WoodWorks™
WOOD PRODUCTS COUNCIL

Timber's Role in Modern Urbanization

NESEA Building Energy Boston

Ricky McLain, PE, SE
Senior Technical Director
WoodWorks

T3 Minneapolis
Architect: MGA | Michael Green Architecture, DLR Group
Structural Engineer: Magnusson Klemencic Associates
Photo: Corey Gaffer courtesy Perkins + Will

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SLB
SOFTWOOD LUMBER BOARD

FOREST SERVICE
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Forestry Innovation Investment®

PROJECT SUPPORT AND CONVERSION

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_____

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

Due to their high strength, dimensional stability and positive environmental performance, mass timber building products are quickly becoming materials of choice for sustainably-minded designers. This presentation will review the environmental performance of mass timber products available, including glue-laminated timber (glulam), cross laminated timber (CLT) and nail laminated timber (NLT), and discuss applications such as seismic post-tensioned, self-centering rocking walls; tornado and blast-resistant structures; hurricane and high wind-resisting systems. We'll provide an overview of key 2021 IBC tall wood code proposals that would see an increase of up to 18 stories for mass timber buildings if approved. Topics will include new construction types, a regime of fire tests conducted to validate the proposals, and an update on the status of the changes.

Learning Objectives

1. Identify mass timber products available in North America and consider how they can be used under current building codes and standards.
2. Review completed mass timber projects that demonstrate a range of applications and system configurations.
3. Discuss benefits of using mass timber products, including structural versatility, prefabrication, lighter carbon footprint, and reduced labor costs.
4. Highlight possibilities for the expanded use and application of mass timber in larger and taller buildings.

TODAY'S AGENDA

MASS TIMBER CONSTRUCTION

MASS TIMBER

- WHAT IS IT – PRODUCTS
- WHY USE IT – APPEAL
- HOW DOES IT WORK – DESIGN TOPICS
- WHERE IS IT USED – CASE STUDIES
- WHAT'S NEXT?

HEAVY TIMBER

Federal Center South, Seattle, WA
Photo: Benjamin Benschneider

MASS TIMBER

Bullitt Center, Seattle, WA
Photo: John Stamets

GLULAM

CROSS-LAMINATED TIMBER (CLT)

NAIL-LAMINATED TIMBER (NLT)

DOWEL-LAMINATED TIMBER (DLT)

Photo: StructureCraft

Photo: StructureCraft

MASS PLYWOOD PANELS (MPP)

Photo: LEVER Architecture

DECKING

Photo: Bernard André Photography

OFFICES | MULTI-FAMILY | COMMERCIAL | EDUCATIONAL

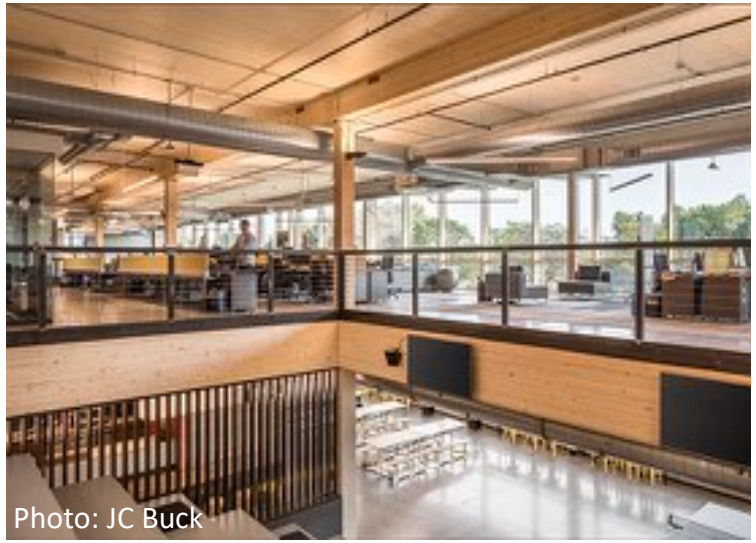


Photo: JC Buck


Photo: William Horne


Photo: LEVER Architecture


Photo: David Sundberg and Gray Organschi Architecture


Photo: ©Albert Vecerka/Esto


Photo: Christian Columbres

Mass Timber Projects In Design and Constructed in the US (December 2018)

Stage	Mass Timber	# of Projects
Construction Started / Built	CLT	85
	NLT	5
	DLT	4
	Heavy Timber Decking	44
	Post & Beam	39
	Total	177
In Design	CLT	141
	NLT	21
	DLT	3
	Heavy Timber Decking	35
	Post & Beam	110
	Total	310
Grand Total		487

AS OF DECEMBER 2018, 487 MASS TIMBER PROJECTS DESIGNED, UNDER CONSTRUCTION OR BUILT

	In Design	7
CT	Construction Started / Built	3
	In Design	5
DC	Construction Started / Built	2
	In Design	1
DE	In Design	1
FL	Construction Started / Built	15
	In Design	13
GA	In Design	11
HI	In Design	1
IA	In Design	1
ID	Construction Started / Built	1
	In Design	2
IL	Construction Started / Built	4
	In Design	10
IN	Construction Started / Built	1
KS	In Design	1
KY	Construction Started / Built	1
LA	In Design	1
MA	Construction Started / Built	15
	In Design	21
MD	Construction Started / Built	1
	In Design	6
ME	Construction Started / Built	1
	In Design	9
MI	Construction Started / Built	1
	In Design	2
MN	Construction Started / Built	1
	In Design	2
MO	Construction Started / Built	4
	In Design	4
NH	In Design	1
NJ	In Design	3
NM	In Design	1
NY	Construction Started / Built	5
	In Design	10
OH	Construction Started / Built	1
	In Design	3
OK	Construction Started / Built	1
	In Design	1
OR	Construction Started / Built	16
	In Design	20
PA	Construction Started / Built	2
	In Design	2
RI	Construction Started / Built	1
	In Design	1
SC	Construction Started / Built	5
	In Design	7
TN	Construction Started / Built	3
	In Design	2
TX	Construction Started / Built	12
	In Design	29
UT	Construction Started / Built	1
	In Design	1
VA	Construction Started / Built	1
	In Design	9
VT	Construction Started / Built	1
	In Design	7
WA	Construction Started / Built	17
	In Design	23
WI	Construction Started / Built	2
	In Design	13
WV	Construction Started / Built	2
WY	In Design	1

Considering mass timber for a project? Ask us anything.

For free project support, contact:
help@woodworks.org
woodworks.org/project-assistance

MASS TIMBER PRODUCTS

GLULAM

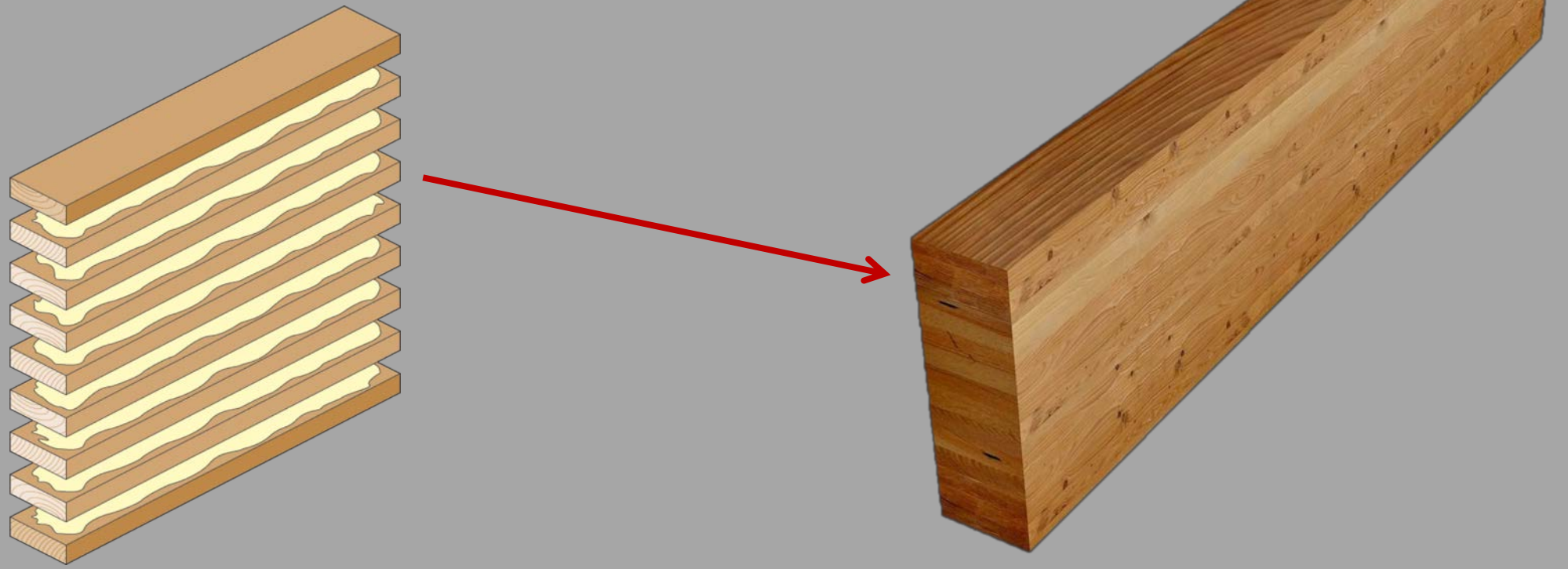
PHOTO CREDIT: ALEX SCHREYER

MASS TIMBER PRODUCTS

GLULAM

GLULAM = A STRUCTURAL COMPOSITE OF LUMBER AND ADHESIVES

- RECOGNIZED IN IBC 2303.1.3 USING ANSI/AITC A 190.1 AND ASTM D 3737
- CAN BE USED FOR FLOOR, ROOF PURLINS, BEAMS, ARCHES, COLUMNS



RADIATOR BUILDING

PORTLAND, OR

PHOTO CREDIT: JOSH PARTEE

RADIATOR BUILDING

PORTLAND, OR

PHOTO CREDIT: JOSH PARTEE

BUILDING INFO:

OFFICE BUILDING

5 STORIES

36,000 SF

COMPLETED 2015

FLEXIBILITY OF SPANS AND SHAPES

RICHMOND OLYMPIC OVAL, RICHMOND, BC, CANADA
DESIGN TEAM: CANNON DESIGN ARCHITECTURE, FAST ± EPP, GLOTMAN SIMPSON
PHOTO CREDIT: STEPHANIE TRACEY, CRAIG CARMICHAEL, JON PESOCHIN, KK LAW CREATIVE,
ZIGGY WELSCH


104’ SPAN GLULAM ARCHES
GLULAM PURLINS @ 4’ O.C
LEMAY AMERICA AUTO MUSUEM
PHOTO CREDIT: WESTERN WOOD STRUCTURES

NAIL LAMINATED TIMBER

PHOTO CREDIT: STRUCTURECRAFT

MASS TIMBER PRODUCTS

NAIL-LAMINATED TIMBER (NLT) PANELS

NAIL-LAMINATED TIMBER (NLT) =

A STRUCTURAL PANEL OF SQUARE-EDGED DIMENSIONAL LUMBER LAMINATIONS (USUALLY 2X) SET ON EDGE AND NAILED WIDE FACE TOGETHER

- RECOGNIZED IN IBC 2304.8.3 (MECHANICALLY LAMINATED DECKING)
- NDS 15.1.1 PROVIDES DISTRIBUTION FACTORS FOR CONCENTRATED LOADS
- CAN BE USED FOR FLOOR, ROOF DECKING. OCCASIONALLY USED FOR SHAFT WALLS

MASS TIMBER PRODUCTS

NAIL-LAMINATED TIMBER (NLT) PANELS

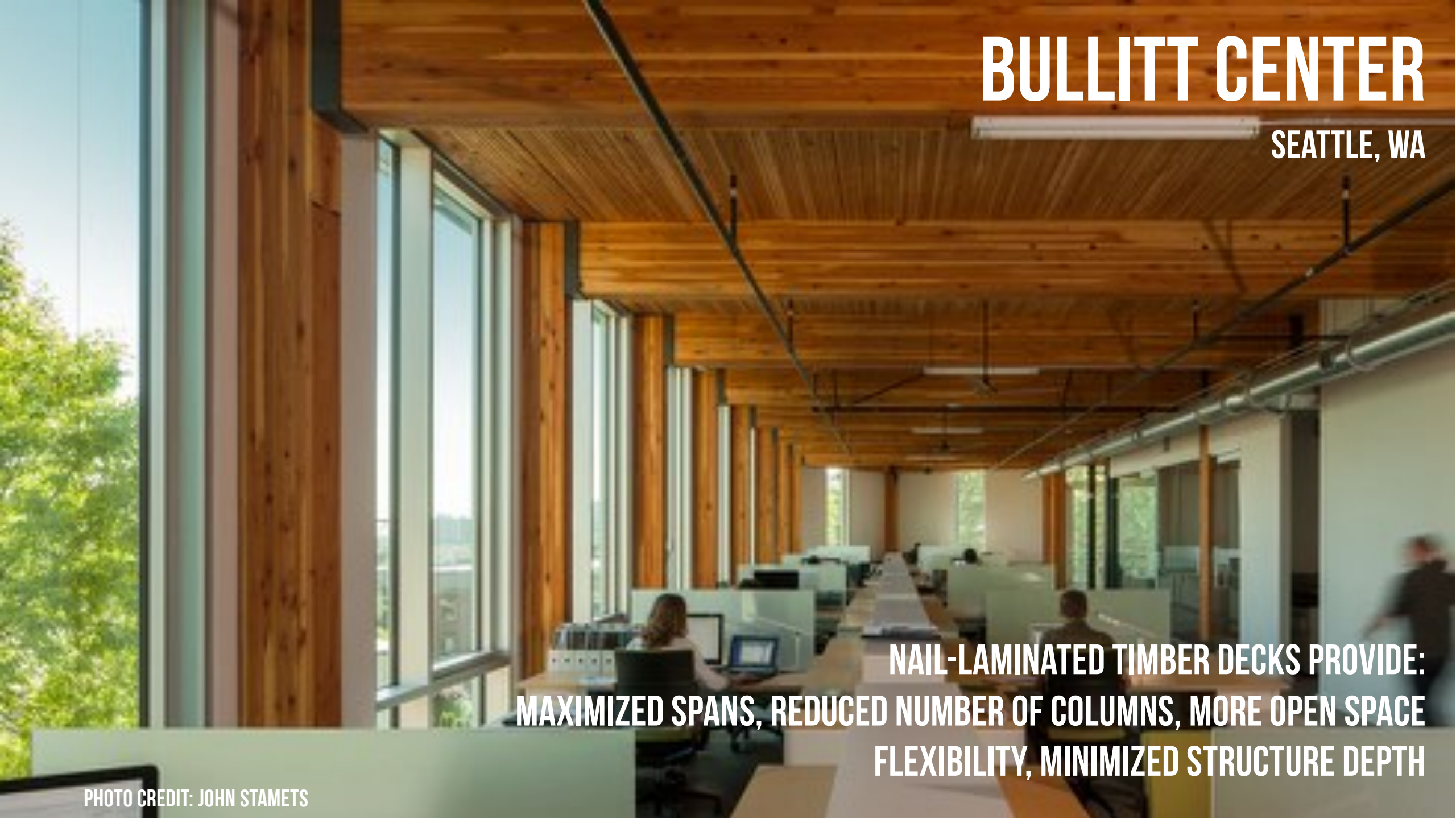
NLT SHRINKAGE/EXPANSION DESIGN:

RULE OF THUMB: LEAVE ONE PLY OUT PER 8’-10’ WIDE PANEL

BULLITT CENTER

SEATTLE, WA

PHOTO CREDIT: BULLITT CENTER



BULLITT CENTER

SEATTLE, WA

NAIL-LAMINATED TIMBER DECKS PROVIDE:
MAXIMIZED SPANS, REDUCED NUMBER OF COLUMNS, MORE OPEN SPACE
FLEXIBILITY, MINIMIZED STRUCTURE DEPTH

PHOTO CREDIT: JOHN STAMETS

MASS TIMBER PRODUCTS

DOWEL-LAMINATED TIMBER (DLT) PANELS

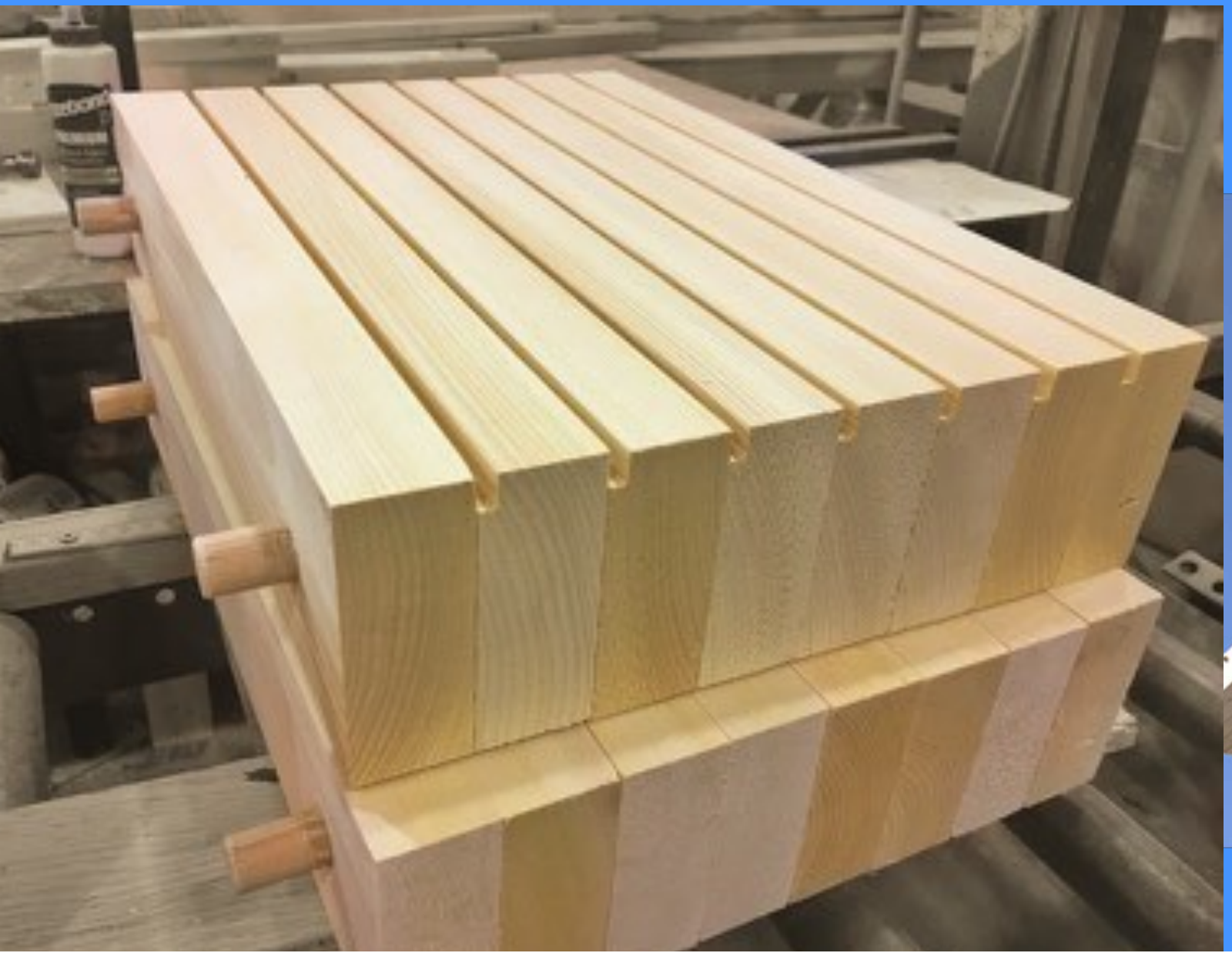


PHOTO CREDIT: STRUCTURECRAFT

MASS TIMBER PRODUCTS

GLUE-LAMINATED TIMBER (GLT) PANELS

PHOTO CREDIT: STRUCTURE FUSION

PHOTO CREDIT: UNALAM

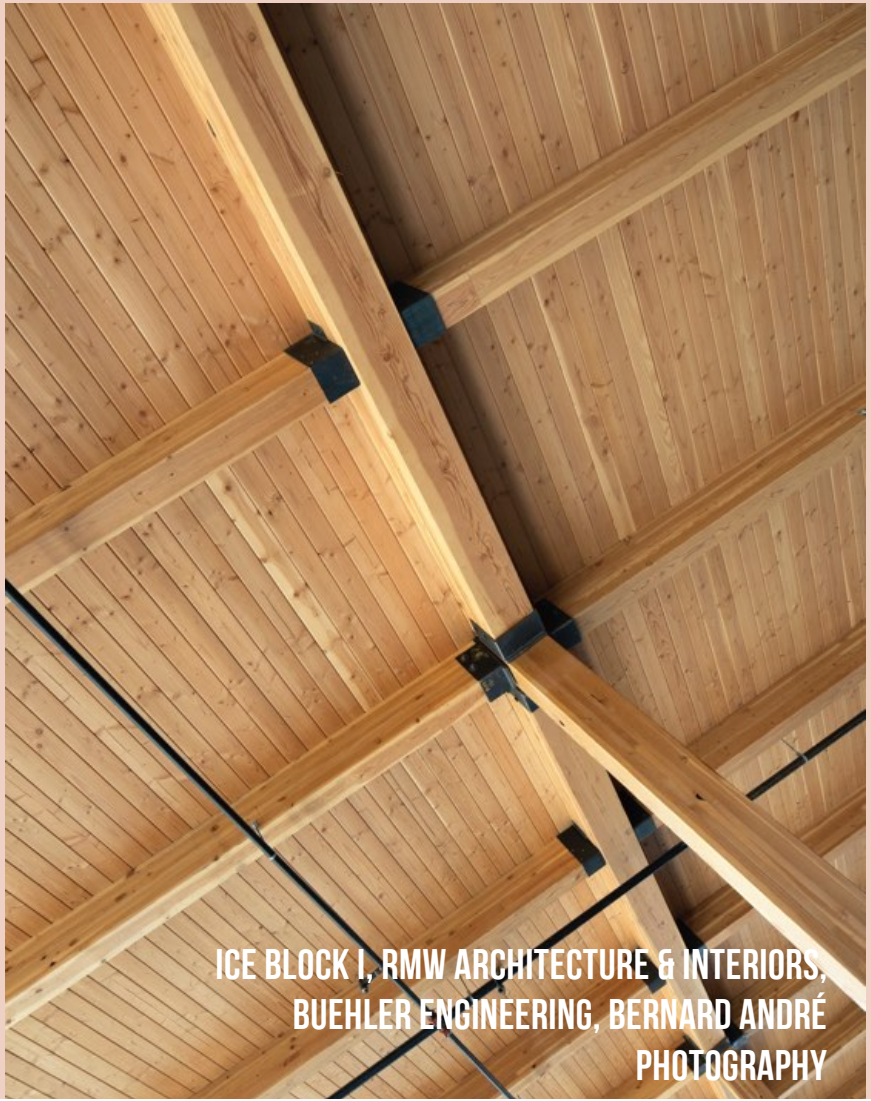
MASS TIMBER PRODUCTS

TONGUE AND GROOVE DECKING

TONGUE AND GROOVE DECKING:

2X, 3X OR 4X SOLID OR LAMINATED WOOD DECKING LAID FLAT WITH INTERLOCKING TONGUE AND GROOVE ON NARROW (SIDE) FACE

- RECOGNIZED IN IBC 2304.8 (LUMBER DECKING)
- 2X USUALLY HAS A SINGLE T&G; 3X AND 4X USUALLY HAVE A DOUBLE T&G
- 6” AND 8” ARE COMMON WIDTHS
- CAN BE USED FOR FLOOR, ROOF DECKING



ICE BLOCK I, RMW ARCHITECTURE & INTERIORS, BUEHLER ENGINEERING, BERNARD ANDRÉ PHOTOGRAPHY

ICE BLOCK I

SACRAMENTO, CA

ICE BLOCK I, RMW ARCHITECTURE & INTERIORS, BUEHLER ENGINEERING, BERNARD ANDRÉ PHOTOGRAPHY

ICE BLOCKS

SACRAMENTO, CA

PHOTO CREDIT: RMW ARCHITECTURE

PHOTO CREDIT: WOODWORKS

MASS TIMBER PRODUCTS

CROSS-LAMINATED TIMBER (CLT)

MASS TIMBER PRODUCTS

CROSS-LAMINATED TIMBER (CLT)

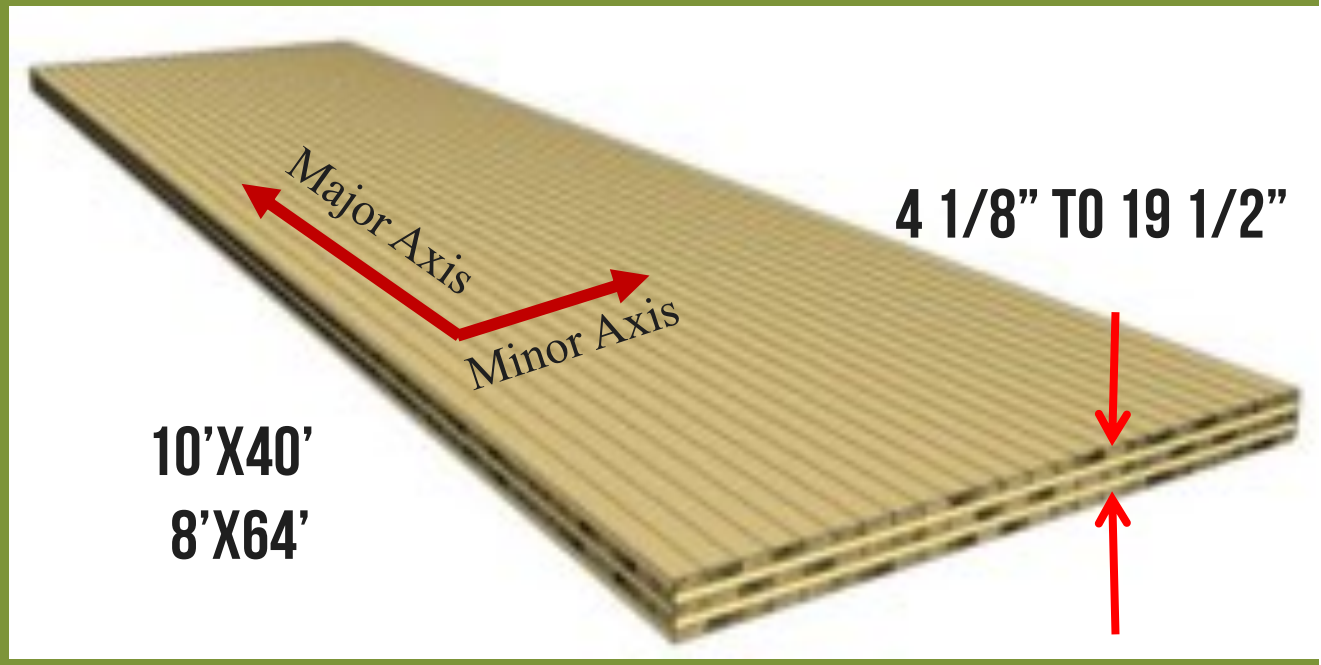
WHAT IS CLT?

SOLID WOOD PANEL

3 LAYERS MIN. OF SOLID SAWN LAMS

90 DEG. CROSS-LAMS

SIMILAR TO PLYWOOD SHEATHING



FIRST TECH CREDIT UNION

HILLSBORO, OR

5 STORIES

156,000 SF

ARCHITECT: HACKER

IMAGE CREDIT: STRUCTURLAM

FIRST TECH CREDIT UNION

HILLSBORO, OR

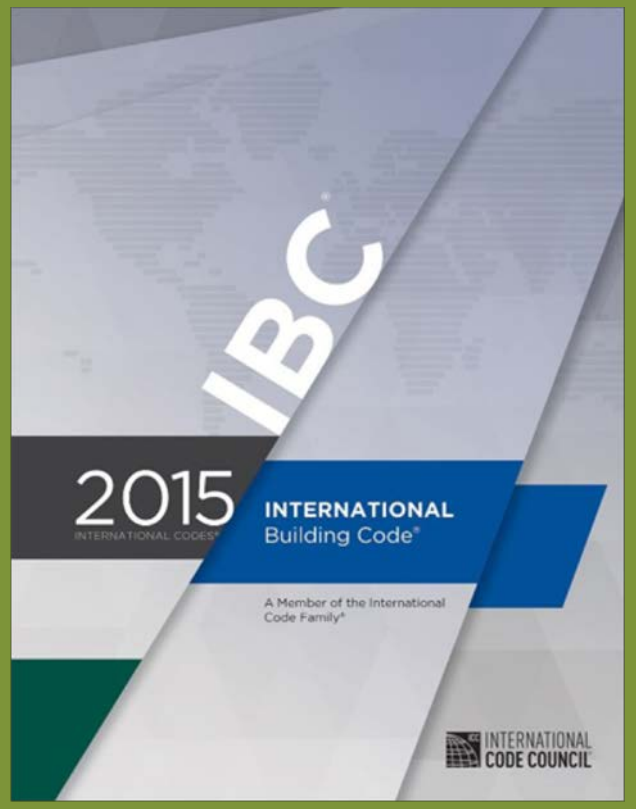
ARCHITECT: HACKER
IMAGE CREDIT: STRUCTURLAM

MASS TIMBER PRODUCTS

CROSS-LAMINATED TIMBER (CLT)

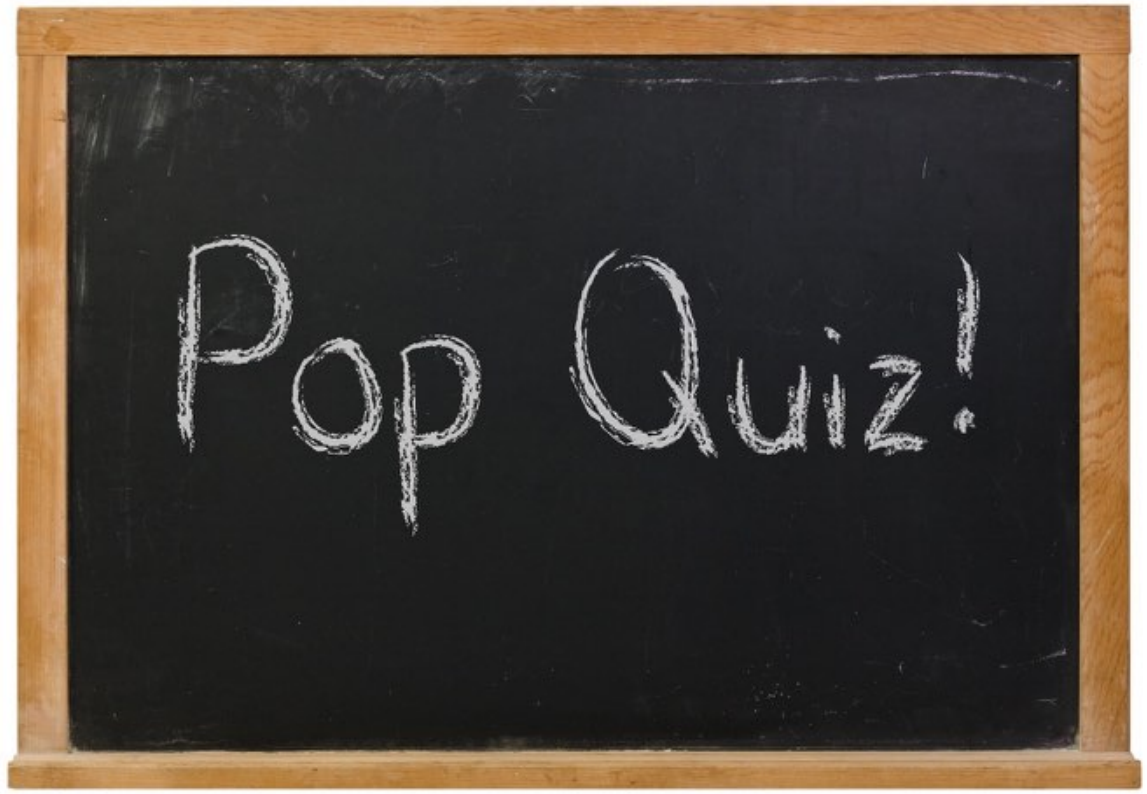
IN 2015 IBC, CLT IS NOW DEFINED IN CHAPTER 2 DEFINITIONS:

[BS] CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of not less than 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.



AND IS REFERENCED IN CHAPTER 23:

2303.1.4 Structural glued cross-laminated timber. Cross-laminated timbers shall be manufactured and identified in accordance with ANSI/APA PRG 320.



MASS TIMBER DESIGN

CONSTRUCTION TYPES

Q: OF THE 5 CONSTRUCTION TYPES, WHICH ONES CAN MASS TIMBER BE USED IN?

A: ALL 5!

CONSTRUCTION TYPES

IBC 602

IBC DEFINES 5 CONSTRUCTION TYPES: I, II, III, IV AND V
A BUILDING MUST BE CLASSIFIED AS ONE OF THESE

CONSTRUCTION TYPES I & II:
ALL ELEMENTS REQUIRED TO BE NON-COMBUSTIBLE MATERIALS

HOWEVER, THERE ARE EXCEPTIONS INLCUDING SEVERAL FOR MASS TIMBER

CONSTRUCTION TYPES

IBC 602

ALL WOOD FRAMED BUILDING OPTIONS:

TYPE III

EXTERIOR WALLS NON-COMBUSTIBLE (MAY BE FRTW)

INTERIOR ELEMENTS ANY ALLOWED BY CODE, INCLUDING MASS TIMBER

TYPE V

ALL BUILDING ELEMENTS ARE ANY ALLOWED BY CODE, INCLUDING MASS TIMBER

TYPES III AND V ARE SUBDIVIDED TO A (PROTECTED) AND B (UNPROTECTED)

TYPE IV (HEAVY TIMBER)

EXTERIOR WALLS NON-COMBUSTIBLE (MAY BE FRTW OR CLT)

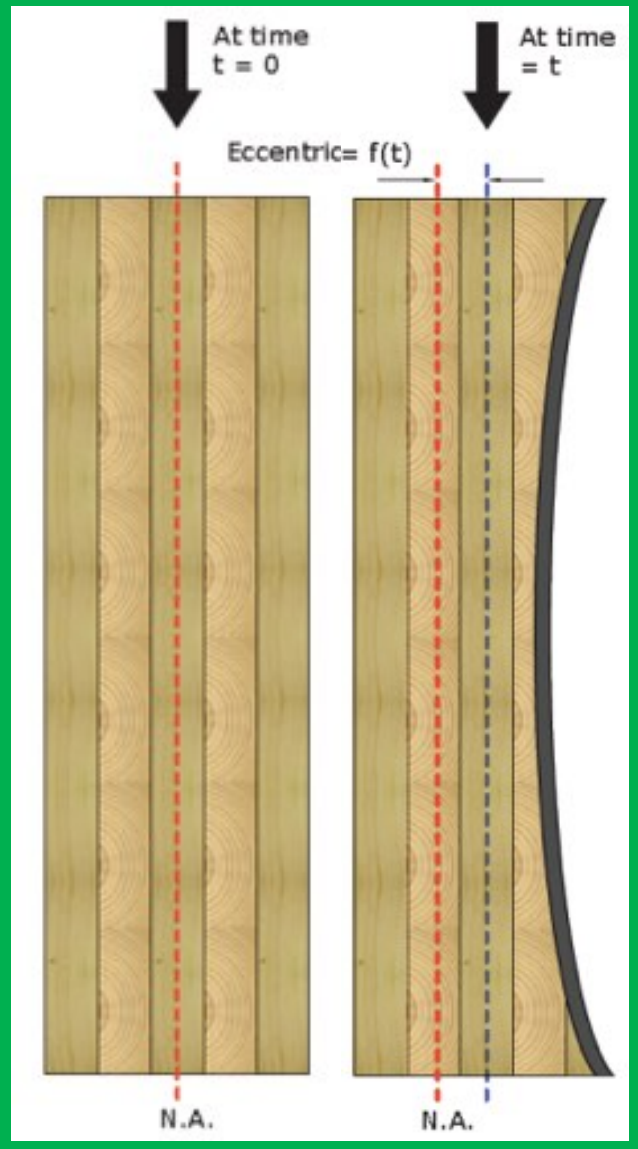
INTERIOR ELEMENTS QUALIFY AS HEAVY TIMBER (MIN. SIZES, NO CONCEALED SPACES)

FIRE RESISTANCE

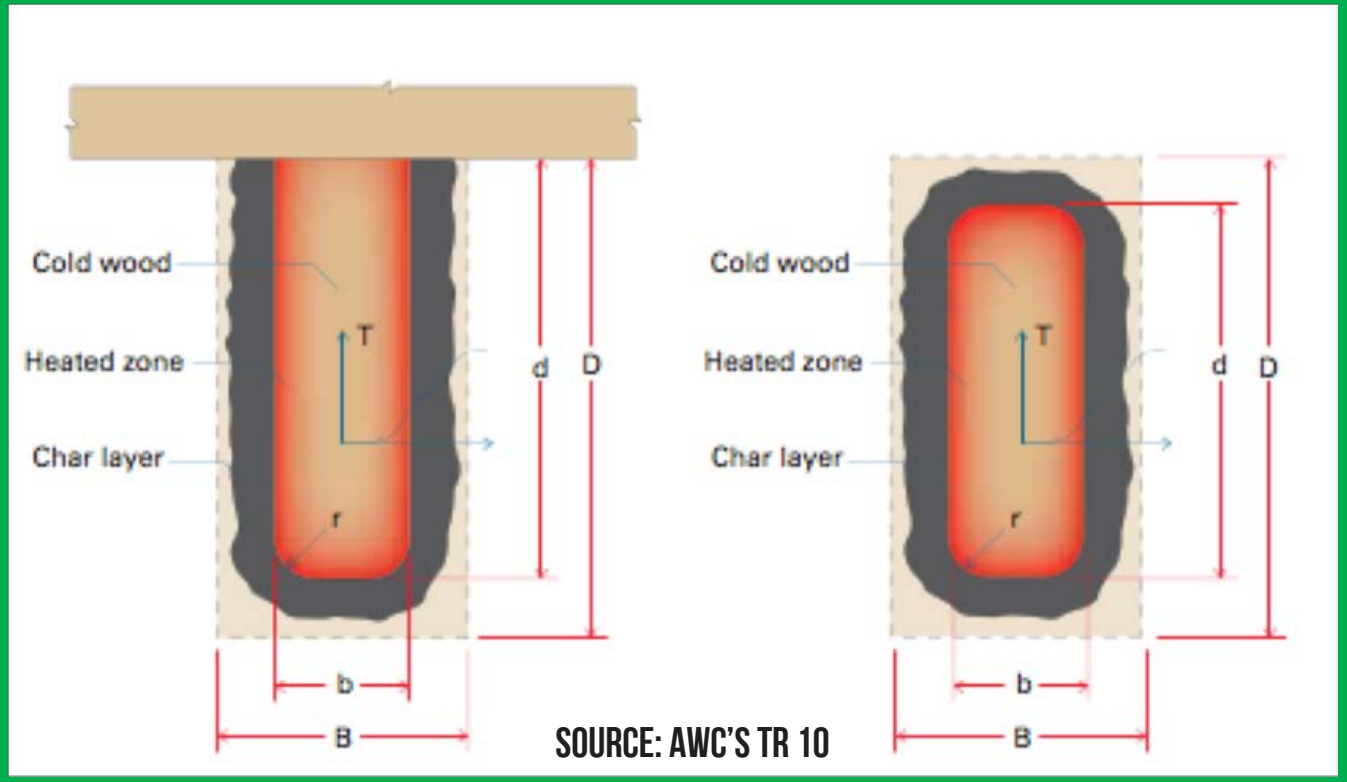
PHOTO CREDIT: FP INNOVATIONS

MASS TIMBER DESIGN

FIRE RESISTANCE



SIMILAR TO HEAVY TIMBER, MASS TIMBER PRODUCTS HAVE INHERENT FIRE RESISTANCE PROPERTIES



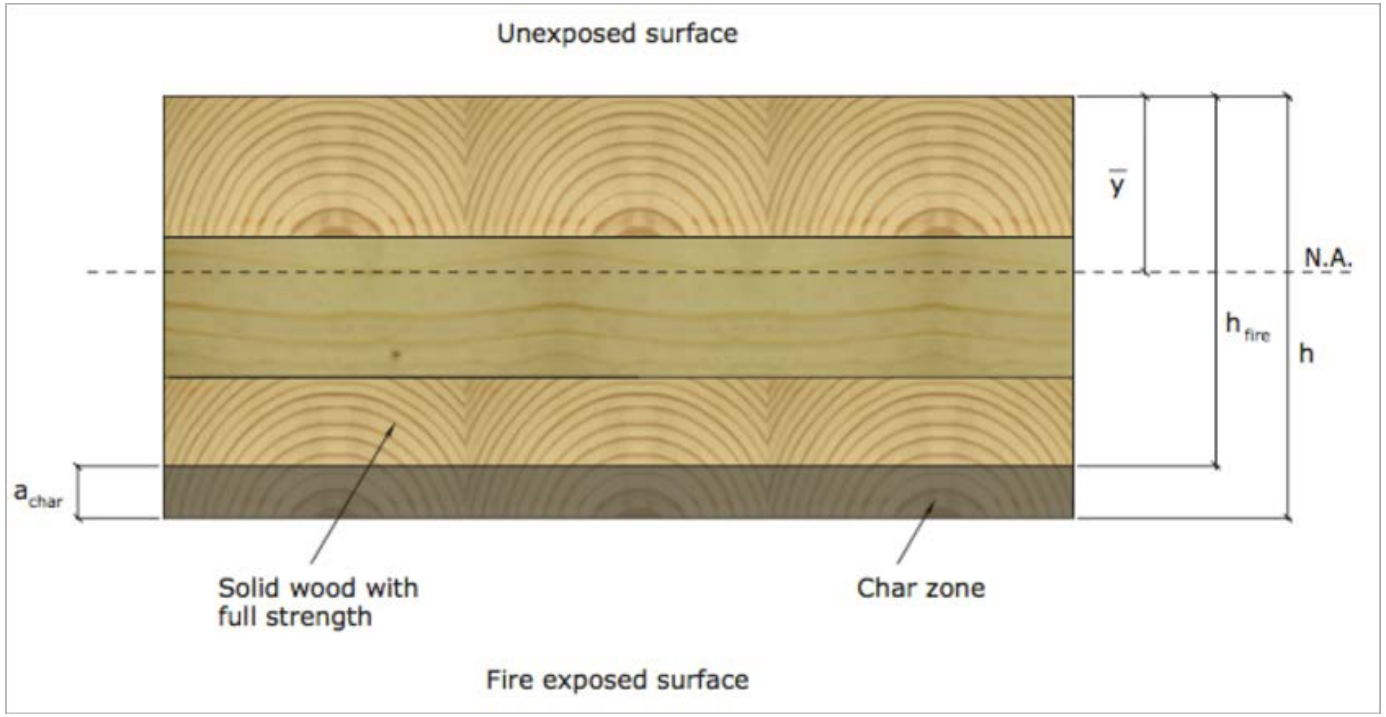
SOURCE: AWC'S TR 10

MT Fire Resistance Ratings (FRR)

How do you determine FRR of MT?

2 Options:

1. **Calculations in Accordance with IBC 722 → NDS Chapter 16**
2. **Tests in Accordance with ASTM E119**



MT Fire Resistance Ratings (FRR)

MT FRR Calculations Method:

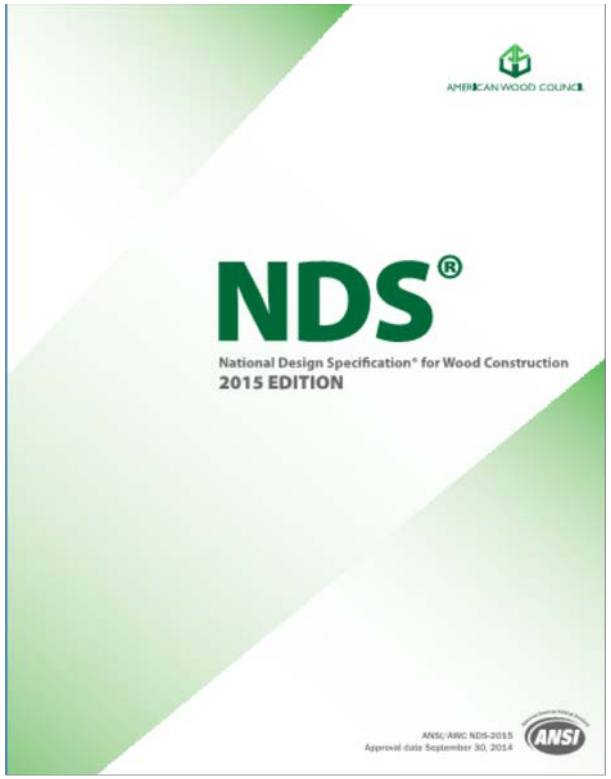
- IBC 703.3 allows several methods of determining FRR. One is calculations per 722.
- 722.1 refers to NDS Chpt 16 for exposed wood FRR

703.3 Methods for determining fire resistance. The application of any of the methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E119 or UL 263. The required *fire resistance* of a building element, component or assembly shall be permitted to be established by any of the following methods or procedures:

3. Calculations in accordance with Section 722.

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 calculations. 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 0216. The calculated *fire resistance* of steel assemblies shall be permitted in accordance with Chapter 5 of ASCE 29. The calculated *fire resistance* of exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/AF&PA *National Design Specification for Wood Construction (NDS)*.

MT Fire Resistance Ratings (FRR)



NDS Chapter 16 includes calculation of fire resistance of NLT, CLT, Glulam, Solid Sawn and SCL wood products

Table 16.2.1B Effective Char Depths (for CLT with β_n=1.5in./hr.)

Required Fire Endurance (hr.)	Effective Char Depths, a_{char} (in.) lamination thicknesses, h_{lam} (in.)								
	5/8	3/4	7/8	1	1-1/4	1-3/8	1-1/2	1-3/4	2
1-Hour	2.2	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.8
1½-Hour	3.4	3.2	3.1	3.0	2.9	2.8	2.8	2.8	2.6
2-Hour	4.4	4.3	4.1	4.0	3.9	3.8	3.6	3.6	3.6

MT Fire Resistance Ratings (FRR)

Nominal char rate of 1.5”/HR is recognized in NDS. Effective char depth calculated to account for duration, structural reduction in heat-affected zone

Table 16.2.1A Char Depth and Effective Char Depth (for β_n = 1.5 in./hr.)

Required Fire Resistance (hr.)	Char Depth, a_{char} (in.)	Effective Char Depth, a_{eff} (in.)
1-Hour	1.5	1.8
1½-Hour	2.1	2.5
2-Hour	2.6	3.2

Table 16.2.1B Effective Char Depths (for CLT with β_n=1.5in./hr.)

Required Fire Endurance (hr.)	Effective Char Depths, a_{char} (in.) lamination thicknesses, h_{lam} (in.)								
	5/8	3/4	7/8	1	1-1/4	1-3/8	1-1/2	1-3/4	2
1-Hour	2.2	2.2	2.1	2.0	2.0	1.9	1.8	1.8	1.8
1½-Hour	3.4	3.2	3.1	3.0	2.9	2.8	2.8	2.8	2.6
2-Hour	4.4	4.3	4.1	4.0	3.9	3.8	3.6	3.6	3.6

MT Fire Resistance Ratings (FRR)

Tested Assemblies Method:

- Many successful Mass Timber ASTM E119 fire tests have been completed by industry & manufacturers


NGC Testing Services

Fire Testing Laboratory

ACCREDITED Testing Laboratory TL-216

TEST REPORT

Page 1 of 53

for

American Wood Council

222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

Standard Methods of
Fire Tests of Building Construction and Materials
ASTM E 119 – 11a

Test Report No: WP-1950

Assignment No: K-1089

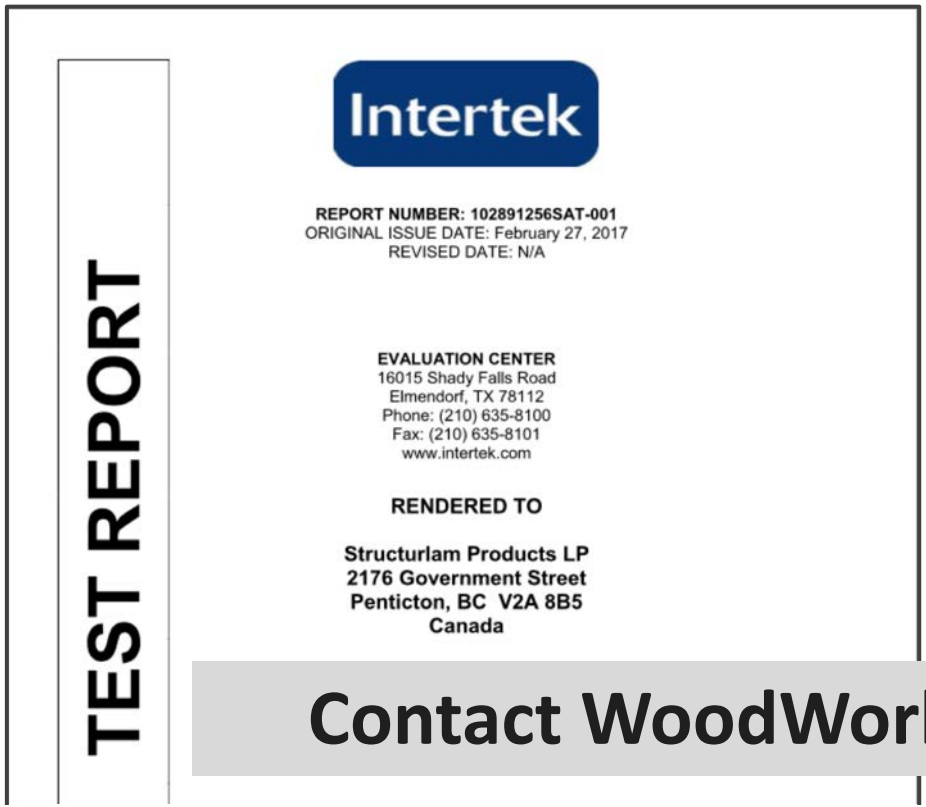
Subject Material: Cross-Laminated Timber and Gypsum Board Wall Assembly (Load-Bearing)

Test Date: October 4, 2012

Report Date: October 15, 2012

Prepared by:
Michael J. Rizzo
Test Engineer

Reviewed by:
Robert J. Merchetti
Director, Laboratory Facilities and Testing Services


TEST REPORT

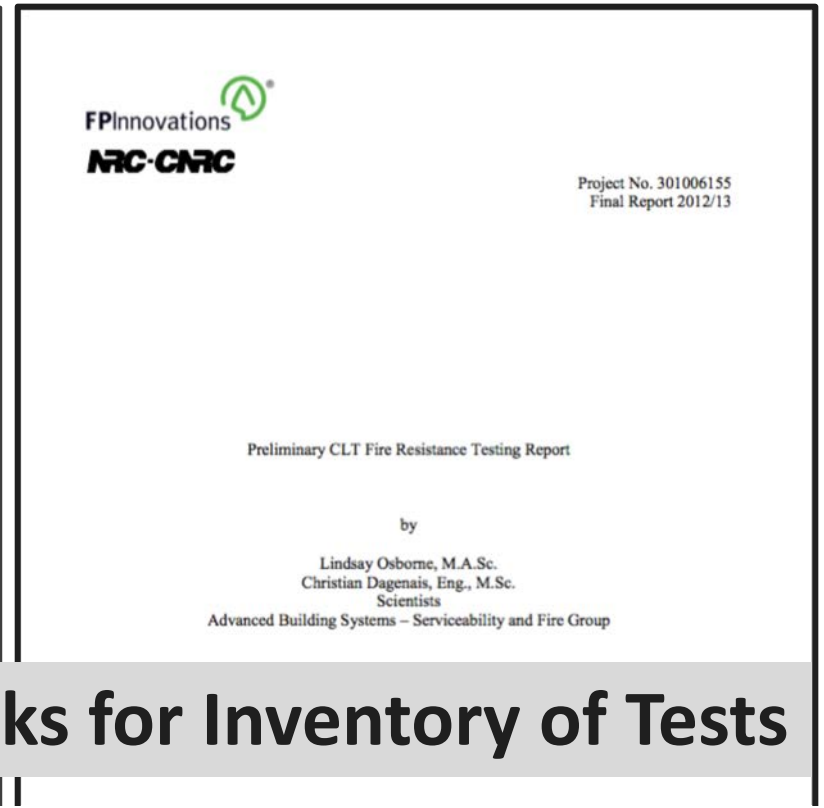
Intertek

REPORT NUMBER: 102891256SAT-001
ORIGINAL ISSUE DATE: February 27, 2017
REVISED DATE: N/A

EVALUATION CENTER
16015 Shady Falls Road
Elmendorf, TX 78112
Phone: (210) 635-8100
Fax: (210) 635-8101
www.intertek.com

RENDERED TO

Structurlam Products LP
2176 Government Street
Penticton, BC V2A 8B5
Canada


FPInnovations
NRC·CNRC

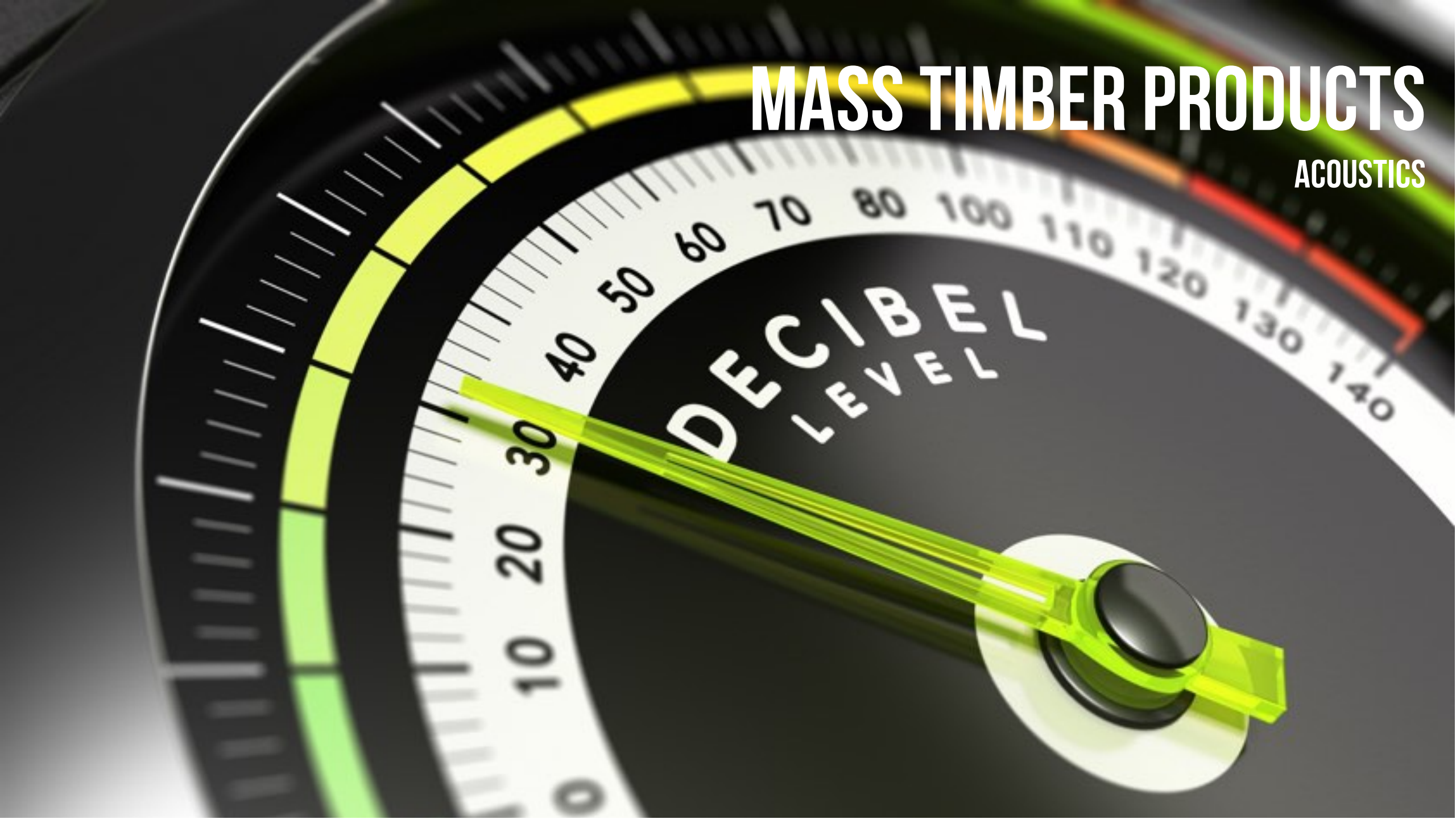
Project No. 301006155
Final Report 2012/13

Preliminary CLT Fire Resistance Testing Report

by

Lindsay Osborne, M.A.Sc.
Christian Dagenais, Eng., M.Sc.
Scientists
Advanced Building Systems – Serviceability and Fire Group

Contact WoodWorks for Inventory of Tests



MASS TIMBER PRODUCTS

ACOUSTICS

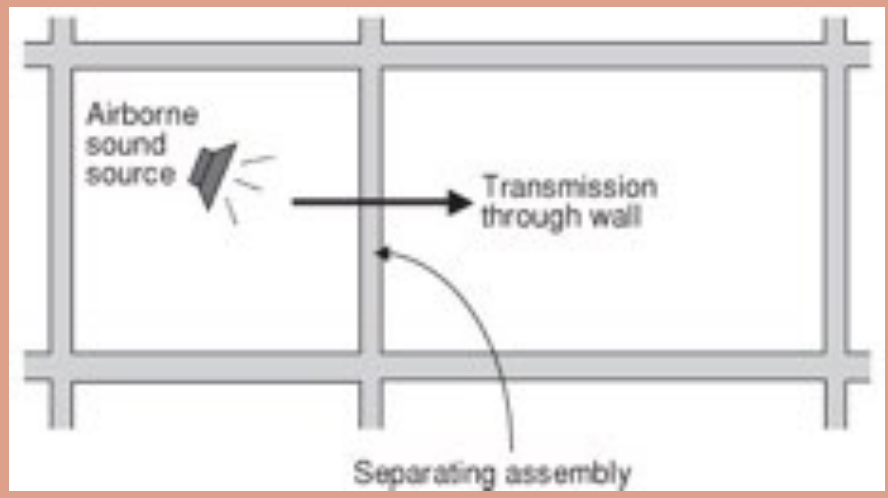
MASS TIMBER DESIGN

ACOUSTICS

AIR-BORNE SOUND:

- SOUND TRANSMISSION CLASS (STC)

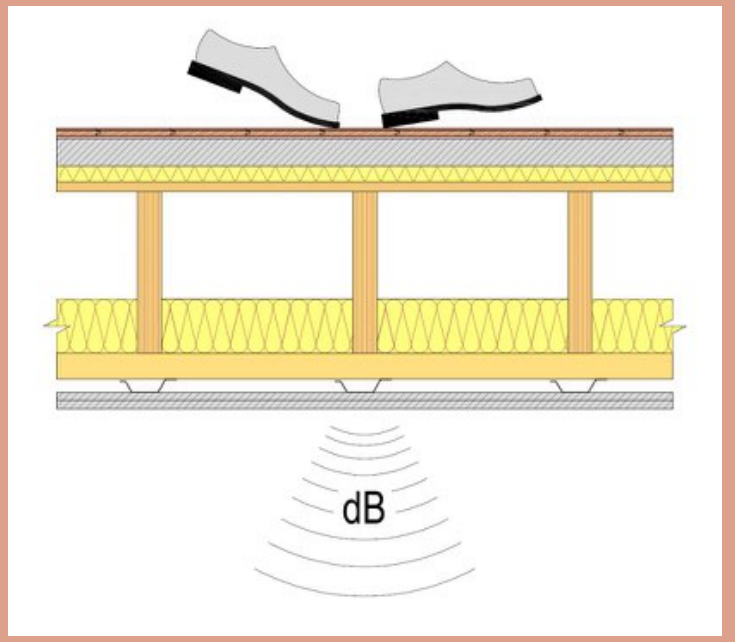
MEASURES HOW EFFECTIVELY AN ASSEMBLY ISOLATES AIR-BORNE SOUND AND REDUCES THE LEVEL THAT PASSES FROM ONE SIDE TO THE OTHER



STRUCTURE-BORNE SOUND:

- IMPACT INSULATION CLASS (IIC)

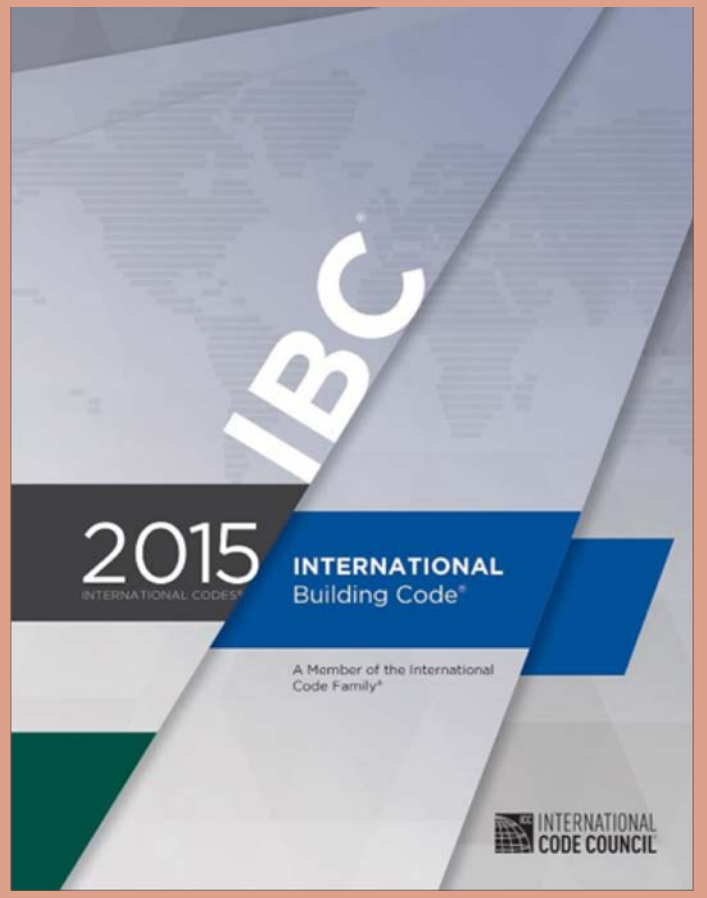
EVALUATES HOW EFFECTIVELY AN ASSEMBLY BLOCKS IMPACT SOUND FROM PASSING THROUGH IT



MASS TIMBER DESIGN

ACOUSTICS – IBC 1207

NO ACOUSTICAL CODE REQUIREMENTS FOR MANY MASS TIMBER BUILDING TYPES SUCH AS OFFICES AND ASSEMBLY. HOWEVER, MANY OWNERS REQUIRE A MINIMUM LEVEL OF PERFORMANCE



CODE REQUIREMENTS FOR RESIDENTIAL OCCUPANCIES:

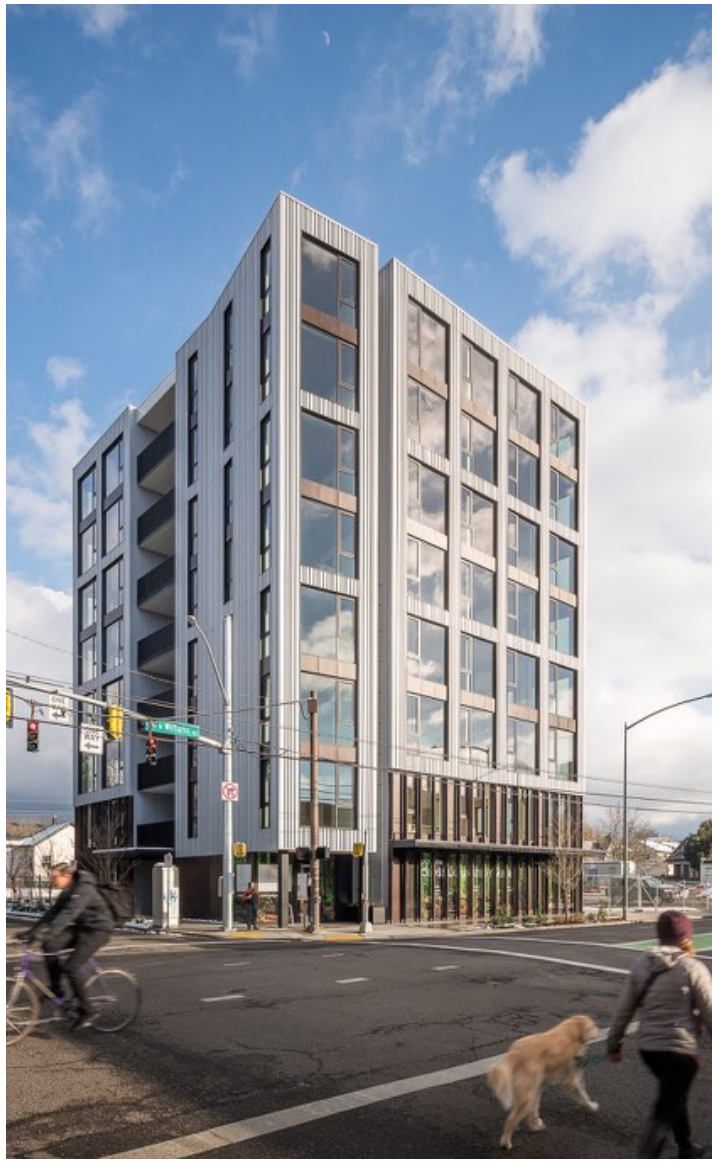
MIN. STC OF 50 (45 IF FIELD TESTED):

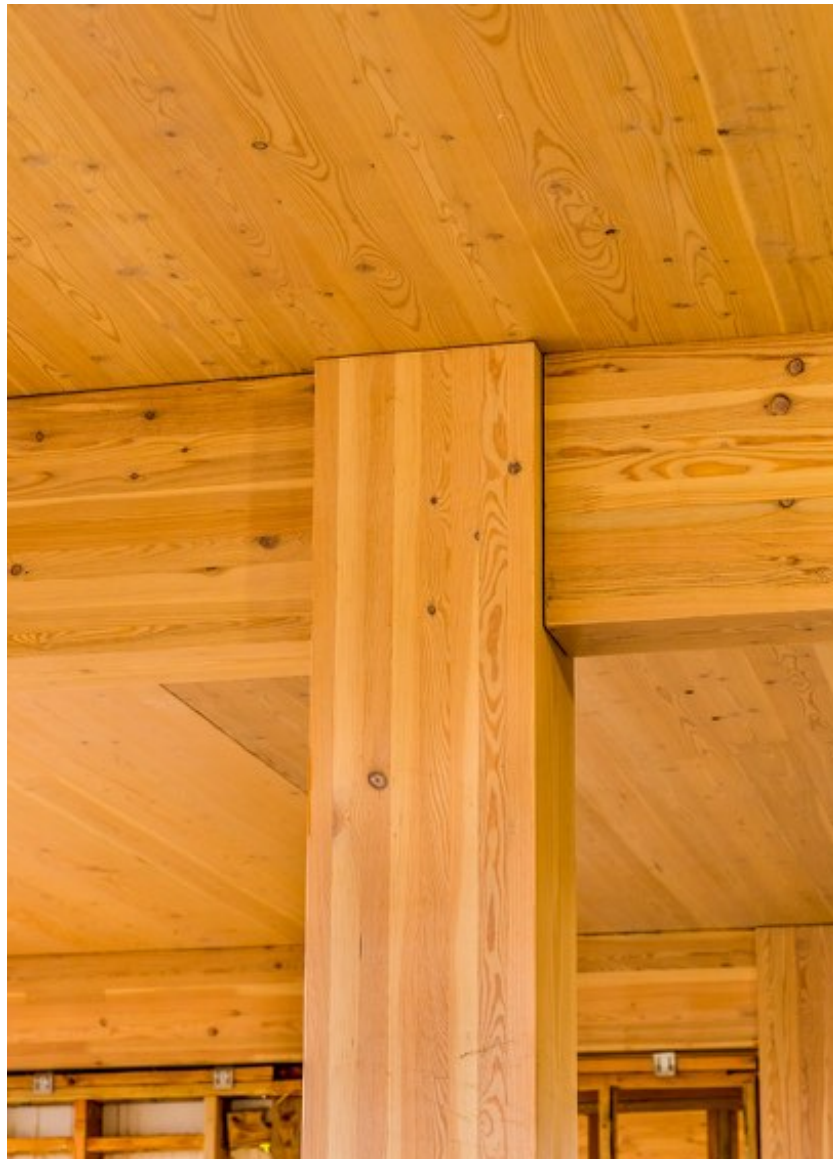
- WALLS, PARTITIONS, AND FLOOR/CEILING ASSEMBLIES

MIN. IIC OF 50 (45 IF FIELD TESTED) FOR:

- FLOOR/CEILING ASSEMBLIES

Mass Timber: Structure Often is Finish





Photos: Baumberger Studio/PATH Architecture/Marcus Kauffman | Architect: PATH Architecture

Mass Timber Acoustics

TABLE 1:

Examples of Acoustically-Tested Mass Timber Panels

Mass Timber Panel	Thickness	STC Rating	IIC Rating
3-ply CLT wall[4]	3.07"	33	N/A
5-ply CLT wall[4]	6.875"	38	N/A
5-ply CLT floor[5]	5.1875"	39	22
5-ply CLT floor[4]	6.875"	41	25
7-ply CLT floor[4]	9.65"	44	30
2x4 NLT wall[6]	3-1/2" bare NLT 4-1/4" with 3/4" plywood	24 bare NLT 29 with 3/4" plywood	N/A
2x6 NLT wall[6]	5-1/2" bare NLT 6-1/4" with 3/4" plywood	22 bare NLT 31 with 3/4" plywood	N/A
2x6 NLT floor + 1/2" plywood[2]	6" with 1/2" plywood	34	33

Source: Inventory of Acoustically-Tested Mass Timber Assemblies, WoodWorks[7]

Mass Timber Acoustics

<u>Concrete Slab:</u>
6” Thick
80 PSF
STC 53

<u>CLT Slab:</u>
6-7/8” Thick
18 PSF
STC 41

Mass Timber Acoustics

There are three main ways to improve an assembly's acoustical performance:

1. Add mass
2. Add noise barriers
3. Add decouplers

Mass Timber Acoustics

Solutions Paper

WoodWorks™
WOOD PRODUCTS COUNCIL

Acoustics and Mass Timber: Room-to-Room Noise Control

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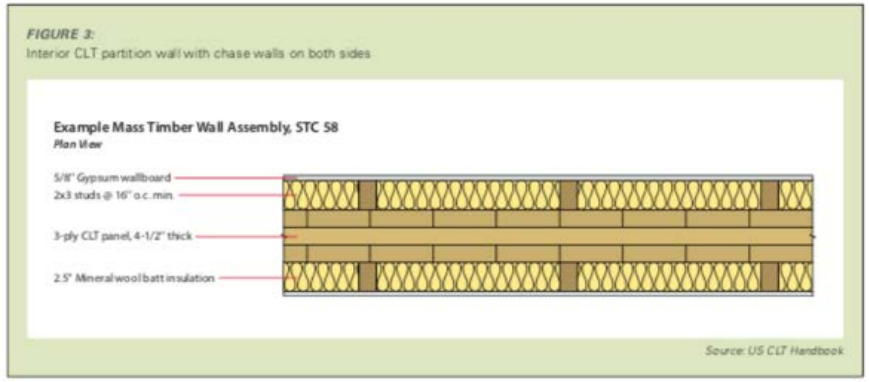
Design Assist + Build: StructureCraft

The growing availability and code acceptance of mass timber—i.e., large solid wood panel products such as cross-laminated timber (CLT) and nail-laminated timber (NLT)—for floor, wall and roof construction has given designers a low-carbon alternative to steel, concrete, and masonry for many applications. However, the use of mass timber in multi-family and commercial buildings presents unique acoustic challenges.

While laboratory measurements of the impact and airborne sound isolation of traditional building assemblies such as light wood-frame, steel and concrete are widely available, fewer resources exist that quantify the acoustic performance of mass timber assemblies. Additionally, one of the most desired aspects of mass timber construction is the ability to leave a building's structure exposed as finish, which creates the need for asymmetric assemblies. With careful design and detailing, mass timber buildings can meet the acoustic performance expectations of most building types.

http://www.woodworks.org/wp-content/uploads/wood_solution_paper-MASS-TIMBER-ACOUSTICS.pdf

FIGURE 3:
Interior CLT partition wall with chase walls on both sides



Source: US CLT Handbook

Mass Timber Assembly Options: Walls

Mass timber panels can also be used for interior and exterior walls—both bearing and non-bearing. For interior walls, the need to conceal services such as electrical and plumbing is an added consideration. Common approaches include building a chase wall in front of the mass timber wall or installing gypsum wallboard on resilient channels that are attached to the mass timber wall. As with bare mass timber floor panels, bare mass timber walls don't typically provide adequate noise control, and chase walls also function as acoustical improvements. For example, a 3-ply CLT wall panel with a thickness of 3.07" has an STC rating of 33.[4] In contrast, Figure 3 shows an interior CLT partition wall with chase walls on both sides. This assembly achieves an STC rating of 58, exceeding the IBC's acoustical requirements for multi-family construction. Other examples are included in the inventory of tested assemblies noted above.

Acoustical Differences between Mass Timber Panel Options

The majority of acoustically-tested mass timber assemblies include CLT. However, tests have also been done on other mass timber panel options such as NLT and dowel-laminated timber (DLT), as well as traditional heavy timber options such as tongue and groove decking. Most tests have concluded that CLT acoustical performance is slightly better than that of other mass timber options, largely because the cross-orientation of laminations in a CLT panel limits sound flanking.

For those interested in comparing similar assemblies and mass timber panel types and thicknesses, the inventory noted above contains tested assemblies using CLT, NLT, glued-laminated timber panels (GLT), and tongue and groove decking.

Improving Performance by Minimizing Flanking

Even when the assemblies in a building are carefully designed and installed for high acoustical performance, consideration of flanking paths—in areas such as assembly intersections, beam-to-column/wall connections, and MEP penetrations—is necessary for a building to meet overall acoustical performance objectives.

One way to minimize flanking paths at these connections and interfaces is to use resilient connection isolation and sealant strips. These products are capable of resisting structural loads in compression between structural members and connections while providing isolation and breaking hard, direct connections between members. In the context of the three methods for improving acoustical performance noted above, these strips act as decouplers. With airtight connections, interfaces and penetrations, there is a much greater chance that the acoustic performance of a mass timber building will meet expectations.

Acoustical isolation strips

Photos: Rothoblaas

Table 1: CLT Floor Assemblies with Concrete/Gypsum Topping, Ceiling Side Exposed

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CLT Panel	Concrete/Gypsum Topping	Acoustical Mat Product Between CLT and Topping	Finish Floor	STC[1]	IIC[1]	Source
CLT 5-ply (6.875")	1-1/2" Gyp-Crete®	Maxxon Acousti-Mat® 3/4	None	47[2] ASTC	47[2] AIIC	1
			LVT	-	49[2] AIIC	
			Carpet + Pad	-	75[2] AIIC	
			LVT on Acousti-Top®	-	52[2] AIIC	
			Eng Wood on Acousti-Top®	-	51[2] AIIC	
		Maxxon Acousti-Mat® ¾ Premium	None	49[2] ASTC	45[2] AIIC	
			LVT	-	47[2] AIIC	
			LVT on Acousti-Top®	-	49[2] AIIC	
	1-1/2" Levelrock® Brand 2500	USG SAM N25 Ultra	None	45[6]	39[6]	15
			LVT	48[6]	47[6]	16
			LVT Plus	48[6]	49[6]	58
			Eng Wood	47[6]	47[6]	59
			Carpet + Pad	45[6]	67[6]	60
			Ceramic Tile	50[6]	46[6]	61
		Soprema® Insonomat	None	45[6]	42[6]	15
			LVT	48[6]	44[6]	16
			LVT Plus	48[6]	47[6]	58
			Eng Wood	47[6]	45[6]	59
			Eng Wood	47[6]	49[6]	59

More than 400 Tested Assemblies

http://bit.ly/mass-timber-assemblies