Code Applications for Traditional Glued-laminated Timber and Innovative Cross-laminated Timber

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Description

This presentation will focus on traditional Glued-laminated Timber (GLT) and innovative Cross-laminated Timber (CLT) wood structural framing members. GLT has been adopted in the IBC and utilized throughout the world for several decades on a wide variety of buildings. Often selected for aesthetic reasons or its unparalleled design flexibility, glulam also offers superior structural performance combined with long term durability. CLT has been recently adopted under AWC's National Design Specification (NDS) for Wood Construction 2015 as well as ICC's 2015 International Building Code (IBC). It has been used for over a decade in other parts of the world such as Europe and Australia and has made its way into North America within the last 10 years. Similar to GLT, in addition to its structural capabilities, it's selected for aesthetic appeal, structural simplicity and speed of construction. Additionally both offer sustainable qualities as they are manufactured from a renewable resource and store carbon. Structural and fire protection characteristics of GLT and CLT will be discussed as well as IBC code provisions that allow the specification of them in both residential and commercial applications for a wide variety of occupancies.

Learning Objectives

- Be able to identify code acceptance of glued-laminated timber and cross-laminated timber.
- Become familiar with a number of technology advances and standards related to glued-laminated timber and cross-laminated timber.
- Improve design knowledge on building systems made with new types of engineered wood products.
- Become acquainted with the unique fire resistive characteristics of glued-laminated timber and cross-laminated timber as it influences the use of wood in building construction.
- Understand the application of NDS Chapter 16 can be utilized to provide up to 2-hours of fire-resistance.
Outline

- Overview & Building Code Allowances
- Glued-laminated Timber
- Cross-laminated Timber
- Fire

Traditional Stick Framed Construction
Simpson Strong-Tie Demo Lab
Cal Poly, San Luis Obispo, CA

Raleigh Durham Airport, North Carolina
Pedestrian Bridge - 105 ft. Span

Stadhaus, London, UK
The Story of Wood – Wood Carbon Cycle

Warner Drive – Culver City, CA

- Type V Construction
- Assembly & Business Occupancy


Architect: Profeta Royalty Architecture
Structural Engineer: Structural Focus
Completed: 2011
Warner Drive – Culver City, CA

• Nail Laminated Timber – 2x12 vertical mechanically connected w/nails
• NDS principles of mechanics

Architect: Profeta Royalty Architecture
Structural Engineer: Structural Focus
Completed: 2011

Bullitt Center – Seattle, WA

250 YEAR STRUCTURE
HEAVY TIMBER, CONCRETE & STEEL

Architect: Miller Hill Partnership
Structural Engineer: DCI Engineers
Photo Credit: Miller Hull Partnership

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Bullitt Center – Seattle, WA

- Glulam beams and columns
- Nail-laminated timber floors

Architect: Miller Hill Partnership
Structural Engineer: DCI Engineers
Photo Credit: Miller Hull Partnership

Climate Change: The Role of CO₂

2,400 sf home = 32 m³ structural wood = 29 metric tons CO₂ = 5.7 passenger annual emissions

Source: FP Innovations
Stradthaus – 24 Murray Grove – Tallest Modern Mixed Use Timber Structure

London infill project
29 flats (mixed affordable and private)
Ground floor office
4x less weight than precast concrete
~1/2 the construction time of precast concrete (saved 22 weeks vs. conc. 30%)
Saves 300 metric tons of CO2
21 years of energy usage for the building

Forte’, Melbourne,

10 stories

Forte will have positively affected the environment by:
- Storing (sequestering) 761 tonnes CO2 eq over the life of the building
- Equivalent to taking 345 cars off the road for a year
- Saving 7.7 GL of water
- Lowering evapotranspiration by 75% in the surrounding area
- In addition, the smart design and efficient systems of the building could save on average over $300 per year on energy and water bills.
Forte’, Melbourne,

10 stories, 23 apartments
https://youtu.be/pHpthNBiYqE
Where is GLT Allowed in IBC 2015?

- Types I and II are generally noncombustible inside and out - Roof applications
- Types III have noncombustible exteriors with interiors of any material.
- Type IV & V are generally combustible such as wood although V includes any material permitted.
Where is GLT Allowed in IBC 2015?

<table>
<thead>
<tr>
<th>TABLE 601</th>
<th>FIRE RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)</th>
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</thead>
<tbody>
<tr>
<td>BUILDING ELEMENT</td>
<td>TYPE I</td>
</tr>
<tr>
<td>Primary structural frame&lt;sup&gt;2&lt;/sup&gt; (see Section 202)</td>
<td>3&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Bearing walls</td>
<td></td>
</tr>
<tr>
<td>Exterior&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Interior</td>
<td></td>
</tr>
<tr>
<td>Nonbearing walls and partitions</td>
<td>Exterior</td>
</tr>
<tr>
<td>Nonbearing walls and partitions</td>
<td>Interior&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Floor construction and associated secondary members</td>
<td>(see Section 202)</td>
</tr>
<tr>
<td>Roof construction and associated secondary members</td>
<td>(see Section 202)</td>
</tr>
</tbody>
</table>

For SI: 1 foot = 304.8 mm.

<sup>a</sup> 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.

<sup>b</sup> Except in Group E, I, R, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be exposed to elevation.

<sup>c</sup> In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.

<sup>d</sup> Not less than the fire-resistance rating required by other sections of this code.

<sup>e</sup> Not less than the fire-resistance rating based on fire separation distance (see Table 602).

<sup>f</sup> Not less than the fire-resistance rating as referenced in Section 708.10.

Where is CLT Allowed in IBC 2015?

**Type IV Construction**

**602.4** Type IV. Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces. *Cross laminated timber (CLT)* dimensions used in this section are actual dimensions.
Where is CLT Allowed in IBC 2015?

**Code modifications to Ch. 23 Wood**
2303.1.4 Structural glued cross laminated timber. Cross-laminated timbers shall be manufactured and identified as required in ANSI/APA PRG 320-2011.

CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of at least three layers of solid-sawn lumber or structural composite lumber where the adjacent layers are cross-oriented and bonded with structural adhesive to form a solid wood element.

**Code modifications to Ch. 35 Reference Standards**

Where is CLT allowed in IBC 2015?

**Type IV Construction - Exterior Walls**

602.4.2 Cross-laminated timber complying with Section 2303.1.4 shall be permitted within exterior wall assemblies with a 2-hour rating or less provided:

- Exterior surface of the cross-laminated timber is protected fire retardant treated wood sheathing complying with 2303.2 and not less than 15/32 inch thick;
- OR
- gypsum board not less than ½ inch thick;
- OR
- a noncombustible material.
Where is CLT allowed in IBC 2015?

Type IV Construction - Floors

602.4.6.2 CLT. Cross laminated timber shall be not less than 4 inches (102 mm) in thickness. It 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...

Where is CLT allowed in IBC 2015?

Type IV Construction - Roofs

602.4.7 Roofs. Roofs shall be without concealed spaces and wood roof decks shall be sawn or glued laminated... or of cross laminated timber... Cross laminated timber roofs shall be not less than 3 inch nominal in thickness and shall be continuous from support to support and mechanically fastened to one another.
Where is CLT allowed in IBC 2015?

Type IV Construction - Walls & Partitions

602.4.8.2 Exterior walls. All exterior walls shall be of one of the following:
1. Noncombustible materials; or
2. Not less than 6 inches in thickness and constructed of one of the following:
   2.1 Fire retardant treated wood in accordance with 2303.2 and complying with 602.4.1 or
   2.2 Cross laminated timber complying with 602.4.2.

Type IV Construction

- All structural elements can be CLT
  - Exterior walls
  - Floor
  - Roof
  - Interior walls
Type V Construction

- All structural elements can be combustible construction
  - Exterior walls
  - Floor
  - Roof
  - Interior walls

Type III Construction

- So where could CLT go?
  - Almost anywhere!
  - Exterior Walls need to be non-combustible or FRT Wood (2 hour or less)
  - Interior any material permitted by code
  - Roof
Possibilities for CLT?

**Summary**
- 2015 IBC – most occupancies
  - Types VB and IV
  - Possibly Types VA, IIIA and IIIB

Table 504.4
Allowable Number of Stories Above Grade Plane
## Table 506.2
Allowable Area Factor In Square Feet

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<th>SEE FOOTNOTE</th>
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</table>

Example

R-2 Occupancy Type IV Construction NFPA 13R Sprinklers
60 feet (85 feet w/NFPA 13 Sprinklers)
4 stories (5 stories w/ NFPA 13 Sprinklers)
Allowable area = 20,500 sf
Governing Codes for Wood Design

2015 IBC references in 2015 NDS

IBC 2015 Referenced Standards

ANSI A190.1-2012
ANSI/APA PRG 320-2011
2015 NDS Chapter Reorganization

2012 NDS
- 1-3 General
- 4-9 Products
- 10-13 Connections
- 14 Shear Walls & Diaphragms
- 15 Special Loading
- 16 Fire

2015 NDS
- 1-3 General
- 4-10 Products +CLT
- 11-14 Connections
- Shear Walls & Diaphragms
- 15 Special Loading
- 16 Fire

2015 NDS
Product Chapters
- Ch. 5 Structural Glued Laminated Timber
- Ch. 10 Cross-Laminated Timber
Outline

- Overview & Building Code Allowances
- Glued-laminated Timber
- Cross-laminated Timber
- Fire

What is Glulam?

- Glulam = a structural composite of lumber and adhesives
Glulam – Characteristics

Glulam:
• Wood laminations bonded together
• Wood grain runs parallel to the length

Typical Widths:
• 3-1/8", 3-1/2, 5-1/8" and 6-3/4" (possibly 10-3/4")

Laminations:
1-3/8" for Southern Pine
1-1/2" for Douglas Fir

Glulam = One of the Original Engineered Wood Composites

Lumber Laminations

Glue Lines

Natural Characteristics

End Joint
Standards

- Product qualification and quality assurance requirements are specified
- Third-party inspection is required on an on-going basis
- All glulam must bear a grademark meeting ANSI A190.1 -2012

Glulam Adhesives

- Adhesives used for glulam must meet:
  - ASTM D 2559 for Exterior-Use
    - Designation: D 2559 – 04
    - Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions
  - ASTM D 7247 for heat durability
    - Designation: D 7247 – 07a
    - Standard Test Method for Evaluating the Shear Strength of Adhesive Bonds in Laminated Wood Products at Elevated Temperatures
Lumber Species

- Traditional softwoods
  - Douglas Fir & Southern Pine
- Other softwoods
  - Spruce-Pine-Fir and Hem-Fir
- Naturally durable softwoods
  - Alaska Yellow Cedar
  - Port Orford Cedar
- Hardwoods
- Mixed species layups

Glulam Lay-Ups

- Compression Zone
- Inner Zone
- Tension Zone
- Unbalanced Beam
Glulam Manufacturing - Engineered Layups

Simple Span - Unbalanced Layup

Glulam Lay-Ups

Unbalanced Beam

Compression Zone

Inner Zone

Tension Zone
Note the “TOP” Stamp – for Unbalanced Layup
Natural Aesthetics of Glulam

Glulam Manufacturing-
Appearance Classifications

**Appearance Classifications:**
- Framing (-L) (3-1/2", 5-1/2")
- Industrial (-L)
- Architectural
- Premium (verify local availability)

Note: Appearance classifications do not affect design values.
Curved Shapes

Disney Ice Arena, Anaheim, CA
Architect: Frank Gehry
Structural Engineer: John A. Martin Associates

Marking

Structural Use
Appearance Grade
Laminating Specification
Wood Species
Applicable Standard

APA EWS
B IND EWS 24F-1.8E DF
MILL 0000 ANSI/ITC A190.1-2007

Structural Grade Designation
Glulam Design: 2015 NDS

2015
1. General Requirements for Building Design
2. Design Values for Structural Members
3. Design Provisions and Equations
4. Sawn Lumber
5. **Structural Glued Laminated Timber**
6. Round Timber Poles and Piles
7. Prefabricated Wood I-Joists
8. Structural Composite Lumber
9. Wood Structural Panels
10. Cross-laminated Timber
11. Mechanical Connections
12. Dowel-Type Fasteners
13. Split Ring and Shear Plate Connectors
14. Timber Rivets
15. Special Loading Conditions
16. Fire Design of Wood Members

NDS 2015 Supplement

1. **Sawn Lumber Grading Agencies**
2. **Species Combinations**
3. **Section Properties**
4. **Reference Design Values**
   - Sawn Lumber and Timber
   - MSR and MEL
   - Decking
   - Non-North American Sawn Lumber
   - Structural Glued Laminated Timber
   - Timber Poles and Piles
NDS Stress Classes

- Stress Classes Combined for Simplicity

Table 5A  Reference Design Values for Structural Glued Laminated Softwood Timber

Use with Table 5A Adjustment Factors

<table>
<thead>
<tr>
<th>Stress Class</th>
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Alaska Yellow Cedar
Santa Monica, CA Reservoir Cover
Preservative Treatment of Glulam

Untreated glulam in pressure cylinder ready for treatment

Preservative forced into wood cells under pressure

Incising used for difficult to treat species
No effect on glulam strength
Preservative Treatments

- Considerations for preservative treatments
  - Incising may be required for some hard to treat species
  - Fastener corrosion may occur with some waterborne arsenical treatments - use hot dipped galvanized or stainless steel connectors
  - Field cuts require field applied treatments
  - Structural properties not affected by approved treatments and processes

Naturally Durable Species

- Port Orford Cedar 22F-1.8E
- Alaska Yellow Cedar 20F-1.5E
- Western Red Cedar 16F-1.3E
- California Redwood 16F-1.1E
Outline

• Overview & Building Code Allowances
• Glued-laminated Timber
• Cross-laminated Timber
• Fire

Concept of Cross Laminated Timber

Photos provided by FPInnovations
CLT Layup, Press and Glue

CNC Technology

Slide Courtesy of Structurlam
Ready to Ship

Slide Courtesy of Structurlam

CLT - Typical Construction Details

- Internal spline
- Double surface spline
- Single surface spline
- Half-lapped
Bending Members

Design properties available for out-of-plane loading
No design properties (not applicable) for in-plane loading

Typical Panel Connectors
Typical Panel Connectors

CLT Design: 2015 NDS

2015
1. General Requirements for Building Design
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14. Timber Rivets
15. Special Loading Conditions
16. Fire Design of Wood Members
Chapter 10 – Cross-Laminated Timber

10.1 General

10.1.1 Application
Chapter 10 applies to engineering design with performance-rated cross-laminated timber.

10.1.2 Definition
Cross-Laminated Timber (CLT) – a prefabricated engineered wood product consisting of at least three layers of solid-sawn lumber or structural composite lumber where the adjacent layers are cross-oriented and bonded with structural adhesive to form a solid wood element.

10.1.3 Standard Dimensions

10.1.4 Specification

Laminations: 5/8”-2” sawn lumber or SCL
Panel thickness: 20” max
In-Service MC: 16%

Graphics provided by FPInnovations
Chapter 10 – Cross-Laminated Timber

10.2 Reference Design Values

10.2.1 Reference Design Values

Reference design values for cross-laminated timber shall be obtained from the cross-laminated timber manufacturer’s literature or code evaluation report.

10.2.2 Design Section Properties

Reference design values shall be used with design section properties provided by the cross-laminated timber manufacturer based on the actual layup used in the manufacturing process.

10.3 Adjustment of Reference Design Values

10.3.1 General

Reference design values: \( F_d(A_{nom}) \), \( F_{d}(A_{nom}) \), \( F_{d}(Q_{u}) \), \( F_{d}(A_{nom}) = F_{d}(A) \), \( (E)_{lim} \), and \( (E)_{lim} \) provided in 10.2 shall be multiplied by the adjustment factors specified in Table 10.3.1 to determine adjusted design values: \( F_{d}(A_{nom}) \), \( F_{d}(A_{nom}) \), \( F_{d}(A) \), \( F_{d}(Q_{u}) \), \( F_{d}(A_{nom}) \), \( (E)_{lim} \), and \( (E)_{lim} \).

10.3.2 Load Duration Factor, \( c_0 \) (ASD only)

All reference design values except stiffness, \( (E)_{lim} \), \( (E)_{lim} \), and compression perpendicular to grain, \( F_{d}(A) \), shall be multiplied by load duration factor, \( c_0 \), as specified in 2.3.2.
NDS – Chapter 12

Seismic Design Options

- **ASCE 7 Minimum Design Loads for Buildings and Other Structures**

- **Response Modification Coefficient, R**
  - CLT not recognized system in ASCE 7 Table 12.2-1
  - Options
    - Performance-based design procedure per ASCE 7
    - Demonstrating equivalence to an existing ASCE 7 system
  - ASCE 7-10, FEMA P695, and FEMA P795
    - Quantification of Building Seismic Performance Factors; Component Equivalency Methodology

- **Research**
  - NEES-CLT - John Van de Lindt
  - FPInnovations
Shake Table Tests on 7-story Building

- Conducted at E-Defense
- Building weight 270t
  - Self weight 120t
  - Added weight 150t
- Panel thickness
  - 140 mm (5.5”) floors 1 and 2
  - 125 mm (4.9”) floors 3 and 4
  - 85 mm (3.3”) top 3 floors
- Wall panels length 2.3 m (7.5’)

Outline

- Overview & Building Code Allowances
- Glued-laminated Timber
- Cross-laminated Timber
- Fire
How is Fire-Resistance Provided?

- **IBC 703 Fire-Resistance Ratings and Fire Tests**
  - IBC Section 703.2 Tested assemblies tested in accordance with ASTM E119 or UL 263
- **IBC 703.3 Methods for determining fire resistance**
  - IBC Section 721 Deemed to comply tables (prescriptive)
  - IBC Section 722 Calculated Fire Resistance

**NOTE:** Type IV Construction – for other than the walls, HT – required dimensions have performance presumed to be adequate

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Fire Performance Glulam vs. Steel
Fire Performance of Wood vs. Steel

http://www.aiic-glulam.org/shopcart/Pdf/superior%20fire%20resistance.pdf

Chapter 16 – Fire (ASD)

- Fire resistance up to two hours
  - Columns
  - Beams
  - Tension Members
  - ASD only
- Products
  - Lumber
  - Glulam
  - SCL
  - Decking
  - CLT - NEW

SECTION 722
CALCULATED FIRE RESISTANCE

722.1 General. The provisions of this section contain procedures by which the fire resistance of specific materials or combinations of materials is established by calculation. These procedures apply only to the information contained in this section and shall not be otherwise used. The calculated fire resistance of concrete, concrete masonry and clay masonry assemblies shall be permitted in accordance with ACI 216.1/TMS 6216. The calculated fire resistance of steel assemblies shall be permitted in accordance with Chapter 5 of ASCE 19. The calculated fire resistance of exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/NAFMA National Design Specification for Wood Construction (NDS).
2015 NDS Methodology

- Chapter 16 - Fire Design of Wood Members
- Mechanics Based Model
- Supported by empirical data
- CLT & GLT

Chapter 16 - Calculated Resistance

- Fire resistance of exposed wood members may be calculated using the provisions of NDS Chapter 16
Typical Glulam Beam Layup

- 24F-V4 Doug Fir (12 Lamination Example)

  - 2 - L2 Dense Grade Outer Comp. Lams
  - 1 - L2 Grade Inner Comp. Lam
  - 6 - L3 Grade Core Lams
  - 1 - L2 Grade Inner Ten. Lam
  - 1 - L1 Grade Outer Tension Lams
  - 1 - 302-24 Outer Tension Lams

For 1-hour fire rated beam: substitute additional tension lam for core lam

Tension Lam Provisions

Fire Protection
Fire Rated Glulam

- **16.3 Wood Connections**
  - Where fire endurance is required, connectors and fasteners shall be protected from fire exposure
  - Wood
  - Fire-rated gypsum board
  - Coating

Connections
Chapter 16 – Fire Design - CLT

16.2.1.3 For cross-laminated timber, the effective char depth, \( a_{\text{char}} \), shall be calculated as follows:

\[
a_{\text{char}} = 1.2 \left( \frac{n_{\text{lum}} \cdot h_{\text{lum}} + \beta_0 \left( t - \left( n_{\text{lum}} \cdot t_{\text{g}} \right) \right)}{h_{\text{lum}}} \right)^{0.813} \left( \frac{1}{n_{\text{lum}}} \right)^{1.23}
\]

New

Table 16.2.1B Effective Char Depths (for CLT with \( \beta_0 = 1.5\text{in./hr.} \))

<table>
<thead>
<tr>
<th>Required Fire Endurance (hr.)</th>
<th>Effective Char Depth, ( a_{\text{char}} ) (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum thickness, ( h_{\text{min}} ) (in.)</td>
</tr>
<tr>
<td>1-Hour</td>
<td>2.2, 2.2, 2.1, 2.0, 2.0</td>
</tr>
<tr>
<td>1/2-Hour</td>
<td>3.4, 3.1, 3.0, 2.9, 2.8</td>
</tr>
<tr>
<td>2-Hour</td>
<td>4.4, 4.1, 4.0, 3.9, 3.8</td>
</tr>
</tbody>
</table>

Fire Tests


Fire Test

American Wood Council
ASTM E119 Fire Endurance Test
• 5-Ply CLT (approx. 7” thick)
• 5/8” Type X GWB each side
• Sought 2 hour rating
• RESULTS: 3 hours 6 minutes

GLT and CLT Adhesives

CLT- ANSI/APA PRG 320-2011 references ANSI/AITC 405-2008
GLT- ANSI/AITC 405-2008 – references D7247
GLT and CLT Adhesives

CLT-ANSI/APA PRG 320-2012 references ANSI/APA 405-2008
GLT - ANSI/APA 405-2008 – references D7247

TREET - Bergen, Norway

Under Construction
14 story
Architect: Artec
Structural Engineer: Sweco
Calculated Fire Resistance?

- Chapter 16 NDS
  - Charring Rate and Char Depth
  - Modified char depth model
  - Step-wise approach
Fire Performance

- Char layer
- Heated zone
- Cross-section used for calculating capacity

Calculated Fire Resistance?

- **Net section properties**

Typical one foot section
Chapter 16 – Fire (ASD)

Code Updates - Design of Fire-Resistive Exposed Wood Members

http://www.awc.org/publications/download.php

Chapter 16 – Fire (ASD)

Technical Report No. 10
- Background on NDS provisions
- Design examples
- Floor assembly lumber joist provisions

TR-10 currently being up-dated which will include CLT
Free download www.awc.org
Pedestrian Bridge, Burnaby, B.C.

Architect: Perkins+Will
Engineer: Fast+Epp
Photo Credit: Stephan Pasche
The Cathedral of Christ the Light
Oakland, CA

Design Team: Skidmore Owings & Merrill, Craig W. Harman
Webcor Builders
GLT Manf: Western Wood Structures
Photo Credit: Timothy Hursley, Cesar Rubio, and John Blaustein,
The Cathedral of Christ the Light
Oakland, CA

Condominiums, Chibougamau, Quebec

Architect: ABCP Architecture

Project Description

Location: Chibougamau
Date on Site: 2015-10-10
Materials Volume:
- CLT= 1950m²
- Glu-lam: 70m³
- Steel= 700 kg

Fabrication Time (Estimated): 3 weeks
Erection Time (Estimated): 7-8 weeks for the structure
Actual - 22 construction days (10 hours a day) - 5 men

Source: Nordic Engineered Wood
Private Army Hotel
Redstone Arsenal Huntsville, AL

Four stories 58,000 sq ft
Architect: Lend Lease

Franklin Elementary School
Franklin, WV

46,200 sq. ft.  8 week assembly
Architect: MSES Architects, Fairmont, WV

Source: LignaTerra
Franklin Elementary School

Scheduled completion date: Winter 2015

Private Army Hotel
Redstone Arsenal Huntsville, AL

Four stories 58,000 sq ft
Architect: Lend Lease
What’s next?

- **AWC is leading the building code effort to respond to the design community**
- **Strong desire for Sustainability Buildings**
  - Low carbon footprint
  - Energy Efficiency
  - Sustainable building materials
  - Renewable
  - Carbon storing
What’s next?

- Massive Timber Products
- Incorporates New Technology
- Basic Code Requirements needs revisiting
  - Protect Public Health, Safety and Well-being

Support Building Safety!

GLT and CLT in the 2018 IBC

- **510.12** (new) Special occupancy provision allowing up to 9 story CLT
  Stand-alone provisions for a special occupancy R-1/R-2 with height increase similar to other existing special occupancies (G165-15)

- **602.3** CLT in exterior walls of Type III
  Provides for CLT exterior walls in Type III construction (G172-15)

- **Structural Composite Lumber in Heavy Timber Construction**
  Reorganizes and clarifies the minimum dimensional requirements for sawn lumber, GLT, SCL, and CLT when used as an element of heavy timber construction (G178-15)

- **602.4** Concealed spaces in Type IV
  Provides for protected concealed spaces in Type IV construction (G181-15)

- **602.4 SCL elements in CLT exterior walls**
  Provides for GLT and SCL elements in exterior walls of Type IV CLT construction (G182-15)
Questions?

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info@awc.org