



specifying

wood

construction

mass timber focus

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specifications estimating research documentation



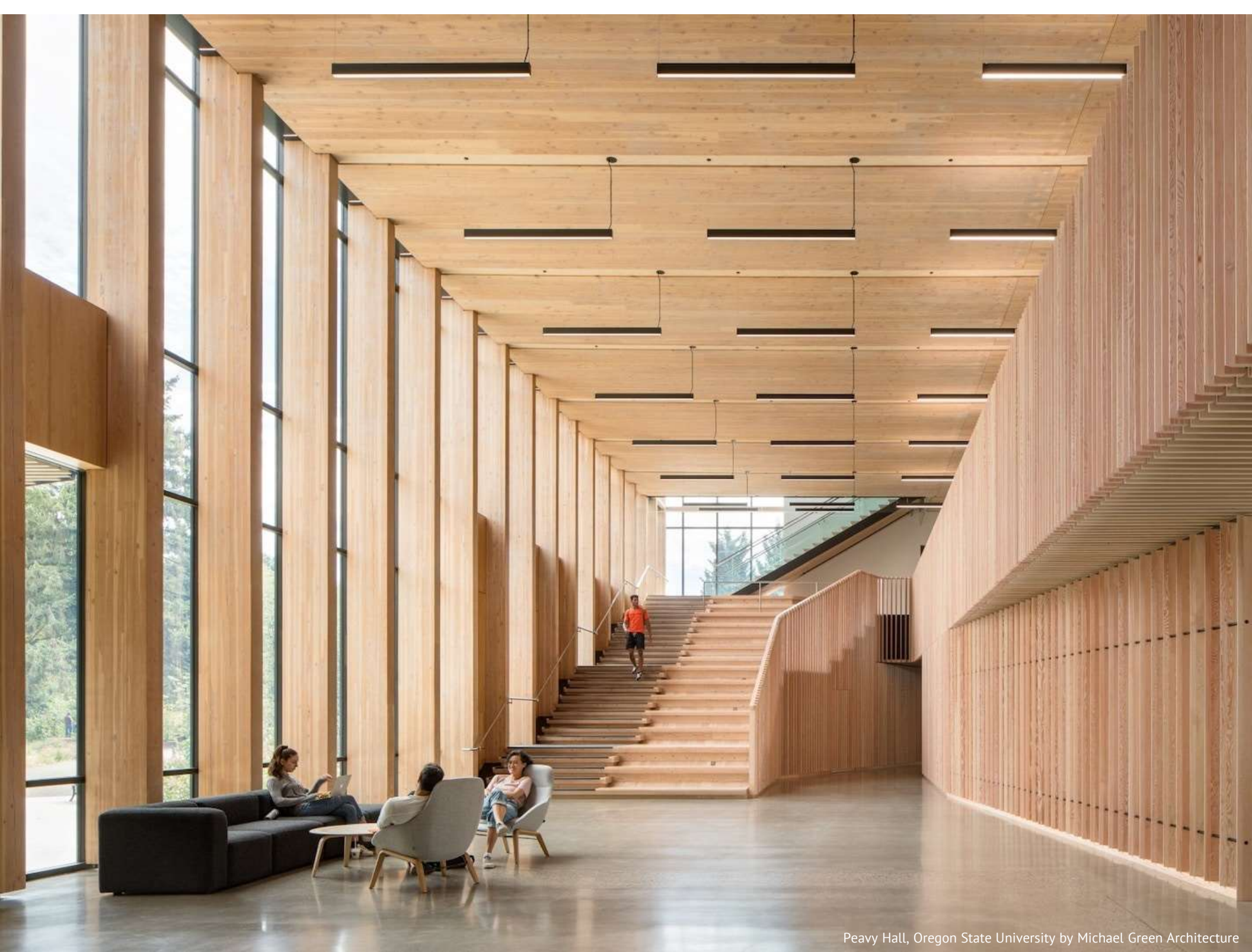
Recent, current and forthcoming developments in forest management, lumber harvesting and processing, panel and member fabrication and milling, and structural design are leading to the **potential capacity to sequester carbon for a century or more** within the structural members of the buildings we design and construct.

Framework Mass Timber High-Rise Building, Lever Architecture



These developments, along with the **standards, codes and testing requirements** that make them credible and equivalent to other systems **may allow mass timber and engineered wood products to become the predominant structural materials**, especially for most structures from two to ten floors in height.

Founders Hall University of Washington, Seattle by LMN Architects



Peavy Hall, Oregon State University by Michael Green Architecture

Pacific
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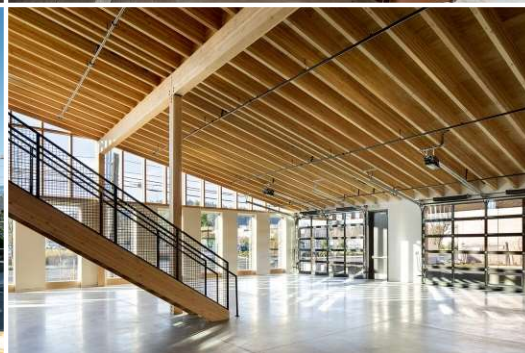
creative office

mass timber

900 SW Sandy, Lever Architecture
Redmond Senior and Community Center, Opsis Architecture

School of Art+design at Portland State Univ., Lever Architecture
Forest Grove City Hall, FFA Architecture And Interiors

Kirkland Urban East, Lever Architecture
Thesis Headquarters, Lever Architecture





Overview



Mass Timber

Types of mass timber panels

Standards

Species, grades and layup

Appearance classifications

Fabrication and tolerances

Adhesives, fasteners and connectors

Delegated design

Coordination and shop drawings

Method statements

Sealers and finishes

Fire-rated connections



Cross-laminated timber
Dowel-laminated timber
Mass plywood

Mass Timber



Types of mass timber panels

Cross-laminated timber

Dowel-laminated timber

Nail-laminated timber

Glued-laminated timber

Structural composite lumber

(Mass plywood panel and others)



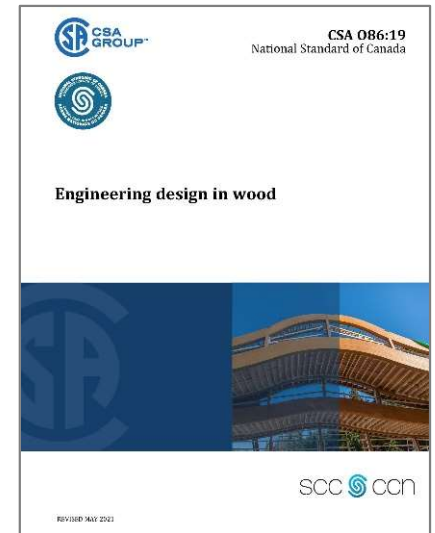
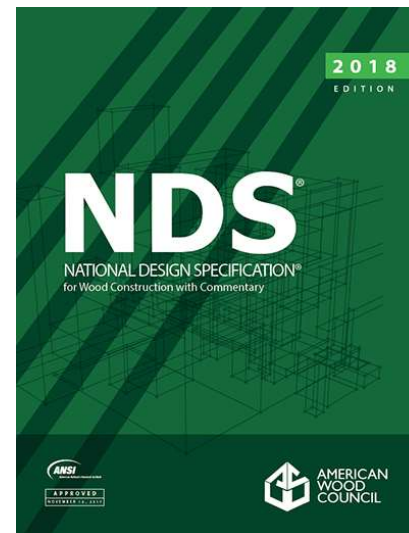
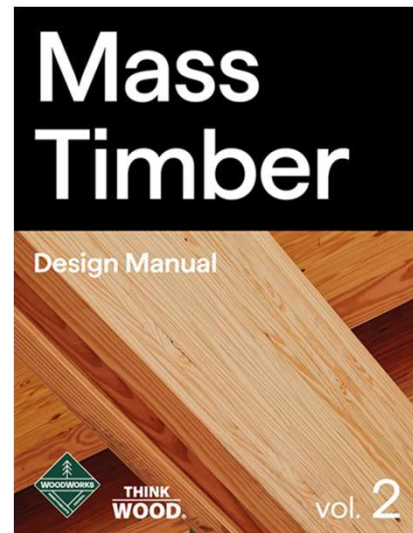
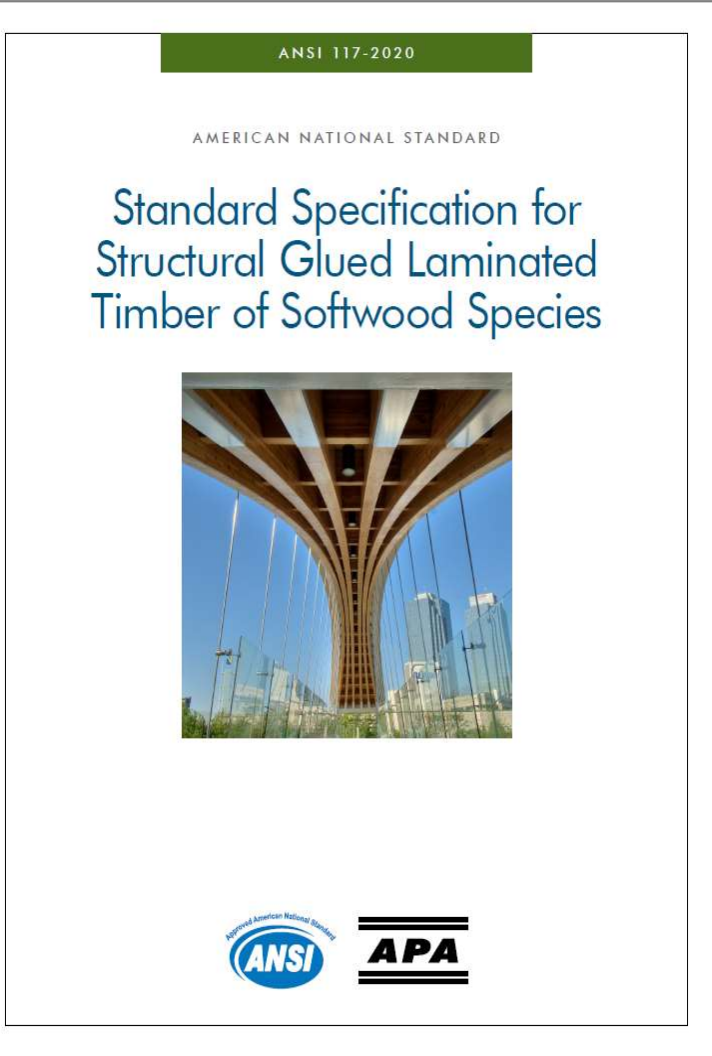
Nail-laminated timber
Glued-laminated timber
Structural composite lumber

Mass Timber

Standards

ANSI 117-2020: Standard Specification for Structural Glued Laminated Timber of Softwood Species (excerpt from the Engineered Wood Construction Guide, Form E30)

Woodworks, a division of the wood products council, provides their **Mass Timber Design Manual, Vol.2**



APA ANSI 117: Standard Specification for Structural Glued Laminated Timber Of Softwood Species (above)
Mass Timber Design Manual (near right)
National Design Specification (middle right)
CSA 086, Engineering Design In Wood (far right)

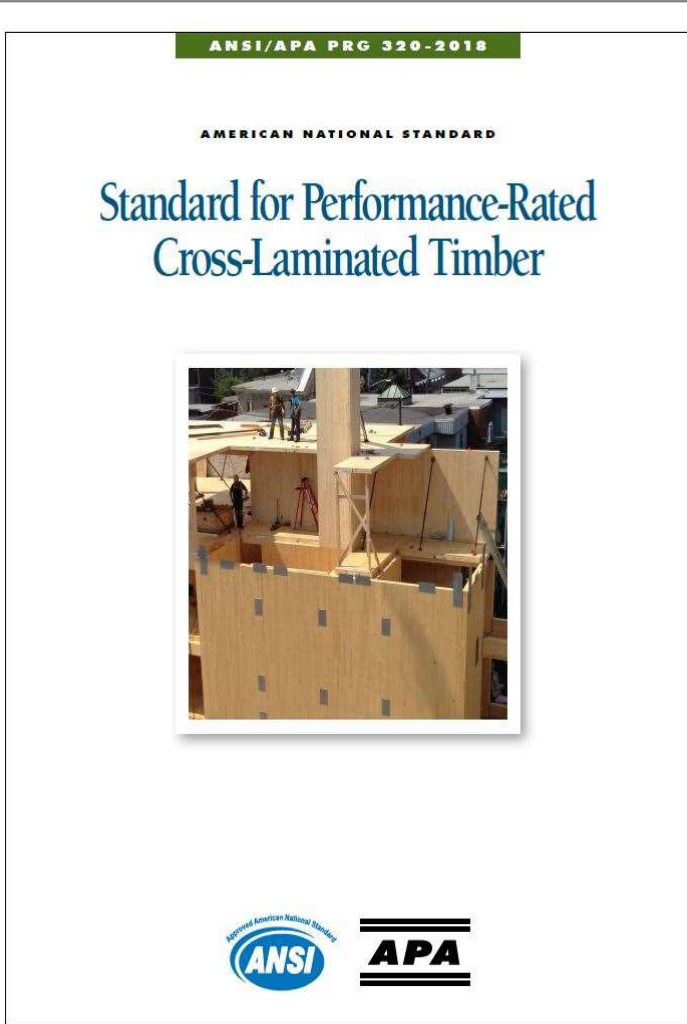
The **National Design Specification (NDS)** (for the U.S.) and the **CSA 086, Engineering Design In Wood** (for Canada) are referenced as North American standards for structural wood design.

Mass Timber

Cross-Laminated Timber (GLT)

Structurally finger-jointed, graded lumber, laminated into panels with hardwood dowels pressed into the lamellas

Fabrication:



APA ANSI PRG-320-2018 Standard for
Performance-rated Cross-laminated Timber

Standard:

APA ANSI PRG-320-2018 Standard for Performance-rated Cross-laminated Timber requirements for the manufacture and quality control of structural cross-laminated timber

Mass Timber

Statewide Alternate Method
No. 15-01



Cross-laminated timber Seismic force-resisting systems

Statewide Alternate Methods are approved by the division administrator in consultation with the appropriate advisory board. The advisory board's review includes technical and scientific facts of the proposed alternate method. In addition:

- Building officials shall approve the use of any material, design or method of construction addressed in a statewide alternate method;
- The decision to use a statewide alternate method is at the discretion of the applicant; and
- Statewide alternate methods do not limit the authority of the building official to consider other proposed alternate methods encompassing the same subject matter.

Code/edition/section: 2022 Oregon Structural Specialty Code (OSSC)—Section 1613
American Society of Civil Engineers (ASCE) 7-2016 or ASCE 7-2022

Date: Issued—Jan. 15, 2015
Updated—Feb. 2, 2023

Subject: Cross-laminated timber (CLT)—Seismic force-resisting system

Background:

Cross-laminated timber (CLT) is a wood product with both residential and nonresidential applications. CLT is defined and recognized as a viable construction material subject to specific construction requirements within Chapters 2, 5, 6, 7, 17 and 23 of the 2022 OSSC. Building Codes Division has prepared this statewide alternate method to recognize CLT shear walls as a seismic force-resisting system (SFRS) for the application of ASCE 7-16 or ASCE 7-22, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, Section 12.2, utilizing prescriptive design procedures.

Structures exceeding the prescriptive design procedures contained in this statewide alternate method will need to follow the performance-based procedures as outlined in OSSC Section 104.10 and ASCE 7-16 Section 1.3.1.3.

Discussion:

ASCE 7-16 is the standard referenced in OSSC Section 1613 for the development of seismic design loads and associated criteria for structures. ASCE 7-16 Chapter 12 establishes seismic design coefficients and factors for various types of SFRSs typically used in building construction. These design coefficients and factors for SFRSs, identified in ASCE 7-16 Table 12.2-1, are the Response Modification Coefficient, R , the Overstrength Factor, Ω , and the Deflection Amplification Factor, C_d .

These seismic design coefficients and factors are not included for CLT shear walls in ASCE 7-16. However, they have been introduced for platform-framed CLT shear walls meeting certain limitations in ASCE 7-22. Two paths are provided in this statewide alternate method for the use of CLT shear walls.

Alternate method path 1: Utilize the “cross-laminated timber shear walls” and “cross-laminated timber shear walls with shear resistance provided by high-aspect ratio panels only” systems in ASCE 7-22 Table 12.2-1. These systems are restricted to platform-framed construction with specific detailing requirements and use a response modification coefficient, R , of 3 or 4, respectively. This path utilizes the seismic chapters of ASCE 7-22 and all of the requirements and limitations therein. However, when using this path, design for dead, live, snow, wind, and other effects would follow ASCE 7-16. The specific chapters of ASCE 7-22 referenced are for seismic design only. (See below for details.)

1535 Edgewater St. NW, Salem, OR 97304

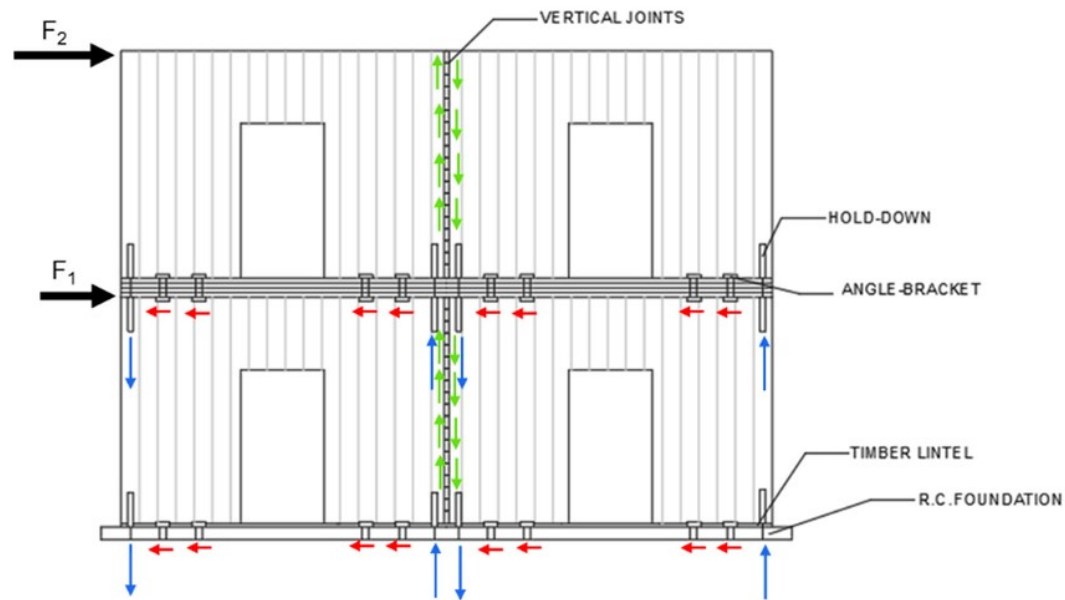
503-378-4133

oregon.gov/bcd

Cross-Laminated Timber (GLT)

...cont'd: CLT may be used as vertical, shear force-resisting elements; as well as for gravity and diaphragm forces

Application example:



Standard:

State of Oregon's **Statewide Alternate Method, No. 15-01**, Cross-Laminated Timber Provisions for CLT as seismic force-resisting elements

Mass Timber



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ICC-ES Evaluation Report ESR-4069

Reissued November 2022

Revised December 2022

This report is subject to renewal November 2024.

DIVISION: 06 00 00 —WOOD, PLASTICS AND COMPOSITES
Section: 06 17 21—Dowel-Laminated Timber

REPORT HOLDER:

STRUCTURECRAFT BUILDERS INC.

EVALUATION SUBJECT:

DOWEL-LAMINATED TIMBER (DLT)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2018, 2015, 2012 and 2009 *International Residential Code®* (IRC)

For evaluation for compliance with codes adopted by the Los Angeles Department of Building Safety (LADBS) see [ESR-4069 LABC and LARC Supplement](#).

Properties evaluated:

- Structural
- Fire Resistance

2.0 USES

StructureCraft DowelLam™ Dowel-Laminated Timber (DLT) is a mechanically laminated timber panel, pegged together by hardwood dowels, for use as floor and roof deck panels in Types III, IV (Heavy Timber) and V Construction, and in Types I and II Construction where permitted by IBC Section 603 and elsewhere in the code. StructureCraft DowelLam™ Dowel-Laminated Timber may also be used in structures regulated under the IRC when an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

StructureCraft Dowel-Laminated Timber panels described in this evaluation report consist of planed and finger-jointed sawn lumber laminations, set on edge and mechanically

fastened together by inserting $\frac{1}{4}$ -inch diameter profiled hardwood dowels running perpendicular to the wide faces of the laminations. The dowels are inserted into predrilled holes $\frac{1}{32}$ inch less than the $\frac{1}{4}$ -inch dowel diameter to secure a tight fit. The moisture content of the lumber at the time of manufacture does not exceed 19 percent, and the dowels are dried to 5 to 8 percent moisture content prior to insertion. Once inserted, the dowels swell as they come into equilibrium with the higher moisture content of the surrounding lumber, providing additional friction for a tight fit of the dowel in the laminations.

The StructureCraft Dowel-Laminated Timber panels are available in thicknesses of 4 inches nominal (89 mm) to 12 inches nominal (286 mm), widths of 12 inches (305 mm) to 14 feet (4.3 m) and lengths up to 60.7 feet (18.5 m).

3.2 Material:

3.2.1 Wood Laminations: Wood laminations used in manufacturing StructureCraft Dowel-Laminated Timber are produced from either visually graded or mechanically stress rated lumber as required in the approved StructureCraft quality documentation. The moisture content of the laminations is 19 percent or less, prior to insertion of the wood dowels. Finger joints in the laminations, where used, meet the requirements for Certified End Joints according to the West Coast Lumber Inspection Bureau (WCLIB). The adhesive used for the finger joints is a non-formaldehyde-based, one-component polyurethane, also conforming to the approved StructureCraft quality documentation.

3.2.2 Dowels: The $\frac{1}{4}$ -inch diameter wood dowels used in StructureCraft DLT are hardwood dowels manufactured in accordance with the standards contained in the approved StructureCraft quality documentation. A profile of the dowel is shown in Figure 1. Dowel patterns for the different DLT panel thicknesses, including dowel spacing and positioning within the panel, are shown in Figure 2.

4.0 DESIGN AND INSTALLATION

4.1 General:

Design and installation of StructureCraft Dowel-Laminated Timber panels described in this evaluation report must be in accordance with this evaluation report, the applicable code provisions, and the StructureCraft published design and/or

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Page 1 of 10

Dowel-Laminated Timber (DLT)

Structurally finger-jointed, graded lumber, laminated into panels with hardwood dowels pressed into the lamellas

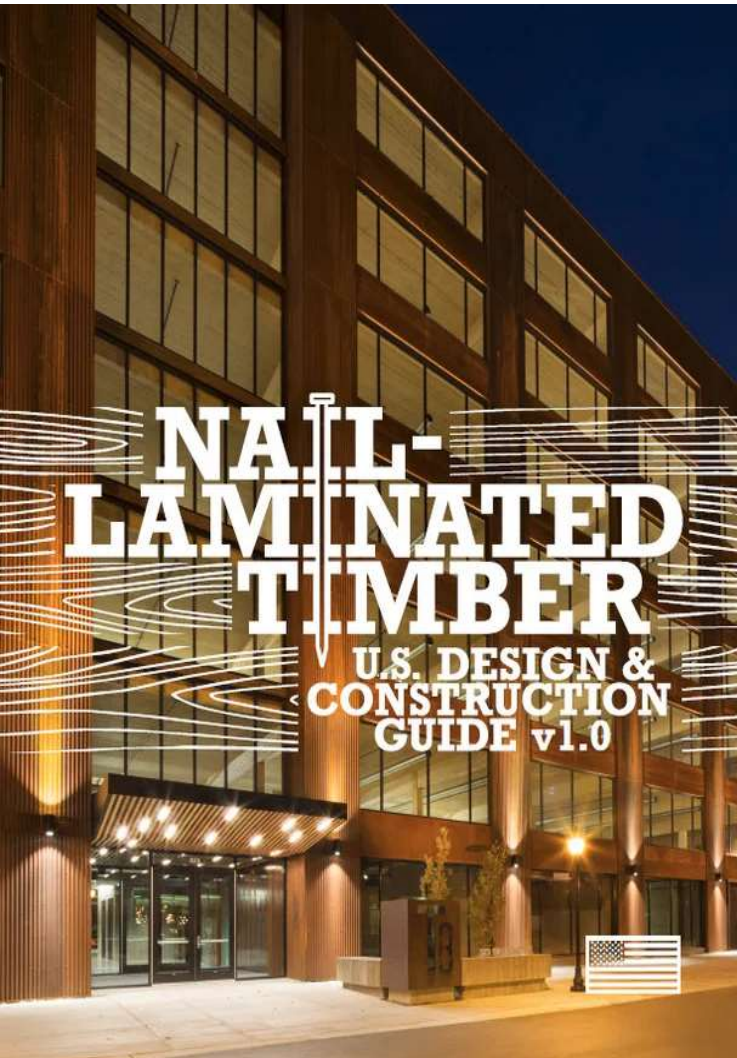
Fabrication:



Standard:

International Building Codes (IBC) recognizes products manufactured according to manufacturer-developed **ICC-ES Evaluation Reports**, such ESR-4069 by Structurecraft

Mass Timber



Nail-Laminated Timber: U.S. Design & Construction Guide v1.0

Nail-Laminated Timber (NLT)

Century-old construction material; boards are nominal 2, 3, and 4 inches, depths are nominal 4, 6, 8, 10 or 12 inches

Fabrication:



Standards:

Nail-Laminated Timber: U.S. Design & Construction Guide v1.0 can be used to guide design

AITC, APA, ICC-ES, Intertek, or PFS-TECO provide third Party product evaluation reports

Mass Timber

AMERICAN NATIONAL STANDARD

ANSI A190.1-2022 Product Standard for Structural Glued Laminated Timber

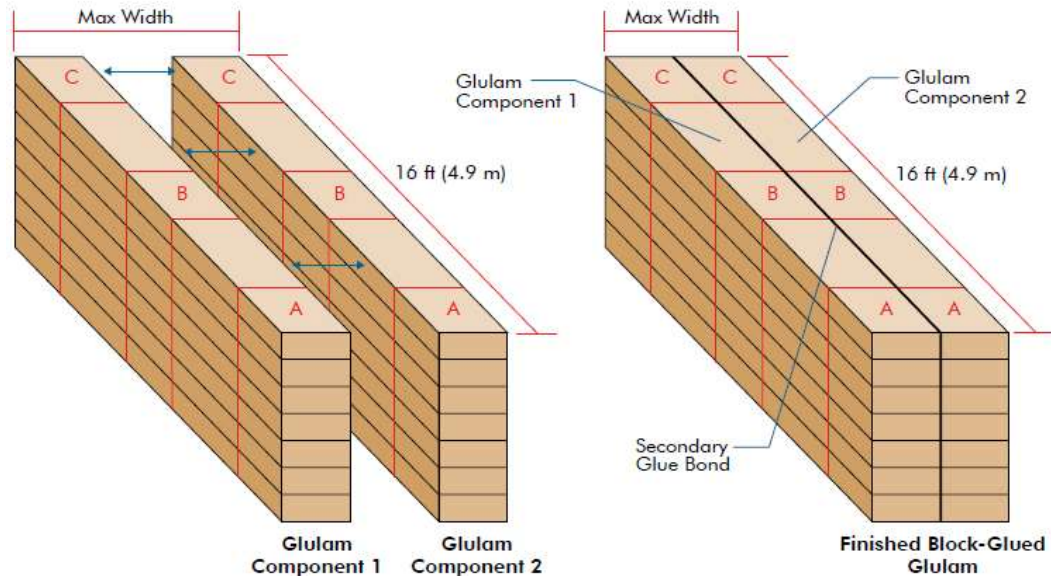


Glued-Laminated Timber (GLT)

Family of solid, uniformly engineered and highly predictable wood products designed for structural use

Fabrication:

BLOCK-GLUING ON THE EDGE OF GLULAM COMPONENTS (DRAWING NOT TO SCALE)



Standard:

ANSI A190.1-2022 Product Standard for Structural Glued Laminated Timber requirements for the manufacture and quality control of structural glued-laminated timber

Mass Timber

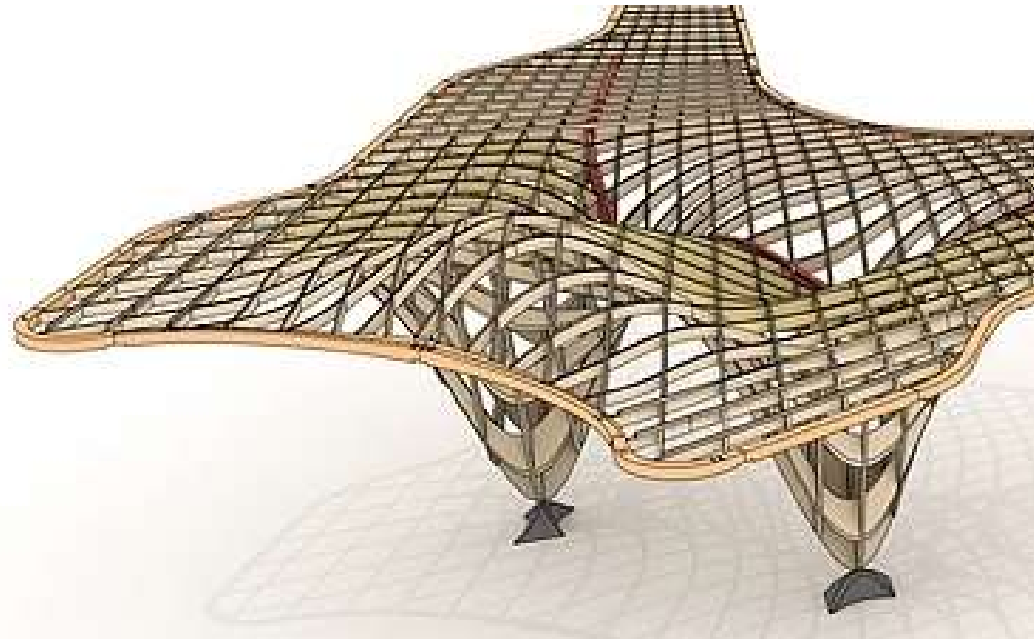
Glued-Laminated Timber (GLT)

...cont'd:

Used in plank orientation GLT provides structural floor or roof deck assemblies. **Grain of all laminations runs parallel with length of members**, which then can be customized as straight, curved, arched, and tapered.



Bunjil Place, Narre Warren, Australia by FJC Studio



Mass Timber



Structural Composite Lumber Selection and Specification

AN EXCERPT OF THE ENGINEERED WOOD CONSTRUCTION GUIDE



Structural Composite Lumber (SCL)

Types:

Laminated Veneer Lumber (LVL) scarfed or lap-jointed veneers, layered lamellas joined as billets and then as panels; a panel version is **Mass Plywood Panels (MPP)**

Parallel Strand Lumber (PSL) strand length to thickness ratio ~300

Laminated Strand Lumber (LSL) strand length to thickness ratio ~150

Oriented Strand Lumber (OSL) strand length to thickness ratio ~75

Standard:

APA Structural Composite Lumber Selection and Specification (excerpt from the Engineered Wood Construction Guide, Form E30)

Mass Timber

Mass Plywood Panels (MPP)

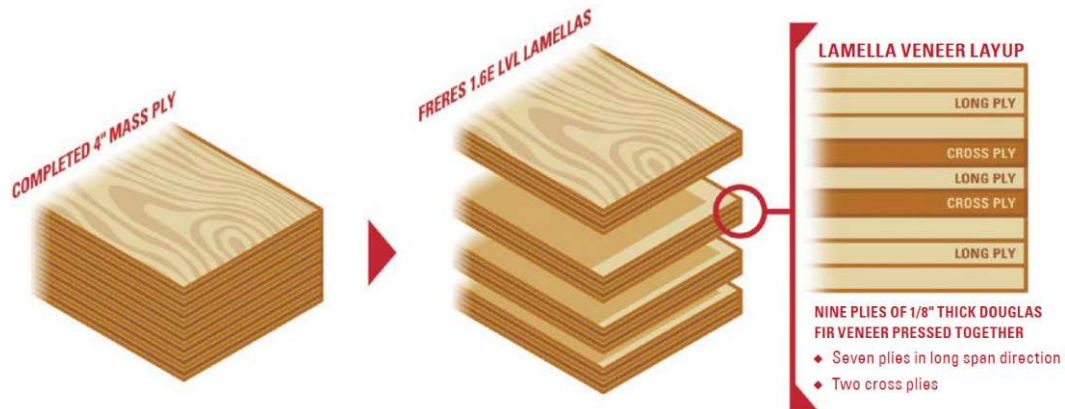
Version of LVL **Structural Composite Lumber** manufactured by Freres Lumber in Oregon; another is Stora Enso (Finland)

Fabrication:

PANEL WIDTH



F16 MASS PLY LAYUP



Standards:

International Building Codes (IBC) recognizes products manufactured according to manufacturer-developed **ICC-ES Evaluation Reports**, such as ESR-4759 by Freres Lumber



Joint Evaluation Report



ESR-4759

Reissued July 2022

This report is subject to renewal July 2024.

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 13—Laminated Veneer Lumber

REPORT HOLDER:

FRERES LUMBER CO., INC.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: The design provisions for structural composite lumber in the ANSI/APA National Design Specification® (NDS) for Wood Construction, as referenced in the applicable code, are applicable to Freres Single Ply

EVALUATION

FRERES

1.0 EVALUATION

Compliance

■ 2021, 2015

Code®

■ 2021, 2015

Residential

For evaluation

Los Angeles

see ESR-4759

Property

■ Structural

2.0 USES

Freres Single Ply

in structural

rafters, roof

panels (MPP)

columns, and

applications

3.0 DESCRIPTION

Freres Single Ply

additional

ES Acceptance

(AC408) and

(AC124). The

species and

product are

approved

with the

Single Ply

in three grades

LVL is manufactured

widths from 3' to 11'

and lengths from 8' to 24'

Ply LVL is 1/8" thick

thickness

ICC-ES Evaluation Report

ESR-4759

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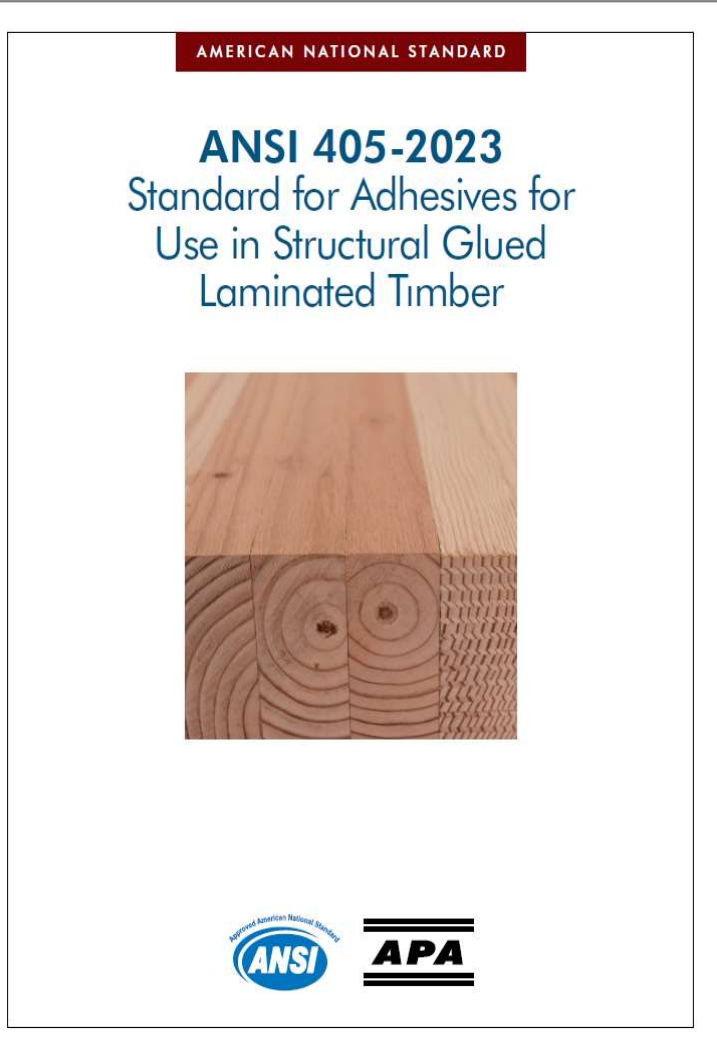


Mass Timber

Adhesives, General

Standards:

For CLT fabricated to ANSI/ APA PRG 320, adhesives are required to meet the requirements of **ANSI 405: Standard for Adhesives for Use in Structural Glued Laminated Timber**



This includes the evaluation of adhesives according to the following **moisture and bond durability** test standards:

ASTM D2559, ASTM D1151, ASTM D7247, and ASTM D1183.

Mass Timber



Dark brown glue, left
Clear/ white glue, right

Adhesives, Additional

European Standards: Meet requirements of **DIN 68141** and **EN301** and **EN302** to grade of service required in accordance with the **National Design Specification (NDS)**

Exterior Exposure Standards : **Exterior-type adhesive** complying with **ASTM D2559**

Appearance Requirements: Adhesives shall be **white/ clear glue** instead of dark brown glue, for preferred aesthetic appearance

Premium Appearance Requirements:

The highest standard glulam appearance classification; all exposed knots and voids filled with a **wood-tone filler putty** or **clear wood inserts** , for **highest aesthetic appearance**

Mass Timber

Adhesives, Fire-Resistance

Fire Testing:

Adhesives are **required to qualify with fire testing** in accordance with **ASTM E119** (in the U.S.) or **CAN/ ULC S101**.



High-Temperature Testing:

To **ensure adhesives will not melt at elevated temperatures** and allow delamination of layers, they are required to meet heat durability testing to **ASTM D7247** and the **CSA O177** flame tests.

This document is not an ASTM standard and is intended only to provide the user of an ASTM standard an indication of what changes have been made to the previous version. Because it may not be technically possible to accurately depict all changes accurately, ASTM recommends that users consult prior editions as appropriate. In all cases, only the current version of the standard as published by ASTM is to be considered the official document.

ASTM
INTERNATIONAL
Designation: D7247 – 16 D7247 – 17

Standard Test Method for Evaluating the Shear Strength of Adhesive Bonds in Laminated Wood Products at Elevated Temperatures¹

This standard is issued under the designation D7247; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscript symbol (n) indicates an editorial change since the last revision or approval.

1. Scope

1.1 This standard describes a test method for evaluating the comparative shear strength of a planar adhesive bond at both ambient and elevated temperatures relative to the performance of solid wood under the same conditions. The test method is based on the breaking load after the specimen is exposed to either ambient (or a constant elevated temperature for a specified duration as described in Section 7. This standard does not preclude the development and implementation of other methods that provide equivalent performance meeting the intent of this method.

1.2 This test method is intended for the evaluation of adhesives that can be used to assemble test specimens in accordance with Test Method D905. The evaluation of other types of adhesives, such as the binder systems used for strand-bused products, is beyond the scope of this test method *method, except as noted in 1.4.*

1.3 This test method is intended for the evaluation of adhesives as a component of laminated wood products at elevated temperatures. The evaluation of fire performance on fire-rated laminated wood products or assemblies is beyond the scope of this test method.

1.4 This test method may be used for the evaluation of heat durability for binder adhesives used in strand-based structural wood composites, such as oriented strand lumber (OSL) and laminated strand lumber (LSL), by substituting strand-based composite specimens for the brooded specimens.

1.5 The exact formulation of adhesive supplied to the manufacturer of laminated wood products shall be evaluated. Modifications to the adhesive formulation require a separate evaluation unless approved by the manufacturer of the laminated wood product, qualified agency, and code evaluation agency.

1.6 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 This standard does not purport to address all of the safety concerns, such as the fire hazard if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.8 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

D905 Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading

D907 Terminology of Adhesives

D2395 Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials

D2915 Practice for Sampling and Data Analysis for Structural Wood and Wood-Based Products

D4933 Guide for Moisture Conditioning of Wood and Wood-Based Materials

D5266 Practice for Estimating the Percentage of Wood Failure in Adhesive Bonded Joints

D5436 Specification for Evaluation of Structural Composite Lumber Products

¹ This test method is under the jurisdiction of ASTM Committee D10 on Adhesives and is the direct responsibility of Subcommittee D10.30 on Wood Adhesives. Current edition approved April 15, 2017. Published April 2018. Originally approved in 2006. Last previous edition approved as D7247 – 06a in 2006. This standard was withdrawn January 2018 and reinstated in April 2018 as D7247 – 16, D38. An AASHTO D4414-16 (17) is D7247 – 17.

² The referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For a formal list of ASTM Standards visit the standard's Document Summary page on the ASTM website.

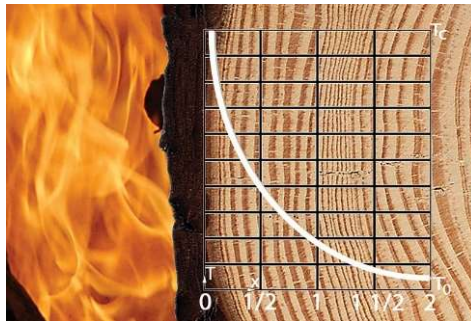
Mass Timber



Adhesives, Char Delamination

When mass timber is exposed to heat, a thermal breakdown process occurs and a layer of char forms on its surface.

CLT products certified to **ANSI/ APA PRG 320-2018 or 2019** require adhesives that meet requirements of full-scale Compartment Fire Test (CFT) specified in the standards and **do not result in the char layer fall-off** when exposed to fire, which is known to cause a second flash-over and fire re-ignition.

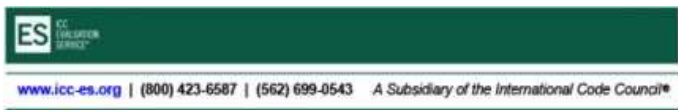


The 2021 IBC and IRC and the 2020 NBC **specifically require CLT to be certified** to these new adhesive standards to avoid Char Delamination.

Mass Timber

Fasteners and Connectors

Fasteners: For use in mass timber erection, fasteners shall meet requirements of **ICC-ES Acceptance Criteria AC233, Acceptance Criteria for Dowel-type Threaded Fasteners Used in Wood.**



ACCEPTANCE CRITERIA FOR DOWEL-TYPE THREADED FASTENERS USED IN WOOD

AC233

Approved February 2022

Previously approved October 2020, February 2020, October 2019, October 2018, April 2015, June 2014, June 2012, June 2011, June 2010, October 2009, February 2007, October 2006, February 2006, October 2005, June 2005, June 2004

(Previously editorially revised December 2020, August 2015, August 2013)

PREFACE

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The provisions of this code are not intended to prevent the installation of any materials 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, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

This acceptance criteria has been issued to provide interested parties with guidelines for demonstrating compliance with performance features of the codes referenced in the criteria. The criteria was developed through a transparent process involving public hearings of the ICC-ES Evaluation Committee, and/or on-line postings where public comment was solicited.

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If this criteria is a revised edition, a solid vertical line (|) in the margin within the criteria indicates a change from the previous edition. A deletion indicator (-) is provided in the margin where any significant wording has been deleted.

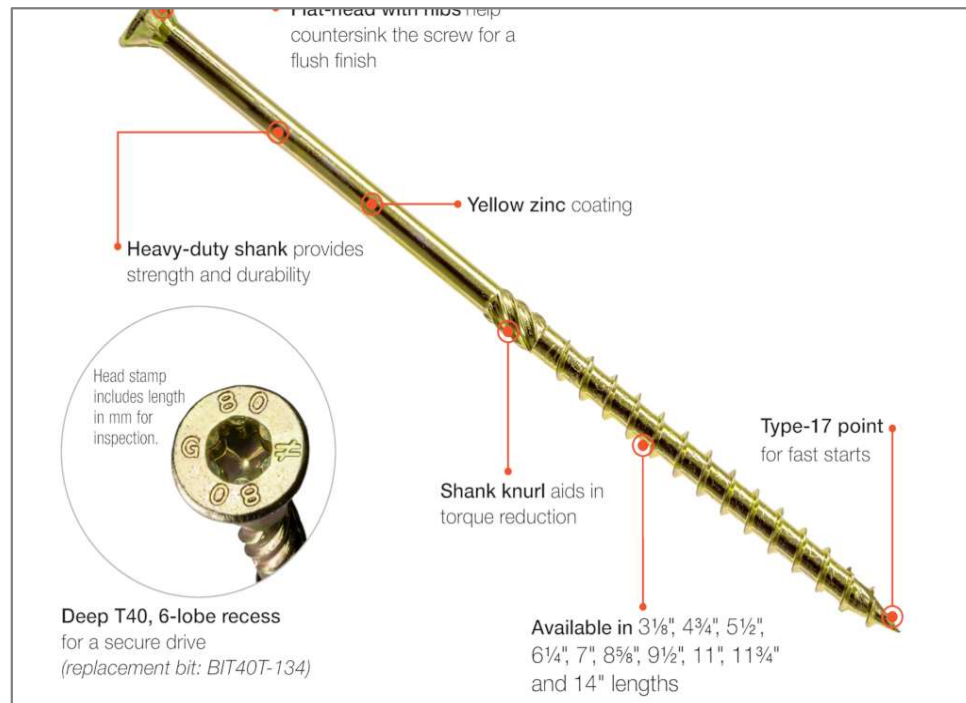
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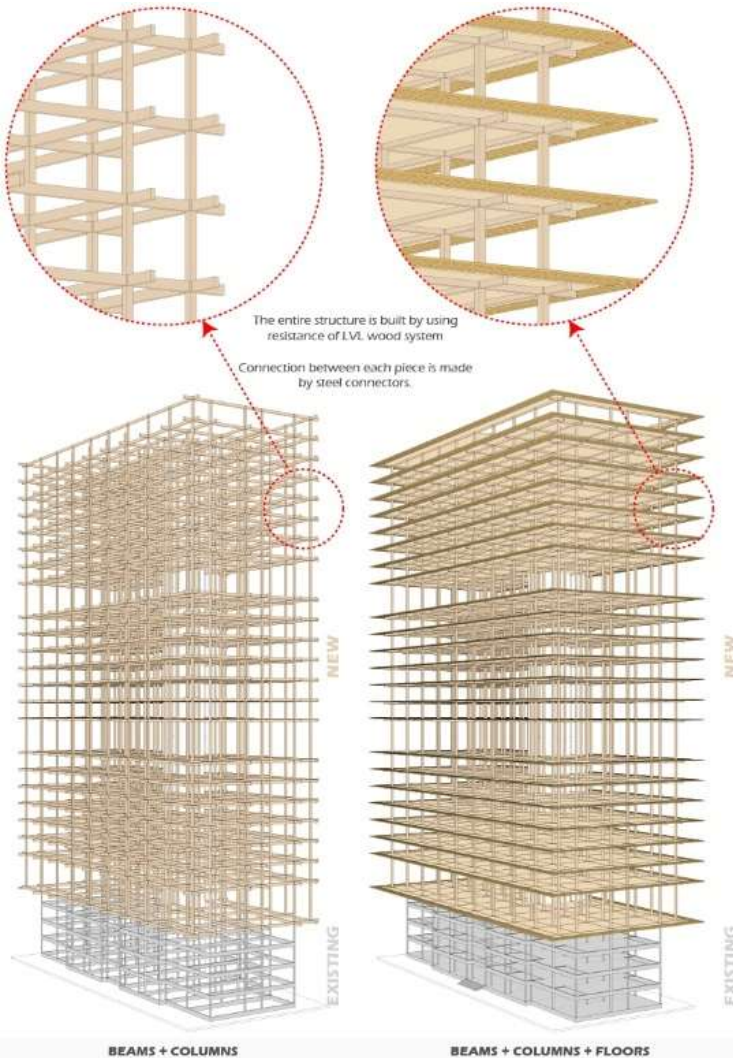
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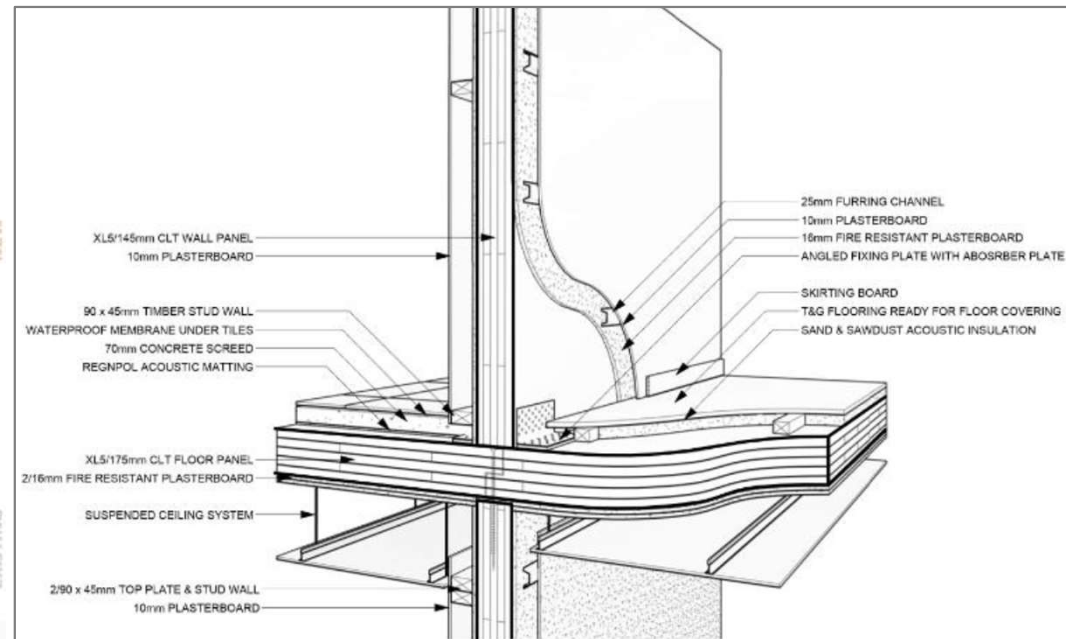
Connectors: For use in mass timber erection, connectors shall meet requirements of **ASTM A36** and shall be galvanized to meet **ASTM A123**.

Mass Timber



Delegated Design

When a project's mass timber frame and panels are not designed by the project's structural engineer, **Gravity and Lateral Systems** are designed by the **manufacturer's qualified professional engineer** to comply with **the project's performance requirements and design criteria**.

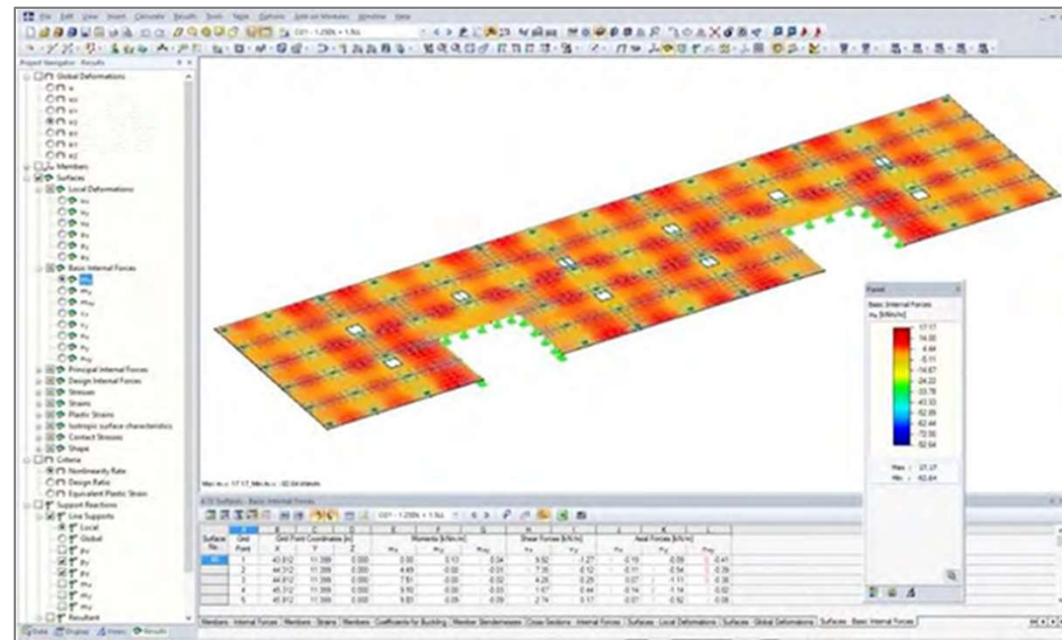
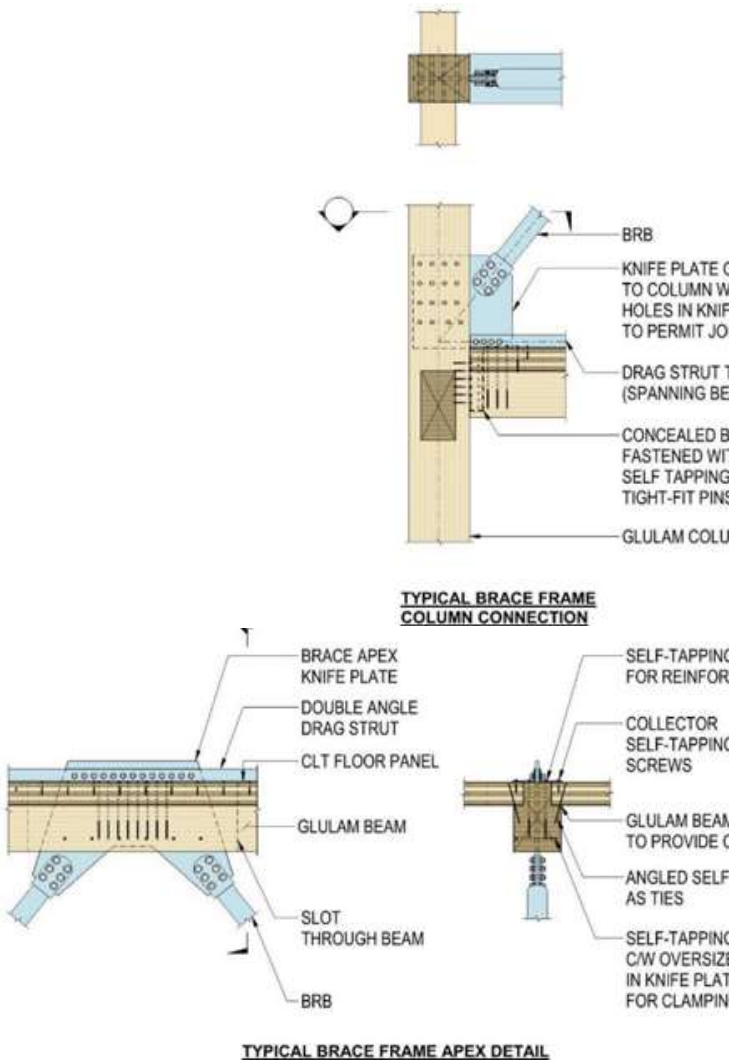


Alternatively, the manufacturer, fabricator or erector may only be responsible for design of **Erection Rigging and Bracing Systems**.

Mass Timber

Shop Drawings

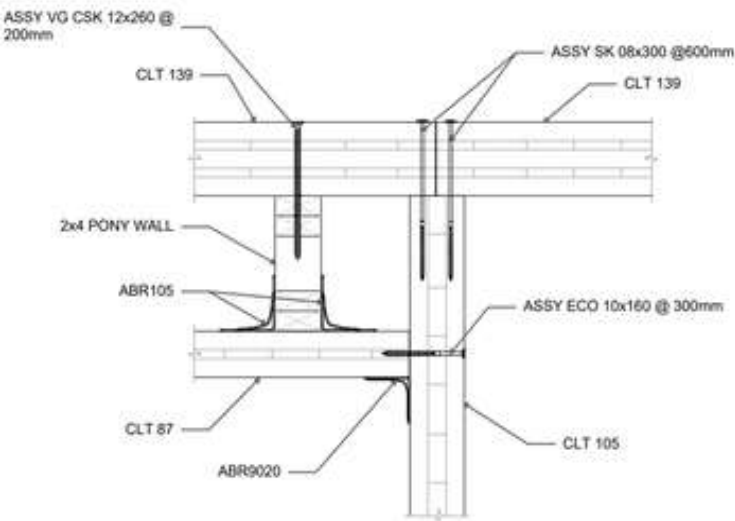
Mass timber panel and member Shop Drawings shall be prepared by a **qualified professional engineer registered in the project location and employed by the mass timber manufacturer**, including interfaces with related structural trades, e.g. steel braced frame or concrete shear walls.



Structural engineer's interface/ connection shop drawing detail (above)
LOD400 single piece shop drawing for deck panels (right)

Shop drawings shall include all calculations and analysis data. All documents shall be **signed and sealed by the manufacturer's professional engineer of record**.

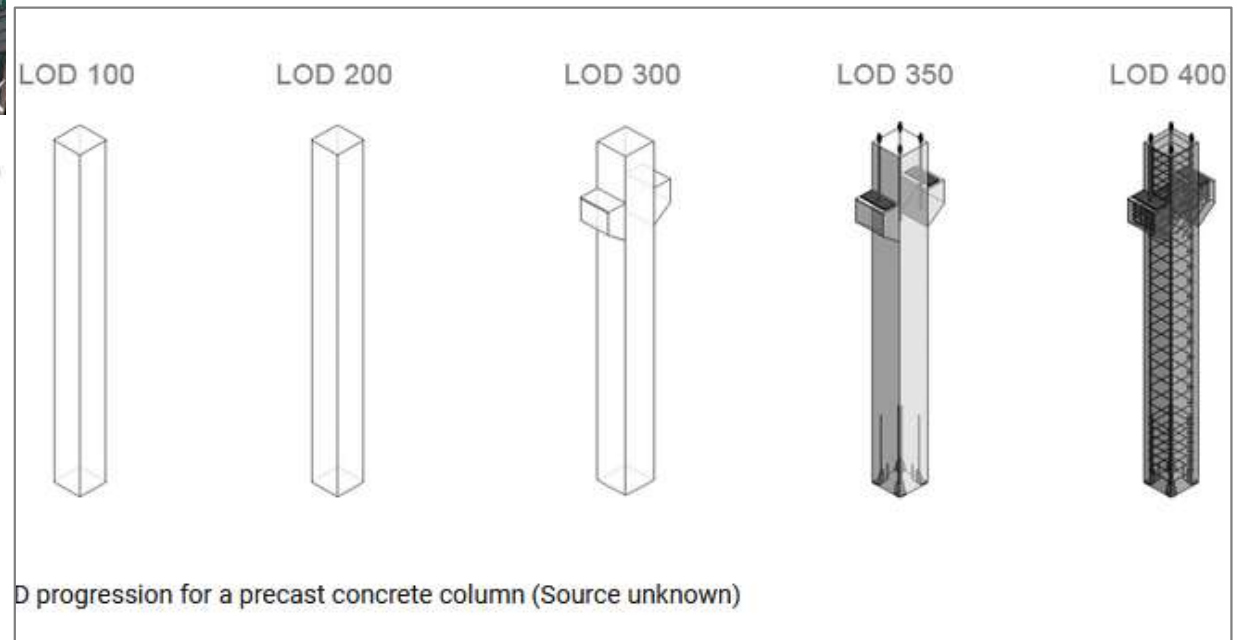
Mass Timber



Design team's BIM model for multiple trades, for clash detection (top)
Structural engineer's LOD300 connection detail (above)
Examples demonstrating Level of Detail (right)

Shop Drawings

Mass timber panel and member **Shop Drawings** shall include interfaces with fire protection, plumbing, mechanical, and electrical routing and components. Shop Drawings shall include **connection details**, **coordination** with other trades, and **single piece drawings**.



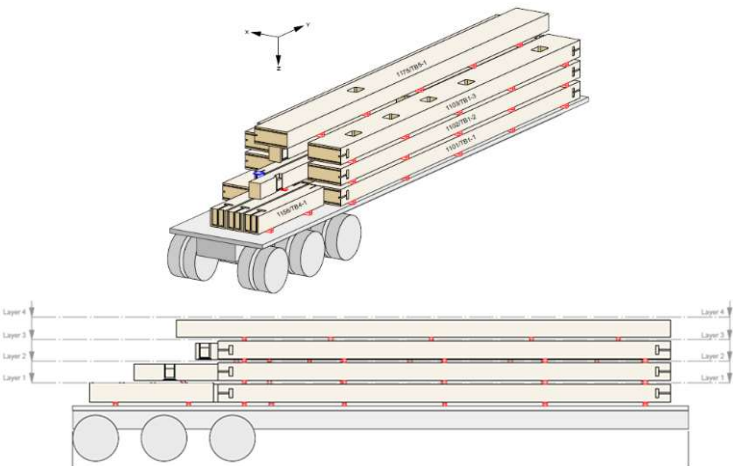
Level of Detail (LOD) process:

LOD300 for slab plans and connections

LOD350 for panel layout and MEPF sleeves

LOD400 for single piece shop drawings

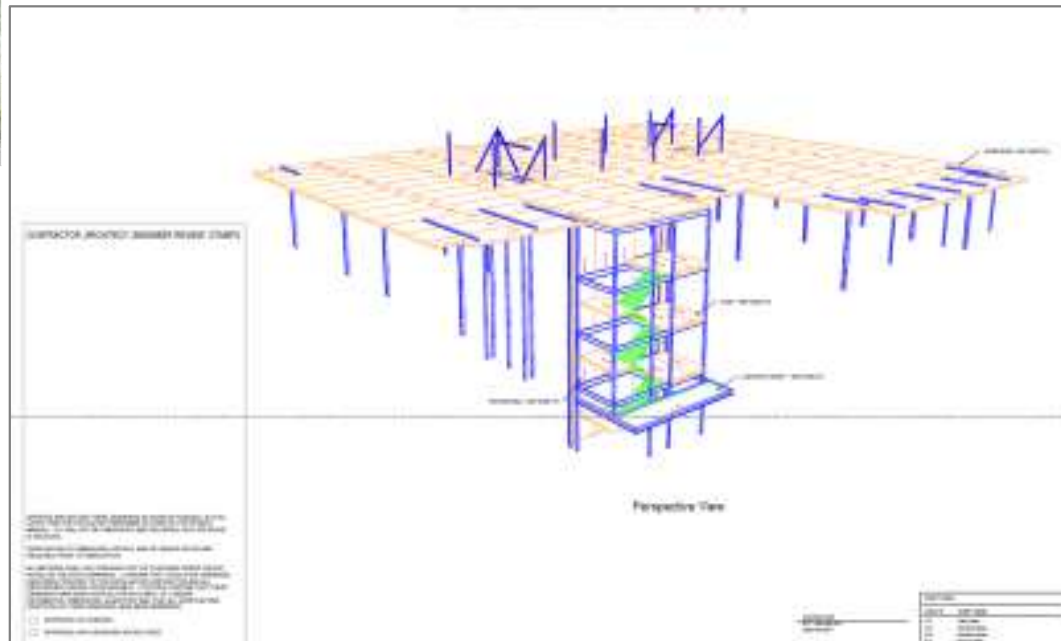
Mass Timber



Architect's BIM design model (top)
Manufacturer's delivery loading model (above)
Manufacturer's BIM erection coordination model (right)

Coordination Drawings

The manufacturer shall develop coordination drawings and scheduling that considers downstream matters, including **palleting/ containerizing, delivery means, onsite spatial constraints, and installation sequencing** influencing erection.



The **architect may provide** their BIM design model for use to develop the **coordination drawings by the manufacturer and erector.**

Mass Timber

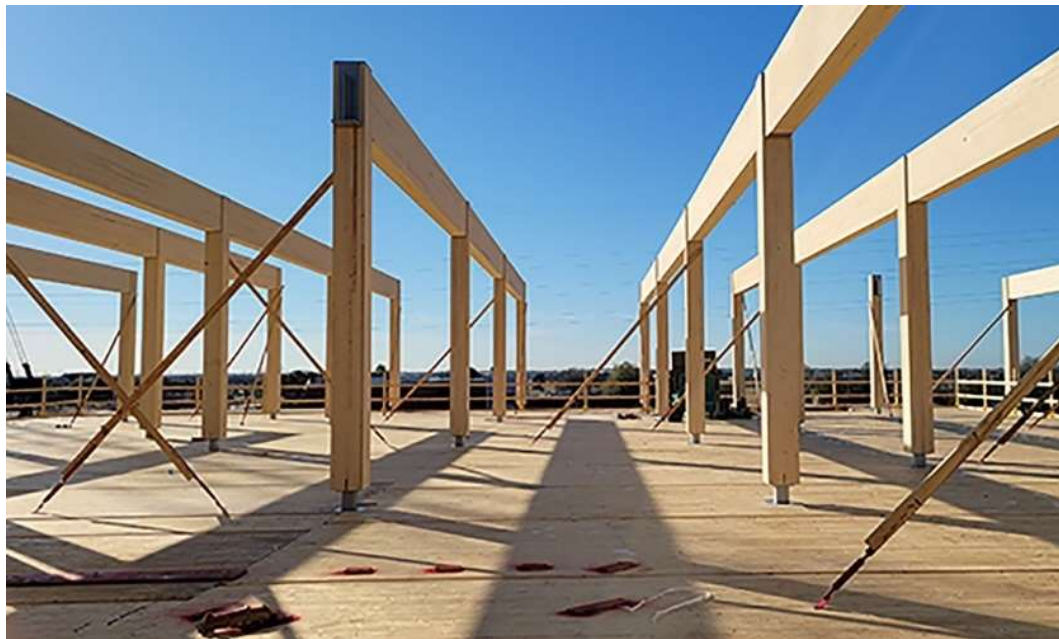


Rigging for erection operations (above)
Bracing of erected posts and beams (right)

Method Statements

Temporary Bracing Plan:

Evaluation of **temporary loading conditions** and **bracing options** for mass timber components to structure during installation, including support and connection type.



Rigging Plan:

Lifting and handling requirements for each different panel type, taking into consideration **openings** and **cut-outs**, and providing **attachment hardware** and **attachment locations**.

Mass Timber

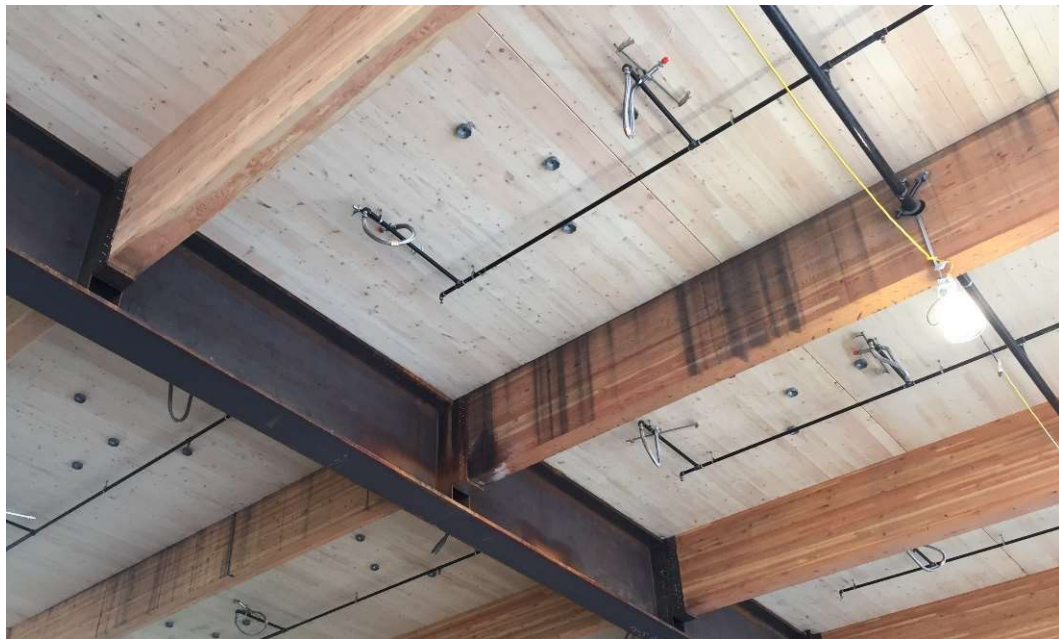


Standing water moisture

Method Statements

Weather and Moisture Protection Plan:

Specifications include **factory- or shop-applied moisture resistive membrane** at topsides of mass timber panels, similar to **self-adhered, vapor-permeable** building envelope weather barriers.



Contractor shall provide on-site effort using **covering and removal sequence** and **standing water mitigation plan** during construction.

Mass Timber



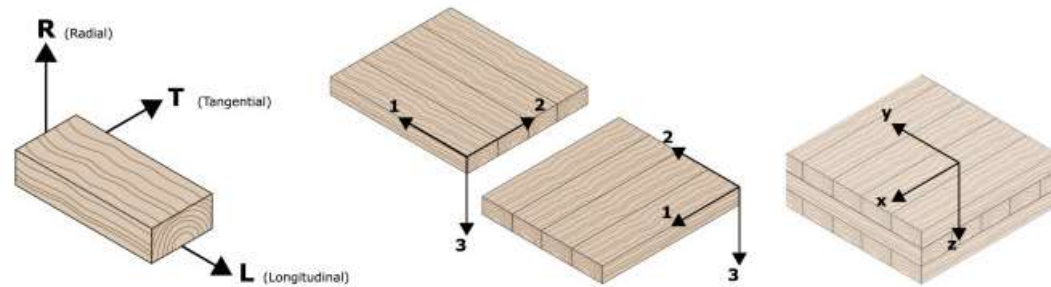
CLT Species, Grades and Layup

Stress Grades:

E1, E2, E3, V1 and V2. Visually graded lumber (V) is standard for exposed CLT surfaces; **V1 is most standard.**

Available species:

Douglas Fir, Southern Yellow Pine, Spruce, and mixed species of **Douglas Fir-Larch** or **Western Spruce-Pine-Fir.**



(d)



Example Specification:

Stress Grade: V1.

Longitudinal Layers: No. 2 Douglas Fir-Larch lumber.

Transverse Layers: No. 3 Douglas Fir-Larch lumber..

3-layer CLT panels, V1 grade

Mass Timber



CLT Appearance Classifications

Architectural Appearance

Suitable for applications where appearance an important consideration.

Face layers exposed to view are free of loose knots.

All knot holes and voids over 3/4 in. filled.

Exposed surfaces sanded smooth.

Edge joints are squeezed tight at manufacturing.



Industrial Appearance

Suitable for use in concealed applications and where appearance is not the primary concern.

Loose knots and open knot holes are not filled.

Wane and other flaws limited only to the lumber grade, permitted on the surface layers, and unlimited length.

Exposed surfaces are not sanded.

Architectural appearance grade (top)
Industrial appearance grade (bottom)

Mass Timber



DC Southwest Library, Washington DC by Perkins & Will (above)
Various acoustic-enhancing profiles and fillers by StructureCraft (right)

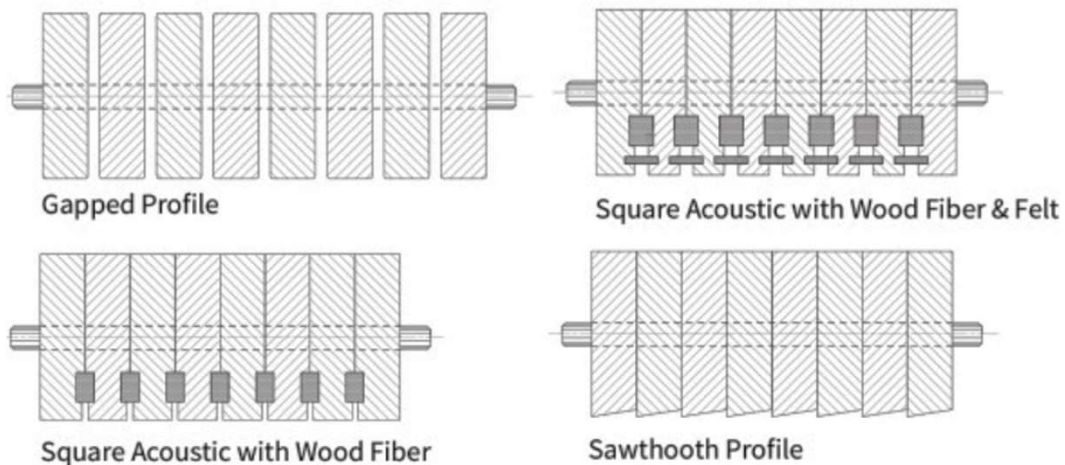
Dowel-Laminated Timber (DLT) Species

Species:

Available species include: **Douglas Fir** and **Spruce**, with hardwood dowels (not visible in final assembly).

Profiles:

Available profiles can provide **enhanced acoustic performance**.



Acoustic Fillers:

Laminated boards can accommodate **acoustical filler materials** to enhance sound-controlling characteristics for ceilings and walls..

Mass Timber



Brentwood Skytrain Station, Burnaby, BC by Perkins & Will (above)
Various acoustic-enhancing profiles and fillers by StructureCraft (right)

Nail-Laminated Timber (NLT)

Species:

Available species include standard lumber species: **Douglas Fir**, **Southern Yellow Pine**, **Spruce**, and mixed species of **Douglas Fir-Larch** or **Western Spruce-Pine-Fir**.

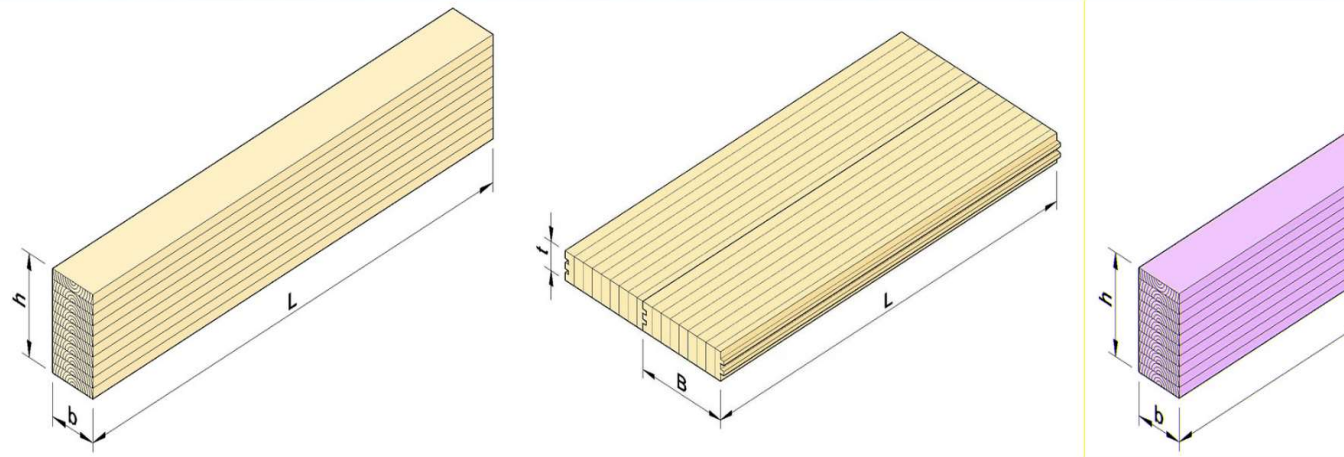
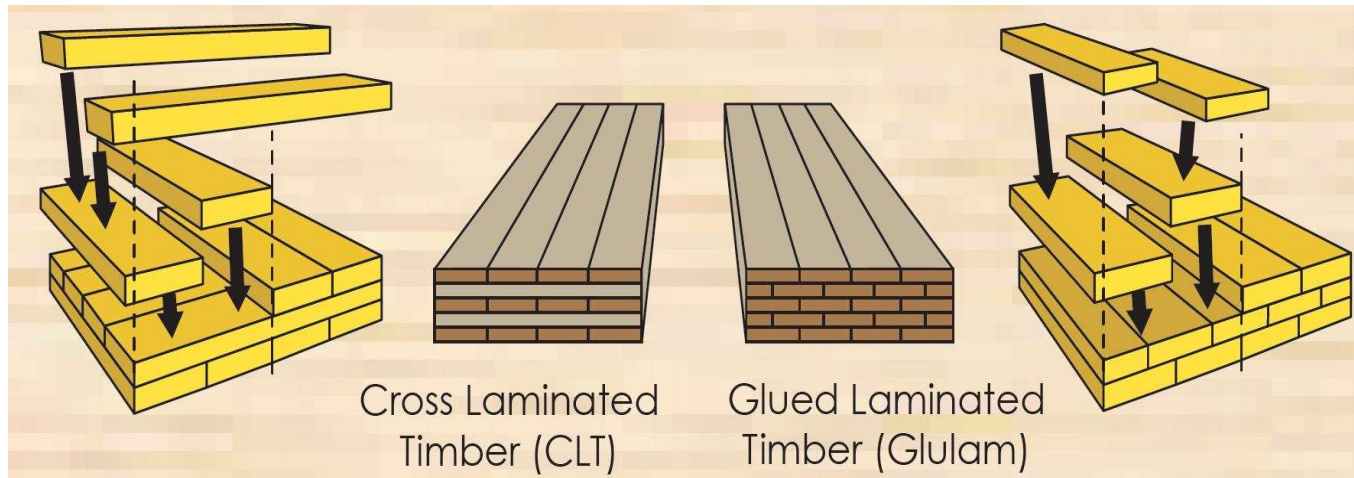
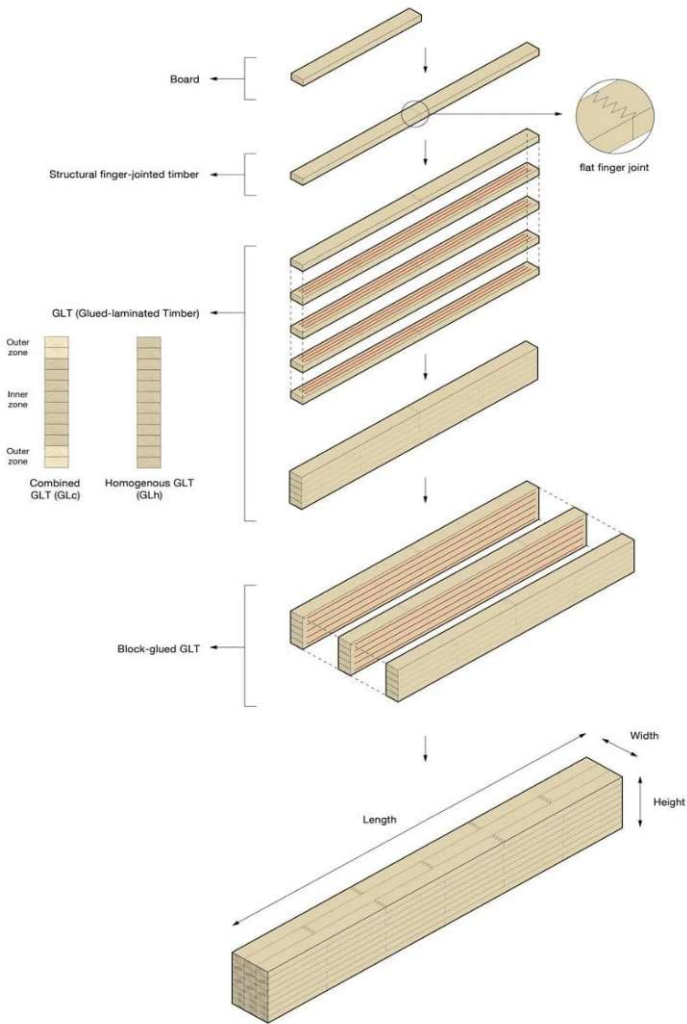


Mass Timber

Glued-Laminated Timber (GLT)

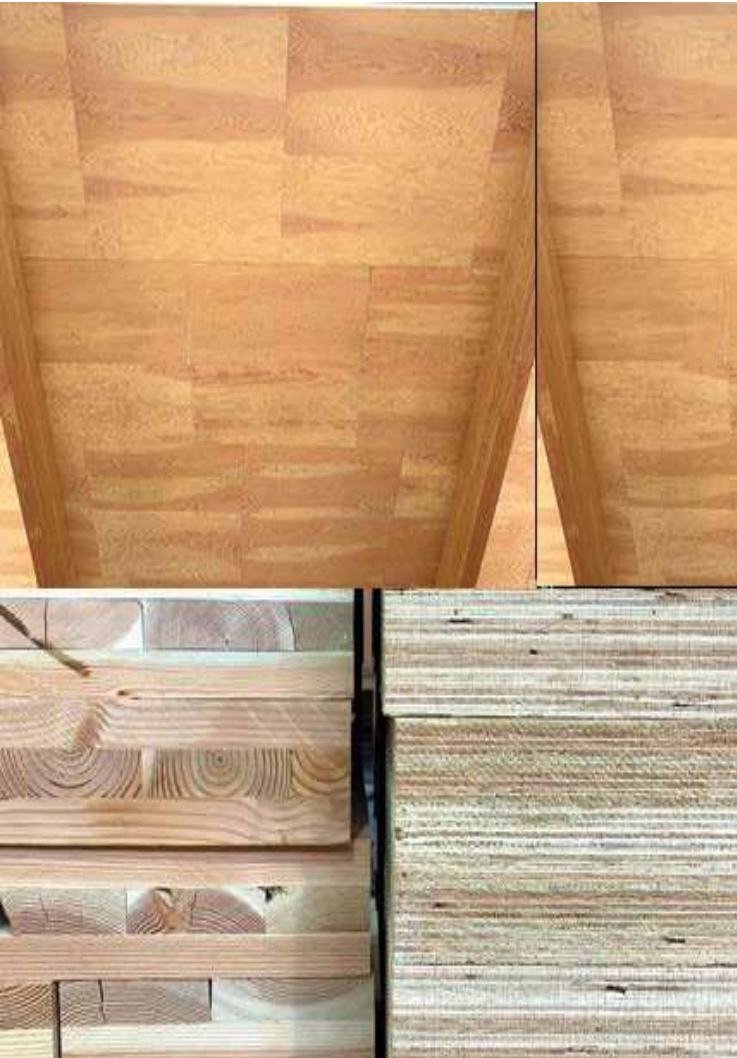
Species:

Available species include standard lumber species: **Douglas Fir, Southern Yellow Pine, Spruce**, and mixed species of **Douglas Fir-Larch** or **Western Spruce-Pine-Fir**.



Block-glued GLT members (above)
Comparison of CLT to GLT (right top)
Laminating lamellas, then joining into panels (right bottom)

Mass Timber



Upgraded Architectural appearance grade, specific to Freres Engineered Wood (top)

CLT and MPP comparison (bottom)

MPP columns and beams installed at Nature Conservancy, Portland by Lever Architecture (right)

Structural Composite Lumber (SCL) Grades

Mass Ply (MPP) Appearance Grades:

Standard Architectural: Closed knots, reduced knot size, knot quantity not limited, and splits limited to 1/2 in." width and 24 in. length.



Upgraded Architectural: Semi-clear-of-knot face grade ply applied to one or both faces of billet. Knots and defects limited to eight defects per 32 sf of panel surface.

Mass Timber



Fabrication Tolerances

Manufacturing Tolerances:

Thickness: Plus or minus **1/16 inch (1.6 mm)** or **2 percent** of panel thickness, whichever is greater.

Width: Plus or minus **1/8 inch (3.2 mm)**.

Length: Plus or minus **1/4 inch (6.4 mm)**.

Squareness: Lengths of two panel face diagonals measured between panel corners shall not differ by more than **1/8 in. (3.2 mm)**.

Straightness: Deviation of edges from straight line between adjacent panel corners shall not exceed **1/16 inch (1.6 mm)**.

Image caption

Mass Timber



Sealers and Finishes

Factory-Applied Protective Finish:

Factory-apply protective coating to mass timber panels and members within an enclosed, weather-protected finishing and storage space

Interior Finish:

Base Coat, Basis-of-Design Product: **KP-12 UVW by Sansin Corp.**; www.sansinactoryfinish.com.

Top Coats: Same as Base Coat; Tint as required to match Architect's sample.

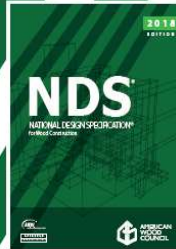
Exterior Finish:

Base Coat, Basis-of-Design Product: **SDF Enviro Stain by Sansin Corp.**; www.sansinactoryfinish.com.

Finish Coat, Basis-of-Design Product: Same as Base Coat; Tint as required to match Architect's sample.



Mass Timber



Calculating the
Fire Resistance of
Wood Members
and Assemblies
Technical Report No. 10

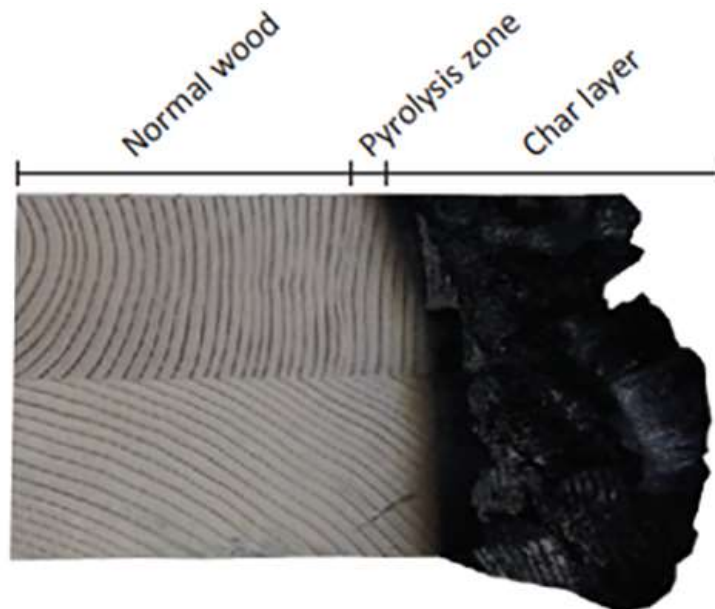


February 2021

AWC TR10-2020, Technical Report 10 - Calculating the Fire Resistance of Wood Members and Assemblies

Fire-Rated Connections

Concealed Fire Rated Beam Hanger Systems Technical Report No. 10 (TR 10) - **Calculating the Fire Resistance of Wood Members and Assemblies**, published by the American Wood Council, is applicable in the U.S. **Annex B of CSA 086 - Fire Resistance of Large Cross-section Wood Elements** provides guidance on calculating fire resistance rating based on structural criteria in Canada.

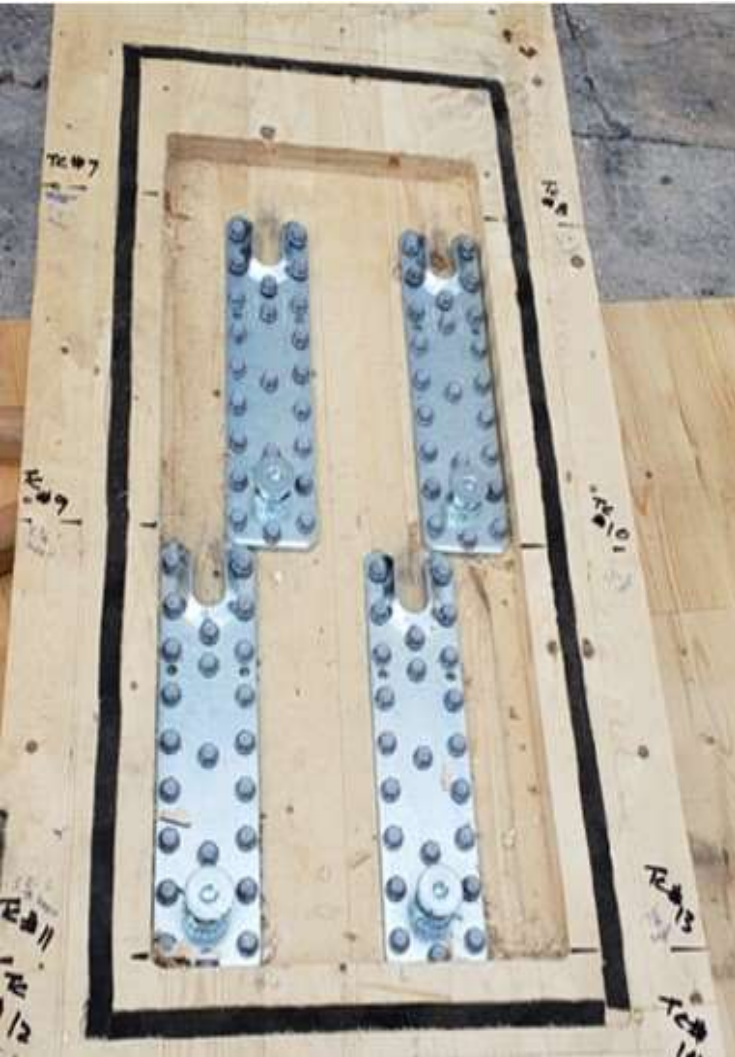


Wood
Cover



Wood Cover

Mass Timber



Fire-Rated Connections

Intumescent Strips

Specification: **Shop-applied intumescent strip** set into recessed channel along edge or face of mass timber member or panel, as indicated.

Size: Actual 3/16 in. thick x 1 in. wide.

Installation: **Set into recessed channel** 1/4 in. deep x 1-1/8 in. wide (for 1/8 in. tolerance).

Wrap strip shall be **installed on one side of the joint** as indicated, located 1-1/2 in. maximum from the face of wall panel, unless otherwise indicated.

Wrap strip may be stapled, nailed, or otherwise mechanically held in place.

Basis-of-Design Product: **CP 648E Wrap Strip by Hilti;**
www.hilti.com.

m.thrailkill.architect.llc
specifications estimating research documentation

q+a