M1305.1.1 Appliances in Rooms

Appliances installed in a compartment, alcove, basement or similar space shall be accessed by an opening or door and an unobstructed passageway measuring not less than 24 inches (610 mm) wide and large enough to allow removal of the largest appliance in the space, provided there is a level service space of not less than 30 inches (762 mm) deep and the height of the appliance, but not less than 30 inches (762 mm), at the front or service side of the appliance with the door open.

M1305.1.2 Appliances in Attics

Conditioned attics containing appliances shall be provided with an opening and a clear and unobstructed passageway large enough to allow removal of the largest appliance, but not less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) long measured along the centerline of the passageway from the opening to the appliance. The passageway shall have continuous solid flooring in accordance with Chapter 5 not less than 24 inches (610 mm) wide. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present along all sides of the appliance where access is required. The clear access opening dimensions shall be not less than of 20 inches by 30 inches (508 mm by 762 mm), and large enough to allow removal of the largest appliance.

Exceptions:

1. The passageway and level service space are not required where the appliance can be serviced and removed through the required opening.
2. Where the passageway is unobstructed and not less than 6 feet (1829 mm) high and 22 inches (559 mm) wide for its entire length, the passageway shall be not more than 50 feet (15 250 mm) long.

May 04, 2021

RE: Code Amendment Support

I am in favor of the proposed amendment to the State Mechanical Code to restrict the placement of split HVAC air handlers in unconditioned attic spaces. This practice effects the efficiency of the unit, adding to an increased use of electricity. It also impacts air quality and leads to difficulty in properly maintaining the units. I am the broker/owner for 2 real estate companies in Valdosta. Anchor Realty currently manages over 750 units in and around Valdosta. I have seen the negative impacts of the practice of placing these units in the unconditioned attics many times in the form of costly repairs, complaints about poor air quality, inefficient cooling, and high energy bills. I strongly support the amendment to the Georgia Mechanical Code to prohibit that attic placement.

Sincerely,

Anthony G. (Tony) Barker

Broker, Re/Max of Valdosta

Broker, Anchor Realty of South Georgia, LLC

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Home Energy Rating Variability Study:
A Comparison in New Single-family Homes

September 30, 2018

Midwest Energy Efficiency Alliance (MEEA)

Northeast Energy Efficiency Partnership (NEEP)

Northwest Energy Efficiency Alliance (NEEA)

South-central Partnership for Energy Efficiency as a Resource (SPEER)

Southeast Energy Efficiency Alliance (SEEA)

Southwest Energy Efficiency Project (SWEEP)

Prepared for the U.S. Department of Energy

Disclaimer

Table of Contents

Summary

The addition of the *Energy Rating Index* (ERI) in the International Energy Conservation Code (IECC) marked the first time that an energy rating had been incorporated directly into a national model code. The ERI differs from traditional compliance paths in that code compliance, and related home performance, is determined by comparing a home's energy rating to a specified target rating for each climate. The incorporation of the ERI also brought important questions related to code implementation, many centering on the expected consistency of the approach, as well as the roles and responsibilities of those working to implement and verify codes at the state and local levels. The U.S. Department of Energy (DOE) Building Energy Codes Program therefore commissioned a study in attempt to better understand how home energy ratings might function as a code compliance mechanism, and to address the question of variability that could be expected if enlisting the HERS Index[1] for the purpose of demonstrating code compliance via the ERI path.

Methodology

DOE engaged the regional energy efficiency organizations (REEOs) to collect data, targeting new single-family homes across U.S. climates, as represented by the respective REEO regions. In order to ensure objectivity of the results, the study was conducted as a blind effort, with raters unaware that multiple ratings were being conducted on the same home. Highlights of the Methodology include:

- Each study identified a homebuilder who was willing to participate in the study, providing a house at the final inspection stage of construction
- Multiple RESNET-certified HERS Raters (typically 4-6 per home) were commissioned to perform a plan review and field inspection based on RESNET protocol—each was provided construction documentation for the home and conducted onsite verification
- Ratings were conducted over a four to six day period to assure consistent field conditions and that there would be no overlap of raters onsite
- REEO staff coordinated the individual home assessments and provided quality control, monitoring site procedures and noting observations
- Each home received a preliminary HERS Index and Building Summary Report

Results

In total, 56 total ratings were gathered across 11 homes. The average rating variability observed for an individual home was approximately 13 points. More information on the range of scores observed and their expected impact on residential energy use is outlined in the Key Outputs section.

Beyond the overall ratings and energy use projections, several inconsistencies were noted amongst additional data points, including many efficiency measures known to have a significant impact on residential energy consumption. Notably, home size and geometry, HVAC equipment, and utility rates, among others. A wide range of software packages and versions were also employed for calculating the energy ratings.

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[1] The HERS Index was chosen as the focal point of the study based on its use within several state codes and the incorporation of RESNET Standard 301 into the IECC.

The results of the study provide insight on the range of potential variability that might be expected under the ERI path and how home energy ratings might function as a code compliance mechanism. It also raises many important questions that are not yet addressed. For example:

- What portion of variability is due to human subjectivity compared to that which is inherent to the selected software or underlying calculation methodology?
- What are the primary drivers of variability sensitivity, including key attributes and inputs with the most significant effect on rating variance and projected energy use?
- What is the effect of variability on home energy performance (i.e., actual energy use)?
- What level of variability is acceptable to industry and affected stakeholders?
- What range of variability will ensure equitable energy use compared to traditional prescriptive and performance-based code compliance paths?

These require further investigation and should be expanded as part of future research efforts.

Background

An Introduction to Home Energy Ratings

The Home Energy Rating System (HERS) is an index used to measure home energy efficiency developed and administered by the Residential Energy Services Network (RESNET)[2]. The system is widely used for inspecting and calculating a home's energy performance, including for many above-code programs such as the ENERGY STAR for New Homes program. HERS can be used in both new construction and existing home applications. A HERS Index Score is intended to communicate home's energy performance in an easy and simple manner, portraying the basic energy efficiency characteristics of the home, including heating, cooling and watering heating, and other loads contributing to the cost of owning and operating the home.

Key features accounted in the HERS Index Score include:

- Exterior walls (both above and below grade)
- Floors over unconditioned spaces (e.g., garages or cellars)
- Ceilings and roofs
- Attics and foundations
- Windows and doors
- Vents and ductwork
- HVAC and water heating systems (and controls)
- Envelope air tightness
- Heating and cooling distribution system tightness

A certified Home Energy Rater (HERS Rater) assesses the energy efficiency of a home, assigning it a relative performance score. To calculate a home's HERS Index Score, a certified RESNET HERS Rater does an energy rating on a home and compares the data against a reference home, which is a modeled home design to the same geometry and specified characteristics as the actual home. As the projected energy usage of the home decreases, so does the HERS Index – approximately one point for every one percent improvement over a baseline index of 100. According to RESNET, a home with a HERS Index Score of 70 is 30 percent *more* energy efficiency than the RESNET Reference Home. Similarly, a home with a HERS Index Score of 130 is 30 percent *less* energy efficiency than the same Reference Home[3].

Home Energy Ratings in the International Energy Conservation Code

The HERS Index is widely recognized amongst the residential design, construction and code compliance community, and several states have incorporated a HERS compliance option within their codes as part of the state adoption process. These compliance options typically take the form of requiring a HERS Index Score that must be met (or exceeded) in lieu of traditional prescriptive or performance-based compliance paths. In more recent years, the HERS Index has also been incorporated directly into the model energy code for low-rise residential buildings, the International Energy Conservation Code (IECC). The 2015 IECC introduced a new performance path via (an added) Section R406, known as the *Energy Rating Index*, or ERI.

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[2] http://www.hersindex.com/understanding

[3] https://www.resnet.us/hers-index

Residential Energy Services Network (RESNET)

The Residential Energy Services Network, or RESNET, is a non-profit organization that serves as the membership and credentialing body for RESNET-certified home energy raters, and as the development body administering the industry standards backing the HERS Index, most notably ANSI/RESNET/ICC Standard 301, the Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index. This Standard is a joint publication of the American National Standards Institute (ANSI), RESNET, and the International Code Council (ICC), and serves as the technical basis for performing and calculating a HERS Score.

Learn more about RESNET at www.resnet.us.

Regional Energy Efficiency Organizations (REEOs)

The Regional Energy Efficiency Organizations (REEOs) are non-profit organizations with the shared goal of connecting key market stakeholders and best practices to leverage the power and benefits of energy efficiency across the United States. The REEO network is comprised of six individual organizations representing various regions of the country:

- Midwest Energy Efficiency Alliance (MEEA)
- Northeast Energy Efficiency Partnership (NEEP)
- Northwest Energy Efficiency Alliance (NEEA)
- South-Central Partnership for Energy Efficiency as a Resource (SPEER)
- Southeast Energy Efficiency Alliance (SEEA)
- Southwest Energy Efficiency Project (SWEEP)

Each REEO is an independent non-profit organization working together to provide a mix of programs and tools to help advance energy efficiency as a resource. In addition to working within their specific regions, the REEOs also collaborate on areas of common interest, including policy, technical assistance programs and communications.

Learn more about the REEO network at
http://www.neep.org/network/regional-energy-efficiency-organizations-network.

U.S. Department of Energy

The U.S. Department of Energy (DOE) Building Energy Codes Program is directed by federal statute to perform several functions related to building energy codes for residential and commercial buildings. As part of its directives, DOE is required to review updated editions of the model energy codes, including the International Energy Conservation Code (IECC), and issue a *determination*[4] as to whether the updated edition will result in increased energy efficiency in residential buildings. DOE is also directed to participate in industry model code review and consensus processes, providing technical support and conducting analysis to review the technical and economic basis of code updates. In addition, DOE is directed to provide technical assistance to states implementing building energy efficiency codes.

Learn more about the DOE Building Energy Codes Program at www.energycodes.gov/about.

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[4] https://www.energycodes.gov/development/determinations

Study Purpose

The addition of the *Energy Rating Index* in the 2015 International Energy Conservation Code (IECC) marked the first time that an energy rating had been incorporated into a national model code. While a number of states have incorporated alternative paths built around energy ratings at the state level, this was the first time that a rating option was incorporated within the model code directly as an alternative compliance path. While the HERS Index was not originally specified within the ERI path, the connection was made more explicit when ANSI/RESNET/ICC Standard 301 was incorporated by reference in the 2018 IECC.

Many stakeholders played a role in establishing the ERI and multiple variations were considered as part of the code development process administered by the International Code Council (ICC). The IECC ultimately settled on a relatively simplistic approach by which a home must achieve an ERI at or below (better) than a specified threshold targets for each climate zone in addition to meeting the mandatory requirements of the IECC as well as the prescriptive envelope requirements of the 2009 IECC[5]. In establishing these targets, interested and affected parties provided thorough testimony and analysis supporting the specified thresholds, which vary by only one point between most climate zones, and by a range of just five points across all climates.

The U.S. Department of Energy (DOE) Building Energy Codes Program is directed by statute to perform several activities related to building codes. These include participation in industry processes to review and update building codes, such as the IECC, and providing technical assistance to states implementing building energy codes.[6] The ERI path is fundamentally different from traditional compliance paths in that home performance is determined by comparing a home's energy rating (i.e., ERI) to targets specified in the IECC. There is significant interest in understanding how the ERI will impact residential energy efficiency, how it will function as a compliance path, and what assistance will be needed by states and local code jurisdictions working to implement new editions of the IECC.

DOE therefore commissioned a study in attempt to better understand how home energy ratings might function as a code compliance mechanism. Specifically, to address the question of variability that could be expected when enlisting the HERS Index for the purpose of demonstrating code compliance via the ERI path. Data on HERS ratings for new homes was collected by the REEOs across their respective regions, aggregated and reported. The intent of the study was to provide insight to raters, the code compliance community, and other affected stakeholders for general awareness and to aid ongoing quality assurance efforts. In this initial study, DOE desired objective data and key outputs of the HERS rating process, and specifically did not attempt to understand the *why* behind the ratings, such as isolating or quantifying specific inputs and variables that may be the cause of variability. Consistency and replicability of the rating process is crucial to the ERI path, and to ensure that households can expect equitable levels of energy performance regardless of compliance path.

Methodology

The purpose of the study was to increase understanding of how home energy ratings might function as a code compliance mechanism, including the level of variability that could be expected when enlisting the HERS Index for the purpose of demonstrating code compliance via the ERI path. The REEOs sampled 11

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[5] As outlined in Table 402.1.2 or 402.1.4 of the 2009 IECC

[6] https://www.energycodes.gov/about/statutory-requirements

homes[7] across each of their 6 regions for a total of 56 individual ratings. Each home was assessed by 4 to 6 different local RESNET-certified raters. The methodology required a blind study where individual raters were not made aware they were evaluating the same home. This was crucial to ensure objectivity and replicate conditions that could be present when employing the ERI path.

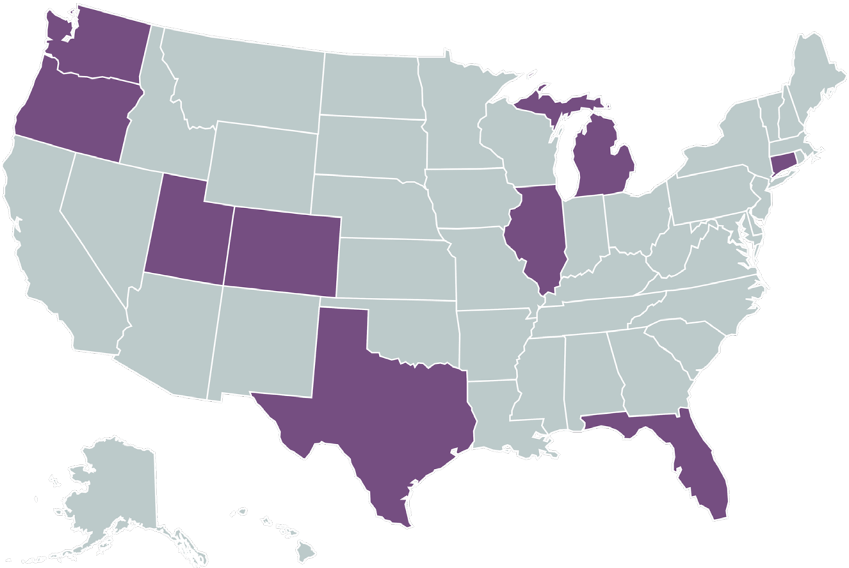

Figure: Data collection locations across states and regions

General Protocol

The protocol implemented was as follows. Each REEO:

1. Identified a homebuilder who was willing to participate in the study and able to provide a single-family house ready to receive a final blower door and duct blaster test.
2. Hired four to six RESNET-certified HERS Raters, each from a different company to perform a plan review and field inspection (based on RESNET protocol).
3. Received a projected HERS Index and relevant input documentation from each of the raters.
4. Aggregated the collection of data and reported findings.

House Selection

The houses selected for the study were new single-family homes. Each home was recently completed, or close to completion, and ready for final inspection and testing (based on the requirements identified in the IECC). For each region, the respective REEO selected two homes in separate states, and targeted 4-6 ratings per home.

It is important to note that homes were targeted across multiple states and therefore their codes and related energy efficiency requirements varied. Homes were not screened based on the applicable code

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[7] An additional home in Malta, NY also participated in the study, but for diagnostic testing only and did not receive projected HERS Indices.

or evaluated for the purposes of determining compliance (e.g., whether mandatory code measures were met, prescriptive requirements, etc.). It's also important to highlight that the study sought data on the consistency of multiple ratings on a *single* home and not whether the resulting ratings complied with the code (via the ERI targets specified in the IECC).

Communication Protocol

A REEO staff member or a contractor coordinated raters hired to provide the projected HERS Index. Each REEO generally conducted the following activities:

- Delivery of supporting documentation (i.e., available plans, specifications, and similar information depicting the energy efficiency characteristics of the home)
- Coordinating the ratings and site activities
- Arranging payment
- Other administrative aspects (e.g., email communication, responding to inquiries, etc.)

When initially contacted, raters were generally informed that the builder was considering using a HERS score as a marketing tool or as a means of complying with code, where applicable. They were told that the builder desired to know what HERS Score the home achieved, but that a *confirmed* rating was not necessary for the home.

Prior to the onsite assessment, all raters were provided the same information and documentation (e.g., house plans, window schedules, insulation values and other default or non-observable information). This information was intended to provide a consistent collection of information about a given home to all applicable raters and to aid in the calculation of the HERS Score. If an individual rater made further inquiries about the home or related documentation, responses were provided only to the rater who asked the question.

One thing to note is that a HERS Rater would often be involved throughout the design and construction process in order to verify all inputs required for a confirmed rating. In this case, the limited time window did not allow for verification of items that were already in place and no longer visible, such as wall cavity insulation. While this approach ensured that inspections could be completed quickly for the purposes of the study, it left less opportunity for discovery and interaction that would ideally be part of the rating process. However, in all cases, required information that was not directly observable was provided to all raters in order to maintain consistency amongst variables for a given home.

On-Site Assessments

To ensure consistent field conditions and maintain study objectivity (blindness), ratings were conducted over two-week period, at maximum, with no overlap of raters on the project site. A member of the REEO staff or a hired contractor met each rater at the subject house, answered questions and monitored the onsite data collection.

Rating Documentation

The following was generally requested to accompany each rating:

- An informational Home Energy Rating Certificate[8]
- Building Summary
- Performance Report

In some cases, not all requested documentation was provided by the rater. In other cases, raters provided additional documentation, such as AHRI certificates. For houses assessed in Florida, the EnergyGauge Input Summary Report was provided by all raters upon completion of the projected HERS Index.[9]

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[8] The Home Energy Rating Certificates received had a draft watermark printed on the document; "NOT CERTIFIED. For certification this rating must be registered." This indicated that the rating was not uploaded to the RESNET database as a confirmed rating.

[9] The Florida energy code requires the use of EnergyGauge software for calculating code compliance.

Key Outputs: Reported HERS Index and Annual Energy Usage

The study encompassed 11 homes across 9 states that are geographically dispersed across the U.S. for a total of 56 individual ratings. Each home received a minimum of at least 4 ratings, with some homes receiving up to 6 ratings. The outputs targeted include the projected *HERS Score* and *annual energy usage* for each home. These are commonly calculated by HERS Raters and are of primary interest to the homeowner or prospective home buyers.

Table: Projected HERS Index by Home and Location

Location		**HERS Index**					
Seattle, WA		76	71	79	75	74	-
Portland, OR		83	82	86	86	88	-
Orlando, FL		70	74	71	59	-	-
Tallahassee, FL		71	62	72	74	-	-
Dallas-Fort Worth, TX		78	71	79	67	65	64
Austin, TX		69	64	55	75	64	-
Denver, CO		67	70	79	68	99	-
Salt Lake City, UT		42	51	43	50	-	-
Chicago, IL		44	42	51	44	49	40
Grand Rapids, MI[10]		65	60	58	60	-	-
Derby, CT[11]	(w/o PV)	N/A	55	43	N/A	50	45
	(w/PV)	19	N/A	N/A	28	30	22

The variability of ratings assigned to a particular home ranged from a low of 6 points (Portland) to a high of 32 points (Denver). A majority of homes (7 of the 11) experienced variability of 10 or more points. Average variability across all homes studied was approximately 13 points.

In terms of projected annual energy usage (MMBtu), similar trends are observed. Variability ranges from a low of 6.3 MMBtu in Salt Lake City to a high of 98 MMBtu in Denver[12]. Average variability across all homes studied was 36 MMBtu.

Additional information on each home, including the more detailed inputs and data points provided by individual raters, is outlined in the Appendix.

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[10] The Grand Rapids home was not at the typical point of construction for a certified HERS rating. The home was insulated, had drywall installed and finished, and was relatively air sealed. However, the finished flooring, lighting, water heater, air conditioner, thermostat, toilets, and appliances were not installed. More information about the home is listed in the Appendix.

[11] The Derby, CT home had a PV system and several raters chose to evaluate the home either with or without the PV contribution (and in some cases chose to evaluate both scenarios)

Table: Projected Annual Energy Usage by Home and Location

Location[13]	**Projected Annual Energy Usage** (MMBtu)					
Seattle, WA	55.01	82.37	83.17	69.80	64.57	
Portland, OR	52.99	55.69	46.26	47.36	54.98	
Dallas-Fort Worth, TX	97.1	89	66	84.5	53.4	78.6
Austin, TX	68.5	50.3	49.4	58.8	62.1	
Denver, CO	141.4	157.4	121.7	105.4	203.4	
Salt Lake City, UT	39.0	44.5	41.8	45.3		
Chicago, IL	61.4	80.2	92.2	83.0	77.3	55.4
Grand Rapids, MI[14]	93.2	60.8	85.0	79.0		
Derby, CT (w/o PV)	28.4	80.2	44.2	59.3	60.9	

Conclusion

The current study sought an understanding of what variability might be experienced if enlisting the HERS Index for the purpose of demonstrating compliance with the Energy Rating Index (ERI) path of the IECC. The study included eleven homes across each region of the U.S., as represented by the regional energy efficiency organizations (REEOs), and a total of 56 individual ratings. Average observed per-house variability in the study was approximately 13 points. Variability between the maximum and minimum ratings for an individual home ranged from as little as 6 points to as much as 32 points. Similarly, projected annual energy consumption from a low of 6.3 MMBtu to a high of 98 MMBtu, and averaging 36 MMBtu of variability for an individual home.

While the study deliberately did not evaluate the causation of variability or sensitivity of individual variables, it did record data on many of the inputs and assumptions used by raters in establishing the respective HERS Scores. These data points include many notable attributes that are generally considered to have a significant impact on energy use in single-family homes, such as:

- Envelope and duct tightness
- Envelope insulation levels and installation quality
- Total window area and orientation
- Percentage of high-efficacy lighting
- Appliance and equipment efficiency
- Mechanical ventilation

Several of these additional data points were noted as inconsistent, including some attributes that were directly observable by the rater (e.g., roof color) or provided as part of the home's construction documents (e.g., wall insulation R-value). A wide range of software was also noted, with the average home being rated using three different versions of software. One home was rated with five different

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[13] For houses assessed in Florida, the EnergyGauge Input Summary Report and the informational Home Energy Rating Certificate did not include projected annual energy usage measured in MMBtu.

[14] The Grand Rapids home was not at the typical point of construction for a certified HERS rating. The home was insulated, had drywall installed and finished and was relatively air sealed. However, the finished flooring, lighting, water heater, air conditioner, thermostat, toilets, and appliances were not installed. More information about the home is listed in the appendix.

versions of REM/Rate software amongst six raters. It is unclear to what extent this may contribute to the overall variability for each home. Additional information on these additional data points is presented in the appendix, organized by the respective regions represented in the study.

While the study attempts to assess basic levels of ERI variability, it is based on a relatively small sample of homes, and should not be considered statistically representative. However, it does provide a preliminary sampling of results and raises many important questions for further inquiry. The level of variability observed in the study is notable in comparison to the ERI targets established in the IECC, which typically vary by only one point between climate zones and by five points across all climates.

Looking to the future, there is a need for additional inquiry to more comprehensively assess:

- What portion of variability is due to human subjectivity compared to that which is inherent to the selected software or underlying calculation methodology?
- What are the primary drivers of variability (sensitivity), including key attributes and inputs with the most significant effect on rating variance and related energy use?
- What is the effect of variability on home energy performance (i.e., actual energy use)?
- What level of variability is acceptable to industry and affected stakeholders?
- What range of variability will ensure equitable energy use compared to traditional prescriptive and performance-based code compliance paths?

These questions and others are critical to ensuring the quality and consistency of home energy ratings, as well equitable performance of homes demonstrating code compliance via an ERI.

Appendix

Northwest Region: Seattle, WA and Portland, OR

Project Team: Northwest Energy Efficiency Alliance (NEEA)

Summary: For houses assessed in WA and OR, NEEA collected the following information from email communication and documents, on-site observations, the RemRate™ and informational Home Energy Rating Certificate.

General Observations

NEEA's project team observed each rater's on-site process, noting their overall workflow, data collection methods, and specific areas of emphasis or deviation. The observations were as follows:

1. Some rating companies sent two field representatives to the site while others utilized just one rater to perform the work. Generally, the larger companies provided two field representatives and employed scheduling/job management software.
2. One rating company utilized an outside subcontractor to deliver performance testing services.
3. Raters generally completed the field visit in one and a half to two hours while one of the raters took nearly three hours to complete testing and inspections.
4. At the Portland site, raters noted a disconnected supply duct at the downstairs powder room. This was noted at different points in the inspection and testing processes. Some discovered the disconnected duct upon initial walkthrough and test set up, while others did not until after their duct test had been completed (requiring them to re-test). One rater did not note the disconnected duct.
5. One rater declined to perform a duct test after discovering the disconnected duct, noting that he would use a stand-in value in the energy model, per RESNET allowances. This rater noted that he typically notifies the builder and allows them time to repair such issues prior to testing.
6. There were slight variations in how building performance tests were set up and performed, notably the configuration of interior doors, baseline pressure measurements, and taping of duct registers and the dryer vent termination. None of the raters were observed performing multiple pressure blower door tests.
7. Some raters performed Combustion Appliance Zone (CAZ) and Zonal Pressure Relief (ZPR) tests while others did not.
8. There was variation in how insulation and air sealing inspections were performed, or what assumptions were made for unobservable areas. Some raters utilized the insulation certificate and/or historical knowledge of the subcontractors' work. Some performed detailed visual inspection of the crawlspace and attic areas, documenting areas where improvements were needed. Others looked only just inside the attic/crawlspace hatch, noting insulation depth to estimate R-value.
9. There was some variation in methods for testing and inspecting ventilation systems. Some raters performed detailed inspections and noted whether the home's ventilation system met code or ASHRAE standards while others performed airflow tests on the home's exhaust fans.

10. There were variations in how raters assessed showerhead and faucet aerator flow rates. Some noted the manufacturer's stamp for rated flow while others took flow measurements. At the Portland site, several raters did not make note of fixture flow rates.

11. Raters performing work at the Portland site invoiced from $300 to $660 for their services. Average cost for these services was $427.

12. Raters performing work at the Lake Stevens site invoiced from $550-$1500 for their services. Average cost for these services was $923.

Overview – Portland, OR

Rater	HERS Index	REM/Rate Version	Cost of Rating	Weather Location	Conditioned Area (sq. ft)	Volume (cu ft)
A	83	15.3	$660	Portland, OR	1,405	12,767
B	82	15.3	$300	Portland, OR	1,422	13,290
C	86	15.3	$300	Portland, OR	1,405	11,942
D	86	15.3	$325	Portland, OR	1,405	12,786
E	88	15.3	$550	Portland, OR	1,443	14,144

Overview – Lake Stevens, WA

Rater	HERS Index	REM/Rate Version	Cost of Rating	Weather Location	Conditioned Area (sq. ft)	Volume (cu ft)
F	76	15.3	$1,045	Seattle, WA	2,921	27,691
G	71	15.3	$1,500	Snohomish CO AP, WA	2,921	24,742
H	79	15.3	$750	Whidbey Island, WA	2,921	24,829
I	75	15.3	$550	Seattle, WA	3,004	26,954
J	74	15.3	$770	Seattle, WA	2,990	25,561

Key Inputs – Portland, OR

Rater	HERS Index	Bedrooms (count)	Shell Area (sq ft)	2012 IECC UA	Primary Heat Source	DHW Source
A	83	3	4,401	299.3	42k Gas Furnace 93% AFUE; 19k Gas Fireplace 70.6% AFUE	0.62 EF Gas Storage
B	82	3	4,398	294.2	100k Gas Furnace 93% AFUE	0.62 EF Gas Storage
C	86	3	4,244	266.6	100k Gas Furnace 93% AFUE	0.62 EF Gas Storage
D	86	3	3,739	245.0	100k Gas Furnace 95% AFUE	0.59 EF Gas Storage
E	88	3	4,390	316.4	100k Gas Furnace 93% AFUE	0.62 EF Gas Storage

Key Inputs – Lake Stevens, WA

Rater	HERS Index	Bedrooms (count)	Shell Area (sq. ft)	2012 IECC UA	Primary Heat Source	DHW Source
F	76	4	6,096	391.3	68.4k Gas Furnace 95% AFUE	0.93 EF Gas Tankless
G	71	5	7,107	461.2	68k Gas Furnace 95% AFUE	0.91 EF Gas Tankless
H	79	5	6,182	397.3	30k Gas Furnace 90% AFUE	0.58 EF Gas Storage
I	75	5	6,911	397.3	100k Gas Furnace 95% AFUE	0.93 EF Gas Tankless
J	74	4	6,809	413.9	72k Gas Furnace 95% AFUE	0.91 EF Gas Tankless

Estimated Annual Energy Use – Portland, OR

Rater	HERS Index	EUI (kBtu/sf)	Total (MMbtu)	Heating (kWh)	Heating (Therms)	DHW (Therms)	Lighting & Appliance (kWh)	Appliance (Therms)
A	83	37.7	53.0	265.4	323.6	160.6	4865.8	30.7
B	82	39.2	55.7	317.4	340.8	171.1	4543.6	30.7
C	86	32.9	46.3	180.5	256.8	160.1	4950.3	30.7
D	86	33.7	47.4	255.6	241.1	183.9	5835.3	30.7
E	88	38.1	55.0	118.5	331.2	171.1	5615.2	30.7

Estimated Annual Energy - Lake Stevens, WA

Rater	HERS Index	EUI (kBtu/sf)	Total (MMbtu)	Heating (kWh)	Heating (Therms)	DHW (Therms)	Lighting & Appliance (kWh)	Appliance (Therms)
F	76	18.8	55.0	353.5	387.7	128.7	11139.6	0.0
G	71	28.2	82.4	966.9	590.0	130.4	6962.9	80.1
H	79	28.5	83.2	1111.8	514.2	257.1	7183.5	36.1
I	75	23.2	69.8	978.2	489.8	142.7	9047.1	36.1
J	74	21.6	64.6	649.9	491.6	125.7	9041.7	0.0

Southeast Region: Orlando and Tallahassee, FL

Project Team: Southeast Energy Efficiency Alliance (SEEA)

Summary: For houses assessed in Florida, SEEA collected the following information from email communication and documents, on-site observations, the EnergyGauge™ Input Summary Report and informational Home Energy Rating Certificate.

Orlando House Description

The house is located in a suburban city of Orlando, FL and is constructed on an infill lot on an established street of houses built during the post-World War II era. The house is a single-story on slab, concrete masonry unit (CMU) construction with a two-car garage. All the equipment is located in a small utility room adjacent to the garage. The ceilings are 10 feet tall in the whole house except for the foyer and the front office (15 feet). Attic insulation is spray foam and is installed at the roofline. The home's heating, cooling, hot water and cooking range are all electric. SEEA noted that a majority, if not all, of the lamps in the house were incandescent.

Additional Observations – Orlando

Rater	A	B	C	D
Time On-site	2 hours	1.5 hours	1.5 hours	2 hours
Rater Personnel	2	1	3	1
Performed Blower Door Test	Yes	Yes	Yes	Yes
Blower Door Test Location	Garage entry	Garage entry	Garage entry	Garage entry
Sealed Registers During Blower Door Test	(Most)	Yes	Yes	Yes
Performed Duct Leakage Test	Yes	Yes	Yes	Yes
Checked Attic Insulation	Yes	Yes	Yes	No
Photos of Nameplates	Yes	No	Yes	Yes
Counted Light Bulbs	No	No	Yes	No

HERS Rating Certificate and Input Summary, Utility Rates

Rater	HERS Index	Utility Rate (cents/kWh)	Annual Energy Use (KwH/year)	Annual Energy Cost
A	70	13.17	11,993	$1,373
B	74	11.18	13,114	$1,501
C	71	11.26	11,958	$1,369
D	59	8.73	10,387	$1,189

Note: Energy Gauge v5.1 does not include the individual costs in kWh for heating, cooling, hot water and lights and appliances in the reports SEEA received from HERS raters.

Input Summary: Project and Climate

Rater	Bedrooms (count)	Occupants (count)	Conditioned Area (sq. ft)
A	3	4	2,399
B	4	5	2,399
C	3	4	2,399
D	3	1	2,399

Input Summary: Envelope

Infiltration

Rater	Conditioned Volume (cu. ft)	CFM50	ACH50
A	23,990	919.9	2.3006
B	25,443.8	1064.7	2.5108
C	25,189.5	869	2.0699
D	23,990	966.5	2.4171

Exterior Walls

Rater	Gross Wall Area (sq. ft)	Net Wall Area (sq. ft)	R-Value	Door Area (sq. ft)
A	2,539	2,052	5	45
B	2,546	2,049	4.1	45
C	2,523	2,038	14	45
D	2,585.51	2095.3	14.5	45.3

Note: The building input summary does not include wall grading, therefore, it has not been included in the report.

Windows

Rater	Area (sq ft)	Area Facing West (sq ft)	U Factor	SHGC	Shade-Summer
A	441	85	0.27-0.65	0.20-0.26	Drapes/Blinds, exterior 50% screening
B	451	77.2	0.27-0.55	0.20-0.25	Drapes/Blinds
C	440	77.3	0.27-0.65	0.2-0.25	Drapes/Blinds
D	444.9	80.9	0.33-0.55	0.21-0.25	Drapes/Blinds

Ceiling and Roof

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Ceiling Insulation (R-value)	Deck Insulation (R-value)	Attic Type
A	2,638	2,599	1	20	Unvented
B	2,399	2,599	0	20	Unvented
C	2,399	2,599	0	20	Unvented
D	2,399	2,683	1	20	Unvented

Input Summary: Mechanical

Mechanical Equipment

Rater	Cooling Capacity (kBtu/hr)	Total Air Flow (CFM)	Heating Set Point (Deg F)	Cooling Set Point (Deg F)	Heating Capacity (kBtu/hr)	Heating Efficiency (HSPF)	Cooling Efficiency (SEER)
A	42	1,260	70	75	42	8.5	14.5
B	42	1,260	70	75	42	8.2	15
C	42	1,200	70	75	42	8.5	14.5
D	42	1,260	70	75	42	8.5	14.5

Duct System Inputs

Rater	Duct Surface Area (sq. ft)		Total Leakage (cfm25)	Leakage to the Outside (cfm25)	Location of Ducts	AHU Location
	Supply	Return				
A	479.8	119.95	163.5	10.3	Attic	Main
B	479.8	252.5	252.5	28	Main	Main
C	479.8	119.95	N/A	19	Attic	Main
D	479.8	119.95	N/A	35	Main	Main

Input Summary: Appliances and Lighting

Rater	Ceiling Fans (count)	Exterior Lamps (count)	Interior Lamps (count)	Refrigerator (KwH/year)	Dishwasher (KwH/year)	Range Oven (fuel)
A	2	19	44	691	270	Electric
B	0	11	14	423	142	Electric
C	5	18	37	705	270	Electric
D	N/A	18	37	N/A	N/A	N/A

Tallahassee House: Description

The house is located in a suburb of Tallahassee, FL. The house is a single-story on slab, stick construction (2x4 walls), with a two-car garage. The air handle unit is located in the attic and the tankless water heater is located on the exterior of the house. The ceilings are 9 feet tall, with the exception of the entry, dining room and the vaulted ceiling in the great room and kitchen. The house is run mainly by electricity with the exception of a natural gas cooking range and a tankless propane water heater. SEEA noted that a majority of the lamps in this house were compact fluorescent (CFL) or LEDs.

Additional Observations

	Rater E	Rater F	Rater G	Rater H
Time On-Site	1 hour	1 hour	1.5 hours	2 hours
Rater Personnel	1	1	2	3
Blower Door Test Location	N/A	N/A	N/A	Screened porch entry
Sealed Registers during Blower Door Test	Yes	Yes	Yes	No
Performed Total Duct Leakage Test	Yes	Yes	Yes	Yes
Checked Attic Insulation	Yes	Yes	Yes	No
Took Photos of Nameplates	No	No	Yes	No
Counted Light Bulbs	No	No	Yes	No

HERS Rating Certificate and Input Summary, Utility Rates

Rater	HERS Index	Electricity Rate (cents/kWh)	Annual electricity use (KwH/year)	Annual natural gas use (therms/year)	Annual LPG use (gal/year)	Annual total energy cost
E	71	11.45	N/A	N/A	N/A[15]	$1,532
F	62	11.42	8,210	0	117	$1,466
G	72	N/A	10,179	117	0	$1,165
H	74	N/A	8,974	131	31	$1,027

Note: Energy Gauge v5.1 does not include the individual costs in kWh for heating, cooling, hot water and lights and appliances in the reports SEEA received from HERS raters.

Input Summary: Project and Climate

All raters consistently listed the same project and climate information.

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[15] The rater did not provide a draft HERS Certificate, but instead an excel document. In the excel document provided, the rater indicated that there was a propane tankless water heater, but did not provide a separation of energy usage.

Input Summary: Envelope

Infiltration Inputs

Rater	Conditioned Area (sq. ft)	Conditioned Volume (cu. ft)	CFM50	ACH50
E	2,152	19,368	1,784	5.5266
F	2,152	22,165.6	2,586	7
G	2,152	21,520	1,858.5	5.1816
H	2,152	20,444	2,242	6.5799

Exterior Wall Inputs

Rater	Gross Wall Area (sq. ft)	Net Wall Area (sq. ft)	R-value	Door area (sq. ft)
E	2,037	1,731	13	46
F	1,998	1,661	13	40
G	1,957.30	1604.97	13	40
H	2,049.5	1,704.9	13	20

Note: The building input summary does not include wall grading, therefore, it has not been included in the report.

Window Inputs

Rater	Area (sq. ft)	Area Facing West (sq. ft)	U-factor	SHGC	Shade-Summer
E	261	0	0.34	0.3	Drapes/Blinds, exterior 50% screening
F	297	0	0.34-0.59	0.26-0.34	Drapes/Blinds
G	312.33	0	0.35	0.26	Drapes/Blinds
H	324.6	114	0.34-0.4	0.26-0.31	Drapes/Blinds

Ceiling and Roof Details

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Ceiling Insulation (R-value)	Deck Insulation (R-value)	Attic Type
E	2,152	2,407	38	0	Vented
F	2,352	2,407	38	0	Vented
G	2,152	2,407	38	0	Vented
H	2,152	2,407	38	0	Vented

Input Summary: Mechanical

Mechanical Equipment

Rater	Cooling Capacity (kBtu/hr)	Total Air Flow (CFM)	Heating Set Point (Deg F)	Cooling Set Point (Deg F)	Heating Capacity (kBtu/hr)	Heating Efficiency (HSPF)	Cooling Efficiency (SEER)
E	28	1,545	70	75	28	9	15
F	48.5	1,455	70	75	29.8	9	16
G	48.5	1,455	70	75	29.8	9	16
H	48.5	1,455	70	75	45	9	16

Duct System Inputs

Rater	Duct Surface Area (sq. ft)		Total Leakage (cfm25)	Leakage to the Outside (cfm25)	Location of Ducts	AHU Location
	Supply	Return				
E	430.4	107.6	N/A	142.7	Attic	Main
F	475.1	88	N/A	N/A	Main	Main
G	430.4	107.6	258	150	Attic	Attic
H	500	107.6	198	198	Attic	Attic

Input Summary: Appliances and Lighting

Rater	Ceiling Fans (count)	Exterior Lamps (count)	Interior Lamps (count)	Refrigerator (KwH/year)	Dishwasher (KwH/year)	Range Oven (fuel)
E	5	8	37	691	372	Electric
F	0	100	200	615	270	Gas
G	5	18	37	N/A	N/A	N/A
H	N/A	18	37	N/A	N/A	N/A

South-central Region: Dallas-Fort Worth and Austin, TX

Dallas-Fort Worth House Description

SPEER obtained permission from a homebuilder to use one of their spec homes in the Dallas-Fort Worth metropolitan area. The home was 2404 square feet with four bedrooms and three bathrooms. The raters were told to assume grade 1 wall insulation installation, and were given the following data regarding the envelope, HVAC and water heating: southern orientation, exterior sheathing 7/16" OSB, R15 blown in blanket fiberglass in walls, R38 blown fiberglass in attic (R19 under HVAC walkways and vaulted ceilings), windows - SHGC .25 and U-factor .35, ducts R8/R6 supply/return, radiant barrier, heat pump HSPF 8.2, water heater EF .88, and 14 SEER 5 ton AC. The home's heating, cooling, and hot water were all electric. All appliances except for the range were electric. All of the ducts in the home were located in unconditioned space.

Additional Observations

	Rater A	Rater B	Rater C	Rater D	Rater E	Rater F
Time On-Site	2.5 hours	1.3 hours	1 hour	2.5 hours	1 hour	55 minutes
Rater Personnel	1	1	2	1	1	1
Location blower Door Test	Garage entry	Garage entry	Garage entry	Back porch entry	Garage entry	Garage entry
Sealed Registers During Blower Door Test	No	No	No	No	Yes	No
Performed Total Duct Leakage Test	Yes	Yes	Yes	Yes	Yes	Yes
Performed Duct Leakage to Outside Test	Yes	Yes	Yes	Yes	Yes	Yes
Took Photos of Nameplates	Yes	Yes	Yes	Yes	Yes	Yes
Counted Bulbs	No	No	No	Yes	No	No
Other		Used different duct insulation values than provided.	Used different insulation grading value than provided.			

HERS Ratings and Home Size

Rater	HERS Index	REM/Rate Version	Cost of Rating	Conditioned Area (sq. ft)	Conditioned Volume (cu. ft)
A	78	14.6.1	$550	2404	25,242
B	71	14.6.2.1	$350	2404	23,752
C	79	15.1	$450	2404	24,047
D	67	14.6.4	$500	2360	23,506
E	65	15.2	$573	2292	21,708
F	64	14.6.1	$375	2402	27,405

Estimated Annual Energy Cost

Rater	MMBtu	Service Fee	Total Cost
A	97.1	$174	$1,765
B	89	$60	$2,119
C	66	$489	$2,672
D	84.5	$72	$2,379
E	53.4	$60	$2,402
F	78.6	$81	$1,569

Energy Cost/MMBtu

Rater	Heating	Cooling	Hot Water	Lighting & Appliance
A	$0.05	$0.03	$0.05	$0.07
B	$0.06	$0.04	$0.11	$0.11
C	$0.11	$0.12	$0.11	$0.11
D	$0.07	$0.05	$0.14	$0.13
E	$0.15	$0.15	$0.15	$0.15
F	$0.05	$0.04	$0.09	$0.08

Input Summary: Envelope

Wall Details

Rater	Conditioned Area (sq. ft)	Uo Value	Continuous Insulation (R-value)	Insulation Grade
A	2173	0.078	0	1
B	2310	0.074	.5	1
C	2614.7	0.082	0	2
D	2476	0.079	0	1
E	2463	0.070	.4	1
F	2671	0.059	3	1

Window Details

Rater	Area (sq. ft)	Area Facing West (sq. ft)	Shade – Winter	Shade – Summer
A	307	204	None	None
B	341	16	None	None
C	306.9	16	None	None
D	300.8	182.8	None	Some
E	273	16	None	Some
F	279	16	None	None

Ceiling and Roof Details

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Continuous Insulation (R-value)	Cavity Insulation (R-value)	Cavity Depth (in)
A	2404	2468	19	R-19	5.5
B	2493	3020	25	R-13	3.5
C	2485	2485	20.7	R-17.3	5.5
D	2444	2444	25	R-13	3.5
E	2323	2323	N/A	R-30	10
F	2404	3005	25	R-13	3.5

Input Summary: Mechanical

Mechanical Details

Rater	Tons	Heating Set Point (deg F)	Cooling Set Point (deg F)	Heating Efficiency (HSPF)	Cooling Efficiency (SEER)	Water Heater (EF)
A	5	68	78	8.2	14	0.95
B	5	70	75	8.2	14	0.95
C	5	72	75	8.2	14	0.95
D	5	68	78	8.2	14	0.88
E	5	72	75	8.2	14	0.86
F	3	68	78	8.2	14	0.88

Duct Details

Rater	Returns (count)	Duct Surface Area (sq. ft)		Total Leakage (CFM25)	Leakage to the Outside (CFM25)	Location
		Supply	Return			
A	6	649.1	601	96	3.99	100% Unconditioned
B	5	649.1	601	186	7.74	100% Unconditioned
C	2	649.1	240.4	271	11.27	100% Unconditioned
D	4	637.2	472	216	9.15	100% Conditioned
E	1	356.2	66	183.36	8	100% Conditioned
F	4	649.1	480.8	75	3.12	80% Unconditioned 20% Conditioned

Infiltration and Ventilation Details

Rater	Rate (CFM)	Hours	Fan Watts	ACH50
A	52	24	275	3.82
B	130	9	120	4.56
C	161	9.2	681	4.41
D	130	9.5	250	4.2
E	56	24	100	5
F	75	24	19.9	3.7

Lighting and Appliance Details

Rater	Ceiling Fan (CFM/W)	Dishwasher (EF)	High Efficacy Lighting	
			Interior	Exterior
A	29	0.46	100%	100%
B	127.4	0.84	100%	100%
C	0	275 kWh/yr	0%	0%
D	70.4	260 kWh/yr	100%	0%
E	100	0.71	75%	100%
F	70.4	0.46	100%	100%

Austin House Description

SPEER obtained permission from a homebuilder to use one of their spec homes in the Austin metropolitan area. The home was 1629 square feet with three bedrooms and two bathrooms. The given R-value for vertical surfaces was R-13 and for roof surfaces was R-25. The home uses gas for heating, water heating and the kitchen range, all other uses are electric. The house has a silver reflective metal roof.

Additional Observations

	Rater G	Rater H	Rater I	Rater J	Rater K
Time On-Site	1 .75 hours	3.25 hours	1.75 hours	1.25 hours	1.75 hours
Rater Personnel	1	2	2	1	1
Performed Blower Door Test	Yes	Yes	Yes	Yes	Yes
Performed Total Duct Leakage Test	Yes	Yes	No	No	Yes
Took Photos of Nameplates	Yes	Yes	Yes	Yes	Yes
Counted Light Bulbs	Yes	Yes	No	No	Yes
Other	Measured all exterior walls of house to make sure they matched plans.		Used light bulb information from plans. Provided efficiency rebate information.	Removed vent in bedroom to see if ducts were sealed.	Used central air return for duct leakage test.

HERS Ratings and Home Size

Rater	HERS Index	REM/Rate Version	Cost of Rating	Conditioned Area (sq. ft)	Conditioned Volume (cu. ft)
G	69	14.6.4	$400	1,629	22,653
H	64	15.3	$400	1,635	20,825
I	55	15.3	$600	1,643	19,716
J	75	15.3	$500	1,635	14,715
K	64	14.6.1	$500	1,630	14,886

Estimated Annual Energy Cost

Rater	MMBtu	Service Fee	Total Cost
G	68.5	$237	$1,162
H	50.3	$72	$1,096
I	49.4	$324	$997
J	58.8	$120	$992
K	62.1	$361	$1,342

Energy Cost by Use

Rater	Heat	Cooling	Hot Water	Lighting & Appliance
G	$202	$237	$92	$394
H	$106	$237	$39	$642
I	$135	$34	$26	$478
J	$100	$219	$38	$515
K	$90	$256	$50	$585

Input Summary: Envelope

Wall Details

Rater	Area (sq. ft)	Uo Value	Cavity Insulation (R-Value)	Insulation Grade
G	1809	0.085	13	1
H	2045	0.084	13.5	1
I	2393	0.071	19	1
J	1809	0.071	13	1
K	2009.5	0.097	Path Layers	N/A

Window Details

Rater	Area (sq. ft)	Area Facing West (sq. ft)	Shade – Winter	Shade – Summer
G	380.6	80.2	None	None
H	379.2	113.1	Varied	Varied
I	337	32	Varied	Varied
J	372	126	Varied	Varied
K	341.72	92.24	None	None

Ceiling and Roof Details

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Continuous Insulation (R-value	Cavity Insulation (R-value)	Cavity Depth (in.)
G	1629	1922	0	25	7
H	1963	1963	3.7	23.2	5.5
I	1643	2053.75	3	35	6.1
J	1635	2043.75	5	25	3.5
K	1630	1745	7	Path Layers	Path Layers

Input Summary: Mechanical

Mechanical Details

Rater	Tons	Heating Set Point (deg F)	Cooling Set Point (deg F)	Heating Efficiency (HSPF)	Cooling Efficiency (SEER)	Water Heater (EF)
G	2.5	68	78	95	15	0.85
H	2.9	70	75	95	16	0.96
I	3	68	78	94	16	0.83
J	3	68	78	80	14	0.97
K	2.9	68	78	95	16	0.99

Duct Details

Rater	Returns (count)	Duct Surface Area (sq. ft)		Total Leakage (CFM25)	Leakage to the Outside (CFM25)	Location
		Supply	Return			
G	1	439.8	81.5	149	9.15	Conditioned
H	4	441.5	327	63	3.85	Conditioned
I	1	443.6	82.2	N/A	N/A	Conditioned
J	1	441.5	81.8	N/A	N/A	Conditioned
K	4	440.1	326	159	9.75	Conditioned

Infiltration and Ventilation Details

Rater	Rate (CFM)	Hours	Fan Watts	ACH50
G	N/A	N/A	N/A	1.96
H	108	10	250	1.36
I	130	16.2	75	1.29
J	53	24	150	5
K	69	2	244.8	1.98

Lighting and Appliance Details

Rater	Ceiling Fan (CFM/W)	Dishwasher (EF)	High Efficacy Lighting	
			Interior	Exterior
G	0	0.80	30%	0%
H	115	0	80%	100%
I	N/A	N/A	N/A	N/A
J	0	0.46	100%	0%
K	70.4	0	86%	100%

Southwest Region: Denver, CO and Salt Lake City, UT

Denver House Description

SWEEP obtained permission from a homebuilder to utilize one of their spec homes located southeast of the Denver Metropolitan area. The construction of the home was complete, and a PDF file of the house plans was given to SWEEP in addition to HVAC and building envelope specifications. The home was listed as 4262 square feet from the plans. It had three bedrooms and two and a one-half bathrooms. The raters were told to assume the home was constructed under 2009 IECC construction practices in an area with no energy code inspections. Raters received the plans before arriving on-site and performing the rating.

At the time of the rating the clothes washer, dryer and refrigerator were not installed. The garage lighting was 100% LED lighting, a fluorescent light in a closet and all of the remaining lights were incandescent light bulbs. The above grade wall assembly consisted of 2x6 studs 16oc with fiberglass batt insulation in the cavity. This house has a gas furnace, electric AC unit and standard tank gas water heater. All appliances except for the range and one oven were electric. The dryer was not plumbed for natural gas and no refrigerator or washer and dryer were installed.

Additional Observations

	Rater A	**Rater B**	**Rater C**	**Rater D**	**Rater E**
Time On-Site	1.75 hours	1.5 hours	4.5 hours	2.5 hours	3 hours
Rater Personnel	1	1	1	1	2
Bedroom (count)	5	5	5	3	4
Performed Blower Door Test	Yes	Yes	Yes	Yes	Yes
Sealed Registers During Blower Door Test	No	No	No	No	No
Performed Total Duct Leakage Test	No	No	Yes	Yes	Yes
Performed Duct Leakage to Outside	No	No	Yes	Yes	No
Took Photos of Name plates	No	Yes	Yes	Yes	Yes
Counted Light Bulbs	No	Yes	Yes	Yes	Yes
Other	Retrotec Blower door	Retrotec Blower door	Retrotec Blower door, Used infrared Camera	Minneapolis (TEC) Blower door	Retrotec Blower door, Used infrared Camera

HERS Ratings and Home Size

Rater	HERS Index	REM/Rate Version	Cost of Rating	Conditioned Area (sq. ft)	Conditioned Volume (cu. ft)
A	67	15.3	$625	4,267	42,670
B	70	15.1	$925	4,260	44,300
C	79	14.6.4	$1,500	4,251	33,087
D	68	14.6.4	$500	3,931	42,455
E	99	15.3	$1,220	4,264	46,009

Estimated Annual Energy Cost

Rater	MMBtu	Service Fee	Total Cost
A	141.4	$120	$1626
B	157.4	$50	$2411
C	121.7	$0	$2714
D	105.4	$0	$2294
E	203.4	$120	$2944

Energy Cost/MMBtu

Rater	Heat	Cooling	Hot Water	Lighting & Appliance
A	$406	$95	$99	$906
B	$993	$127	$165	$1076
C	$1077	$129	$222	$1286
D	$838	$94	$164	$1198
E	$1208	$188	$131	$1297

Wall Details

Rater	Area (sq. ft)	Uo Value	Insulation Grade	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)
A	4,250	0.061	1	0	19
B	3,862	0.060	1	0	19
C	2,853	0.069	3	0	20
D	3,270	0.063	1	0	18
E	2,187	0.072	3	0	19

Window Details

Rater	Area (sq. ft)	Area Facing West (sq. ft)	Shade – Winter	Shade – Summer
A	451	296	0.85	0.70
B	423	266	0.85	0.70
C	242	148	0.85	0.70
D	412	299	0.85	0.70
E	374	267	0.85	0.70

Door Details

Rater	Opaque Area (sq. ft)	Uo Value	Opaque Area (R-value)
A	40	0.155	5.5
B	18	0.329	2.1
C	45	0.311	2.28
D	40	0.184	4.5
E	48	0.447	1.3

Ceiling and Roof Details

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Cont. Insulation (R-Value)	Cavity insulation (R-Value)	Cavity Depth (in.)	Insulation Grade	Uo
A	2,255	2,255	0	38	11.3	1	0.027
B	2,467	2,908	8	20	5.78	1	0.027
C	2,157	2,697	10	27	8.58	3	0.040
D	2,109	2,363	25	13	7.64	1	0.026
E	2,330	2,497	13	25	7.08	2	0.028

Mechanical Details

Rater	Systems (count)	Tons Cooling	Heating Set Point (deg F)	Cooling Set Point (deg F)	Heating Efficiency (AFUE)	Cooling Efficiency (SEER)	Water Heating (EF)
A	3	3	68	78	93.0	13.5	0.62
B	3	3	68	76	93.0	13	0.62
C	3	4	68	78	93.0	13	0.62
D	3	3	68	76	93.0	13	0.62
E	4	3	68	78	93.0	13	0.62

Duct Details

Rater	Returns (count)	Duct Surface Area (sq. ft)		Total Leakage (CFM25)	Leakage to the Outside (CFM25)	Location
		Supply	Return			
A	5	864	800	Did not test	Did not test	100% conditioned
B	8	863	799	Did not test	Did not test	90% conditioned 10% unconditioned
C	9	861	797	Could not get test pressure	Could not get test pressure	93% conditioned 7% unconditioned
D	8	796	590	Could not get test pressure	Could not get test pressure	90 % conditioned 10% unconditioned
E	7	864	800	Could not get test pressure	Could not get test pressure	100% Conditioned

Lighting and Appliance Details

Rater	Ceiling Fan (CFM/Watt)	Refrigerator (kWh/year)	Dishwasher (EF)	High Efficacy Lighting	
				Interior	Exterior
A	None	637	0.46	10%	0%
B	80	430	270 kWh/yr.	5%	0%
C	75	691	270 kWh/yr.	10%	0%
D	None	775	270 kWh/yr.	0%	50%
E	None	0	270 kWh/yr.	0%	100%

Infiltration and Ventilation Details

Rater	Rate (CFM)	Hours	Fan Watts	ACH50
A	None	24	None	3.52
B	None	24	None	3.33
C	None	24	None	4.30
D	None	24	None	3.24
E	None	24	None	2.86

Salt Lake City House Description

The Salt Lake City home was completed in July 2016 and is 2,100 square feet in size, with 1,050 square feet on the main level and a 1,050 square foot basement. The home was built to Passive House standards and includes a ductless heating and cooling system. The home also has an extremely airtight envelope, high insulation values, and advanced windows and doors. At the time of the assessments, the home was finished and unoccupied.

The home is served by a ductless “two headed” mini-split heat pump and an HRV. Two raters reported two mechanical systems in the home and one rater reported three systems (perhaps due to their counting the heat pump system as two units). SWEEP was informed that the lighting in the home was 100% LED.

HERS Rating and Home Size

Rater	HERS Index (from plans)	HERS Index (in field)	REM/Rate Version	Conditioned Area (sq. ft)	Conditioned Volume (sq. ft)
F	42	44	v15.1	2,096	16,151
G	51	47	v14.6.3	2,063	17,305
H	43	NR	v14.6.4	1,956	15,648
I	50	50	v15.1	1,798	16,182

Estimated Annual Energy Cost

Rater	MMBtu	Service Fee	Total Cost
F	39	$153	$1087
G	44.5	$153	$1231
H	41.8	$101	$944
I	45.3	$153	$1123

Energy Cost/MMBtu

Rater	Heating	Cooling	Hot Water	Lights/Appliances
F	$28.64	$30.80	$7.13	$29.25
G	$19.59	$10.71	$24.47	$29.10
H	$25.29	$27.33	$7.40	$26.06
I	$25.87	$28.70	$7.42	$27.36

Wall Details

Rater	Area (sq. ft)	Uo Value	Insulation Grade	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)
F	1,136	0.025	1	21	22
G	1,141	0.074	1	21	22
H	1,008	0.022	1	24	23
I	N/A	N/A	N/A	N/A	N/A

Window Details

Rater	Area (sq. ft)	Area Facing West (sq. ft)	Shade – Winter	Shade – Summer
F	207	44	0.85	0.7
G	157	35	0.85	0.7
H	218	45	0.85	0.7
I	N/A	N/A	N/A	N/A

Door Details

Rater	Opaque Area	Uo Value	R-Value of Opaque Area
F	40	0.891	0.2
G	40	0.149	5.75
H	42	0.187	4.4
I	N/A	N/A	N/A

Ceiling and Roof Details

Rater	Ceiling Area	Roof Area	Cont. Insulation (R-Value)	Cavity Insulation (R-Value)	Cavity Insulation Grade	Framing Factor
F	1,048	1,310	12	64	1	0.11
G	1,005	1,005	7	69	1	0.11
H	1,079	1,079	7	69	1	0.1412
I	N/A	N/A	N/A	N/A	N/A	N/A

Mechanical Details

Rater	Systems (count)	Heating Set Point (deg F)	Cooling Set Point (deg F)	Heating Efficiency (HSPF)	Cooling Efficiency (SEER)	Water Heating (EF)
F	2	68	78	9.3	18	0.95
G	2	68	78	9.3	18	0.95
H	3	68	78	N/A	12.5	0.95
I	N/A	N/A	N/A	N/A	N/A	N/A

Lighting and Appliance Details

Rater	Ceiling Fan (CFM/Watt)	Refrigerator (kWh/year)	Dishwasher (EF)	High Efficacy Lighting	
				Interior	Exterior
F	0	701	0	100%	100%
G	0	701	0.46	100%	100%
H	0	701	0	90%	100%
I	N/A	N/A	N/A	N/A	N/A

Infiltration and Ventilation

Rater	Rate (CFM)	Hours	Fan Watts	ACH50
F	125	24	126	0.69
G	253	24	166	0.11
H	95	24	126	0.13
I	N/A	N/A	N/A	0.6

Midwest Region: Chicago, IL and Grand Rapids, MI

Chicago House Description

The house is a 2,880-sq. ft., two-story craftsman-style with a conditioned basement. This house is certified with EPA Indoor Airplus and Energy Star v. 3.1. At the time of the rating, the home was nearing obtaining a CO and all appliances except for a washer and dryer were installed. The home has a smart thermostat and is mechanically ventilated with an air-cycler.

Below are key features of the house (confirmed by MEEA and the builder), which were compared to the results obtained by the six raters.

Home Characteristics

General Characteristics	**Conditioned Area (sq. ft)**	**Conditioned Volume (cu. ft)**	**Stories Above Grade**	**Bedrooms**	**Conditioned Basement**
	2,880	24,000	2	3	Yes
Structural Characteristics	**Slab**	**Foundation**	**Above Grade Walls**	**Sheathing**	**Roof**
	Poured Concrete	Poured Concrete	2x6 plates w/ 2x4 staggered studs at 24" O.C.	Zip System panels wrapped in Tyvek	24" O.C. 2x4 raised heel trusses
Building Thermal Envelope	**Slab Insulation**	**Foundation Wall Insulation**	**Above Grade Wall Insulation**	**Attic Insulation (measured)**	**Windows (U-Factor)**
	R-10	R-15 (exterior)	R-21 or R-13.3 + 7.6	R-56	.18-.22
Mechanical Equipment & Ventilation	**Gas Furnace Efficiency (AFUE)**	**Electric AC Efficiency (SEER)**	**Tankless Water Heater Efficiency (EF)**	**Air Cycler (CFM)**	**Air Cycler (Watts)**
	96	13.5	0.97	100	139
Lights & Appliances	**Refrigerator Efficiency (kwh/yr.)**	**Dishwasher Efficiency (kwh/yr.)**	**Washer Efficiency (kwh/yr.)**	**Dryer Efficiency (EF)**	**High Efficacy Lighting – Interior/ Exterior**
	685	270	704	2.67	98% / 75%

Additional Observations

Variables	Rater A	Rater B	Rater C	Rater D	Rater E	Rater F
Time On-Site	2 Hours	2 Hours	1.5 Hours	1 Hour	1 Hour	2 Hours
Rater Personnel	1	2	2	2	1	1
Performed Air Leakage Test	Yes	Yes	Yes	Yes	Yes	Yes
Location of Air Leakage Test	Front Entry	Front Entry	Front Entry	Front Entry	Back Entry	Front Entry
Sealed Registers for Duct Test	Yes	Yes	Could not test	Unable to observe	Yes	Yes
Performed Duct Leakage to Outside Test	Yes	Yes	Could not test	Unable to observe	Yes	Yes
Performed Total Duct Leakage Test	Yes	Yes	Could not test	Unable to observe	Yes	Yes
Noted Equipment Model #s	Yes	Yes	Yes	Unable to observe	Yes	No
Counted Light Bulbs	Yes	No	No	Unable to observe	No	No
Used Infrared Camera	No	No	Yes	Unable to observe	No	No
Notes		Additional staff was a trainee	Rater scheduled HERS provider QC of this rating.	Rater arrived 1 hour before MEEA staff		

Note: Rater C could not conduct a duct pressure test because carpet was being installed in the bedrooms.

HERS Ratings and Home Size

Rater	HERS Index	REM/Rate Version	Cost of Rating	Conditioned Area (sq. ft)	Conditioned Volume (cu. ft)
A	44	14.6.4	$900	2,880	25,920
B	42	14.6.4	$450	3,120	28,704
C	51	15.3	$450	2,880	24,000
D	44	14.6.4	$450	2,880	24,000
E	49	15.3	$700	2,880	24,055
F	40	14.6.3.1	$900	2,880	25,920

Estimated Annual Energy Cost

Rater	MMBTU	Service Fee	Energy Cost	Total Cost
A	61.4	$120	$1,067	$1,187
B	80.2	$349	$1,373	$1,722
C	92.2	$180	$1,815	$1,995
D	83.0	$262	$1,436	$1,698
E	77.3	$312	$918	$1,230
F	55.4	$372	$809	$1,181

Energy Costs by Use

Rater	Heat	Cooling	Hot Water	Lighting & Appliance
A	$281	$81	$64	$625
B	$254	$76	$80	$970
C	$404	$126	$88	$1,197
D	$224	$60	$73	$1,264
E	$163	$122	$46	$583
F	$138	$52	$58	$562

Foundation Wall Detail

Rater	Area (sq. ft)	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)	Uo Value (Wall Only)	Insulation Grade
A	563.2	15	0	0.064	3
B	594	15	0	0.064	2
C	563.2	15	0	0.066	3
D	576	15	0	0.063	1
E	563.2	15	0	0.064	3
F	545.6	15	0	0.097	1

Slab Floor Details

Rater	Area (sq. ft)	Continuous Insulation Under Slab (R-value)
A	960	10
B	1040	10
C	960	10
D	960	0
E	960	10
F	960	0

Rim and Band Joist Details

Rater	Area (sq. ft)	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)	Uo Value (Wall Only)	Insulation Grade
A	256	0	20	0.069	3
B	343	0	20.9	0.045	1
C	298.7	0	21	0.053	1
D	256	0	21	0.054	1
E	298.8	0	21	0.045	1
F	256	0	19	0.048	1

Above Grade Wall Details

Rater	Area (sq. ft)	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)	Uo Value	Insulation Grade
A	2554.5	0	20.9	0.064	3
B	2706	7.6	13.3	0.051	1
C	2652	7	21	0.039	1
D	2624	7	15	0.046	1
E	2641.9	7	14	0.049	1
F	2557	7.5	13	0.05	1

Window U-Factor and SHGC Details

Rater	Total Area (sq. ft)	Area Facing West (sq. ft)	U-Factor	SHGC	Shade - Winter	Shade - Summer
A	284.3	63	.19-.22	0.24	0.85	0.7
B	257.5	62.4	.18-.27	.17-.27	0.85	0.7
C	270	77	.19-.22	.24-.27	.85-1	.7-1
D	277	64	0.23	0.17	0.85	0.7
E	254.5	60.9	.18-.22	.24-.27	1	1
F	304.8	69	.18-.22	0.26	0.85	0.7

Ceiling and Roof Details

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Continuous Insulation (R-value)	Cavity Insulation (R-value)	Cavity Depth (in.)	Uo
A	960	1200	44.1	12.6	3.5	0.017
B	1040	1082	47	13	3.5	0.016
C	960	1200	26	30	7.3	0.019
D	960	1200	47	13	3.5	0.016
E	960	1200	49	11	3.5	0.017
F	960	1689	39	10.5	3.5	0.02

Mechanical Equipment Details

Rater	Heating Set Point (deg F)	Cooling Set Point (deg F)	Heating Capacity (kBtu/hr)	Cooling Capacity (kBtu/hr)	Heating Eff (AFUE)	Cooling Eff (SEER)	Water Eff (EF)
A	68	78	39	23	96	13.5	0.97
B	68	78	40	24	96.1	13.5	0.96
C	72	75	39	24	96	13	0.97
D	72	75	38	24	96	13	0.92
E	72	75	39	24	96	13	0.97
F	68	78	38.4	36	96	14	0.97

Duct System Details

Rater	Returns (count)	Supply Duct Surface Area (sq. ft)	Total Duct Leakage (CFM25)	Leakage to Outside (CFM25)	Location
A	5	583.2	12.3	0.49	100% Conditioned
B	8	631.8	6.66	0	100% Conditioned
C	6	583.2	Could not test	Could not test	100% Conditioned
D	7	583.2	7.64	0.87	100% Conditioned
E	6	583.2	6.18	0.42	100% Conditioned
F	4	739.3	6.91	0	33% Conditioned 34% Attic

Note: The builder used Aeroseal® to seal the duct work so at the time of testing the plenum had not been sealed.

Lighting and Appliance Details

Rater	High Efficacy Lighting		Dishwasher (kWh/yr.)	Refrigerator (kWh/yr.)	Clothes Washer (kWh/yr.)	Clothes Dryer (EF)
	Interior	Exterior				
A	97.8	75	270	685	704	2.67
B	100	100	270	709	96	3.3
C	75	10	260	749	704	3.01
D	100	100	358	505	704	3.9
E	100	100	467	677	704	2.67
F	100	100	467	691	487	2.67

Ventilation and Infiltration

Rater	Rate (CFM)	Hours	Fan Watts	CFM/Watt	ACH50
A	51	8	139	0.37	1.05
B	62	24	370	0.17	0.9
C	132	18.8	383	0.34	0.8
D	135	12	135	1.00	1.2
E	120	12	140	0.86	1.1
F	140	10.1	140	1	1.1

Grand Rapids House Description

The house is a 2,240 square-foot, one story ranch-style home with a finished conditioned basement. This house had a simple design but unfortunately was at the typical point of construction to receive a certified HERS rating. The home did not have the finished flooring, lighting, appliances, or a water heater and air conditioner installed during the time of the rating. In addition, raters were unable to test the duct work because the return duct had not been completely installed. Given the unfinished state of the home, all raters who agreed to rate the home only agreed to do so on the basis of providing a projected rating. MEEA provided details on the missing building components to the raters based on the intention of the builder.

Home Characteristics

General Characteristics	**Conditioned Area (sq. ft)**	**Conditioned Volume (cu. ft)**	**Stories Above Grade**	**Bedrooms**	**Conditioned Basement**
	2,240	20,760	1	4	Yes
Structural Characteristics	**Slab**	**Foundation walls**	**Above Grade Walls**	**Sheathing**	**Roof**
	Poured Concrete	8” Concrete Block	2x4 studs @16” OC.	OSB wrapped in Tyvek	16” O.C. 2x4 wooden trusses
Building Thermal Envelope	**Slab Insulation**	**Foundation Wall Insulation**	**Above Grade Wall Insulation**	**Attic Insulation**	**Windows (U-Factor)**
	None	R-15 (batt)	R-15 (batt)	R-60 (blown cellulose)	.29, .30, .45
Mechanical Equipment & Ventilation	**Gas Furnace Efficiency (AFUE)**	**Electric AC Efficiency (SEER)**	**Water Heater Efficiency (EF)**	**Ventilation (CFM)**	**Ventilation (Watts)**
	95.5	13	.60	NA	NA
Lights & Appliances – not installed, provided by MEEA	**Refrigerator Efficiency (kwh/yr.)**	**Dishwasher Efficiency (kwh/yr.)**	**Washer Efficiency (kwh/yr.)**	**Dryer Efficiency (EF)**	**High Efficacy Lighting – Interior (%)**
	582	261	NA	NA	100

Note: MEEA provided each rater with the following information: Slab, foundation, rim, wall and ceiling insulation levels; Appliance information; Air conditioning size and level of efficiency; Hot water heater fuel source, size and level of efficiency; High efficacy lighting percentage.

Additional Observations

Variables	Rater G	Rater H	Rater I	Rater J	Rater K
Time On-Site	1 Hour	.75 Hours	1.5 Hours	1 Hour	.5 Hours
Rater Personnel	1	2	1	1	1
Performed Air Leakage Test	Yes	Yes	Yes	Yes	No
Location of Air Leakage Test	Front Entry	Side Entry	Front Entry	Front Entry	Did not test
Performed Duct Leakage to Outside Test	Could not test	Could not test	Could not test	Could not test	Could not test
Performed Total Duct Leakage Test	Could not test	Could not test	Could not test	Could not test	Could not test
Noted Window Stickers	Yes	Yes	Yes	Yes	No
Noted Heating Equipment Model #	Yes	Yes	Yes	Yes	No
Asked about Lighting	Yes	No	Yes	Yes	No
Used Infrared Camera	No	No	Yes	No	No
Asked If Home Would Have Whole-House Mechanical Ventilation	Yes	No	Yes	Yes	No
Notes		Rater did not engage MEEA during the rating process	Rater brought an infrared camera gauge insulation grading	Rater explained the rating process in detail to MEEA	Rater wanted to wait conduct final rating when house was closer to completion

Energy Ratings and Home Size

Rater	HERS Index	REM/Rate Version	Cost of Rating	Conditioned Area (Sq. ft.)	Conditioned Volume (cu. Ft.)	Bedrooms
G	65	14.6.4	$900	2240	20760	3
H	60	14.6.4	$500	2240	18700	3
I	58	15.3	$625	2240	19694	4
J	60	15.3	$765	2240	17920	4

Estimated Annual Energy Cost

Rater	MMBTU	Service Fee	Energy Cost	Total Cost
G	93.2	$120	$1,385	$1,505
H	60.8	$141	$1,257	$1,398
I	85.0	$210	$1,313	$1,523
J	79.0	$60	$650	$710

Foundation Wall Details

Rater	Area (sq. ft)	R-Value	Uo Value (Wall Only)	Insulation Grade
G	1022	15	0.115	3
H	908	15	0.086	1
I	908	15	0.121	2
J	928	15	0.122	3

Slab Floor Details

Rater	Area (sq. ft)	R-Value (under slab)
G	1,120	0
H	1,120	0
I	1,120	0
J	1,120	0

Rim and Band Joist Details

Rater	Area (sq. ft)	Continuous Insulation (R-Value)	Cavity insulation (R-Value)	Uo Value (Wall Only)	Insulation Grade
G	136	0	19	0.057	2
H	136	0	19	0.047	1
I	136	0	15	0.063	1
J	136	0	15	0.076	3

Above Grade Wall Details

Rater	Area (Sq. ft.)	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)	Uo Value	Insulation Grade
G	1,322	0	15	0.092	3
H	1,308	5	15	0.058	3
I	1,268	0	15	0.079	1
J	1,248	0	15	0.092	3

Window U-Factor and SHGC Details

Rater	Total Area (sq. ft)	Area Facing West (sq. ft)	U-Factor	SHGC	Shade - Winter	Shade - Summer
G	141.9	85.7	.28,.29,.45	0.32	0.85	0.7
H	171	60	.28,.29	.27,.32	1	1
I	162.5	57.5	.29,.45	.32,.59	0.85	0.7
J	121	48	.28,.29	0.32	0.85	0.7

Ceiling and Roof Details

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Continuous Insulation (R-value)	Cavity Insulation (R-value)	Cavity Depth (in.)	Uo
G	1120	1401	46.5	10.5	3.5	0.017
H	1200	2245	47	13	3.5	0.016
I	1120	1400	46.5	13.5	3.5	0.017
J	1120	1400	47	13	3.5	0.017

Mechanical Equipment Details

Rater	Heating Set Point (deg F)	Cooling Set Point (deg F)	Heating Capacity (kBtu/hr)	Cooling Capacity (kBtu/hr)	Heating Efficiency (AFUE)	Cooling Efficiency (SEER)	Water Efficiency (EF)
G	N/A	N/A	78	30	95.5	13	0.6
H	68	78	48	24	95.5	13	0.67
I	68	78	80	30	95.5	13	0.67
J	68	78	64	30	94	13	0.62

Duct Leakage

As indicated previously, the return duct was not installed during the time of the inspection, so raters were unable to test the duct work while on site. All ducts that were installed were in conditioned space.

Lighting and Appliance Details

Rater	High Efficacy Lighting		Dishwasher (kWh/yr.)	Refrigerator (kWh/yr.)	Clothes Washer (kWh/yr.)	Clothes Dryer (EF)
	Interior	Exterior				
G	100%	100%	261	582	704	2.67
H	50%	50%	269	647	151	2.67
I	100%	100%	260	582	151	2.67
J	100%	100%	260	582	96	3.48

Note: The lighting and appliances were not installed during the time of the field inspections. MEEA told the raters that the home would have 100% LED lights and provided the appliance model numbers for the dishwasher and refrigerator that would be installed. MEEA did not provide model numbers for the clothes washer and dryer.

Ventilation and Infiltration Details

Rater	Rate (CFM)	Hours	Fan Watts	CFM/Watt	Cooling Season Strategy	ACH50
G	0	24	0	0.00	Natural Vent.	2.6
H	0	24	0	0.00	None	3.0
I	50	24	15	3.33	Exhaust Only	2.4
J	0	24	0	0.00	Natural Vent.	3.2

Note: Bath fans were installed but were not operational during the field inspections. All raters asked about whether whole house continuous ventilation would be installed in the home, and MEEA said only bath fans would be installed.

All raters tested the total air leakage in the home but obtained slightly different results. Three raters used the front door and one used the side door to conduct the test. Given that the home was not sealed for a final blower door test, Raters A and C taped kitchen exhaust and plumbing penetrations.

Northeast Region: Derby, CT and Malta, NY

Derby House Description

The house studied has 2762 square feet of conditioned space; this includes the first floor with two bedrooms and a conditioned basement. The Home is certified Energy Star 3.1. The builder received utility incentives for the energy and renewable energy features. At the time of rating only the dishwasher appliance was installed. The house did not have refrigerator or washer/dryer. The house has an air cycler, smart thermostat and PV array. The entire duct system is installed in conditioned space.

Home Characteristics

General Characteristics	**Conditioned Area (sq. ft)**	**Conditioned Volume (cu. ft)**	**Stories Above Grade**	**Bedrooms**	**Conditioned Basement**
	2762	23484	1	2	Yes
Structural Characteristics	**Slab**	**Foundation**	**Above Grade Walls**	**Sheathing**	**Roof**
	Poured Concrete	Poured Concrete	2 x 6 walls 16" O.C.	Gyp Board, continuous insulation, Tyvek	16" O.C. 2 x 10 wood
Building Thermal Envelope	**Slab Insulation**	**Foundation Wall Insulation**	**Above Grade Wall Insulation**	**Attic Insulation (measured)**	**Window (U-factor)**
	R - 10	R - 13	2x6 16" O.C. 2" HDF + R8 FGB + R 6.5 cc	R60 blown cell 18"	0.25
Mechanical Equipment & ventilation	**Gas Furnace Efficiency (AFUE)**	**Electric AC Efficiency (SEER)**	**Tankless Water Heater Efficiency (EF)**	**Air Cycler (CFM)**	**Air Cycler (Watts)**
	NG 96	16	97		
Lights and Appliances	**Refrigerator Efficiency (kwh/yr.)**	**Dishwasher Efficiency (kwh/yr.)**	**Washer Efficiency (kwh/yr.)**	**Dryer Efficiency (EF)**	**High Efficacy Lighting - Interior (%)**
	691	270	2.67	NG	100

Note: The home has a roof mounted solar system.

Additional Observations

Variables	Rater A	Rater B	Rater C	Rater D	Rater E
Time On-Site	1 Hour	4 Hours	3 Hours	3.5 Hours	6 Hours
Rater Personnel	1	1	1	1	1
Performed Blower Door Test	Yes	Yes	Yes	Yes	Yes
Location of Blower Door Test	Front Entry	Front Entry	Front Entry	Front Entry	Front Entry
Sealed registers for Duct Test	Yes	Yes	Yes	Yes	Yes
Performed Duct Leakage Test	Yes	Yes	Yes	Yes	Yes
Performed Total Duct Leakage Test	Yes	Yes	Yes	Yes	Yes
Took Photos of Model #'s	No	Yes	No	No	Yes
Counted Light Bulbs	Yes	Yes	Yes	Yes	Yes
Used Infrared Camera	No	No	No	No	No
Inspected Attic Insulation	No	No	No	No	No
Included PV	Yes	No	No	Yes	Yes
Performed Combustion Testing	No	No	No	No	Yes
Notes		Created SketchUp drawing, modeled REM/Rate on site, traced air leakage	Taped exterior exhaust vents, taped bath exhaust fans, cut open taped dryer vent duct		Spent time speaking with builder regarding details, made observations on moisture issues, traced air leakage

Ratings and Home Size

Rater	HERS Index	REM/Rate Version	Cost of Rating	Conditioned Area (sq. ft)	Conditioned Volume (cu. ft)
A	19 w/PV	v14.6.3	$1,200	3058	28285
B	55	v15.3	$1,200	2635	23106
C	43	v14.6.4	$1,200	2264	19241
D	28 w/PV	v15.3	$1,350	2766	23484
E	30 w/PV 55 w/o PV	v15.3	$975	2735	28396

Estimated Energy Cost

Rater	MMBtu	Service Fee	Total Cost	PV ($/yr.)
A	28.4	$375	$725	($1,022)
B	80.2	$0	$602	NA
C	44.2	$485	$1,609	NA
D	59.3	$435	$978	($912)
E	60.9	N/A	$1,309	($935)

Energy Cost

Rater	Heating ($/Yr.)	Cooling ($/Yr.)	Hot Water ($/Yr.)	Lighting & Appliance ($/Yr.)
A	$181	$85	$82	$1,024
B	$449	$1	$82	$71
C	$138	$83	$34	$898
D	$426	$70	$78	$880
E	$705	$72	$134	$960

Foundation Wall Insulation

Rater	Area (sq. ft)	R-Value	Uo Value (Wall Only)	Insulation Grade
A	4816	31.5	0.043	1
B	3520	6.0	0.988	1
C	2312	17	0.113	1
D	3824	7.5	0.518	1
E	6710	7.5	0.309	1

Slab Floor Insulation

Rater	Area (sq. ft)	R-Value (under slab)
A	1400	7.5
B	1335	10
C	1383	0
D	1383	0
E	1367	7.5

Rim and Band Joist Insulation

Rater	Area (Sq. ft.)	Uo Value	Insulation Grade	R-Value
A	132	0.036	1	14.7
B	134	0.049	1	6.5
C	134	0.075	1	14
D	136	0.042	1	6.5
E	136	0.052	3	6.5

Above Grade Wall Insulation

Rater	Area (sq. ft)	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)	Uo Value	Insulation Grade
A	1254	6.5	19.1	0.045	1
B	1212	6.5	17.1	0.047	1
C	1072	6.5	25.6	0.039	1
D	1548	6.5	20.5	0.047	1
E	1226.6	6.5	19.6	0.048	3

Window U Value and SHGC

Rater	Total Area (sq. ft)	Area Facing West (sq. ft)	U-Value	SHGC	Shade - Winter	Shade - Summer
A	237.9	64	0.21	0.2	0.85	0.7
B	323.4	73	0.28	0.27	0.85	0.7
C	291.5	64	0.25	0.27	0.85	0.7
D	290.3	74	0.25	0.27	0.85	0.7
E	343.7	93	0.25	0.27	0.85	0.7

Ceiling and Roof Insulation

Rater	Ceiling Area (sq. ft)	Roof Area (sq. ft)	Continuous Insulation (R-Value)	Cavity Insulation (R-Value)	Cavity Depth (in.)	Uo
A	1400	1750	0	60	12	0.022
B	1335	1668.75	27.8	38	9.5	0.016
C	1383	1728.75	31.5	28.5	7.5	0.017
D	1281	1601.25	35	25	18	0.017
E	1367	1709	36.8	26.3	7.5	0.016

Mechanical Efficiency

Rater	Heating Set Point (deg F)	Cooling Set Pont (deg F)	Heating Capacity (kBtu/hr.)	Cooling Capacity (kBtu/hr.)	Heating Efficiency (AFUE)	Cooling Efficiency (SEER)	Water Efficiency (EF)
A	68	78	60	36	96	15	0.96
B	68	78	39	18	96	16	0.97
C	68	78	39	18	96	15	0.89
D	68	78	39	18	96	16	0.97
E	68	78	39	18	96	16	0.97

Duct Leakage

Rater	Returns (count)	Supply Duct Surface Area (sq. ft)	Total Duct Leakage (CFM25)	Leakage to Outside (CFM25)	Location
A	5	567	184	0	100% conditioned
B	4	533.6	230	N/A	100% conditioned
C	N/A	N/A	N/A	N/A	N/A
D	4	462.3	185	0	100% conditioned
E	2	276.9	191	0	100% conditioned

Note: Rater C's report was missing the page that contained this information.

Lighting and Appliance Efficiency

Rater	High Efficacy Lighting		Dishwasher (kWh/yr.)	Refrigerator (kWh/yr.)	Clothes Washer (kWh/yr.)	Clothes Dryer (EF)
	Interior	Exterior				
A	100%	100%	0	691	704	2.67
B	81%	100%	305	691	704	3.01
C	95%	100%	270	691	96	3.01
D	100%	100%	270	673	704	2.67
E	89.5%	100%	270	673	704	2.67

Ventilation and Infiltration Details

Rater	Rate (CFM)	Hours	Fan Watts	CFM/Watt	ACH50
A	60	24	40	1.5	1.81
B	74	24	15	4.93	2.22
C	100	11	14.67	6.82	2.06
D	90	13	32	2.81	2.17
E	88	12	10.2	8.63	1.69

Malta, NY: Identifying a House

Only diagnostic testing (blower door, duct blaster, air flow) was conducted on the New York home and not a full rating. Each rater was provided $800 for their services.

Malta, NY House Description

The Malta house is a single-family, detached home. It is a 5000 square foot modern design with two stories above grade, an attached garage, and a conditioned, unfinished basement. The house includes four bedrooms and four full or half bathrooms, a large open floor plan with living room/kitchen area and dining room, plus an office and laundry room. The house uses a natural gas furnace (with a conventional duct system) and water heater, which is located in the basement, as well as an electric central air conditioning system. House is Energy Star 3.1 certified. Building Information:

- Conditioned Area (sq. ft.) - 5000
- Conditioned Volume (cubic ft.) – 44869
- Insulated Shell (sq. ft.) – 9650
- Bedrooms – Four
- House Type – Two Story Single Family Detached
- Foundation Type – Conditioned Basement

Additional Observations

	Rater A	Rater B	Rater C	Rater D	Rater E
Time Spent On-Site	2.5 hours	1.75 hours	3 hours	2.25 hours	2.75 hours
Raters On-site	1	2	1	3	1
Performed Blower Door Test	Yes				
Location of Blower Door Test	Front Door				
Sealed Registers During Blower Door Test	Yes	No	No	No	No
Performed Total Duct Leakage Test	Yes				
Performed Duct Leakage to Outside Test	Yes				
Other		Ran bath tubs during fan flow test to ensure water in the trap.	Did not tighten blower door frame cams 100%.	Used Retrotec tools (all others used Minneapolis)	**Incorrect LTO test**: did not reverse blower door fan flow

Performed Fan Flow Test	No (forgot equipment)	Yes (but did not notice 2nd fan in master bath)	No (forgot equipment)	Yes	Yes
Register Taping Strategy	Took off floor grill covers. Closed louvres. Taped unconnected dryer vent.	Taped to outside of grill covers.	**Missed seals for several registers**. Did not tape fans or dryer vent because this would create “unnatural condition.” Did not close louvres.	Blew smoke through ducts to find poor seals. Sealed additional points (e.g. near air handler)	Did not close louvres.
Duct Testing Cabinet Seal Strategy	Square transition piece pre-taped to cardboard square (sealed rest with duct tape)	Created seal with a combination of duct tape and register seal tape. (Did not remove the air filter.)	Cut the board to fit on-site (connected with duct tape).	Taped around plywood backer (connected with a combo of register tape and painter’s tape).	Register seal tape only.
Duct Testing reference selection	Plenum (test hole pre-drilled)	Closest supply register	Plenum (test hole pre-drilled)	Closest supply register (plenum facing perpendicular to flow)	Plenum (test hole pre-drilled) (plenum facing in the same direction as flow)
Taped Fans (tied in to HRV?)	No	Yes	No	Yes	Yes (but missed one of the fans).
Taped off HRV outside?	No	Yes	No	Yes (did w/ and w/o)	Yes (did w/ and w/o)

Diagnostic Testing Results

Rater	Envelope Leakage (ACH50)	Duct Leakage to Outside (CFM25)	Duct Total Leakage (CFM25)	Air Flow (CFM)			
				Master Bath	Bath One	Bath Two	Half bath
F	1.43	61	580	36	31	32	30
G	1.36	28	876	20	23	22	25
H	1.56	140	1065	No Fan Test Equipment			
I	0.89	0	606	29	22	24	22
J	1.36	41	637	24	28	25	26

POWERS
HEATING & AIR

May 3, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, GA 30329

Reference: Energy, Residential, Building Amendments Subcommittee Agenda Item #3

Dear Mr. Miltiades,

I would like to express my concerns with Agenda Item #3 both as a Conditioned Air Contractor and as a member of the SCAC. The SCAC has worked very hard over the past couple of years to improve the energy efficiency standards of both new construction homes and commercial buildings within the State of Georgia while being mindful of the overall cost to consumers and all constituents in our great State.

While I am very aware of the difficulty of working in hot attics. It is both a health and safety issue which is manageable with the proper training, skills, and tools. And as Michael Brown with JR HOBBS stated to me "150-degree attics can be addressed with ventilation requirements which would reduce the load on the A/C systems and would reduce the energy consumption of these systems."

The Proponent is requesting that we "prohibit the installation of air handling equipment in unconditioned spaces i.e., attics specifically in South Georgia". First, we do not have a climate zone "South Georgia." So where and how would we draw the lines? Second, the unconditioned spaces *such as* attics is not a concise statement but can be open to interpretation later such as garages, crawl spaces, unconditioned basements. And for clarification purposes by stating "air handlers" is he only referencing Heat Pump indoor equipment or also gas furnaces with coils?

Kevin Chenoweth with D&L Heating and Air Inc. also notes that a significant number of homes in Georgia are built with no mechanical room in the living spaces and a majority of these homes are on slabs; thus, many systems are installed in the attics. Making a change like this would require a major shift in the design of a significant number of house plans in Georgia and the redesign of many townhomes as well.

It is my humble opinion that this change would ultimately reduce the number of homes being built on a slab and require more homes to be built off the ground with a crawl space. This means more lumber in every home and less concrete – driving the cost of new homes out of the affordability of many Georgians. The National Association of Home Builders just published their report stating that the price of lumber had climbed 180% since last spring and the data shows 1,000 board feet has gone from roughly $400 in June of 2020 to $1,100 in April of 2021. They also state that lumber costs have forced the average price of new single-family home up by $24,000 over the past 12 months.

In March, the US Producer Price Index (PPP) for Construction materials shows a 45-80% year over year increase in soft wood lumber, plywood, and particle board while ready mix concrete and cement have increase well under 5% since February 2020. Reading and reviewing many websites regarding the projections and expectations of the building materials costs over the next 12-24 months does not look to be very promising for price reductions. Therefore, based on the current economic and construction climate I do not foresee the benefit of this proposal as written and at this time and I strongly encourage that the amendment be denied.

Thank you for the consideration.

Sincerely,

Elaine Powers

Elaine Powers, President

Georgia
Pest Control
Association

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

RE: **Energy, Residential, Building Amendments Subcommittee – Proposed Georgia Structural Pest Control Commission Amendments**

Dear Mr. Miltiades,

The Georgia Pest Control Association (GPCA) was established in 1950 with 16 members. Currently more than 650 pest management companies are active members in the state-wide association. The GPCA represents 85% of the individual pest management operators in the state, accounting for over 9,800 state licensed and regulated professionals.

The pest management industry has a significant economic impact on our state and is charged with the protection of health, safety, and property for Georgia consumers. We are a major employer in the State and an integral part of school operations, commercial establishments, and home management. GPCA is understandably proud of its long, rich history as a partner with the consumers, and law-markers of Georgia.

We started out with leaders focused on professionalism and it remains our focus to this day.

The GPCA supports the proposed amendments put forward by the Georgia Structural Pest Control Commission as they are needed to ensure the protection of Georgia consumers and their property from Wood Destroying Organisms.

Garry Adams
Chairman of the Board

Brantley Russell
President

Cliff Baird
Vice President

Glen Ramsey
Secretary/Treasurer

C Rogers
Connie Rogers
Executive Director

Jim Reynolds

From: James Martin <JMartin@romega.us>
Sent: Wednesday, May 5, 2021 12:29 PM
To: Jim Reynolds; Ted Miltiades
Subject: Fw: DCA codes amendment

FYI

James W. Martin, CBO, MCP
Building Official
Rome/Floyd County Building Inspections
Building Officials Association of Georgia
President
Phone: 706-236-4483

From: Edwards, Todd <TEdwards@ACCG.org>
Sent: Wednesday, May 5, 2021 11:47 AM
To: Laura Norton <laura.norton@peachgr.com>
Cc: Don Bolia <don.bolia@peachgr.com>; Janelle Bova <janelle@peachgr.com>
Subject: RE: DCA codes amendment

Hey Laura:

I would be the contact and ACCG would be okay with this if you could please set an effective date of January 1, 2023 in order to give the counties time to prepare their respective codes/operations appropriately.

Thanks,
Todd

Todd Edwards
Deputy Legislative Director
Office Phone: (404) 589-7820
Cell Phone: (404) 805-7883
Email: tedwards@accg.org

From: Laura Norton <laura.norton@peachgr.com>
Sent: Wednesday, May 05, 2021 10:12 AM
To: Edwards, Todd <TEdwards@ACCG.org>
Cc: Don Bolia <don.bolia@peachgr.com>; Janelle Bova <janelle@peachgr.com>
Subject: FW: DCA codes amendment

Hi Todd! Can you let me know who from your team I should contact about participating in a call regarding this amendment to the building code? They have been asked to be sure GMA and ACCG are ok with this change.

Thanks.

Laura Norton

Laura Norton
Senior Associate
1100 Peachtree St., Suite 675
Atlanta, GA 30309
678-699-6426
laura.noton@peachgr.com

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From: David Southerland <dsoutherland@aiaga.org>
Date: Tuesday, May 4, 2021 at 4:04 PM
To: Laura Norton <Laura.Norton@peachgr.com>
Subject: DCA codes amendment

Laura,

See attached and let me know if you have questions. The goal is to identify who at ACCG should be on our informational call in a couple of weeks.

David

____

David Southerland
Executive Director

AIA Atlanta and AIA Georgia
50 Hurt Plaza, Suite 109, Atlanta, GA 30303
T (678) 553-0509
M (404) 933-4541
dsoutherland@aiaga.org

aiaatl.org | aiaga.org

Jim Reynolds

From: James Martin <JMartin@romega.us>
Sent: Tuesday, May 11, 2021 1:15 PM
To: Jim Reynolds
Cc: Ted Miltiades
Subject: Fw: 2018 IEBC

Jimmy,

Please see the below email from GMA.

James W. Martin, CBO, MCP
Building Official
Rome/Floyd County Building Inspections
Building Officials Association of Georgia
President
Phone: 706-236-4483

From: Thomas Q. Gehl <tgehl@gacities.com>
Sent: Tuesday, May 11, 2021 10:12 AM
To: James Martin <JMartin@romega.us>
Subject: RE: 2018 IEBC

Hi James,
Sorry for the tardy reply. It is outside my bailiwick, so I'll defer to your judgement. But I appreciate you reaching out.
Please give my warm regards to Sammy Rich!
Thanks,
Tom

From: James Martin <JMartin@romega.us>
Sent: Tuesday, May 4, 2021 1:12 PM
To: Thomas Q. Gehl <tgehl@gacities.com>
Subject: 2018 IEBC

Tom,

DCA is currently in the process adopting the 2018 International Existing Building Code as a mandatory code in the state, I would like your input on adopting this code?
BOAG supports the adoption, just wanted GMA'S input.

Thanks,

James W. Martin, CBO, MCP
Building Official
Rome/Floyd County Building Inspections
Building Officials Association of Georgia
President
Phone: 706-236-4483

Thomas Q. Gehl
Director, Governmental Relations
Office: 678-686-6247 Fax: 678-686-6347
www.gacities.com

Hey, did you notice my new email address?

GMANET is now GACITIES.COM. While I'm still getting the emails you send me, please update your contacts to note my new email address.

BUILDING OFFICIALS ASSOCIATION OF
GEORGIA

June 14, 2021

Mr. Ted Miltiades, Director
Office of Construction Codes & Industrialized Buildings
Georgia Department of Community Affairs
60 Executive Park South NE
Atlanta, Georgia 30329

Re: 2018 International Existing Building Code (IEBC) becoming mandatory

Dear Mr. Miltiades,

On behalf of the Building Officials Association of Georgia, the membership would request consideration for statewide training for member jurisdictions on the 2018 International Existing Building Code (IEBC). This permissive code is not widely adopted in Georgia and would be a new mandate for all Georgia jurisdictions. Necessary information should be made available to interested parties and Georgia building departments prior to requesting BOAG support for the proposed adoption of the 2018 IEBC, with Georgia amendments as a new statewide mandatory code. BOAG and interested parties need to fully understand how this proposed new mandatory code should be properly utilized along with its advantages for Georgia, and proper application. In addition, we would need information on its limitations and where it would not be applicable as possibly conflicting with established requirements of current state mandatory codes like the International Building Codes, and Georgia's Life Safety Codes. Training and education would be needed for Georgia building departments and Fire Marshalls along with possible consideration for additional department staffing, permitting, and plan review support.

Thank you for your consideration, if you have any questions or concerns, please contact me directly.

Sincerely,

James W Martin

James W. Martin, CBO, MCP
Building Official
Rome/Floyd County Building Inspections
President
Building Officials Association of Georgia

bsc Building Science Corporation

June 15, 2021

Gregori Anderson
Chairman
State Code Advisory Council
Georgia Department of Community Affairs
60 Executive Park South, NE
Atlanta, GA 30329

RE: Termite Inspections at the Framing Foundation Interface

Dear Chairman Anderson,

Building Science Corporation is a building science consulting firm with clients throughout North America. Our focus is preventing and resolving problems relating to building design, construction and operation. We are internationally recognized for our expertise in moisture dynamics, indoor air quality, and building failure forensic investigations. We have posted hundreds of papers on building performance on our website: www.buildingscience.com

Building Science Corp has reviewed the proposals submitted to the Georgia State Code Advisory Council on termite inspection at the framing foundation interface.

Building Science Corporation believes that the Building Code should not be used to eliminate proven construction methods and options. Buildings should be protected not just from pests and termites but also from fire, wind, earthquakes, floods, rain, humidity, interior contaminants while providing comfort and energy efficiency. Buildings, including houses, are interrelated systems where all of these considerations should be considered together not independently to the exclusion of others.

Foam plastics and spray foams provide numerous benefits by controlling air flow, vapor flow, liquid water flow while providing high thermal resistance. Pests, including termites can be controlled using integrated pest management strategies. Attached is the May, 2021 ASHRAE Journal which discusses these approaches for residential construction – basements, crawlspaces and slab-on-grade construction. Figure 7 illustrating rigid foam plastic has a long proven track record of successful performance in North Carolina and Georgia going back to the mid 1990's. Also attached is Figure 1 which applies to spray polyurethane foam.

Allowing the use of the approaches described in ASHRAE Figure 7 and Figure 1 will maximize flexibility for builders, ensure builders have the tools to meet the Georgia air-tightness requirements, and protect consumers from termites, energy loss, and moisture issues.

The use of air impermeable insulation at the framing foundation interface will help control stack effect, wind and minimize concealed condensation issues. In our opinion, these are as important as maintaining an accessible rim/band joist area because they contribute to rotting and deterioration that is very problematic at the framing foundation interface.

Building Science Corp believes that foam plastics and spray foam can be used in a manner that protects Georgia homeowners if the following three conditions are met:

1. The framing foundation interface is constructed with treated lumber
2. The front face of the sill-plate is left exposed
3. A termite shield is in place

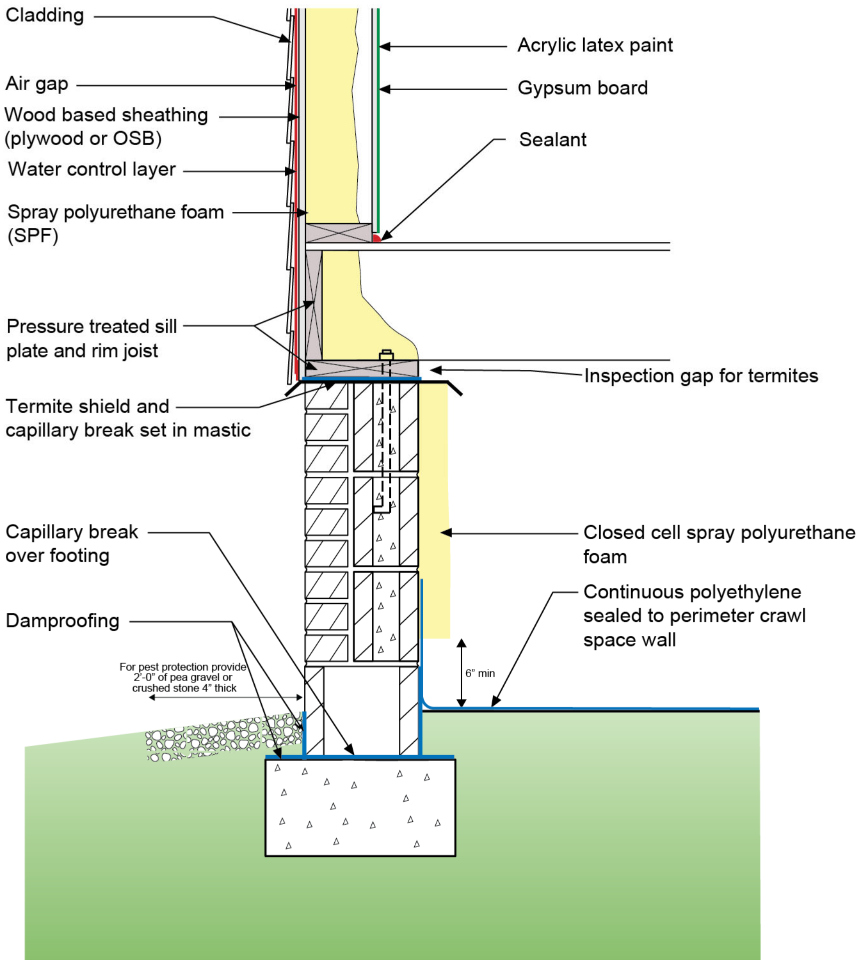
A complete ban on foam plastics and spray foam in the framing foundation interface will undermine the best building science and impact the ability for builders to comply the Georgia Building Code. We believe this is a prudent path forward that addresses termite control.

I am happy to respond to questions. I can be reached at: (978) 852-5232 or joe@buildingscience.com

Yours truly,

Joseph Lstiburek, Ph.D., P.Eng.
Principal, Building Science Corporation

Figure 1


Cladding
Air gap
Wood based sheathing (plywood or OSB)
Water control layer
Spray polyurethane foam (SPF)
Pressure treated sill plate and rim joist
Termite shield and capillary break set in mastic
Capillary break over footing
Dampproofing
For pest protection provide 2'-0" of pea gravel or crushed stone 4" thick
Acrylic latex paint
Gypsum board
Sealant
Inspection gap for termites
Closed cell spray polyurethane foam
Continuous polyethylene sealed to perimeter crawl space wall
6" min

Joseph W. Lstiburek

Pests Can Really Bug You

Consider These Five Integrated Pest Management Strategies

BY JOSEPH W. LSTIBUREK, PH.D., P.ENG., FELLOW ASHRAE

Pests include insects or animals that have a harmful effect on humans, food or living conditions such as termites, ants, cockroaches, mice, rats and dust mites. (We are not going to address telemarketers or lawyers.) To help with the insects and animals, I'll discuss five integrated pest management strategies.

A bit of background first: water, food, dust and clutter provide the conditions for these pests to inhabit buildings. Pests inside homes can lead to allergic reactions, and they often lead to the use of pesticides not good for people to breathe or eat. They can damage or destroy building materials. Water and food are an invitation for pests. Designing homes to be dry and keeping them dry and clean controls pests. Disconnecting buildings from the surrounding soil and ground controls pests.

Infestations of dust mites, cockroaches, mice and rats can all cause allergic reactions. Even after pests are gone, their skin, hair and feces can remain and cause allergies.

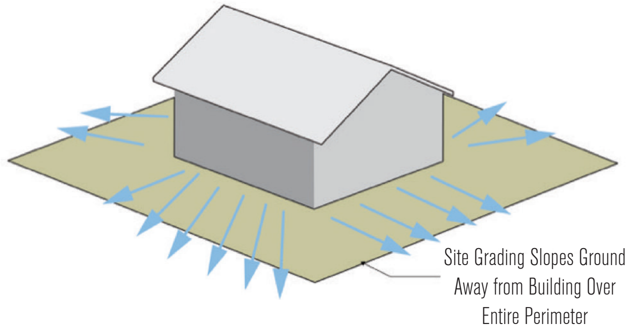
Pest-resistant homes reduce exposure to allergens and asthma triggers released by pests and can reduce the amount of pesticide used when they are necessary. And now for the five strategies.

Keep Pests Out of Homes

Pests tend to love water. Control surface water—slope the ground away from building perimeters (*Figure 1*). Direct rainwater from gutters and downspouts away from buildings (*Figure 2*).

Keep bushes and trees at least 3 ft (0.9 m) from homes. Bushes and trees near a home provide food, a living place and sheltered passage for pests such as rats, mice, birds, cockroaches and ants. For similar reasons, trash

FIGURE 1 Control Surface Water. Slope the ground away from building perimeters.



Joseph W. Lstiburek, Ph.D., P.Eng., is a principal of Building Science Corporation in Westford, Mass. Visit www.buildingscience.com.

FIGURE 2 Gutters and Downspouts. Direct rainwater from gutters and downspouts away from buildings.

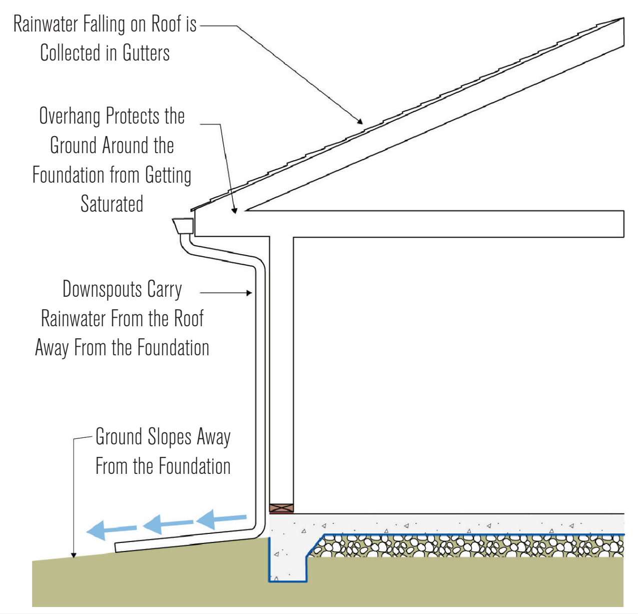
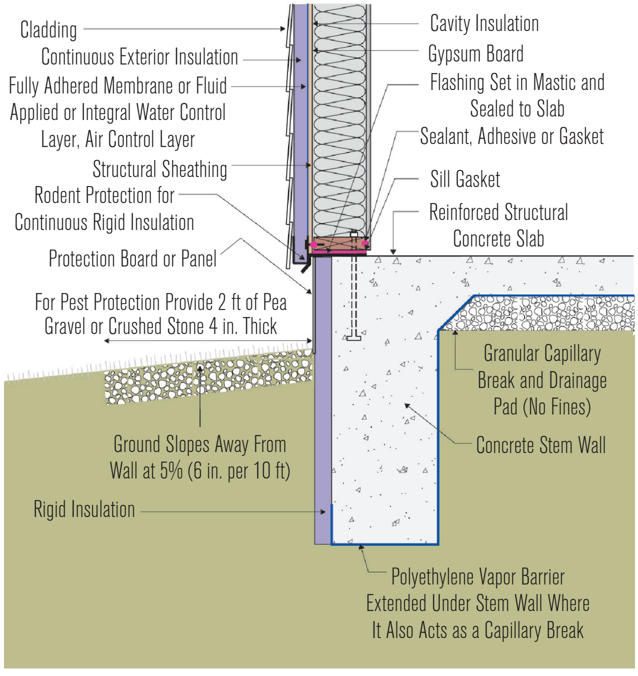


FIGURE 3 Pea Gravel-Crushed Stone Perimeter Pest-Resistant Ground Break (Slab Foundation). The thickness of the pea gravel-crushed stone layer should be a minimum of 4 in. (102 mm). The pea gravel-crushed stone ground break should slope away from the building at approximately 5% (½ in./ft [0.04 mm/m]).



and clutter should not be stored near buildings.

Provide 2 ft (0.6 m) of pea gravel or crushed stone and then plant drought-resistant plants and do not over-irrigate. Alternative pest-resistant ground breaks such as graded basalt particles, concrete skirts or concrete pavers are also effective.

FIGURE 4 Pea Gravel-Crushed Stone Perimeter Pest-Resistant Ground Break (Basement Foundation). The thickness of the pea gravel-crushed stone layer should be a minimum of 4 in. (102 mm). The pea gravel-crushed stone ground break should slope away from the building at approximately 5% (½ in./ft [0.04 mm/m]).

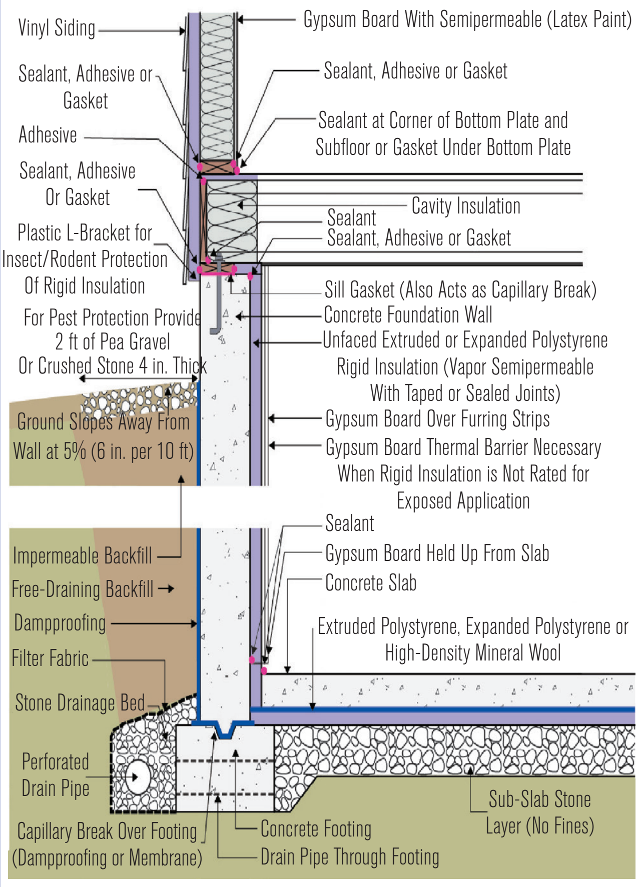


Figure 3 and *Figure 4* as well as *Photo 1* and *Photo 2* illustrate the use of a 2 ft (0.6 m) wide perimeter pest-resistant pea gravel-crushed stone ground break. The thickness of the pea gravel-crushed stone layer should be a minimum of 4 in. (102 mm). The pea gravel-crushed stone ground break should slope away from the building at approximately 5% (½ in./ft [0.04 mm/m]).

Photo 3 and *Photo 4* illustrate the use of a 2 ft (0.6 m) wide perimeter concrete skirt ground break. Its thickness should be a minimum of 4 in. (102 mm). The concrete should be cast on a 4 in. (102 mm) thick stone capillary break. Control joints should be provided every 4 ft (1.2 m). In Climate Zones 5 and higher, the concrete should be air entrained to a minimum of 5% at compressive strength of 3,500 psi (24 132 kPa) to resist freeze-thaw damage. The concrete skirt ground break should slope away from the building at approximately 5% (½ in./ft [0.04 mm/m]).

Photo 5 illustrates the use of a 2 ft (0.6 m) wide

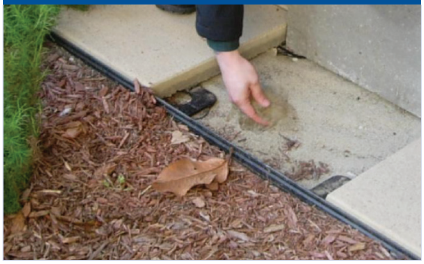
PHOTO 1 Pea gravel-crushed stone perimeter pest-resistant ground break.

PHOTO 2 Pea gravel-crushed stone perimeter pest-resistant ground break.

PHOTO 3 Concrete skirt perimeter pest-resistant ground break.

PHOTO 4 Concrete skirt perimeter pest-resistant ground break.

PHOTO 5 Concrete paver perimeter pest-resistant ground break. (Photo courtesy of the San Francisco Department of the Environment–*Pest Prevention by Design*.)



perimeter concrete paver ground break. The concrete paver should be set on a 4 in. (102 mm) thick sand layer. The concrete paver ground break should slope away from the building at approximately 5% (½ in./ft [0.04 mm/m]).

One of the worst pests are termites. Termites are a major threat to the structural integrity of homes. Here is something obvious—most damage to buildings caused by termites can be avoided by preventing the entry of termites where buildings are connected to the ground. Although obvious, we do dumb things and then try to rely on inter-species chemical warfare to compensate for our dumbness.

Let me repeat the obvious—preventing the entry of termites into the building is the first best strategy. More specifically, prevent the entry of termites into and through basement foundations, crawlspace foundations and slab-on-grade foundations:

- Provide termite shields between foundations and framing;
- Provide inspection ability; and
- Seal foundation service penetrations.

Additionally, homes can be constructed with termite-resistant materials such as borate-treated lumber framing and insulations or inherently termite-resistant materials such as mineral wool insulation.

Borate-treated lumber framing materials must be protected from liquid water to prevent leaching of the borate treatment. Exposed treated lumber framing will lose its efficacy over time. Borated-treated lumber framing should not be exposed to rain and should not be used in ground contact or below grade.

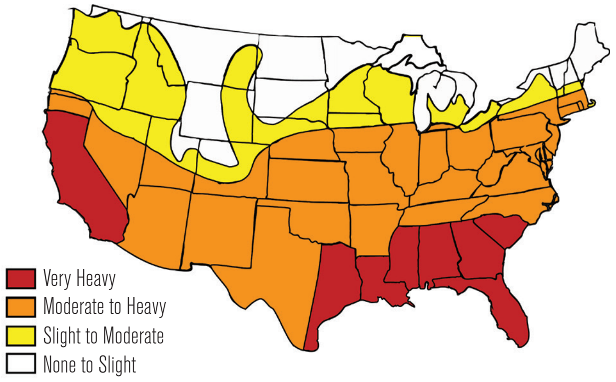
Borate-treated lumber framing is recommended for use in "heavy" termite-infestation regions. Such regions are defined in the 2018 International Residential Code (IRC) in Figure R301.2(7), "Termite-Infestation Probability Map" (*Figure 5*).

Borate-treated cavity insulations such as cellulose are not likely to be exposed to rain and therefore present very little risk from leaching of the borate treatment and are also recommended in heavy termite-infestation regions. Inherently termite-resistant cavity insulations such as mineral wool insulation are also recommended.

Borate-treated expanded polystyrene (EPS) can experience leaching when used below grade or in ground contact. However, the EPS can be protected from liquid water leaching with the use of drainage membranes or capillary breaks. In all cases, all ground contact rigid insulations, including borate-treated EPS, should be used in conjunction with termite shields.

Borate-treated EPS used above grade as continuous exterior insulation is typically protected by back-ventilated and drained cladding assemblies and present low risk from leaching of the borate treatment.

FIGURE 5 Borate-treated lumber framing is recommended for use in "heavy" termite infestation regions. Such regions are defined in the 2018 International Residential Code (IRC). The map below is adapted from R301.2(7) "Termite Infestation Probability," 2018 International Residential Code (IRC).



Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

Figure 6 illustrates a basement foundation insulated on the exterior. Exterior basement foundation insulation can act as a pathway for termite entry. The use of stainless steel termite shields set in mastic and sealed to the top of the foundation wall addresses this pathway. The joints in the termite shield need to be overlapped and sealed. The termite shield needs to extend outward past the exterior edge of the exterior basement foundation insulation and its associated protection layer a minimum of ¾ in. (19 mm) to impede the ability of termites to bridge the shield. This also facilitates visual inspection of the effectiveness of the termite shield.

Note that continuous exterior insulation also needs to be protected from rodents and insects—particularly at the bottom of frame wall and floor assemblies. Rigid formed plastic and "bent" sheet metal have been shown to be effective.

Figure 7 illustrates a crawlspace foundation insulated on the interior. Interior crawlspace insulation can act as a pathway for termite entry. The use of stainless steel termite shields set in mastic and sealed to the top of the foundation wall address this pathway. The joints in the termite shield need to be overlapped and sealed. The termite shield needs to extend outward and inward past the edges of the crawlspace foundation structural wall a minimum of ¾ in. (19 mm) to impede the ability of termites to bridge the shield. An inspection gap should be provided at the top of interior crawlspace insulation. This gap should remain open for the life of the building.

FIGURE 6 Basement foundation insulated on the exterior. In "heavy" termite infestation regions, borate-treated lumber framing and insulation should be used.

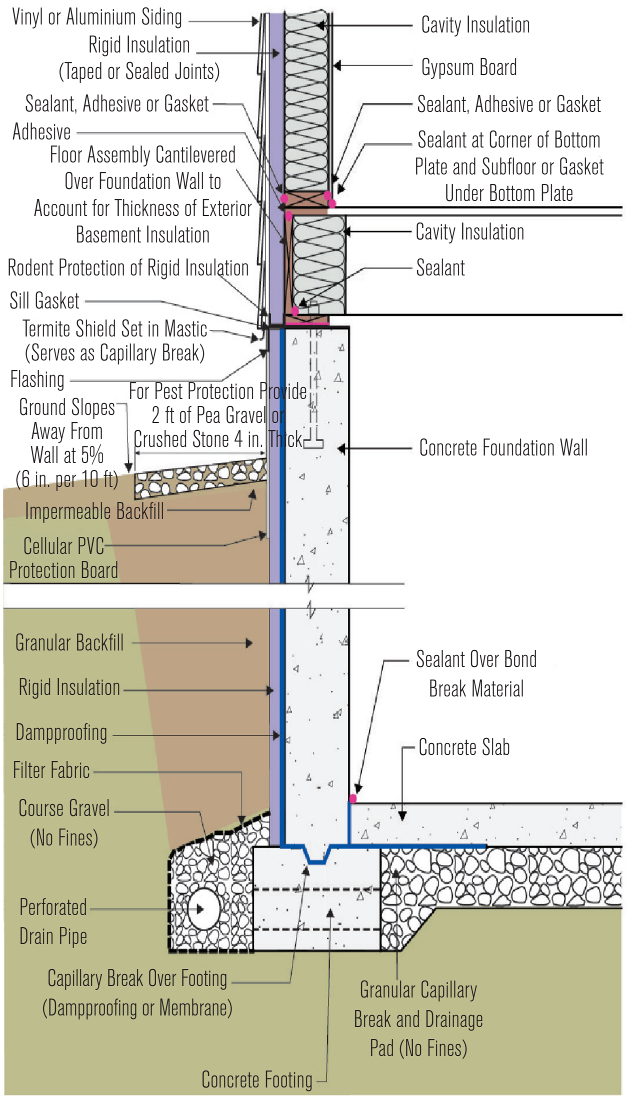


Figure 8 illustrates a slab-on-grade foundation constructed using a masonry stem wall with a thermally uncoupled concrete slab. The concrete slab is cast over a layer of rigid insulation that is "turned up" at the perimeter. The turned up insulation provides an effective thermal break. However, this insulation layer can act as a pathway for termite entry. The use of stainless steel termite shields set in mastic and sealed to the top of the masonry stem wall spanning the insulation thermal break and subsequently sealed to the slab edge addresses this pathway. The joints in the termite shield need to be overlapped and sealed. The termite shield needs to extend outward and inward past the edges of the crawlspace foundation structural wall a minimum of ¾ in. (19 mm) to impede the ability of termites to bridge the shield. This also facilitates visual inspection of the effectiveness of the termite shield.

FIGURE 7 Crawlspace foundation insulated on the interior. The crawlspace is an unvented conditioned crawlspace. In "heavy" termite infestation regions, borate-treated lumber framing and insulation should be used.

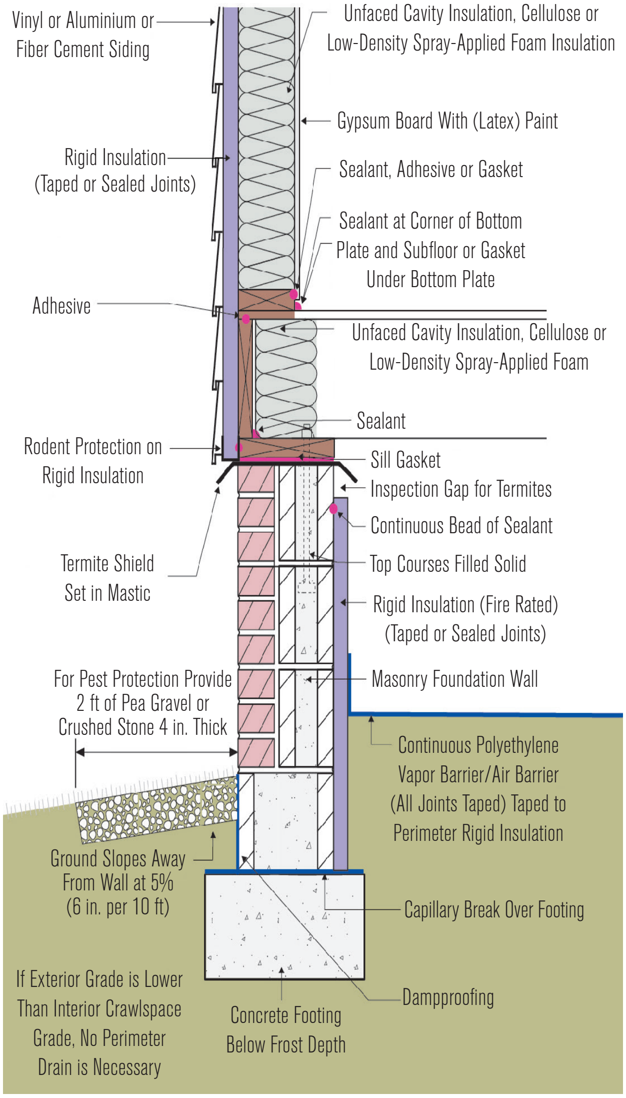
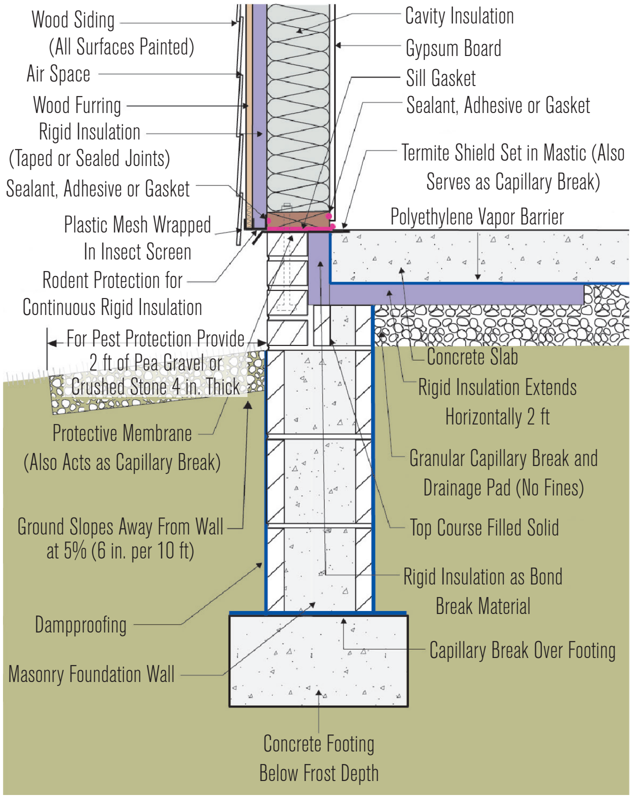


FIGURE 8 Slab-on-grade foundation constructed using a masonry stem wall with a thermally uncoupled concrete slab. In "heavy" termite infestation regions, borate-treated lumber framing and insulation should be used.



Further note that the gap created by the wood furring needs to be sealed at the bottom of the cladding. A plastic mesh wrapped in an insect screen serves this function.

Figure 9 illustrates a slab-on-grade foundation constructed using a monolithic concrete slab/grade beam. Note the "turned down" portion of the concrete slab at the perimeter. This turned down section acts as the "grade beam." The monolithic concrete slab/grade beam is insulated at the perimeter with exterior rigid insulation. Exterior slab edge insulation can act as a pathway for termite entry. The use of stainless steel termite shields set in mastic and sealed to the top of the monolithic concrete slab/grade beam addresses this pathway.

The joints in the termite shield need to be overlapped and sealed. The termite shield needs to extend outward past the exterior edge of the exterior slab edge insulation and its associated protection layer a minimum of ¾ in. (19 mm) to impede the ability of termites to bridge the shield. This also facilitates visual inspection of the effectiveness of the termite shield. Additionally, a removable strip of insulation and protection board providing an inspection gap is recommended.

Penetrations where plumbing and other services penetrate concrete slabs need to be sealed. The most effective approach is to wrap the service penetration with a stainless steel mesh "skirt" clamped to the service penetration. The mesh is subsequently cast into the concrete (*Photo 6*).

Block pest entries. Seal utility openings and joints between materials. Use corrosion-resistant materials such as copper or stainless steel mesh. Rodents can chew through many materials. Prevent animals and insects from entering cladding systems. Protect exterior insulation from ground contact. If ground contact cannot be avoided, use termite shields.

Reduce Interior Water/Moisture Availability

Pests tend to love water. Sound familiar? We already talked about reducing exterior water. We also need to reduce interior water/moisture availability. Too much interior water/moisture results in interior mold, insects, rodents and mites. During air-conditioning periods interior humidity should be maintained at 60% or less. During heating periods interior relative humidity should be limited to 35% or less during the coldest parts of the winter—unless the house is designed to be able to withstand higher interior relative humidities during cold periods.

Dust mites require relative humidities of 70% or higher. Dust mites can colonize carpeting installed on cold surfaces such as uninsulated basement floor slabs. Cold slabs increase the relative humidities of adjacent surfaces. Cold carpets are an ideal breeding ground for dust mites. Interior humidity should be controlled. Install dehumidifiers in basements. Use dehumidifiers to address part-load humidity issues in energy-efficient houses. Dust mites can colonize furniture and clothing. Washing items in hot water (greater than 130°F [54°C]), can kill dust mites and wash away allergens.

Reduce Food Availability

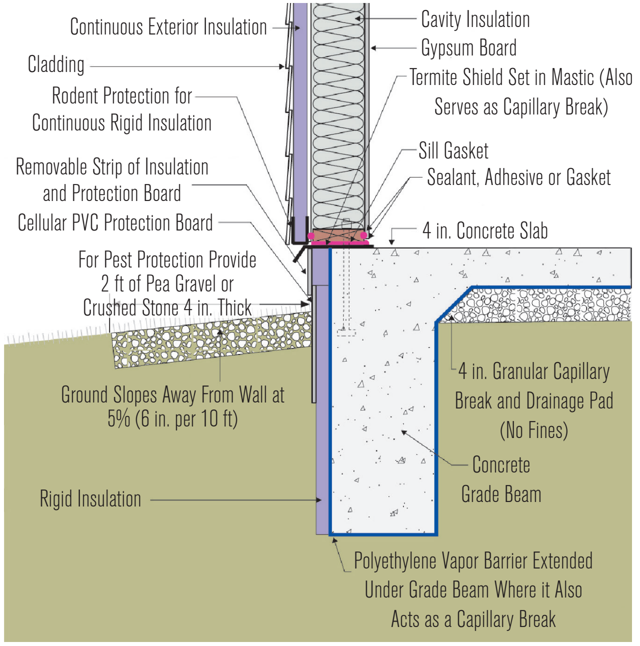
Keep kitchen waste in covered containers. Don't leave food out. Clean dishes. Don't pour grease down drains.

Control Dust

Dust contains asthma triggers. Over two-thirds of dust in homes originates outdoors and is tracked in on feet. House dust is known to contain many hazardous materials. Dust should be stopped at the door. Remove shoes and provide a place for shoes at the door. Provide a welcome mat and keep the welcome mat clean. Vacuum surfaces regularly. Vacuums with high-efficiency filtration are recommended. Make the home easy to clean. Don't clutter homes.

Don't Do Stupid Things

FIGURE 9 Externally insulated slab-on-grade foundation constructed using a monolithic concrete slab/grade beam. In "heavy" termite infestation regions borate-treated lumber framing and insulation should be used. The termite shield needs to extend outward past the exterior edge of the exterior slab edge insulation and its associated protection layer a minimum of ¾ in. (19 mm) to impede the ability of termites to bridge the shield. This also facilitates visual inspection of the effectiveness of the termite shield. Additionally, a removable strip of insulation and protection board providing an inspection gap is recommended.



Don't do stupid things. Of course this is the most difficult strategy to implement. We tend to be inherently stupid. Don't use moth balls. Moth balls release chemicals that are unhealthy. If pesticides are necessary, professionals who specialize in integrated pest management should be used. Do not inject pesticides into wall and building cavities—except boric acid.

Inter-species chemical warfare should be avoided wherever possible. You don't want Dr. Strangelove* doing the work. Done recklessly it can result in a mad outcome—mutual assured destruction.

PHOTO 6 Plumbing and other services that penetrate concrete slabs are sealed with a stainless steel mesh "skirt" clamped to the service penetration. The mesh is subsequently cast into the concrete.

Bibliography

Geiger, C., C. Cox. 2012. "Pest Prevention by Design: Authoritative Guidelines for Designing Pests Out of Structures." San Francisco Department of the Environment. https://tinyurl.com/9v6d554w

Lstiburek, J.W., T. Brennan. 2001. "Read This Before You Move In." Building Science Corporation. https://tinyurl.com/56pzb6uy ■

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*A 1964 satirical film by Stanley Kubrick. "Dr. Strangelove" was played by Peter Sellers. It is considered one of the greatest films of all time. One of the best lines in the film was, "Gentlemen, you can't fight in here. This is the War Room!"