



VIRTUAL/TELECONFERENCE
MASS TIMBER TASK FORCE
Virtual, 4822 Madison Yards Way, Madison
Contact: Brad Wojciechowski (608) 266-2112
December 11, 2023

The following agenda describes the issues that the Task Force plans to consider at the meeting. At the time of the meeting, items may be removed from the agenda. Please consult the meeting minutes for a record of the actions of the Task Force.

AGENDA

10:00 A.M.

OPEN SESSION – CALL TO ORDER – ROLL CALL

- A. Adoption of Agenda (1-2)**
- B. Approval of Minutes of October 25, 2023 (3-4)**
- C. Introductions, Announcements and Recognition**
- D. Reminders: Scheduling Concerns**
- E. Administrative Matters**
 - 1) Department, Staff and Task Force Updates
- F. Administrative Rules Matters – Discussion and Consideration**
- G. Alternative Procedures for Design of Mass Timber Tall Buildings – Discussion and Consideration (5)**
 - 1) Developing Content for Alternative Procedures for Mass Timber Guidebook (7-35)
 - 2) Ed Lisinski, American Wood Council: Mass Timber Alternative Materials and Methods Guide – Discussion and Consideration (36-68)
 - 3) Relating Mass Timber to Other Alternative Building Procedures
- H. Public Comments**

ADJOURNMENT

NEXT MEETING: JANUARY 12, 2024

MEETINGS AND HEARINGS ARE OPEN TO THE PUBLIC, AND MAY BE CANCELLED WITHOUT NOTICE.

Times listed for meeting items are approximate and depend on the length of discussion and voting. All meetings are held virtually unless otherwise indicated. In-person meetings are typically conducted at 4822 Madison Yards Way, Madison, Wisconsin, unless an alternative location is listed on the meeting notice. In order to confirm a meeting or to request a complete copy of the board's agenda, please visit the Department website at <https://dsps.wi.gov>. The board may also consider materials or items filed after the transmission of this notice. Times listed for the commencement of disciplinary hearings may be changed by the examiner for the convenience of the parties. Requests for interpreters for

the hard of hearing, or other accommodations, are considered upon request by contacting the Affirmative Action Officer , or reach the Meeting Staff by calling 608-267-7213.

**VIRTUAL/TELECONFERENCE
MASS TIMBER TASK FORCE
MEETING MINUTES
OCTOBER 25, 2023**

PRESENT: Justin Gavin, Laura Hasburgh, Jordan Komp (*arrived at 10:02 a.m.*), Jason Korb, Marco Lo Ricco, Michael Mazmanian, Richard Paur, Erich Roden

EXCUSED: Alexander Timmer

STAFF: Brad Wojciechowski, Executive Director; Joseph Ricker, Legal Counsel; Dialah Azam, Board Administrative Specialist; and other Department Staff

CALL TO ORDER

Richard Paur, Chairperson, called the meeting to order at 10:00 a.m. A quorum was confirmed with seven (7) members present.

(Jordan Komp arrived at 10:02 a.m.)

ADOPTION OF AGENDA

Amendments to the Agenda:

- Amend **B** to Minutes of March 23, 2023 (6/13/2023 meeting was cancelled)

MOTION: Laura Hasburgh moved, seconded by Erich Roden, to adopt the Agenda as amended. Motion carried unanimously.

APPROVAL OF MINUTES OF MARCH 23, 2023

MOTION: Laura Hasburgh moved, seconded by Michael Mazmanian, to approve the Minutes of March 23, 2023 as published. Motion carried unanimously.

ALTERNATIVE PROCEDURES FOR DESIGN OF MASS TIMBER TALL BUILDINGS

Developing Content for Alternative Procedures for Mass Timber Guidebook

MOTION: Jason Korb moved, seconded by Laura Hasburgh, to designate DSPTS to work on Section 1. Motion carried unanimously.

MOTION: Erich Roden moved, seconded by Michael Mazmanian, to designate Justin Gavin and Jason Korb to work on Section 2. Motion carried unanimously.

MOTION: Justin Gavin moved, seconded by Laura Hasburgh, to designate Laura Hasburgh to work on Section 3.2 and 3.3. Motion carried unanimously.

MOTION: Marco Lo Ricco moved, seconded by Michael Mazmanian, to designate Jordan Komp and Marco Lo Ricco to work on Section 3.1. Motion carried unanimously.

MOTION: Justin Gavin moved, seconded by Jason Korb, to designate Michael Mazmanian and Richard Paur to work on Section 4. Motion carried unanimously.

ADJOURNMENT


MOTION: Laura Hasburgh moved, seconded by Jason Korb, to adjourn the meeting. Motion carried unanimously.

The meeting adjourned at 11:26 a.m.

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**State of Wisconsin
Department of Safety & Professional Services**

AGENDA REQUEST FORM

1) Name and title of person submitting the request: Brad Wojciechowski		2) Date when request submitted: 11/30/2023 <small>Items will be considered late if submitted after 12:00 p.m. on the deadline date which is 8 business days before the meeting</small>	
3) Name of Board, Committee, Council, Sections: Choose an item. Mass Timber Task Force			
4) Meeting Date: 12/11/2023	5) Attachments: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	6) How should the item be titled on the agenda page? Alternative Procedures for Design of Mass Timber Tall Buildings – Discussion and Consideration 1) Developing Content for Alternative Procedures for Mass Timber Guidebook 2) Mass Timber Alternative Materials and Methods Guide – Discussion and Consideration 3) Relating Mass Timber to Other Alternative Building Procedures	
7) Place Item in: <input checked="" type="checkbox"/> Open Session <input type="checkbox"/> Closed Session	8) Is an appearance before the Board being scheduled? (If yes, please complete Appearance Request for Non-DSPS Staff) <input type="checkbox"/> Yes <Appearance Name(s)> <input type="checkbox"/> No	9) Name of Case Advisor(s), if applicable: <Click Here to Add Case Advisor Name or N/A>	
10) Describe the issue and action that should be addressed: <Click Here to Add Description>			
11) Authorization			
		11/30/2023	
Signature of person making this request		Date	
Supervisor (Only required for post agenda deadline items)		Date	
Executive Director signature (Indicates approval for post agenda deadline items)		Date	
Directions for including supporting documents: 1. This form should be saved with any other documents submitted to the Agenda Items folders. 2. Post Agenda Deadline items must be authorized by a Supervisor and the Policy Development Executive Director. 3. If necessary, provide original documents needing Board Chairperson signature to the Bureau Assistant prior to the start of a meeting.			

**State of Wisconsin
Department of Safety & Professional Services**

An Alternate Procedure for the Design and Permitting of (Tall) Mass Timber Buildings

3-23-2023

**An Alternative Procedure for the Design and Permitting of (Tall) Mass Timber Buildings
2023 Edition**

A consensus document developed by the Wisconsin Mass Timber Task Force

Task Force Active Members:

Richard Paur, Chairperson

Justin Gavin

Wisconsin Department of Safety and Professional Services Representative

Laura E. Hasburgh

Jordan T. Komp

Jason P. Korb

Marco T. Lo Ricco

Michael C. Mazmanian

Erich J. Roden

Alexander R. Timmer

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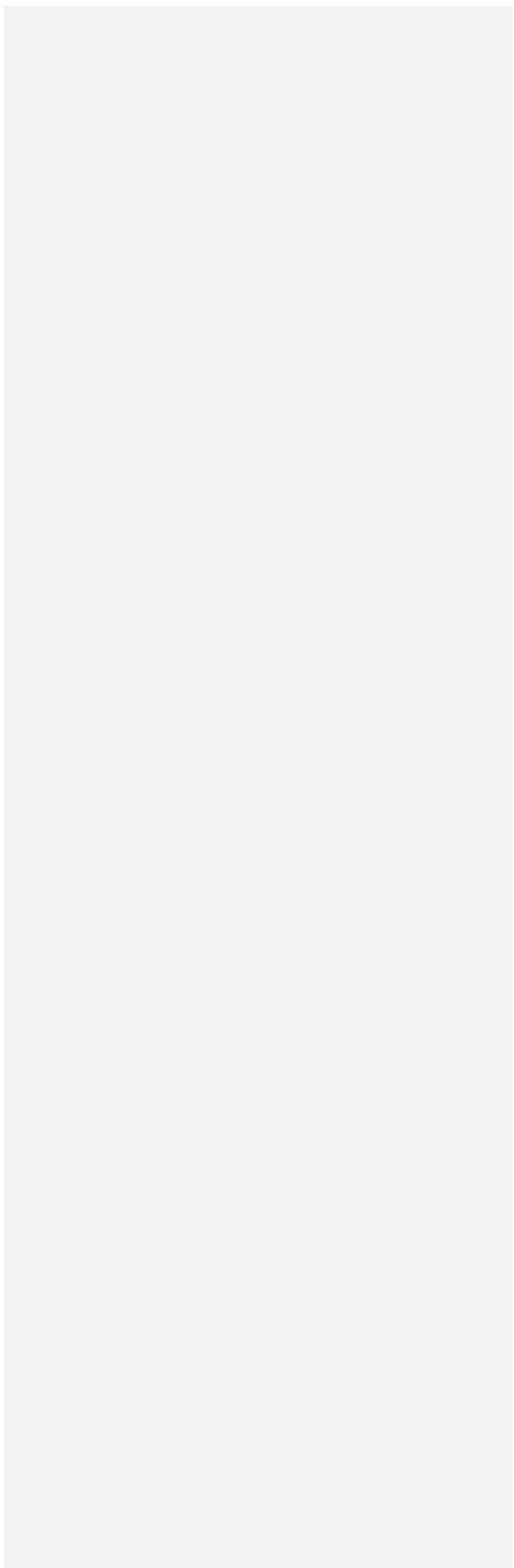


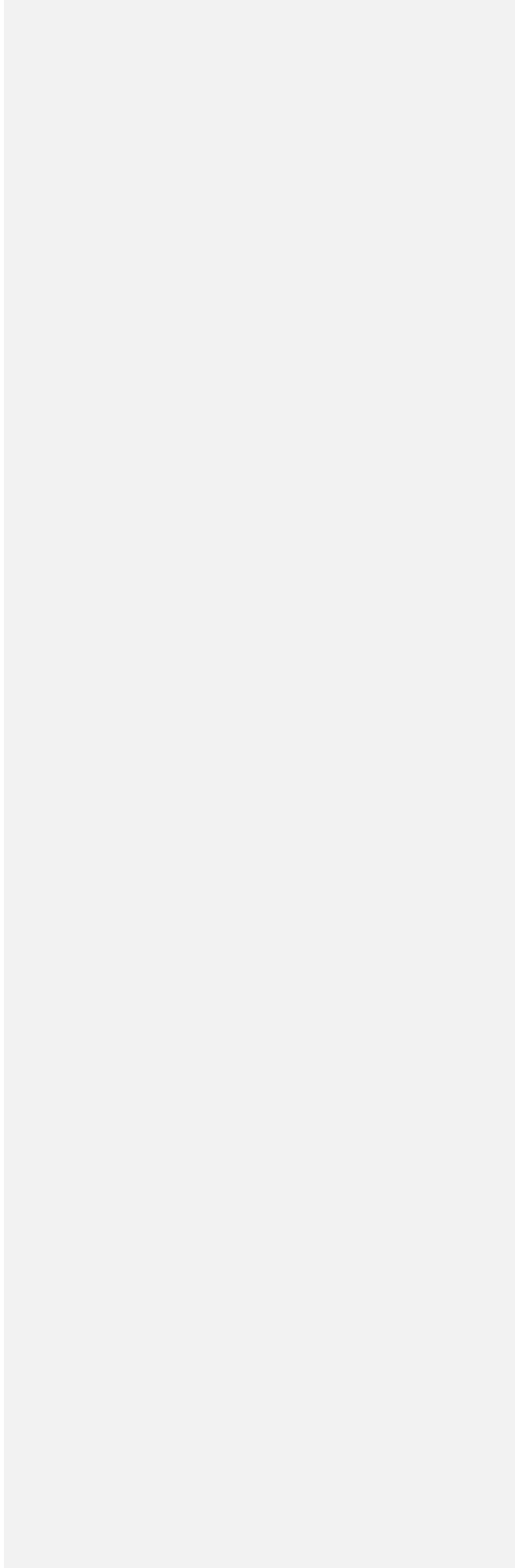
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 - 3.1 Structural Design *MLR*
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- 4 Construction and Post Occupancy
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- 5 Closing Remarks

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[IDEA: Intro to mass timber as a construction method \(American Wood Council for help\)](#)

About the Mass Timber Task Force

The Mass Timber Task Force was created under Wis. Stat. § 227.13 to advise the Department and the Commercial Building Code Council on matters relating to development of mass timber guidelines.

The agency utilized informal conferences and consultations to obtain the viewpoint and advise of interested persons with respect to contemplated rule making. The agency appointed a committee of experts, interested persons or representatives of the public to advise it with respect to any contemplated rule making. The committee shall have advisory powers only.

Members:

Paur, Richard (Chairperson)

Hasburgh, Laura

Komp, Jordan

Korb, Jason

Lo Ricco, Marco

Mazmanian, Michael

Roden, Erich

Timmer, Alexander

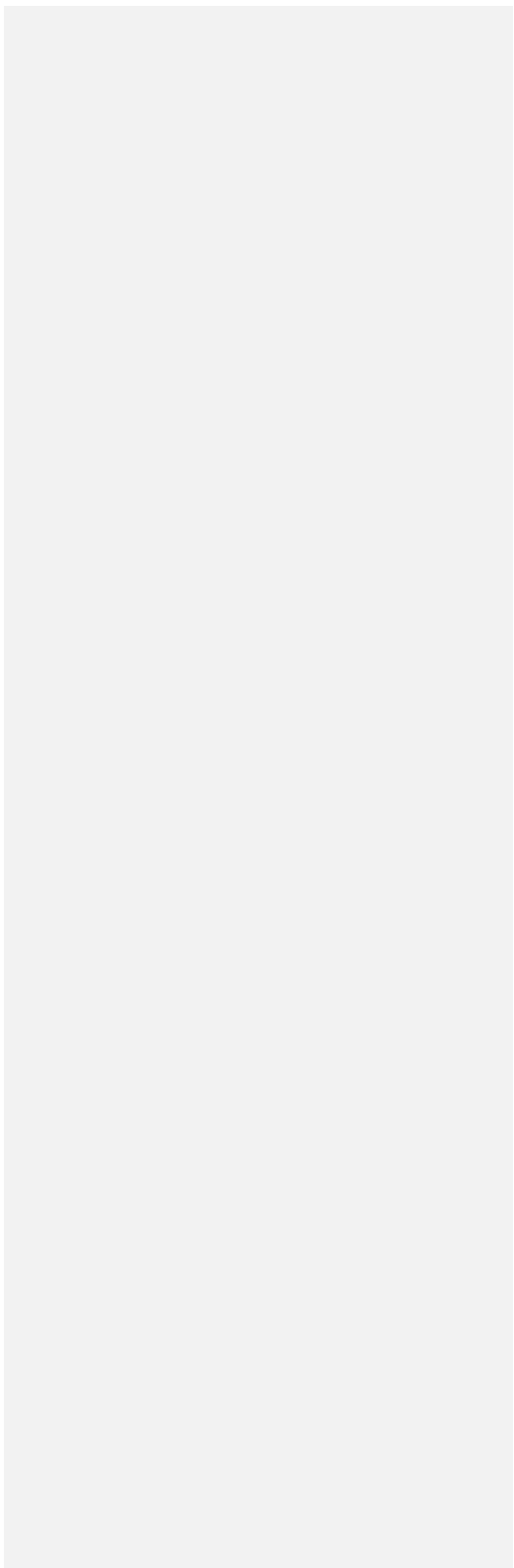
Gavin, Justin

~~*[A]104.11 Alternative materials, design and methods of construction and equipment.
The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.*~~

~~*[A]104.11.1 Research reports.*~~

~~*Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.*~~

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1. Intent, Scope, and Justification

1.1 Intent

The intent of the guidebook is to provide a framework for design professionals to work with permitting officials to facilitate the approval of (tall) Mass Timber structures, utilizing a performance-based design approach. The alternative design methods and materials described in this guidebook must provide, at a minimum, an equivalent level of quality, strength, fire resistance, durability, and safety, as buildings of similar height, occupancy, and area; as they relate to the Wisconsin Commercial Building Code, with references to the International Building Code.

1.2 Scope

The scope of this guidebook is to identify a methodology for the design, review, and approval of mass timber or composite mass timber buildings beyond the prescriptive provisions of IBC Type IV construction.

1.3 Justification

The Wisconsin Commercial Building Code (CBC) and the International Building Code (IBC) have existing provisions for alternative building materials, as well as the use of a performance-based design approach, both in lieu of a standard prescriptive code approach.

Alternate Building Materials

SPS 361.03 (6): *“Nothing in chs. SPS 361 to 366 is intended to prohibit or discourage the design and utilization of new building products, systems, components, or alternate practices, provided written approval from the department is obtained first.”*

SPS 361.50 (2): *“Materials, equipment, and products that meet the intent of chs. SPS 361 to 366 and which are not approved under sub. (1) shall be permitted if approved in writing by the department.*

Approval of materials, equipment, and products shall be based on sufficient data, tests, and other evidence that prove the material, equipment, or product meets the intent of the standards specified in chs. SPS 361 to 366.

Tests, compilation of data, and calculations shall be conducted by a qualified independent third party.”

Performance Based Design

IBC 2021 – Appendix O: *“Appendix O provides an optional design, review and approval framework for use by the building official. Typical uses would include cases of alternate methods in Chapter 1, select areas of the code that require a rational analysis such as Section 909 and elsewhere. It simply extracts the relevant administrative provisions from the ICC Performance Code into a more concise, usable appendix format for a jurisdiction confronted with such a need. Currently there are multiple, varying jurisdictional rules and procedures in many communities regarding procedure and none in even more. The building official is often left alone to reach*

decisions not just on the merits of a design, but must first also decide on the submittal and review process. As an appendix, the provisions herein are entirely optional to a jurisdiction. This appendix can be adopted, adopted with local modifications, or even used on a case-by-case basis as part of a Memorandum of Understanding or similar legal agreement between the jurisdiction and the owner/design team. It simply represents another tool for the jurisdiction to reach for in cases of need; it neither encourages nor creates any additional opportunity for performance-based design.”

The utilization of alternative building materials and design methods are contingent on approvals from the Wisconsin Department of Safety and Professional Services (DSPS). This guidebook outlines practices that have been used prior to the establishment of the Task Force, focusing on their implementation with respect to (tall) Mass Timber structures.

This guide would recommend the mass timber design align with the performance objectives utilized by the Ad Hoc Committee on Tall Wood Buildings (TWB) in providing guidance on the development of future code change proposals, primarily:

1. *No collapse under reasonable scenarios of complete burnout 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 (building height) and risk of collapse.*

Commented [WBD1]: "International Code Council Ad Hoc Committee on Tall Wood Buildings"

2. Permitting and Variance Process

For projects utilizing the alternate design methods and materials outlined in this guide, the following permitting and variance process is recommended.

2.1 Preliminary Meeting

Note: peer review should be included here

A preliminary meeting, likely occurring in the Concept/Schematic Design phase of the project, to introduce the project to the Authority Having Jurisdiction (AHJ), including the following items:

1. Project Location
2. Project Parameters (Height, Number of Stories, Material Exposure,...)
3. Project Timeline
4. Unique/critical project details
5. Design Team Proposed Variance Path (e.g. utilizing this guide)
6. Preliminary AHJ/Fire Department Questions
7. Schedule Next Steps

It is recommended the following parties are in attendance:

1. Authority Having Jurisdiction
2. Fire Department
3. Ownership
4. Architect on Record (A.O.R.)
5. Engineer on Record (E.O.R.)
6. Fire Engineer (if on-board)
7. Contractor (if on-board)

2.2 Process Approval

Based on the introductory meeting, and initial feedback from the AHJ/Fire Department, the design team should formally propose a Variance/Permitting Approval Process (e.g. the Alternate Materials provision, the use of this guide...), including what, if any, supplemental testing, reports, or documentation will be provided in the formal variance.

After reviewing the proposal, the AHJ should formally approve or reject the variance **process**, including any required modifications or supplement documentation to the design team proposal.

2.3 Petition for Variance

Based on the previously accepted variance process, the design team/ownership should formally issue a "Petition for Variance" (or potentially multiple variances depending on the project).

The petition should include the following:

1. The code section(s) being petitioned
2. The variance request
3. The intent of the code section being petitioned
4. Petitioner's comments, including what supplemental documentation (e.g. letters, reports, test results, peer reviews, fire engineering) will be provided with the future issuance of the Permit Documents

If deemed acceptable, the AHJ should provide "Conditional Approval" of the Petition for Variance, noting any specific conditions of approval (e.g. the petitioner carrying out all items noted in the original petition).

If deemed unacceptable, the AHJ should clarify why the petition was rejected, or note what modifications would be required for approval.

3.1.3 Submittal requirements

1. Calculations

Calculations provided to the AHJ should address the:

- a. Fundamental structural design scenario through analysis of standard load combinations, and
- b. Fire safety scenario, where members rely on encapsulation or charring of the structure to meet an endurance rating and prevent collapse.

2. Design and construction documents

Drawings should include a narrative explaining the use of mass timber structural components and delineate framing members and panels used as slabs or decking. Schedules for beams, columns, braces, and connections, should be provided, as customary for communicating the design of any structural material.

A loading plan should also communicate the loads to which mass timber components are designed. Layups and assumed design stress limits, modulus of elasticity in each orthogonal direction, and shear modulus in each orthogonal direction should be listed in the general notes section of the plan set.

3. References

The sources of substantiating information from tests, design standards, engineering reports and research articles should be clearly cited in the peer review calculations.

1. U.S. standards

- a. Because the recent 2021 edition of the NDS specifically address cross-laminated timber (CLT), it is recommended the design team utilize the latest version of this design standard.
- b. For main lateral-force resisting systems (MLFRS) including CLT diaphragms and shear walls, in particular, designers should reference 2021 Special Design Provisions for Wind and Seismic (SDPWS) as a general framework. It is likely that future editions of these documents will include more detailed and specific information on mass timber systems, to supplement the current general framework.
- c. AWC technical report No. 10, Calculating the Fire Resistance of Wood Members and Assemblies provides guidance for calculating the fire endurance of timber structures with architecturally exposed surfaces.
- d. ANSI/APA PRG 320: Standard for Performance-Rated Cross-Laminated Timber is referenced by building codes. Mass timber panels beyond the scope of this document should demonstrate performance with testing and calculations to demonstrate equivalent or enhanced performance.
- e. ANSI A190.1-2022 Product Standard for Structural Glued Laminated Timber is referenced by building codes. Mass timber framing beyond the scope of this document should demonstrate performance with testing and calculations to demonstrate equivalent or enhanced performance.

3. Foreign Standards

Where current state of the art research and documents associated with mass timber fall outside of the United States, references des to foreign codes should check underlying assumptions of design equations and compare models with the design philosophies developed in the United States.

The design team should justify to the AHJ and Peer Reviewer, the use of the design recommendations, factors, and equations provided by these codes, in accordance with U.S. Standards.

If the team specifies material (timber/hardware) sourced outside of the United States, the design team should provide documentation providing equivalency between Eurocode serviceability and strength parameters with those documented in the NDS and applicable ANSI standards. For these materials, it is recommended the team provide an additional equivalent Eurocode design for the controlling members/designs. The peer reviewer (where applicable) should review and comment on the conversion factors from codes outside the United States to NDS parameters/values.

2.4 Issuance of Permit Documents

Outline the Standard Permitting Process (Drawings, Specifications, Calculations)

The permit documents should also be issued to the previously approved Independent Third Party Peer Reviewer, if applicable (refer to section 3.4 for additional information regarding the peer review process)

Update per Peer Review / AHJ Comments

2.5 Permit Approval

Prior to formal issuance of the permit, all AHJ and Peer Review comments should be addressed to the satisfaction of the AHJ.

Formal Issuance Process

- i. Buildings approved under type IV construction
- ii. Documentation:
 1. Structural package
 - a. For members with fire protection based on a protective char layer, supplemental calculations to be provided for both standard occupancy, and extreme event (fire) scenarios.

2. Glulam fire test report (for chars beyond 2 hours)
3. CLT compliance with PRG-320 (2018 or beyond) to avoid heat delamination
4. CLT un-restrained load-bearing floor/ceiling assembly fire test (where fire performance not proved by char) in compliance with ASTM E119-16a *Standard Test Methods for Fire Tests of Building Construction and Materials*
5. Connection load-bearing fire-test (for connections) in compliance with ASTM E119-16a, or supplemental fire engineering per IBC 2021, Section 2304.10.1.

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3. Analysis, Design, and Detailing

Outline of Section

3.1 *Structural design*

3.1.1 Performance objectives

1. Load combinations
2. Fire endurance rating
3. Serviceability criteria
4. Redundancy and progressive collapse mitigation

3.1.2 Scope of performance-based design

1. Load path classifications
2. Lateral force-resisting system
3. Hybrid system
4. Composite action
5. Integrity

3.1.3 Submittal Requirements

1. Calculations
2. Drawings
3. Substantiating documents
 1. U.S. standards
 2. Voluntary design guides and technical resources
 3. Foreign standards

4. Test Data

3.1.4 Proprietary components

For Type IV construction, beyond the prescriptive requirements of the adopted building code, it is noted that an alternate, performance-based, pathway is available for design and permitting.

The goal of this chapter is to provide guidance on design parameters, as well as any necessary supervision by third party professionals (where required), to meet the performance goals agreed to with the AHJ.

3.1 Structural Design

The structural design should follow, at a minimum, the requirements of the National Design Specification referenced by the current version of the Wisconsin Commercial Building Code. The structural calculations provided to the AHJ should include calculations for both the standard design scenario and for a fire scenario, where members rely on charring of the structure.

Given the recent additions to the 2021 NDS, it is recommended the design team utilize the additional requirements of this updated design standard, particularly with respect to the lateral design requirements included in the 2021 Special Design Provisions for Wind and Seismic (SDPWS).

Should the team consider sourcing material (timber/hardware) outside of the United States, the design team should provide documentation providing equivalency between Eurocode serviceability and strength parameters with those documented in the NDS. For these materials, it is recommended the team provide an additional equivalent Eurocode design for the controlling members/designs. The peer reviewer (where applicable) should review and comment on the conversion factors from codes outside the United States to NDS parameters/values.

In addition to the code requirements above, it is recommended that the design utilize, where possible, state of the art research and design documents (as applicable), including the latest versions of the following documents:

1. CLT Diaphragm Design for Wind and Seismic Resistance (Woodworks)
2. U.S. Mass Timber Floor Vibration Design Guide (Woodworks)
3. Current CLT Composite Research (where applicable)
4. Hybrid Steel Frames with Wood Floors (AISC) (where applicable)
5. 2022 Fire Design Specification (FDS) for Wood Construction

Where current state of the art research and documents associated with mass timber fall outside of the United States, if you need to go outside this, the governing codes should be referenced including:

6. EuroCode 5
7. Canadian Code (CSA)

The design team shall justify to the AHJ and Peer Reviewer, the use of the design recommendations, factors, and equations provided by these codes, in accordance with American Standards.

3.1.1 Performance objectives

The performance-based structural design of mass timber systems should meet or exceed the minimum requirements of the National Design Specification (NDS) referenced by the current version of the Wisconsin Commercial Building Code.

Often, performance-based design objectives may be set higher than typically required by code to minimize damage to structures, architectural and mechanical systems, and building contents. Higher performance objectives may result in buildings that exceed safety standards and need less repair when hazardous events occur.

Project stakeholders should determine at the outset whether the performance objectives are intended to be on par or better than objectives underlying minimum code requirements.

1. Load combinations

Performance-based design should address the standard load combinations specified by ASCE/SEI 7 and list whether load cases follow minimum or enhanced requirements. For instance, seismic or wind requirements may be enhanced to mitigate higher magnitude earthquakes or wind events than those typically considered standard for design.

2. Fire endurance

Performance-based fire designs may choose to enhance the duration of fire endurance from the minimum required for occupancy and structure type. For example, a structure that requires a two-hour fire rating may set objectives for three-hour ratings.

3. Serviceability

While strength is essential for structural design, serviceability considerations such as deformations, floor deflections and lateral drift often control design.

4. Redundancy and progressive collapse mitigation

Structural redundancy and measures to prevent disproportionate collapse of building structures, because of a single component failure, is typically addressed via prescriptive detailing measures in standard building codes. Performance-based design objectives specific to progressive collapse mitigation may be defined in the absence of prescriptive guidance for mass timber structures.

5. Structural integrity

The ability of gravity framing to displace and rotate in compatibility with the lateral force-resisting system shall be generally checked in accordance with reference standards, such as ASCE/SEI 7. In addition, the displacement and rotation compatibility of non-structural mechanical and architectural components shall be checked for the expected structural movements.

- a. Utility penetrations through beams or panels may affect both structural strength and fire safety, particularly in exposed mass timber components that are not encapsulated with ignition barriers.
- b. Connection ductility may be necessary for the performance of mass timber components in seismic lateral force-resisting systems or in other extreme loading conditions. The rotational capacity and strengths of connections relying on ductility should be substantiated by tests and analysis.

A concise way to compare code minimum requirements and enhanced objectives of performance-based design may be accomplished in tabular form in the calculations and drawing submittal.

3.1.2 Scope of performance-based design

1. Load path classifications

The International Building Code generally defines BEARING WALL STRUCTURE or FRAME STRUCTURE based on whether walls or columns are the primary supports for vertical loads. In addition, structural systems are defined by the load path for lateral resistance of forces. The performance-based design package should state whether mass timber structural components are

elements of the gravity or lateral force-resisting system or serve dual functions in both vertical and lateral load paths.

2. Lateral Force-Resisting System

Currently, design standards referenced by the building codes contain few prequalified mass timber lateral systems and mostly prescriptive requirements for encapsulation of mass timber components for fire safety. For innovative systems that do not match the details of prequalified mass timber systems, the structural submittal to the AHJ should include peer-reviewed calculations. Such calculations may address both standard design load combinations and fire endurance to demonstrate that the structure will meet or exceed the minimum time of fire rating required by code occupancy.

3. Hybrid system

Mass timber structural components may be configured in hybrid structural systems to work in unison with steel or concrete construction. The role of mass timber components should be clearly defined in the submittal, both in project narrative and on the plans general notes.

4. Composite action

Concrete or cementitious toppings are commonly used in mass timber decking systems. Whether these toppings are intended for composite action between the concrete and mass timber products should be clearly expressed in the structural submittal and drawings. Composite behavior of concrete topping and mass timber panel substrate may have a significant impact on the structural performance of both the decking of the gravity system and the lateral stiffness of the diaphragm.

3.1.3 Submittal documentation

3.2 Fire-Resistance Requirements

The design team should provide clear documentation of what structural elements are considered exposed, concealed and/or partially concealed. The design team should clearly identify the fire rating of each element. For elements where the fire protection is provided by a combination of a non-combustible material and charring layer, the contribution of each toward the overall fire rating should be documented; with the contribution of the non-combustible materials (where applicable) providing a minimum of 2/3 of the overall required fire rating.

3.2.1 Minimum Fire-Resistance Ratings (FRR's)

Primary Structural Frame:

Buildings up to 180'-0" or 12 stories: 2 hours¹

Buildings taller than 180'-0" or 12 stories: 3 hours^{1,2}

¹ Roof support rating is permitted to be reduced by one hour where supporting a roof only (not including additional occupancies/loading)

² For buildings not greater than 420 feet in building height, the fire-resistance rating of floor framing elements (e.g. CLT slabs and glulam beams) shall be permitted to be reduced to 2 hours.

Bearing Walls:

Refer to primary structural frame^{3,4}

³ No reduction for roof framing is permitted

⁴ Minimum fire-rating for exterior walls to be based on fire separation distance

Non-Bearing Walls and Partitions: 0 hours

Floor Construction and Associated Secondary Structural Members: 2 hours

Roof Construction and Associated Secondary Structural Members:

Buildings up to 180'-0" or 12 stories: 1 hour

Buildings taller than 180'-0" or 12 stories: 1.5 hours

Structural Connections

Fire-Resistance Rating to match, at a minimum, the lower of the connecting member(s) FRR.

3.2.2 Mass Timber Fire-Resistance Rating Validation

3.2.2.1

NDS (Char Method)

Primary and Secondary Structure:

The utilization of NDS provisions and calculations for the determination of char rates is a well-established and industry recognized procedure. For the scope of this guideline, the following additional items shall be considered:

- LRFD Fire Factors: 2022 Fire Design Specification (FDS) for Wood Construction has included additional Fire Factors (not currently covered in NDS) for the use of Fire Factors with LRFD provisions (Table 3.2.5).

- Extreme Event Loading: For loading in a fire scenario, the designer is referenced to the 2022 Fire Design Specification (FDS) for Wood Construction section 3.1.3.4.

- Char Calculations Beyond 2 Hours: For members requiring fire ratings beyond the current NDS provisions, the design team shall provide specific testing, verifying the char rates utilized for design. It is recommended that the char rates not be reduced beyond those calculated based on extrapolation of the current NDS equations.

For projects utilizing Douglas Fir, American Spruce or European Spruce, the design team is advised to refer to the 3hr testing provided by the USDA Forest Product Laboratory for the Ascent project.

Connections:

- Bearing type connections should utilize noncombustible protection, or require load tested (under a fire event) to achieve the FRR noted in section 2.1.1.
 - i. Connections utilizing intumescent paint for noncombustible protection should be load tested (under a fire event) to confirm compatibility between materials
 - ii. At the AHJ's discretion, the use of engineering analysis could be provided to validate the fire-resistance rating of connections per section 2304.10.1 of IBC 2021
- All other mass timber connections should be load tested (under a fire event) for the specified fire rating.
- Testing should meet the requirements of Section 2.1.3

3.2.2.2

Non-Combustible Protection

Gypsum detailing requirements to follow IBC 2021 section 722.7. **TT. Korb previously noted some general concerns regarding discrepancies in the IBC 2021 code (section 722.7). It is**

recommended that the guideline specify specific detailing requirements in lieu of relying on a reference to IBC 2021

Korb: Has a lot more that is codified? General requirements. Sealant. ASPM requirements. Specific materials for fire protection. Gypsum must be met. 2 years ago implemented. Special inspections required based on building officials. Who is appropriate qualifications? Daily/monthly/yearly reports. Up to the special inspector to work with owner, contractor.

“Proposal FS81-18 (new IBC 722.7) defined the level of noncombustible protection required and how to achieve this level, including a prescriptive method recognizing 1/2" Type X gypsum board providing 25 minutes of protection and 5/8" Type X gypsum board providing 40 minutes of protection. Proposal FS5-18 (new IBC 703.6) defined methods to determine the level of noncombustible protection provided by other applied materials through using the E119 test procedure. FS73-18 (IBC 718.2.1) added mass timber as a fire blocking material.”

Minimum 2/3 rating from non-combustible materials (if utilized?)

Sealants: Sealing of adjacent mass timber elements per 703.7. Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Fire Blocking: Materials to meeting the requirements of 718.2.1

A new code section, IBC 703.7, was included in proposal FS6-18. It required that certain adhesives be applied at abutting edges and intersections of fire resistance-rated mass timber elements unless the assembly has been shown to provide the required FRR without utilizing sealants.

3.2.2.2

3.2.2.3

Fire Testing/Certification Requirements:

i- Testing to be completed, and results certified, by an independent, accredited 3rd party testing agency. Testing procedure and results to be reviewed for approval by Project AOR, EOR, Fire Engineer, and AHJ.

3.2.3 Exposure

Primary and Secondary Structure:

The floor assembly should contain a non-combustible material no less than 1" in thickness above the mass timber floor. No additional limits are directly required of the primary and secondary structural exposure, contingent on meeting the fire-resistance ratings specified in Section 2.1.1.

Committee to consider if we want to discuss exposure of mass timber walls (not columns) and slabs (e.g. separation of 15 feet if exposing walls/ceilings in a dwelling unit)

Concealed Spaces:

Strong and clear stance

"No exposed mass timber in concealed spaces; concealed space permitted only with noncombustible protection as required for the interior mass timber."

i. **Korb**

1. Prohibition of concealed spaces 4HT has been removed. – (KA comment – concealed spaces language in the IBC and its commentary are not in agreement. For discussion.) gypsum detailing

a. Lean on prescriptive method. (KA comment – gypsum detailing requirements have been defined by Fire Design Specification for Wood Construction – Wood Products Council.)

a.

Exterior Walls (Façade):

- " Exterior side of exterior walls protected by a non-combustible material—e.g., 5/8" Type X gypsum sheathing"

- " No combustible exterior wall coverings except for certain water-resistant barriers"

- " No exposed mass timber on the inside and outside surfaces of exit enclosures and elevator hoistways in high-rise buildings (occupied floor > 75 feet from lowest fire department access)"

- " Noncombustible construction only for exit enclosures and elevator hoistways greater than 12 stories or 180 feet"

3.2.4 Additional Recommendations:

Water Supply:

iii. Dual water supply for buildings 120 feet and above (IBC 403.3.2)

iv. Water supply in accordance with 2021 IFC 3313 and 2021 IBC 3313

Notes regarding 3.2.4 iii.)

[F]403.3.2 Water supply to required fire pumps.

In buildings that are more than 420 feet (128 000 mm) in building height, required fire pumps shall be supplied by connections to no 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 the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through no fewer than one of the connections.

Sprinklers:

- i. Building fully sprinklered with an NFPA 13-compliant sprinkler system

Smoke Evacuation: Fire Department thoughts?

Type 1A Construction?

3.3 Fire Engineering Consultant:

TT Thoughts:

For buildings higher than 12 stories or 180' (only)

Qualifications and Selection

- Previous Mass Timber Experience
- Selected by Ownership/Design to be approved by AHJ

Scope

1. Review mass timber framing and connections protection in concealed areas
2. Review mass timber connections in exposed connections
3. Review gypsum detailing per requirements of Section 3.2.2.2.
4. Smoke evacuation
5. Review testing provided by manufacturers for compliance with relevant standards

Previous committee thoughts: Fire Consultant

2.2.1 Fire rating documentation and justification

- i. Until such time as it is formally adopted by the IBC the documentation provided - just as important as the plan. Project by project basis.
- ii. Envision you have your structural package. Specific char calculations. Heat effected zone. Mass Timber additional fire test. Documentation for any additional testing codified limits. CLT or floor system. Pra 320 correct glue. Review from fire consultant. Unique connectors for testing and data in the package.

3.2.4 Sacrificial Protective layer—of the encapsulation materials. For the purposes of the guidebook, the structural design of the building is beyond the char layer as defined in the International Building Code or the Wisconsin Commercial Building Code. You need to provide a bit more protection. {KA Input}

Commented [WBD2]: Need to define more protection

Commented [WBD3R2]: UL Rating for engineers to have a reference to what we are looking for.

Commented [WBD4R2]: Mr. Korb. KA will look into this.

— 2.1.1 **Sacrificial Protective layer**— of the encapsulation materials. For the purposes of the guidebook, the structural design of the building is beyond the char layer as defined in the International Building Code or the Wisconsin Commercial Building Code **(KA input — prescribed char rate is 1.5 in/HR. Samples tested at FPL charred at rates between 1.29 and 1.31 in/ hr — can this count as extra protection? Species previously untested must pass their own 2 or 3 hour test.)**

2.1.2 Two Areas of Fire Rating

Minimum fire resistance (2-3 hours) primary and secondary structure. Clearly well codified.

The area of exposed areas

IBC limits 2.1.3— Meet code minimum or higher objectives.

a-

3.3 Fire Consultant

2.2.1 Qualification selection. Previous Mass Timber experience. When do we want to require a fire consultant. Limit on number of stories. It is KA recommendation to require a fire engineer for a structure over twelve stories that is not fully encapsulated.

- i. Scope of fire consultant. Fire protection of connections. Concealed systems. Gypsum. Smoke evacuation (KA recommendation — smoke evacuation is in HVAC engineer's scope). May require of testing. They review and or review of the test. Criteria or beta testing of what would qualify fire consultant
 - ii. Specify of the test we want to take place. Their role is to make sure the test gives results that the designer can utilize. Experts appropriate test how/when/where
 - iii. Marco Lo Ricco
 1. Fire endurance
 2. When fire endurance calculations suffice or when fire testing is required. Endurance calculations may be used for fire endurance. Trying to address calculations or testing is needed.
- 3.4 Fire rating documentation and justification
- i. Until such time as it is formally adopted by the IBC the documentation provided — just as important as the plan. Project by project basis.
 - ii. Envision you have your structural package. Specific char calculations. Heat effected zone. Mass Timber additional fire test. Documentation for any additional testing codified limits. CLT or floor system. Prg 320 correct glue. Review from fire consultant. Unique connectors for testing and data in the package.

3.53.4 Peer Review

IT Thoughts

Qualifications and selection

For each project higher than 12 stories or 180', a Mass Timber Peer Review Panel (MTPRP) shall be convened

The MTPRP shall be a panel or a structural engineering firm with **at least three (3) members** with previous experience in relevant mass timber buildings

The MTPRP shall be selected by the Building Official based on their qualifications applicable to the Mass Timber Peer Review of the project. The Building Official may

Commented [ADD5]: Discussion outside of meeting with motion

Commented [WBD6]: Type IV buildings as described above?

request the opinion of the Project Sponsor and EOR on proposed SPRP members, with the Building Official making the final decision on the MTPROP membership.

The MTPRP shall bear no conflict of interest with respect to the project and shall not be part of the design team for the project.

The MTPRP provides their professional opinion to and acts under the instruction of the building official.

Review scope

To provide an independent, objective, technical review of those aspects of the building design that relate to the structural performance of the building according to the requirements and guidelines described on this building, and to advise Building Officials whether the design generally conforms to the intent of this documentation and other requirements set forth by the Building Official.

Review structural calculations, under normal conditions and under a fire scenario; including the use of foreign codes, where applicable.

The MTPROP shall be convened as early in the structural design phase as practicable.

2.4.1 Previous task force committee thoughts: Qualifications and selections

- Performance based approach. To verify prescriptive limitations. Requirements are peer review acting on behalf of the building owner. Due diligence for beyond code. Acting on part of city or building officials reviewing on their behalf. Foreign to DSPS practices. Contract that out? Would have to go through a petition. Special inspections — On the ownership team to run. The reviewer would not be from the state — independent reviewer. (For discussion — the EOR for Ascent performed the Sis. Pros and cons?) It could be a different structural firm outside the state. State could create the committee. Expertise — Not an additional ask for the plan review. Special inspections, the building owner/reviewer. The building official reviews and approves — selected
- Joe Ricker

0. We do have to remember work within the rules we do have. Existing systems or legislative action.

- i. Korb

0. Peer review seems excessive. Everyone will have opinions. The data must speak for themselves.

1. Lo ricco

- Prescriptive measures are approved. We do not need peer review. Peer review intended for performance based route. More general approach.

0. Roles

0. Peer review

Technical. Review responsibilities

Building Officials — Enough data, qualified, threshold for substantial evidence.

Standard of care. Justifying analysis

1 example: Exposed area. 18 story timber structure. Fully encapsulated. How much exposure would trigger a peer review. May be based on occupancy.

1. For areas outside the code. Needs to have some technical judgment in concert with the building review with the engineers. Backstop for building official for technical knowledge on the job.

2. Mazmanian

a. Common practice? Always the option to use this approach for comfort. Always thresholds in the code. If you can use the codified approach, then it is not needed. If you exceed requirements, you must use a performance based approach should have a peer review is required.

b. Where to draw that line.

3.4.1.1.1

DRAFT

4.—Construction and Post-Occupancy

4.

Mass Timber construction to follow the general requirements of Type IV Construction, unless otherwise noted in this guide.

4.1 During Construction

TT Thoughts:

Construction requirements per 2021 IFC 3303.5

Standpipes

Dual water supply

Non-combustible protection installed on levels 4 stories below the active mass timber construction

Required wall coverings shall be installed on levels 4 stories below the active mass timber construction

4.1.1 Special Inspections

TT Thoughts:

Mass timber special inspections

Follow the requirements of IBC 2021 (1705.5.3)...recommend including these requirements specifically in the guideline

Mass timber inspector qualification and selection

Previous experience in relevant mass timber buildings

Submit credentials to the city

Provide access to the plans prior the start of construction

Submit monthly reports to the city

4.2 Post Occupancy

Construction

The owner shall ensure that required passive protection remains in place over the life of the building, section 701.6 of the IFC.

5.0 [Closing Remarks](#)

6.0 Bibliography

1. Voluntary design guides and technical resources

In addition to the code requirements above, it is recommended that the design cite state of the art research and design documents. Examples of documents to cite, wherever applicable, include:

[1] CLT Diaphragm Design for Wind and Seismic Resistance (Woodworks)

[2] U.S. Mass Timber Floor Vibration Design Guide (Woodworks)

[3] CLT Composite engineering testing reports or research articles

[4] Design Guide XX, Hybrid Steel Frames with Wood Floors (AISC)

[5] 2022 Fire Design Specification (FDS) for Wood Construction

This bibliography is not a comprehensive list and may grow in scope and detail, as the mass timber construction industry advances.

Commented [LRMF7]: Convert this to a formatted bibliography.

ii.3.1



Mass Timber AMM Guide

Supplementary Prescriptive Requirements for
Mass Timber Buildings of Type IV Construction

USE WITH THE 8TH EDITION (2023) FLORIDA BUILDING CODE

Mass Timber AMM Guide

Supplementary Prescriptive Requirements
for Mass Timber Buildings of Type IV Construction

USE WITH THE 8TH EDITION (2023) FLORIDA BUILDING CODE

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The American Wood Council (AWC) is an independent organization that provides unaffiliated, non-proprietary information about timber and wood products to professionals and companies involved in building design and construction.

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Updates

While every precaution has been taken to ensure the accuracy of this document, errors may have occurred during development. Updates are posted to the American Wood Council website at www.awc.org. Technical inquiries may be addressed to info@awc.org

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Mass Timber AMM Guide

Supplementary Prescriptive Requirements for Mass Timber Buildings of Type IV Construction for Use with the 8th Edition (2023) Florida Building Code

Introduction

This Guide provides information for code officials to establish requirements for approval of mass timber buildings as Alternative Materials and Methods (AMM) projects under the 8th Edition (2023) of the Florida Building Code (FBC).

Requirements of this Guide are supplementary to requirements of the adopted code and are predicated on acceptability of the 2024 *International Building Code*[®] (IBC) which provides requirements for larger and taller mass timber buildings than permitted by the 8th Edition (2023) of the FBC. This Guide is intended to assist the code official in review and permitting of mass timber buildings; however, it is not intended to limit or restrict buildings from being larger or taller, provided the authority having jurisdiction is satisfied that performance objectives are met.

Primary Considerations for the Code Official - Alternative Materials and Methods Review and Permitting Under Section 104.11 of the 8th Edition (2023) FBC

The development of mass timber building requirements in the I-Codes was through efforts of the International Code Council's (ICC) Tall Wood Building Ad Hoc Committee (TWB). Resource documents including code change proposals for development of the 2021 I-Codes and 2024 I-Codes¹ are available at the ICC website. Primary considerations for AMM review and permitting of mass timber buildings under Section 104.11 of the FBC include the following:

- In accordance with the reasoning adopted by the TWB, existing Type IV, coupled with increased fire safety and fire protection requirements for new Type IV mass timber buildings (i.e., Type IV-A, IV-B, and IV-C in the 2024 I-Codes) as prescribed in this Guide is a basis for review and permitting of larger and taller mass timber buildings than permissible under the FBC.
- Coordination between requirements of this Guide and the Florida Fire Prevention Code (FFPC) by the building code official and the FFPC official. Per FFPC Section 1.3.2.5, the building code AMM type of construction establishes the type of construction:

The Florida Building Code shall be referred to anytime a reference is made to the building code or to NFPA 220, Standard on Types of Building Construction in this Code or an adopted standard.

The requirements of the FFPC can then be applied to the AMM project as they would to any project under the FBC. The FFPC references NFPA 241, which contains specific requirements for safeguarding construction for Tall Mass Timber Wood Structures.

¹<https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/icc-ad-hoc-committee-on-tall-wood-buildings/>

- Requirements for owners responsibility based on Section 701.6 Owners Responsibility of the 2024 International Fire Code:

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 Sections 602.4.1 and 602.4.2 of this Guide. 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.

Resources for the Code Official

Helpful resources that describe development of and/or requirements for the new Type IV-A, IV-B and IV-C construction types include:

1. International Code Council's (ICC) Tall Wood Building Ad Hoc Committee (TWB)
<https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/icc-ad-hoc-committee-on-tall-wood-buildings/>
2. Building Officials Guide to Tall Mass Timber Code Changes
<chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://awc.org/wp-content/uploads/2022/02/TMT-TypeofConstructionComparison-180316.pdf>
3. Tall Mass Timber Type of Construction Comparison
<chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://awc.org/wp-content/uploads/2023/11/MTCC-Guide-Print-20180919.pdf>
4. Understanding the Tall Mass Timber Code Changes - A Toolkit for Fire Officials
https://awc.org/wp-content/uploads/2022/01/tmt_toolkit.pdf
5. DES607: Tall Mass Timber Provisions in the 2021 I-Codes which is a recorded webinar on the new mass timber construction types in the 2021 I-Codes.
<https://www.youtube.com/watch?v=9FwcJNBAGlM>



Supplementary Prescriptive Requirements

This Guide provides supplementary requirements to be used with the 8th edition (2023) of the Florida Building Code and Florida Fire Prevention Code to support alternative materials and methods approval of mass timber Type IV-A, IV-B, IV-C and IV-HT construction consistent with the 2024 I-Codes.

Underlined text indicates additions to the 2023 Florida Building Code.

~~Struckthrough~~ text indicates Florida Building Code text that is proposed to be removed.

This Guide is based upon the mass timber change proposals submitted to the Florida Building Commission supplemented by mass timber change proposals approved for development of and included in the 2024 International Code Council (ICC) I-Codes. The Commission did not approve of the submitted proposals⁶. New mass timber requirements are offered here, as suggested by commissioners, as the basis for an alternative materials and methods approach for approval.

⁶https://www.floridabuilding.org/fbc/commission/FBC_0223/Commission/FBC_Minutes_12-13-2022.pdf
(see Proposal F10174 as an example)



CHAPTER 1
SCOPE AND ADMINISTRATION

SECTION 110
INSPECTIONS

110.3.14. In buildings of Types 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

[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.

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*.

CHAPTER 3
OCCUPANCY CLASSIFICATION AND USE

(No mass timber related changes.)

CHAPTER 4
SPECIAL DETAILED REQUIREMENTS
BASED ON OCCUPANCY AND USE

SECTION 403
HIGH-RISE BUILDINGS

403.3.2 Water supply to required fire pumps. In all buildings that are more than 420 feet (128 000 mm) in *building height* and *buildings* of Type IV-A and IV-B construction that are more than 120 feet (36 576 mm) in *building height*, required fire pumps shall be supplied by connections to no 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 the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through no fewer than one of the connections.

453.8 General requirements for new construction, additions, renovation, and remodeling

453.8.3.3 Type IV. ~~When~~ Where Type IV-HT construction is used, wood shall be exposed and not covered by ceilings or other construction. Type IV-A construction shall comply with Section 602.4.1, Type IV-B construction shall comply with Section 602.4.2, and Type IV-C construction shall comply with Section 602.4.3.

**CHAPTER 5
GENERAL BUILDING HEIGHTS AND AREAS**

**SECTION 504
BUILDING HEIGHT AND NUMBER OF STORIES**

**TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE**

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	<u>65</u>	<u>65</u>	<u>65</u>	65	50	40
	S	UL	180	85	75	85	75	<u>270</u>	<u>180</u>	<u>85</u>	85	70	60
H-1, H-2, H-3, H-5	NS ^{d,e}	UL	160	65	55	65	55	<u>120</u>	<u>90</u>	<u>65</u>	65	50	40
	S	UL	160	65	55	65	55	<u>65</u>	<u>65</u>	<u>65</u>	65	50	40
H-4	NS ^{d,e}	UL	160	65	55	65	55	<u>65</u>	<u>65</u>	<u>65</u>	65	50	40
	S	UL	180	85	75	85	75	<u>140</u>	<u>100</u>	<u>85</u>	85	70	60
I-1 Condition 1, I-3	NS ^{d,e}	UL	160	65	55	65	55	<u>65</u>	<u>65</u>	<u>65</u>	65	50	40
	S	UL	180	85	75	85	75	<u>180</u>	<u>120</u>	<u>85</u>	85	70	60
I-1 Condition 2, I-2	NS ^{d,e,f}	UL	160	65	55	65	55	<u>65</u>	<u>65</u>	<u>65</u>	65	50	40
	S	UL	180	85									
I-4	NS ^{d,g}	UL	160	65	55	65	55	<u>65</u>	<u>65</u>	<u>65</u>	65	50	40
	S	UL	180	85	75	85	75	<u>180</u>	<u>120</u>	<u>85</u>	85	70	60
R _h	NS ^d	UL	160	65	55	65	55	<u>65</u>	<u>65</u>	<u>65</u>	65	50	40
	S13R	60	60	60	60	60	60	<u>60</u>	<u>60</u>	<u>60</u>	60	60	60
	S	UL	180	85	75	85	75	<u>270</u>	<u>180</u>	<u>85</u>	85	70	60

For SI: 1 foot = 304.8 mm.

Note: 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.

- 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 *Florida Building Code, Existing Building*.
- 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 of the *Florida Fire Prevention 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	<u>3</u>	<u>3</u>	<u>3</u>	3	2	1
	S	UL	6	4	3	4	3	<u>9</u>	<u>6</u>	<u>4</u>	4	3	2
A-2	NS	UL	11	3	2	3	2	<u>3</u>	<u>3</u>	<u>3</u>	3	2	1
	S	UL	12	4	3	4	3	<u>18</u>	<u>12</u>	<u>6</u>	4	3	2
A-3	NS	UL	11	3	2	3	2	<u>3</u>	<u>3</u>	<u>3</u>	3	2	1
	S	UL	12	4	3	4	3	<u>18</u>	<u>12</u>	<u>6</u>	4	3	2
A-4	NS	UL	11	3	2	3	2	<u>3</u>	<u>3</u>	<u>3</u>	3	2	1
	S	UL	12	4	3	4	3	<u>18</u>	<u>12</u>	<u>6</u>	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	<u>1</u>	<u>1</u>	<u>1</u>	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	<u>UL</u>	<u>UL</u>	<u>UL</u>	UL	UL	UL
B	NS	UL	11	5	3	5	3	<u>5</u>	<u>5</u>	<u>5</u>	5	3	2
	S	UL	12	6	4	6	4	<u>18</u>	<u>12</u>	<u>9</u>	6	4	3
E	NS	UL	5	3	2	3	2	<u>3</u>	<u>3</u>	<u>3</u>	3	1	1
	S	UL	6	4	3	4	3	<u>9</u>	<u>6</u>	<u>4</u>	4	2	2
F-1	NS	UL	11	4	2	3	2	<u>3</u>	<u>3</u>	<u>3</u>	4	2	1
	S	UL	12	5	3	4	3	<u>10</u>	<u>7</u>	<u>5</u>	5	3	2
F-2	NS	UL	11	5	3	4	3	<u>5</u>	<u>5</u>	<u>5</u>	5	3	2
	S	UL	12	6	4	5	4	<u>12</u>	<u>8</u>	<u>6</u>	6	4	3
H-1	NS ^d							<u>NP</u>	<u>NP</u>	<u>NP</u>			
	S	1	1	1	1	1	1	<u>1</u>	<u>1</u>	<u>1</u>	1	1	NP
H-2	NS ^d							<u>1</u>	<u>1</u>	<u>1</u>			
	S	UL	3	2	1	2	1	<u>2</u>	<u>2</u>	<u>2</u>	2	1	1
H-3	NS ^d							<u>3</u>	<u>3</u>	<u>3</u>			
	S	UL	6	4	2	4	2	<u>4</u>	<u>4</u>	<u>4</u>	4	2	1
H-4	NS ^d	UL	7	5	3	5	3	<u>5</u>	<u>5</u>	<u>5</u>	5	3	2
	S	UL	8	6	4	6	4	<u>8</u>	<u>7</u>	<u>6</u>	6	4	3
H-5	NS ^d							<u>2</u>	<u>2</u>	<u>2</u>			
	S	4	4	3	3	3	3	<u>3</u>	<u>3</u>	<u>3</u>	3	3	2
I-1 Condition 1	NS ^e	UL	9	4	3	4	3	<u>4</u>	<u>4</u>	<u>4</u>	4	3	2
	S	UL	10	5	4	5	4	<u>10</u>	<u>7</u>	<u>5</u>	5	4	3
I-1 Condition 2	NS ^e	UL	9	4	3	4	3	<u>3</u>	<u>3</u>	<u>3</u>	4	3	2
	S	UL	10	5				<u>10</u>	<u>6</u>	<u>4</u>			
I-2	NS ^f	UL	4	2	1	1	NP	<u>NP</u>	<u>NP</u>	<u>NP</u>	1	1	NP
	S	UL	5	3				<u>7</u>	<u>5</u>	<u>1</u>			
I-3	NS ^e	UL	4	2	1	2	1	<u>2</u>	<u>2</u>	<u>2</u>	2	2	1
	S	UL	5	3	2	3	2	<u>7</u>	<u>5</u>	<u>3</u>	3	3	2
I-4	NS ^g	UL	5	3	2	3	2	<u>3</u>	<u>3</u>	<u>3</u>	3	1	1
	S	UL	6	4	3	4	3	<u>9</u>	<u>6</u>	<u>4</u>	4	2	2
M	NS	UL	11	4	2	4	2	<u>4</u>	<u>4</u>	<u>4</u>	4	3	1
	S	UL	12	5	3	5	3	<u>12</u>	<u>8</u>	<u>6</u>	5	4	2

(continued)

TABLE 504.4—continued
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
R-1 ^h	NS ^d	UL	11	4	4	4	4	<u>4</u>	<u>4</u>	<u>4</u>	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	<u>18</u>	<u>12</u>	<u>8</u>	5	4	3
R-2 ^h	NS ^d	UL	11	4	4	4	4	<u>4</u>	<u>4</u>	<u>4</u>	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	<u>18</u>	<u>12</u>	<u>8</u>	5	4	3
R-3 ^h	NS ^d	UL	11	4	4	4	4	<u>4</u>	<u>4</u>	<u>4</u>	4	3	3
	S13R	4	4									4	4
	S	UL	12	5	5	5	5	<u>18</u>	<u>12</u>	<u>5</u>	5	4	4
R-4 ^h	NS ^d	UL	11	4	4	4	4	<u>4</u>	<u>4</u>	<u>4</u>	4	3	2
	S13R	4	4									4	3
	S	UL	12	5	5	5	5	<u>18</u>	<u>12</u>	<u>5</u>	5	4	3
S-1	NS	UL	11	4	2	3	2	<u>4</u>	<u>4</u>	<u>4</u>	4	3	1
	S	UL	12	5	4	4	4	<u>10</u>	<u>7</u>	<u>5</u>	5	4	2
S-2	NS	UL	11	5	3	4	3	<u>4</u>	<u>4</u>	<u>4</u>	5	4	2
	S	UL	12	6	4	5	4	<u>12</u>	<u>8</u>	<u>5</u>	6	5	3
U	NS	UL	5	4	2	3	2	<u>4</u>	<u>4</u>	<u>4</u>	4	2	1
	S	UL	6	5	3	4	3	<u>9</u>	<u>6</u>	<u>5</u>	5	3	2

Note: 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.

- 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 *Florida Building Code, Existing Building*.
- 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 of the *Florida Fire Prevention 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.

**SECTION 506
BUILDING AREA**

**TABLE 506.2
ALLOWABLE AREA FACTOR ($A_f = NS, S1, S13R, S13D$ 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	<u>45,000</u>	<u>30,000</u>	<u>18,750</u>	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	<u>180,000</u>	<u>120,000</u>	<u>75,000</u>	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	<u>135,000</u>	<u>90,000</u>	<u>56,250</u>	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	<u>45,000</u>	<u>30,000</u>	<u>18,750</u>	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	<u>180,000</u>	<u>120,000</u>	<u>75,000</u>	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	<u>135,000</u>	<u>90,000</u>	<u>56,250</u>	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	<u>45,000</u>	<u>30,000</u>	<u>18,750</u>	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	<u>180,000</u>	<u>120,000</u>	<u>75,000</u>	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	<u>135,000</u>	<u>90,000</u>	<u>56,250</u>	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	<u>45,000</u>	<u>30,000</u>	<u>18,750</u>	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	<u>180,000</u>	<u>120,000</u>	<u>75,000</u>	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	<u>135,000</u>	<u>90,000</u>	<u>56,250</u>	45,000	34,500	18,000
A-5	NS												
	S1	UL	UL	UL	UL	UL	UL	<u>UL</u>	<u>UL</u>	<u>UL</u>	UL	UL	UL
	SM												
B	NS	UL	UL	37,500	23,000	28,500	19,000	<u>108,000</u>	<u>72,000</u>	<u>45,000</u>	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	<u>432,000</u>	<u>288,000</u>	<u>180,000</u>	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	<u>324,000</u>	<u>216,000</u>	<u>135,000</u>	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	<u>76,500</u>	<u>51,000</u>	<u>31,875</u>	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	<u>306,000</u>	<u>204,000</u>	<u>127,500</u>	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	<u>229,500</u>	<u>153,000</u>	<u>95,625</u>	76,500	55,500	28,500
F-1	NS	UL	UL	25,000	15,500	19,000	12,000	<u>100,500</u>	<u>67,000</u>	<u>41,875</u>	33,500	14,000	8,500
	S1	UL	UL	100,000	62,000	76,000	48,000	<u>402,000</u>	<u>268,000</u>	<u>167,500</u>	134,000	56,000	34,000
	SM	UL	UL	75,000	46,500	57,000	36,000	<u>301,500</u>	<u>201,000</u>	<u>125,625</u>	100,500	42,000	25,500
F-2	NS	UL	UL	37,500	23,000	28,500	18,000	<u>151,500</u>	<u>101,000</u>	<u>63,125</u>	50,500	21,000	13,000
	S1	UL	UL	150,000	92,000	114,000	72,000	<u>606,000</u>	<u>404,000</u>	<u>252,500</u>	202,000	84,000	52,000
	SM	UL	UL	112,500	69,000	85,500	54,000	<u>454,500</u>	<u>303,000</u>	<u>189,375</u>	151,500	63,000	39,000
H-1	NS ^c												
	S1	21,000	16,500	11,000	7,000	9,500	7,000	<u>10,500</u>	<u>10,500</u>	<u>10,500</u>	10,500	7,500	NP
H-2	NS ^c												
	S1	21,000	16,500	11,000	7,000	9,500	7,000	<u>10,500</u>	<u>10,500</u>	<u>10,500</u>	10,500	7,500	3,000
	SM												
H-3	NS ^c												
	S1	UL	60,000	26,500	14,000	17,500	13,000	<u>25,500</u>	<u>25,500</u>	<u>25,500</u>	25,500	10,000	5,000
	SM												
H-4	NS ^{c, d}	UL	UL	37,500	17,500	28,500	17,500	<u>72,000</u>	<u>54,000</u>	<u>40,500</u>	36,000	18,000	6,500
	S1	UL	UL	150,000	70,000	114,000	70,000	<u>288,000</u>	<u>216,000</u>	<u>162,000</u>	144,000	72,000	26,000
	SM	UL	UL	112,500	52,500	85,500	52,500	<u>216,000</u>	<u>162,000</u>	<u>121,500</u>	108,000	54,000	19,500
H-5	NS ^{c, d}	UL	UL	37,500	23,000	28,500	19,000	<u>72,000</u>	<u>54,000</u>	<u>40,500</u>	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	<u>288,000</u>	<u>216,000</u>	<u>162,000</u>	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	<u>216,000</u>	<u>162,000</u>	<u>121,500</u>	108,000	54,000	27,000

(continued)

TABLE 506.2—continued
ALLOWABLE AREA FACTOR (A_f = 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	<u>54,000</u>	<u>36,000</u>	<u>18,000</u>	18,000	10,500	4,500
	S1	UL	220,000	76,000	40,000	66,000	40,000	<u>216,000</u>	<u>144,000</u>	<u>72,000</u>	72,000	42,000	18,000
	SM	UL	165,000	57,000	30,000	49,500	30,000	<u>162,000</u>	<u>108,000</u>	<u>54,000</u>	54,000	31,500	13,500
I-2	NS ^{d, c}	UL	UL	15,000	11,000	12,000	NP	<u>36,000</u>	<u>24,000</u>	<u>12,000</u>	12,000	9,500	NP
	S1	UL	UL	60,000	44,000	48,000	NP	<u>144,000</u>	<u>96,000</u>	<u>48,000</u>	48,000	38,000	NP
	SM	UL	UL	45,000	33,000	36,000	NP	<u>108,000</u>	<u>72,000</u>	<u>36,000</u>	36,000	28,500	NP
I-3	NS ^{d, e}	UL	UL	15,000	10,000	10,500	7,500	<u>36,000</u>	<u>24,000</u>	<u>12,000</u>	12,000	7,500	5,000
	S1	UL	UL	60,000	40,000	42,000	30,000	<u>144,000</u>	<u>96,000</u>	<u>48,000</u>	48,000	30,000	20,000
	SM	UL	UL	45,000	30,000	31,500	22,500	<u>108,000</u>	<u>72,000</u>	<u>36,000</u>	36,000	22,500	15,000
I-4	NS ^{d, e}	UL	60,500	26,500	13,000	23,500	13,000	<u>76,500</u>	<u>51,000</u>	<u>25,500</u>	25,500	18,500	9,000
	S1	UL	121,000	106,000	52,000	94,000	52,000	<u>306,000</u>	<u>204,000</u>	<u>102,000</u>	102,000	74,000	36,000
	SM	UL	181,500	79,500	39,000	70,500	39,000	<u>229,500</u>	<u>153,000</u>	<u>76,500</u>	76,500	55,500	27,000
M	NS	UL	UL	21,500	12,500	18,500	12,500	<u>61,500</u>	<u>41,000</u>	<u>26,625</u>	20,500	14,000	9,000
	S1	UL	UL	86,000	50,000	74,000	50,000	<u>246,000</u>	<u>164,000</u>	<u>102,500</u>	82,000	56,000	36,000
	SM	UL	UL	64,500	37,500	55,500	37,500	<u>184,500</u>	<u>123,000</u>	<u>76,875</u>	61,500	42,000	27,000
R-1 ^h	NS ^d	UL	UL	24,000	16,000	24,000	16,000	<u>61,500</u>	<u>41,000</u>	<u>25,625</u>	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	<u>246,000</u>	<u>164,000</u>	<u>102,500</u>	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	<u>184,500</u>	<u>123,000</u>	<u>76,875</u>	61,500	36,000	21,000
R-2 ^h	NS ^d	UL	UL	24,000	16,000	24,000	16,000	<u>61,500</u>	<u>41,000</u>	<u>25,625</u>	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	<u>246,000</u>	<u>164,000</u>	<u>102,500</u>	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	<u>184,500</u>	<u>123,000</u>	<u>76,875</u>	61,500	36,000	21,000
R-3 ^h	NS ^d	UL	UL	UL	UL	UL	UL	<u>UL</u>	<u>UL</u>	<u>UL</u>	UL	UL	UL
	S13R												
	S1												
	SM												
R-4 ^h	NS ^d	UL	UL	24,000	16,000	24,000	16,000	<u>61,500</u>	<u>41,000</u>	<u>25,625</u>	20,500	12,000	7,000
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	<u>246,000</u>	<u>164,000</u>	<u>102,500</u>	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	<u>184,500</u>	<u>123,000</u>	<u>76,875</u>	61,500	36,000	21,000
S-1	NS	UL	48,000	26,000	17,500	26,000	17,500	<u>76,500</u>	<u>51,000</u>	<u>31,875</u>	25,500	14,000	9,000
	S1	UL	192,000	104,000	70,000	104,000	70,000	<u>306,000</u>	<u>204,000</u>	<u>127,500</u>	102,000	56,000	36,000
	SM	UL	144,000	78,000	52,500	78,000	52,500	<u>229,500</u>	<u>153,000</u>	<u>95,625</u>	76,500	42,000	27,000
S-2	NS	UL	79,000	39,000	26,000	39,000	26,000	<u>115,500</u>	<u>77,000</u>	<u>48,125</u>	38,500	21,000	13,500
	S1	UL	316,000	156,000	104,000	156,000	104,000	<u>462,000</u>	<u>308,000</u>	<u>192,500</u>	154,000	84,000	54,000
	SM	UL	237,000	117,000	78,000	117,000	78,000	<u>346,500</u>	<u>231,000</u>	<u>144,375</u>	115,500	63,000	40,500
U	NS ⁱ	UL	35,500	19,000	8,500	14,000	8,500	<u>54,000</u>	<u>36,000</u>	<u>22,500</u>	18,000	9,000	5,500
	S1	UL	142,000	76,000	34,000	56,000	34,000	<u>216,000</u>	<u>144,000</u>	<u>90,000</u>	72,000	36,000	22,000
	SM	UL	106,500	57,000	25,500	42,000	25,500	<u>162,000</u>	<u>108,000</u>	<u>67,500</u>	54,000	27,000	16,500

(continued)

TABLE 506.2—continued
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as
applicable) IN SQUARE FEET^{a, b}

For SI: 1 square foot = 0.0929 m².

Note: 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.

- 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 *Florida Building Code, Existing Building*.
- 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 of the *Florida Fire Prevention 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.

SECTION 508
MIXED USE AND OCCUPANCY

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.

Exception: The thermal barrier shall not be required on the top of horizontal assemblies serving as occupancy separations.

SECTION 509
INCIDENTAL USES

509.4.1 Separation. Where Table 509.1 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the *building* by a *fire barrier* constructed in accordance with Section 707 or a *horizontal assembly* constructed in accordance with Section 711, or both. Construction supporting 1-hour *fire barriers* or *horizontal assemblies* used for incidental use separations in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.

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 (12.7mm) 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.

Exception: The thermal barrier shall not be required on the top of horizontal assemblies serving as incidental use separations.

**CHAPTER 6
TYPES OF CONSTRUCTION**

**SECTION 601
GENERAL**

**TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS**

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	<u>3</u> ^a	<u>2</u> ^a	<u>2</u> ^a	HT	1 ^{b,c}	0
Bearing walls												
Exterior ^{e,f}	3	2	1	0	2	2	<u>3</u>	<u>2</u>	<u>2</u>	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	<u>3</u>	<u>2</u>	<u>2</u>	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	<u>0</u>	<u>0</u>	<u>0</u>	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	<u>2</u>	<u>2</u>	<u>2</u>	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 ^{1/2} ^b	1 ^{b,c}	1 ^{b,c}	0 ^c	1 ^{b,c}	0	<u>1^{1/2}</u>	<u>1</u>	<u>1</u>	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. Where every part of the roof construction is 20 feet or more above any floor immediately below, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking, except where any of the following conditions apply.
 1. In Group F-1, H, M and S-1 occupancies.
 2. Where the roof is an occupiable space.
 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.

SECTION 602 CONSTRUCTION CLASSIFICATION

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 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire resistance rating or heavy timber 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. 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 *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, 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 vehicle 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 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 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 less than or equal to 100 percent of the floor area in any dwelling unit within a story or fire area within a story.

1.2 Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area less than or equal to 40 percent of the floor area in any dwelling unit within a story or fire area within a story.

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.

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

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 shall be not less than 15 feet (4572 mm) from unprotected portions of other 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. Except where unprotected mass timber ceilings are permitted in Section 602.4.2.2.2, 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 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/m², a total heat release of less than 20 MJ/m² 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/m².

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.

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 or with concealed spaces complying with Section 602.4.4.3. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, SCL and cross-laminated timber (CLT) and the 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 rated or heavy timber conforming with Section 2304.11.2.2 shall be permitted.

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 not less than 4 inches (102 mm) in thickness 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 Heavy timber structural members appurtenant to the CLT exterior wall shall meet the requirements of Table 2304.11 and be fire-resistance rated as required for the exterior wall. The exterior surface of the cross-laminated timber and heavy timber elements is shall be 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.
3. A noncombustible material.

602.4.4.3 Concealed spaces. Concealed spaces shall not contain combustible materials other than building elements and electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums

in accordance with Section 602 of the *International Mechanical Code*. Concealed spaces shall comply with applicable provisions of Section 718. Concealed spaces shall be protected in accordance with one or more of the following:

1. The building shall be sprinklered throughout in accordance with Section 903.3.1.1 and automatic sprinklers shall also be provided in the concealed space.
2. The concealed space shall be completely filled with noncombustible insulation.
3. Combustible surfaces within the concealed space shall be fully sheathed with not less than 5/8-inch *Type X gypsum board*.

Exception: Concealed spaces within interior walls and partitions with a 1-hour or greater *fire-resistance rating* complying with Section 2304.11.2.2 shall not require additional protection.

602.4.3 602.4.4.4 Exterior structural members. Where a fire separation distance 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.

CHAPTER 7
FIRE AND SMOKE PROTECTION FEATURES

SECTION 703
FIRE-RESISTANCE RATINGS AND FIRE TESTS

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 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.

703.9 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.

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 ^c	OCCUPANCY GROUP F-1, M, S-1 ^f	OCCUPANCY GROUP A, B, E, F-2, I, R ¹ , 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
	IB, 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 412.4.1.

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.

SECTION 722 CALCULATED FIRE-RESISTANCE

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.

**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

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 1/4-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).

CHAPTER 14 EXTERIOR WALLS

SECTION 1405 INSTALLATION OF WALL COVERINGS

1405.5 Wood veneers. Wood veneers on exterior walls of buildings of Type I, II, III and IV-HT construction shall be not less than 1 inch (25 mm) nominal thickness, 0.438-inch (11.1 mm) exterior *hardboard* siding or 0.375-inch (9.5 mm) exterior-type *wood structural panels* or *particleboard* and shall conform to the following:

1. The veneer shall not exceed 40 feet (12 190 mm) in height above grade. Where *fire-retardant-treated wood* is used, the height shall not exceed 60 feet (18 290 mm) in height above grade.
2. The veneer is attached to or furred from a noncombustible *backing* that is fire-resistance rated as required by other provisions of this code.
3. Where open or spaced wood veneers (without concealed spaces) are used, they shall not project more than 24 inches (610 mm) from the *building* wall.

SECTION 1406 COMBUSTIBLE MATERIALS ON THE EXTERIOR SIDE OF EXTERIOR WALLS

1406.2.1 Type I, II, III and IV-HT construction. On buildings of Type I, II, III and IV-HT construction, exterior wall coverings shall be permitted to be constructed of combustible materials, complying with the following limitations:

1. Combustible exterior wall coverings shall not exceed 10 percent of an exterior wall surface area where the fire separation distance is 5 feet (1524 mm) or less.
2. Combustible exterior wall coverings shall be limited to 40 feet (12 192 mm) in height above grade plane.
3. Combustible exterior wall coverings constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation shall not be limited in wall surface area where the fire separation distance is 5 feet (1524 mm) or less and shall be permitted up to 60 feet (18 288 mm) in height above grade plane regardless of the fire separation distance.
4. Wood veneers shall comply with Section 1405.5.

1406.3 Balconies and similar projections. Balconies and similar projections of combustible construction other than fire-retardant-treated wood shall be fire-resistance rated where required by Table 601 for floor construction or shall be of heavy timber construction in accordance with Section 2304.11. The aggregate length of the projections shall not exceed 50 percent of the building's perimeter on each floor.

Exceptions:

1. On buildings of Type I and II construction, three stories or less above *grade plane*, *fire-retardant-treated wood* shall be permitted for balconies, porches, decks and exterior stairways not used as required exits.
2. Untreated wood, and plastic composites that comply with ASTM D7032 and Section 2612, are permitted for pickets and rails or similar guardrail devices that are limited to 42 inches (1067 mm) in height.
3. Balconies and similar projections on buildings of Type III, IV-HT and V construction shall be permitted to be of Type V construction, and shall not be required to have a *fire-resistance rating* where sprinkler protection is extended to these areas.
4. Where sprinkler protection is extended to the balcony areas, the aggregate length of the balcony on each floor shall not be limited.

CHAPTER 17
SPECIAL INSPECTION AND TESTS

SECTION 1711
MASS TIMBER CONSTRUCTION

1711.1 Inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1711.1.

TABLE 1711.1
REQUIRED INSPECTIONS OF MASS TIMBER CONSTRUCTION

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

1711.2 Sealing of mass timber.

1711.2.1. 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.

1711.2.2. Periodic 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.

CHAPTER 23 WOOD

SECTION 2301 GENERAL

2301.3 ~~Nominal sizes~~ **Dimensions.** For the purposes of this chapter, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions (see Section 2304.2). Where dimensions of *cross-laminated timber* thickness are specified, they shall be deemed to be actual dimensions.

SECTION 2304 GENERAL CONSTRUCTION REQUIREMENTS

2304.10.8 Fire protection of connections. Connections used with *fire-resistance-rated* members and in *fire-resistance-rated assemblies* of Type IV-A, IV-B or IV-C construction shall be protected for the time associated with the fire-resistance rating. Protection time 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.

2304.11.1.1 Columns. Minimum dimensions of columns shall be in accordance with Table 2304.11. Columns shall be connected in an *approved* manner. Columns shall be continuous or *aligned vertically from floor to floor* in ~~superimposed throughout~~ all stories of Type IV-HT construction and ~~connected in an approved manner~~. Girders and beams at column connections shall be closely fitted around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal *loads* across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof *loads* only. Where traditional heavy timber detailing is used, connections shall be permitted to be by means of reinforced concrete or metal caps with brackets, or shall be connected by properly designed steel or iron caps, with pintles and base plates, or by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other *approved* methods.

2304.11.3 Floors. Floors shall be without concealed spaces or with concealed spaces complying with Section 602.4.4. Wood floors shall be constructed in accordance with Section 2304.11.3.1 or 2304.11.3.2.

2304.11.3.1 Cross-laminated timber floors. *Cross-laminated timber* shall be not less than 4 inches (102 mm) in ~~actual~~ thickness. *Cross-laminated timber* shall be continuous from support to support and mechanically fastened to one another. *Cross-laminated timber* shall be permitted to be connected to walls without a shrinkage gap providing swelling or shrinking is considered in the design. Corbelling of masonry walls under the floor shall be permitted to be used.

2304.11.3.2 Sawn or glued-laminated plank floors. Sawn or glued-laminated plank floors shall be one of the following:

1. Sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, 15/32-inch (12 mm) wood structural panel or 1/2-inch (12.7 mm) particleboard.
2. Planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or 15/32-inch (12 mm) wood structural panel or 1/2-inch (12.7 mm) particleboard.

The lumber shall be laid so that no continuous line of joints will occur except at points of support. Floors shall not extend closer than 1/2 inch (12.7 mm) to walls. Such 1/2-inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbelling of masonry walls under the floor shall be permitted to be used in place of molding.

2304.11.4 Roof decks. Roofs shall be without concealed spaces ~~and roof~~ or with concealed spaces complying with Section 602.4.3. Roof decks shall be constructed in accordance with Section 2304.11.4.1 or 2304.11.4.2. Other types of decking shall be permitted to be used where equivalent fire resistance and structural properties are being provided. Where supported by a wall, roof decks shall be anchored to walls to resist forces determined in accordance with Chapter 16. Such anchors shall consist of steel bolts, lags, screws or approved hardware of sufficient strength to resist prescribed forces.

2304.11.4.1 Cross-laminated timber roofs. Cross-laminated timber roofs shall be not less than 3 inches (76 mm) in ~~actual~~ thickness and shall be continuous from support to support and mechanically fastened to one another.

CHAPTER 31
SPECIAL CONSTRUCTION

**SECTION 3102
MEMBRANE STRUCTURES**

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 the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

CHAPTER 33
SAFEGUARDS DURING CONSTRUCTION

SECTION 3314

Fire safety requirements for buildings of Types IV-A, IV-B, and IV-C construction

3314.1 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.

Exceptions:

1. *Shafts* and vertical exit enclosures shall not be considered a part of the active mass timber construction.
2. Noncombustible material on the top of mass timber floor assemblies shall not be required 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 shall not be considered a part of the active mass timber construction.

CHAPTER 35 REFERENCED STANDARDS

AISI S220-20 North American Standard for Cold-formed Steel Framing-Nonstructural Members, 2020 722.7.2.1, 2203.1, 2203.2, 2211.1, 2211.2, 2214.3, Table 2506.2, Table 2507.2

ANSI/APA PRG 320-19 Standard for Performance-Rated Cross-Laminated Timber 602.4, 2303.1.4

ASTM C920-18 A Standard for Specification for Elastomeric Joint Sealants 1711.2.1, 2415.4, Table 2506.2, B303.6, E303.3.1

ASTM C1002-18 20 Specification for Steel Self-piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 722.7.2.2, Table 2506.2, Table 2705.2

ASTM D3498—03 19a Standard Specifications for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems 1711.2.1, 2314.4.4, 2322.1.5

ASTM E84—18 b21a Test Methods for Surface Burning Characteristics of Building Materials

202, 402.6.4.4, 406.7.2, 452.2.16.3, 602.4.1.1, 602.4.2.1, 602.4.3.1, 703.5.2, 720.1, 720.4, 803.1.1, 803.1.4, 803.10, 803.11, 806.7, 1403.5, 1404.12.1, 1407.9, 1407.10.1, 1409.9, 1409.10.1, 1510.6.2, 1510.6.3, 2303.2, 2314.4.4, 2603.3, 2603.4.1.13, 2603.5.4, 2603.5.5, 2603.7.1, 2604.2.4, 2606.3.5.4, 2606.4, 2612.3, 2614.3, 3105.6

NFPA 275—17 22 Standard Method of Fire Tests for the Evaluation of Thermal Barriers 508.4.4.1, 509.4.1, 1407.10.2, 1409.10.2, 2603.4

UL 723-2018 Standard for Test for Surface Burning Characteristics of Building Materials 202, 402.6.4.4, 406.7.2, 602.4.1.1, 602.4.2.1, 602.4.3.1, 703.5.2, 720.1, 720.4, 803.1.1, 803.1.4, 803.10, 803.11, 806.7, 1403.5, 1404.12.1, 1407.9, 1407.10.1, 1409.9, 1409.10.1, 1510.6.2, 1510.6.3, 2303.2, 2603.3, 2603.4.1.13, 2603.5.4, 2603.5.5, 2603.7, 2604.2.4, 2606.4, 2612.3, 2614.3, 3105.3.4.1, D102.2.8, D106

APPENDIX D FIRE DISTRICTS

SECTION D102 BUILDING RESTRICTIONS

D102.2.5 Structural fire rating. Walls, floors, roofs and their supporting structural members shall be a minimum of 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.

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