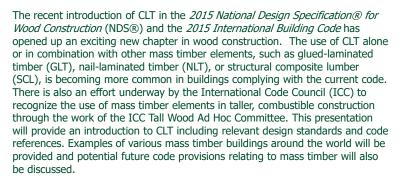




Description

Cross-laminated timber (CLT) has been in use worldwide for over 15 years, but most notably in Europe. Building with CLT has increased in popularity for many reasons including: just-in-time fabrication and job site delivery, speed and efficiency in construction, reduced job site noise and on-site labor force, substitution of high embodied materials with a renewable resource that sequesters carbon, and creating a living or work space that has the aesthetics of exposed wood.

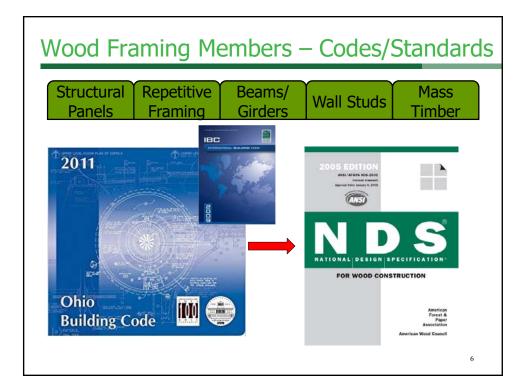


Learning Objectives

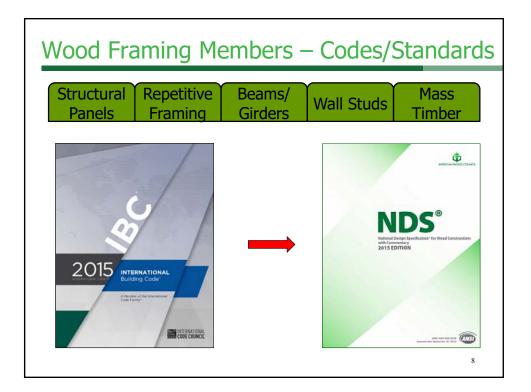
At the end of this program, participants will be better able to

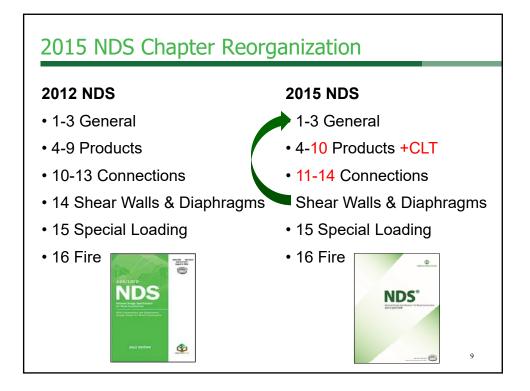
- 1. Differentiate between mass timber and light frame construction
- 2. Define cross-laminated timber (CLT)
- 3. Identify code and standard updates relevant to CLT and other mass timber elements
- Recognize notable mass timber structures around the world
- 5. Understand how wood performs in fire conditions
- 6. Comprehend current tall wood building code developments and resources

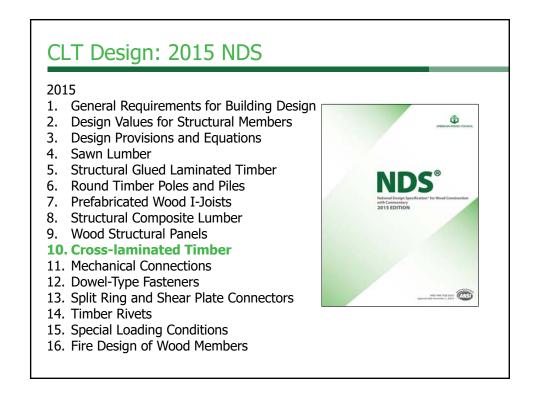


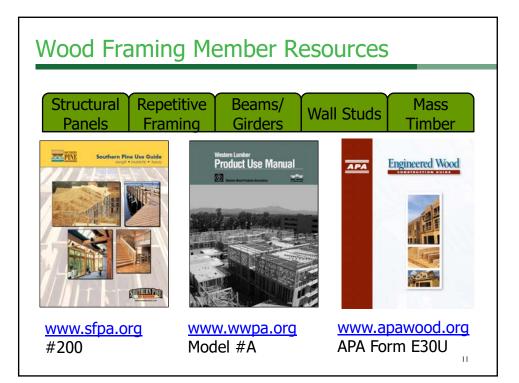






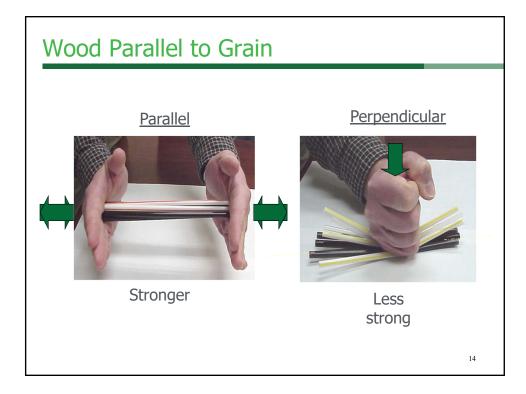


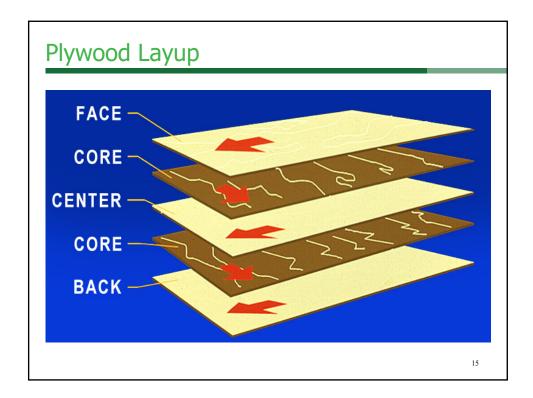


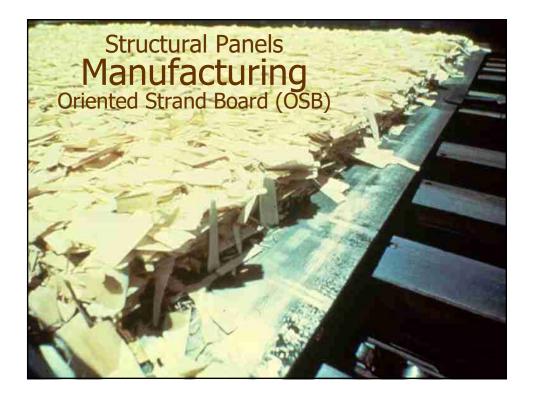




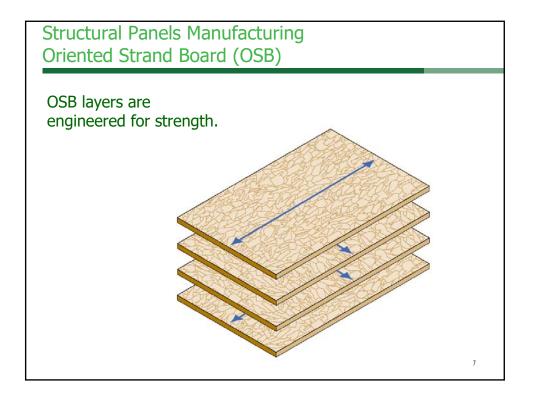


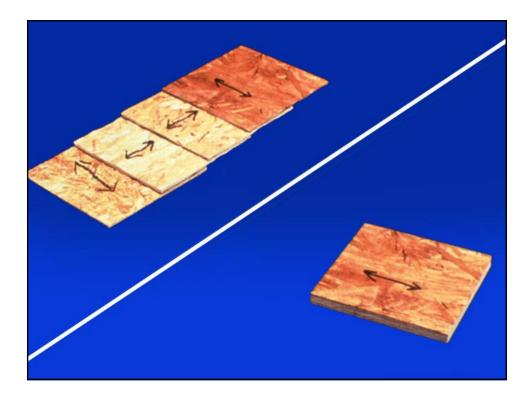


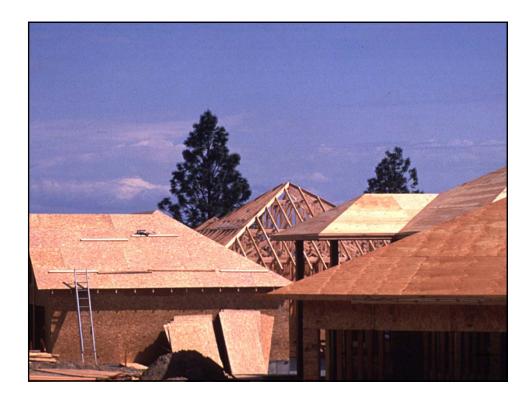


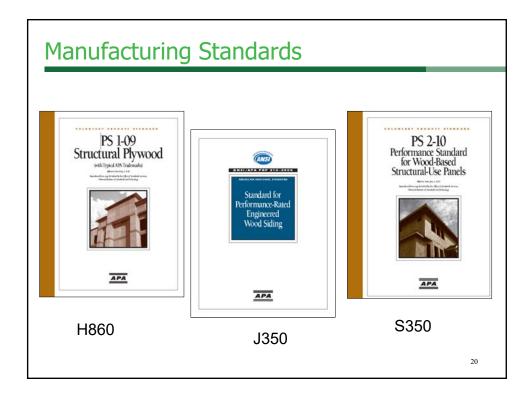


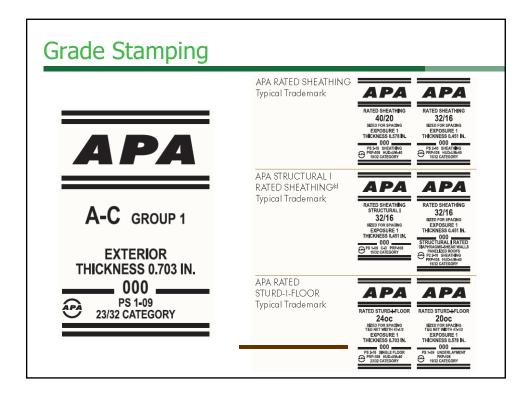
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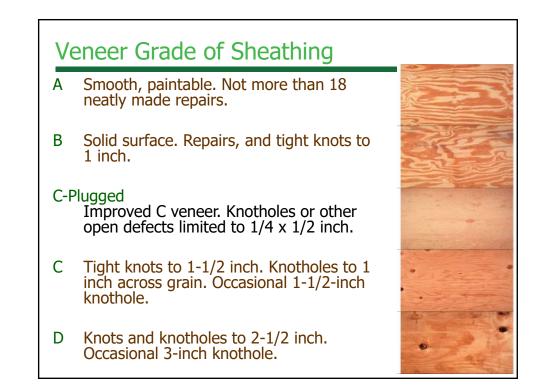


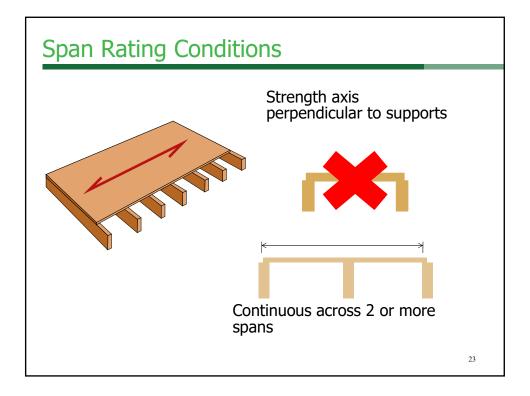


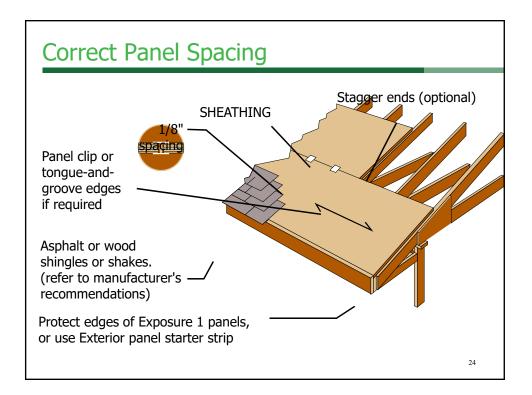






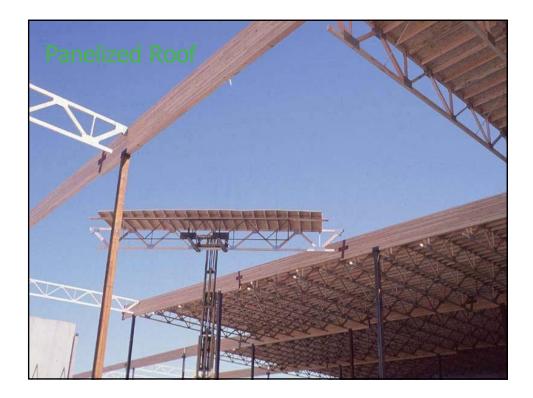


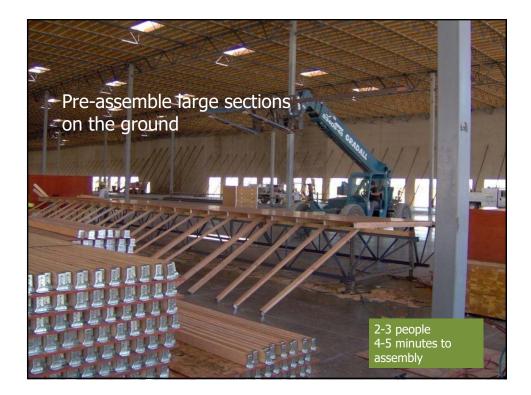






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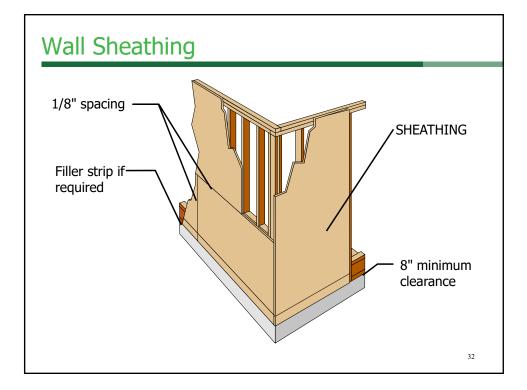


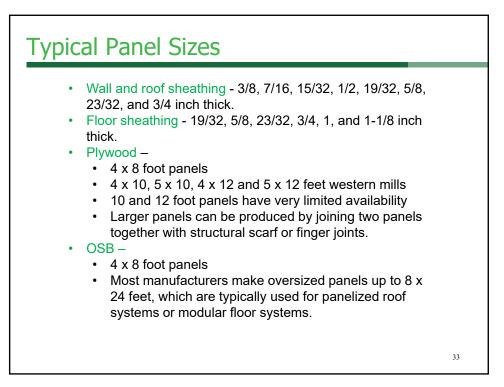






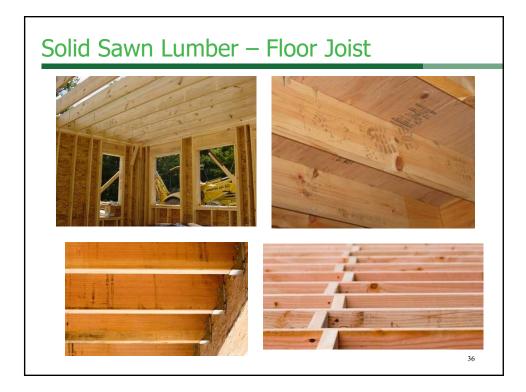


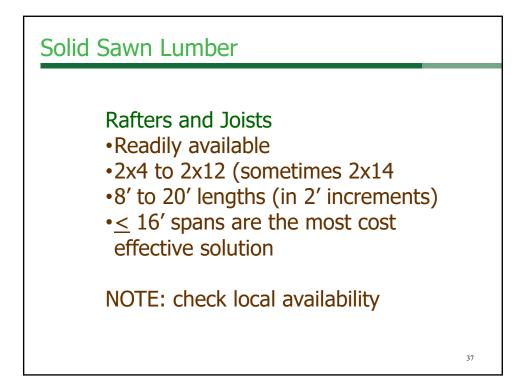




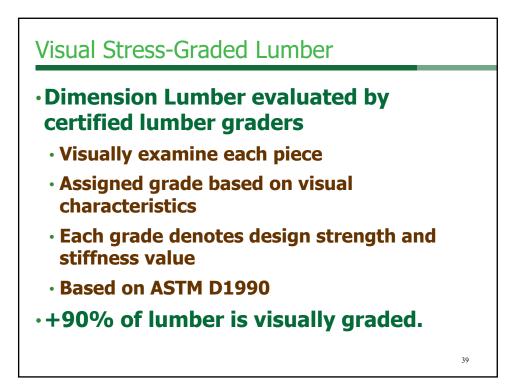


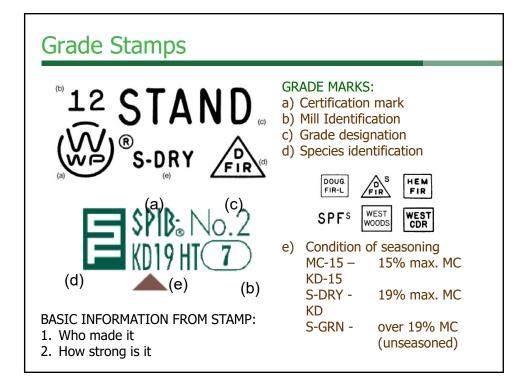


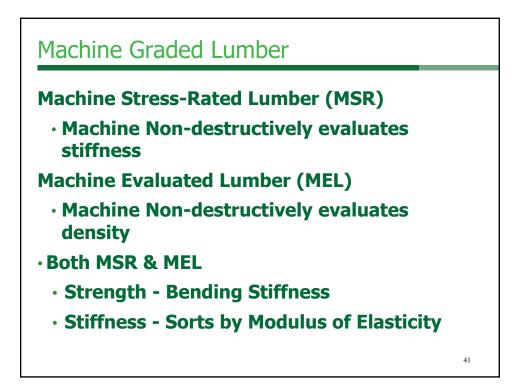


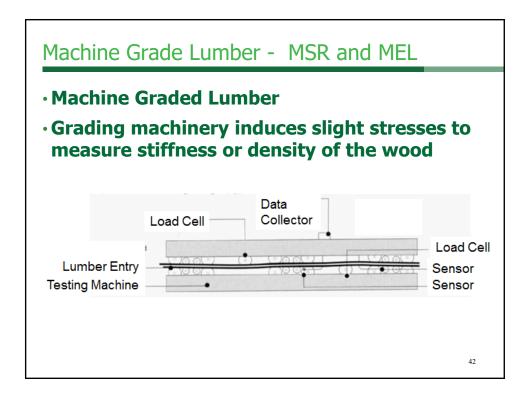


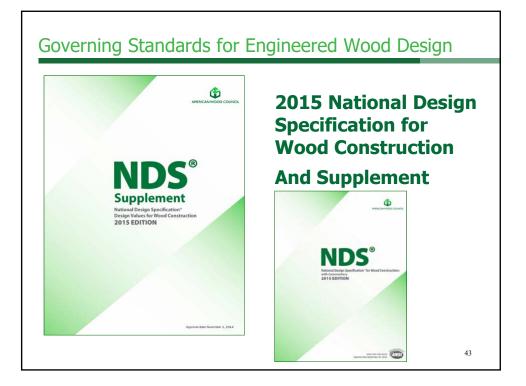


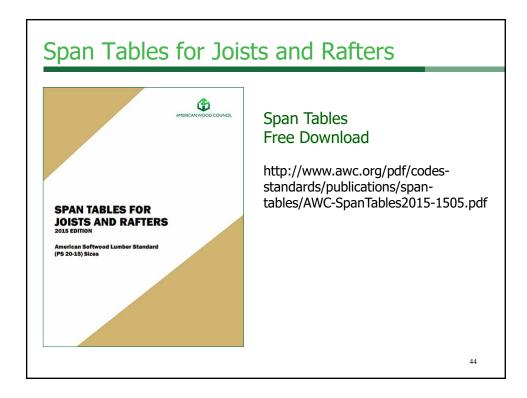


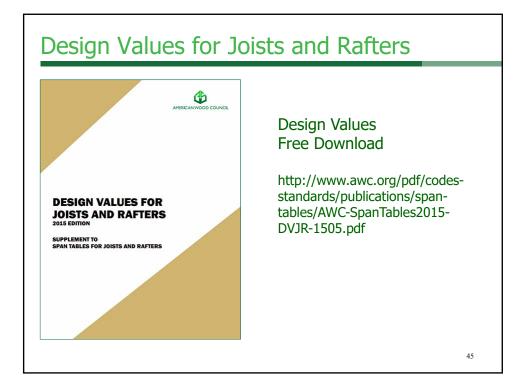


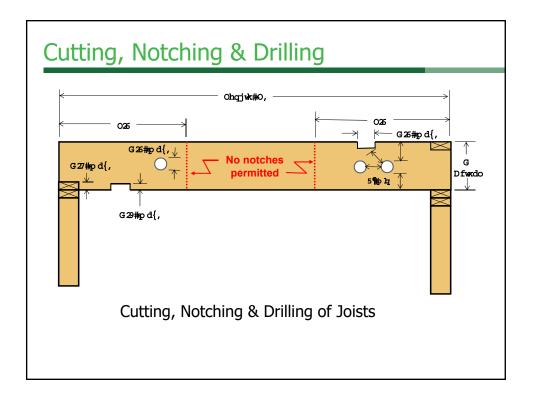


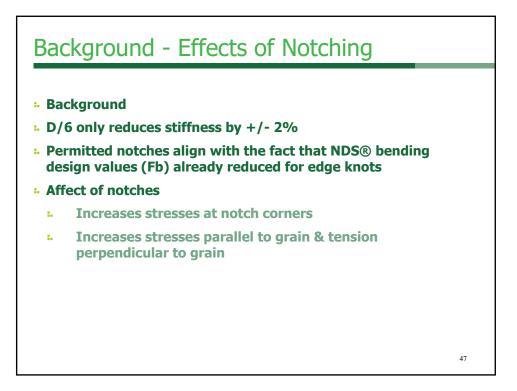


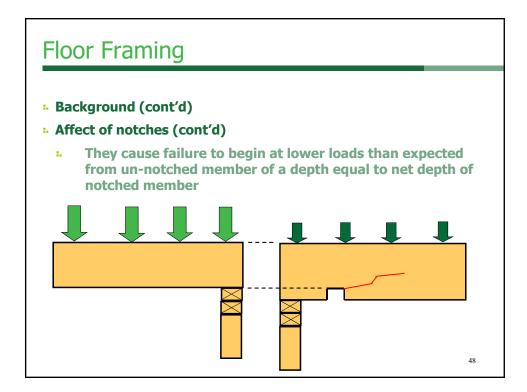


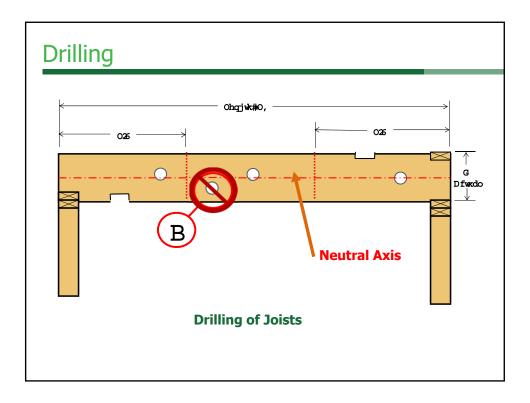


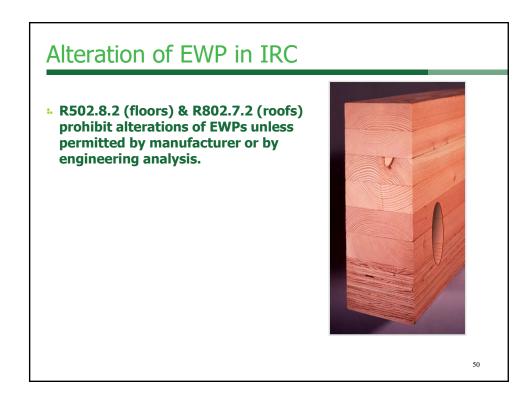




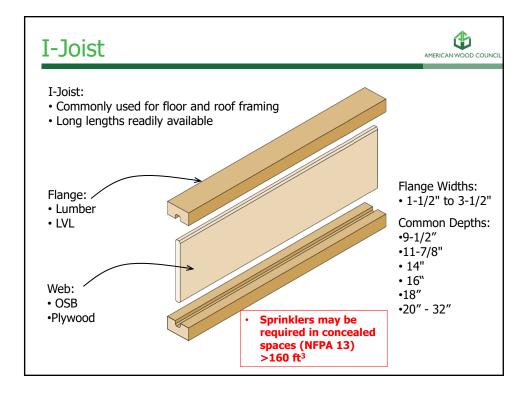


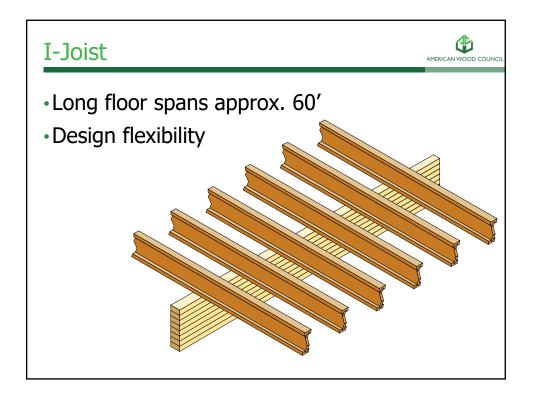




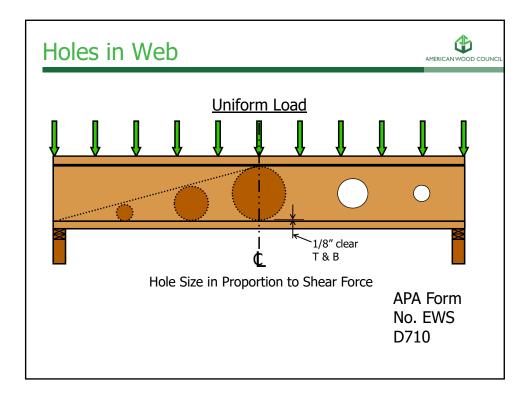


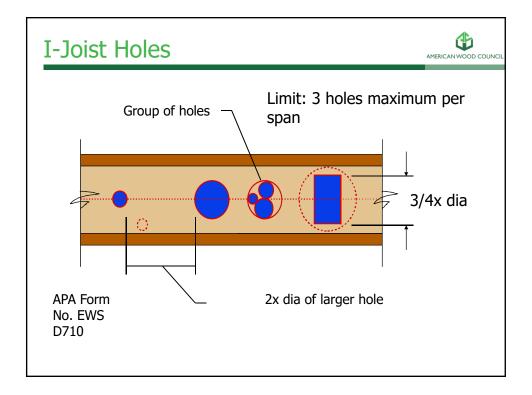


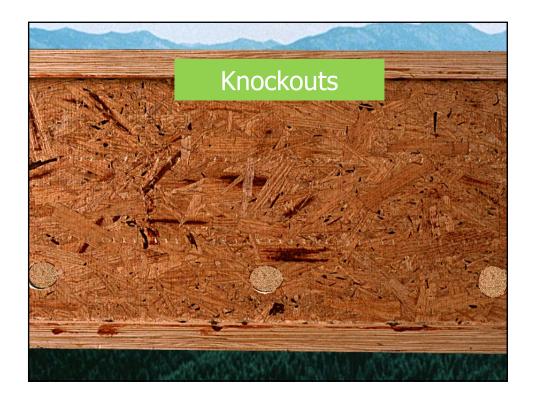


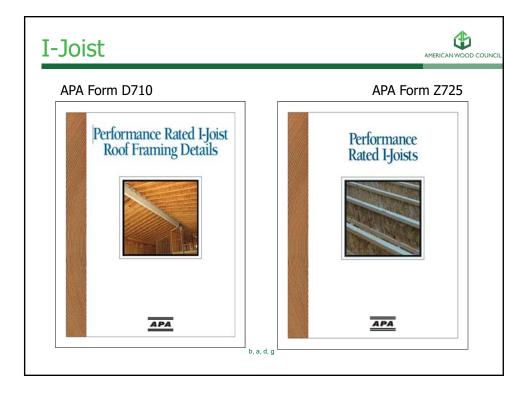


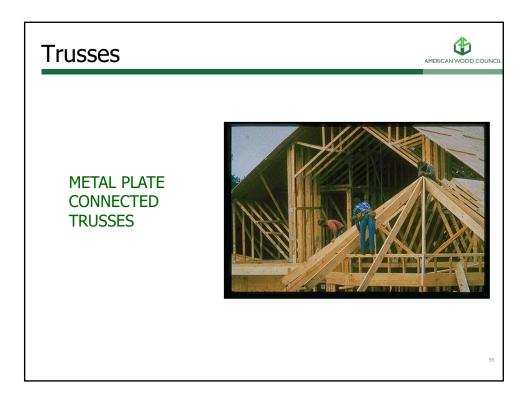


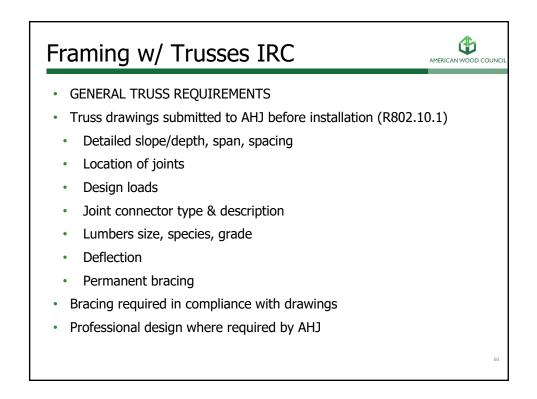


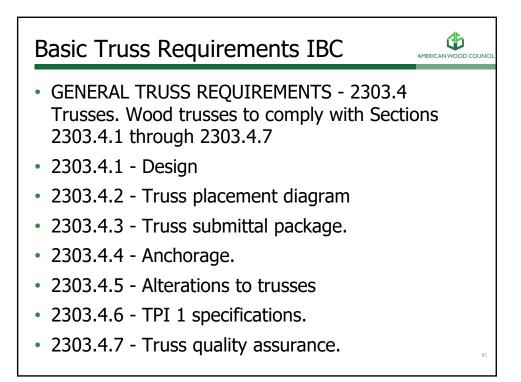


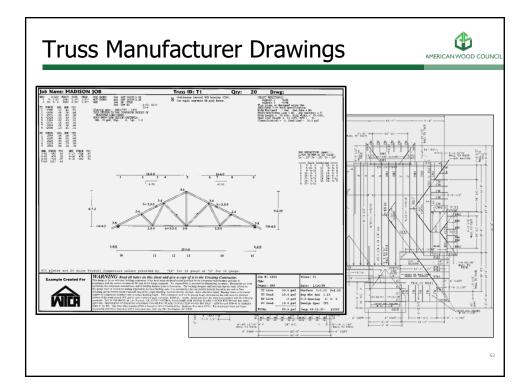


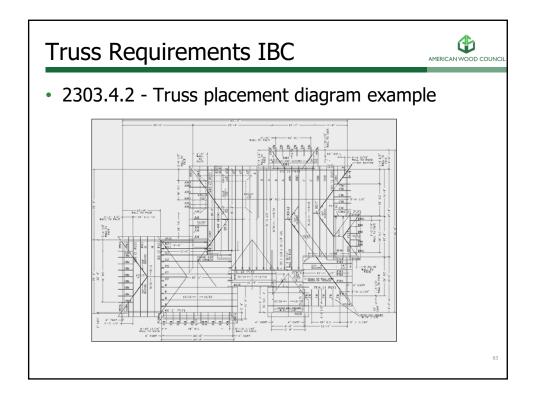


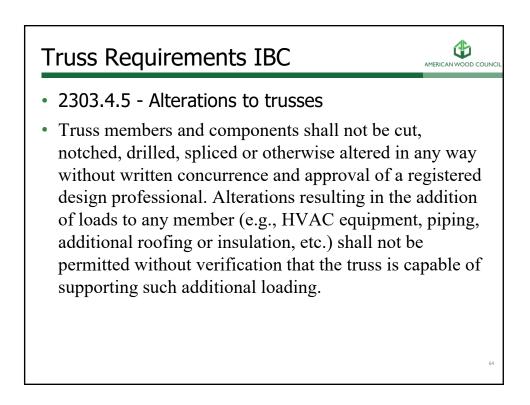


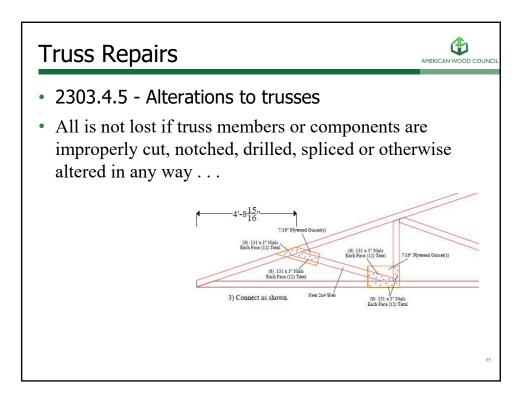














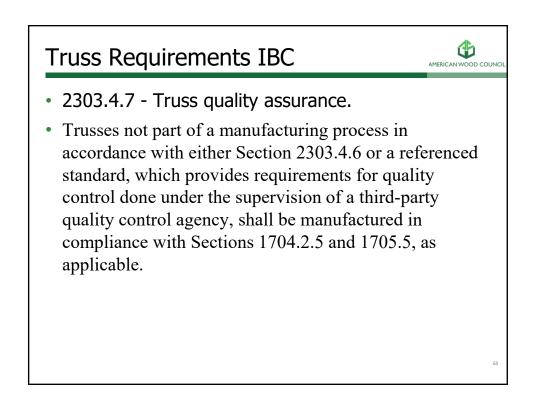
Truss Requirements IBC

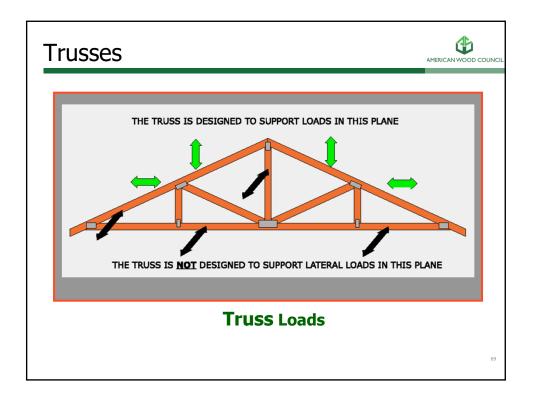
- 2303.4.6 TPI 1 specifications.
- In addition to Sections 2303.4.1 through 2303.4.5, the design, manufacture and quality assurance of metal-plate connected wood trusses shall be in accordance with TPI 1. Job-site inspections shall be in compliance with Section 110.4, as applicable.

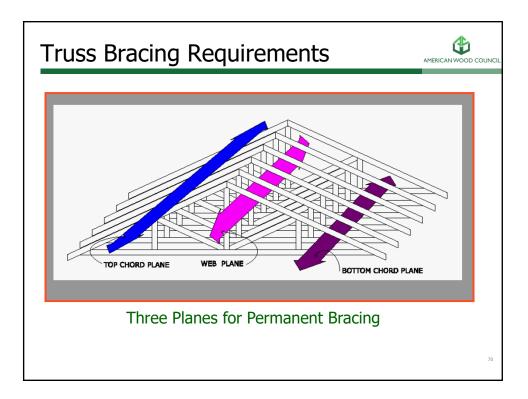
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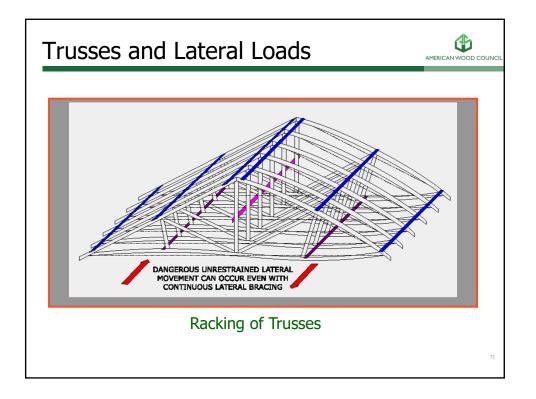
AMERICAN WOOD COUNC

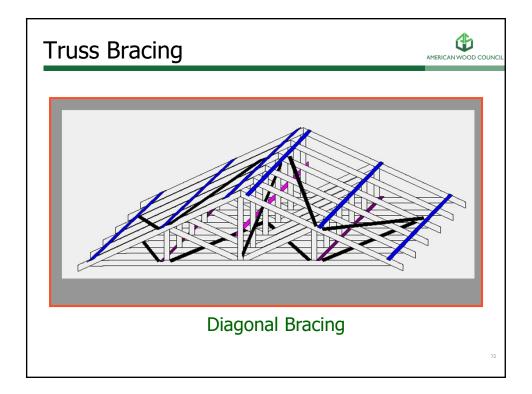


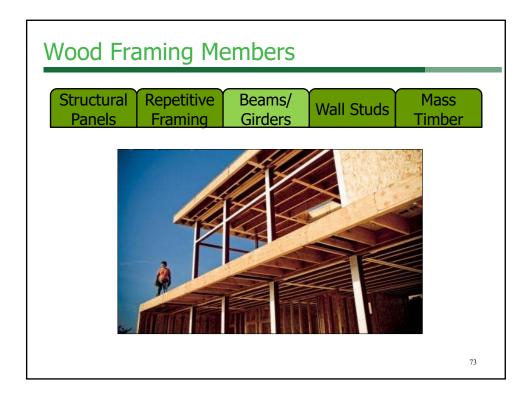


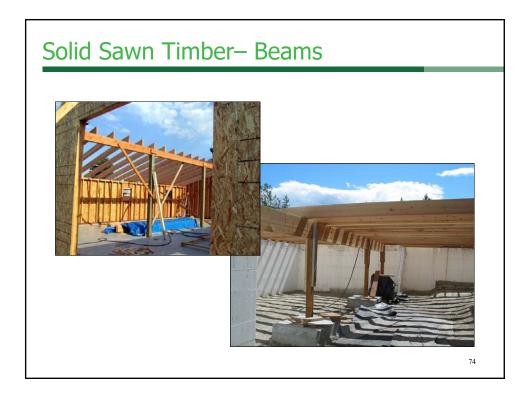


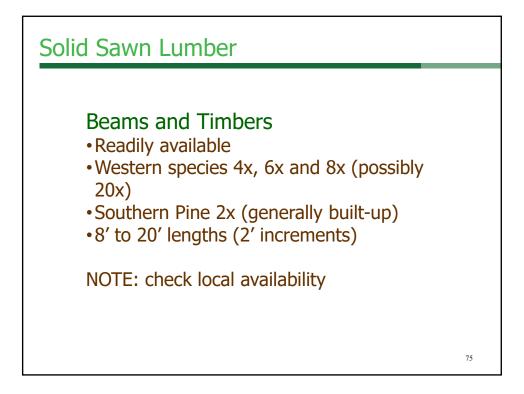


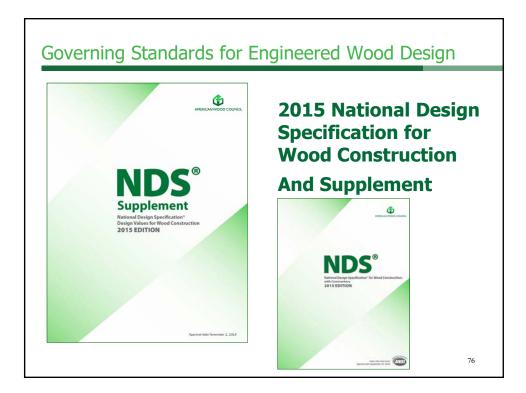


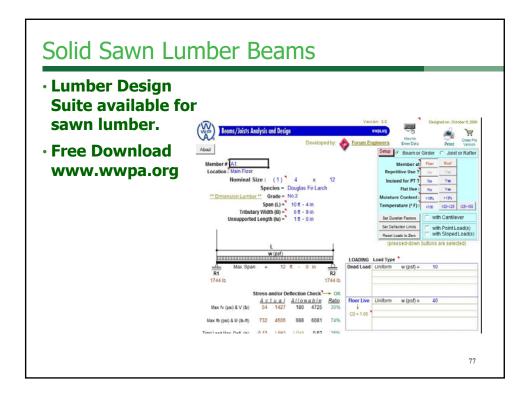


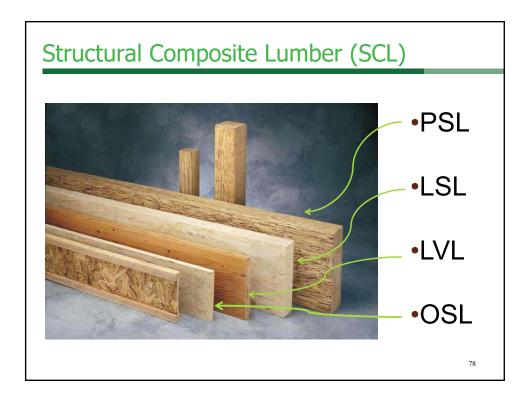


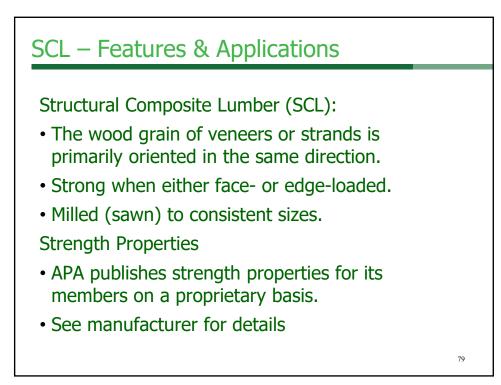


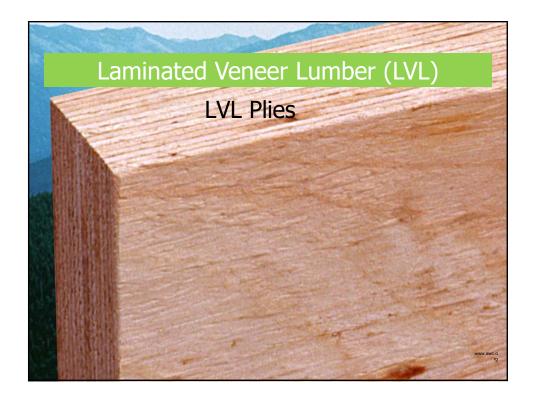


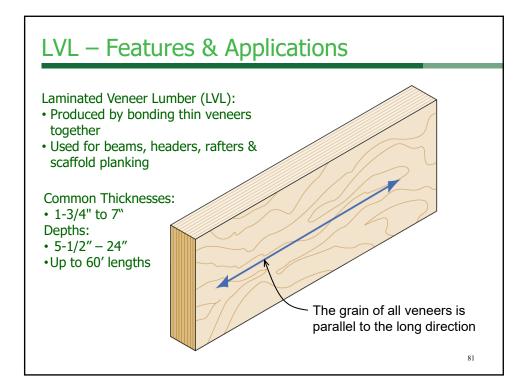
















SCL Products – Parallel Strand Lumber

Parallel Strand Lumber (PSL):

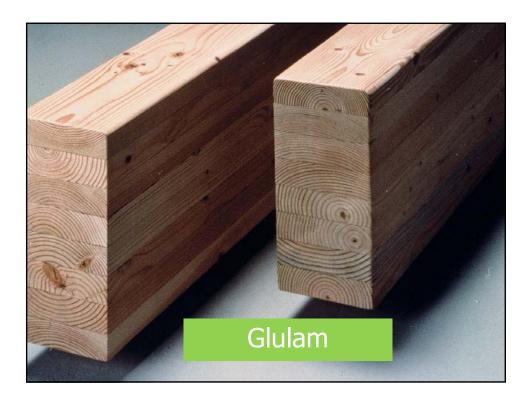
- Manufactured from veneers clipped into long strands in a parallel formation and bonded together
- Strand length-to-thickness ratio is around 300
- Used for headers and beam as well as columns.

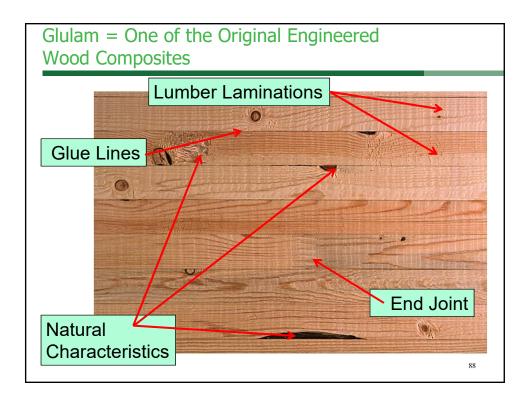


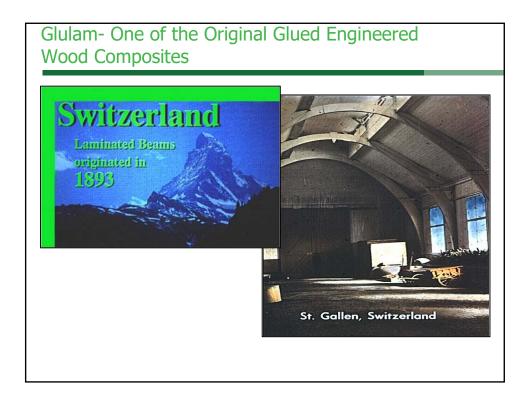


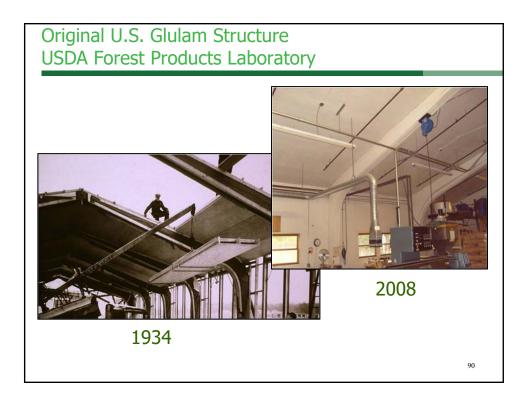


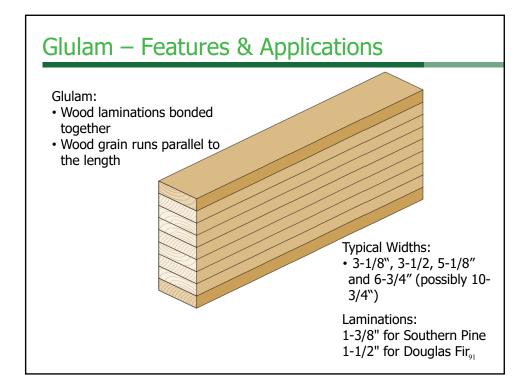


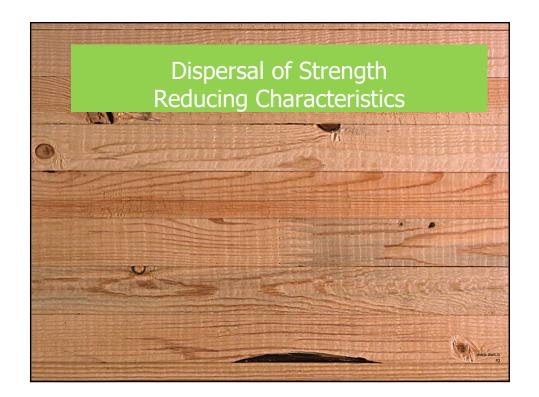


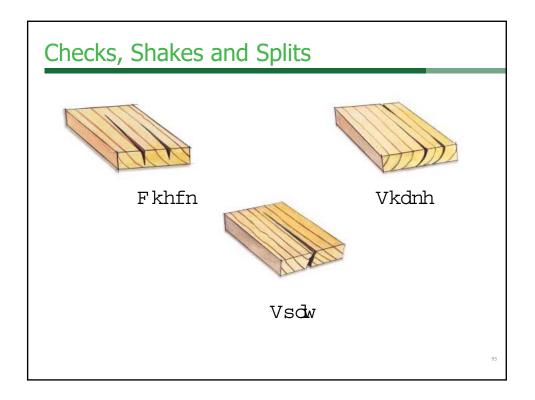


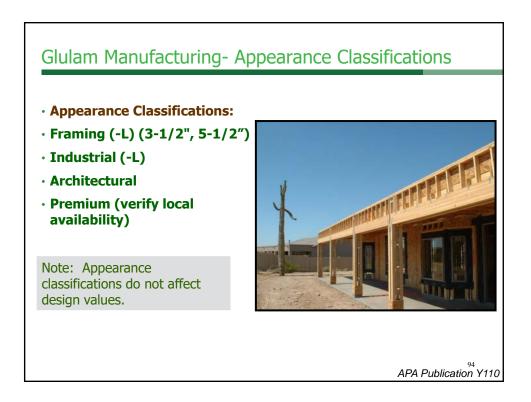


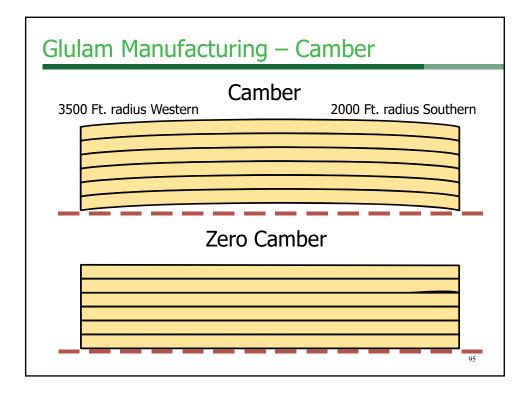


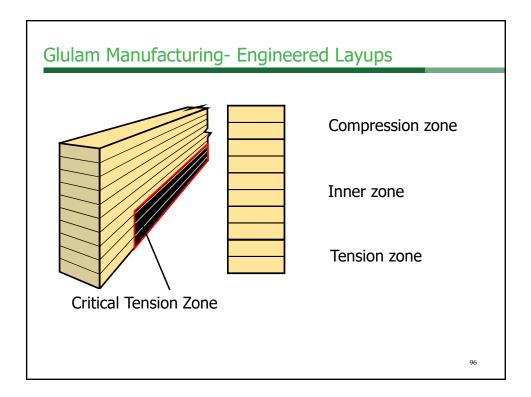


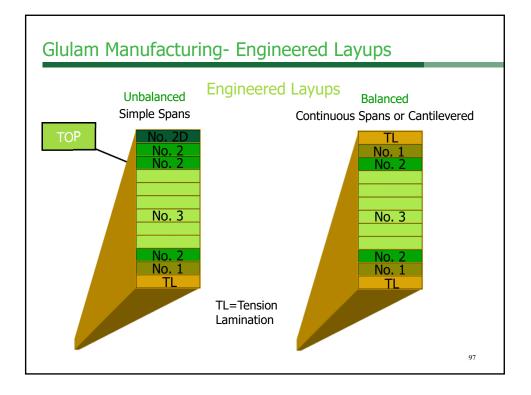


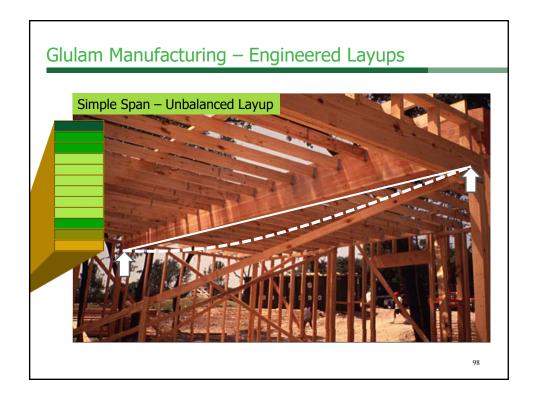




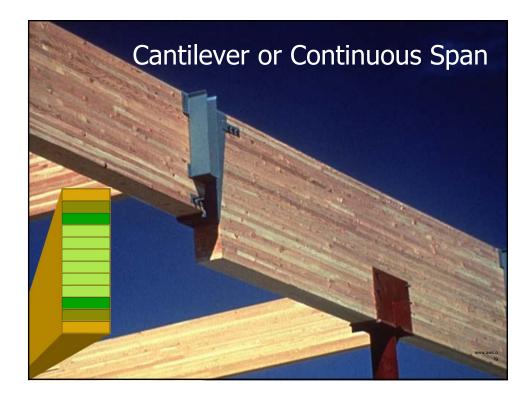


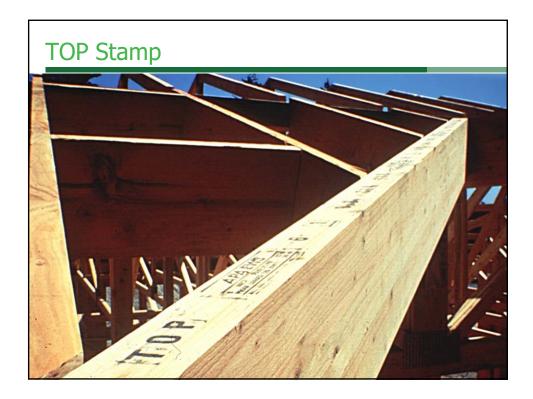














Unbalanced Layups

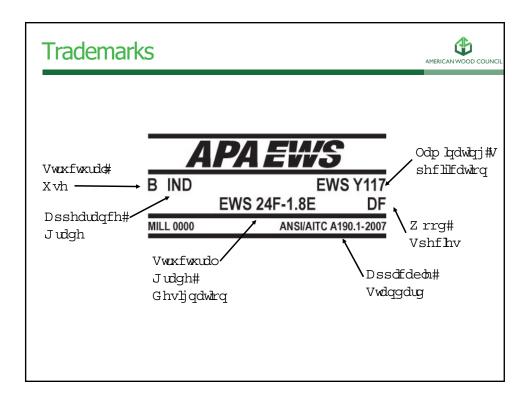
"Upside Down" Bending Stresses For Glulam

Based on full-size beam tests conducted at APA, the "upside down" bending stress is <u>75%</u> of the normal bending capacity



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Vrxu£h=Wkrp dv#Z kaklp vrq

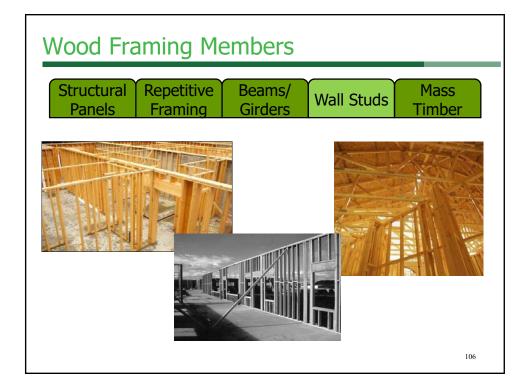


Glulam Manufacturing – Decay Resistance

Alternative to Preservative Treatment:

- Alaska Yellow Cedar
- Western Red Cedar
- Port Orford Cedar





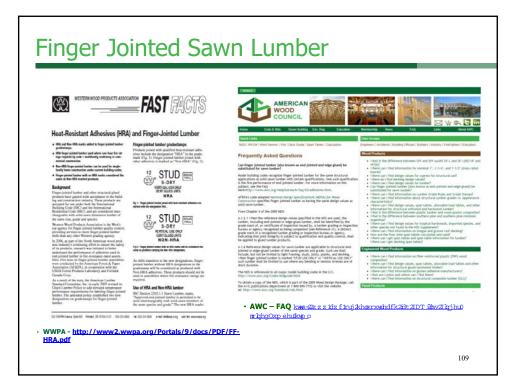
Stud Walls

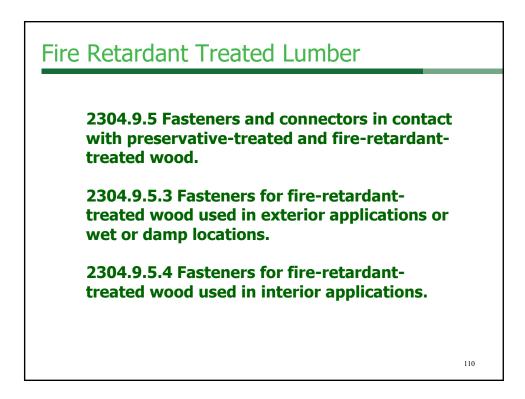
- For walls over 10' prescriptive tables are not applicable. Engineering is required.
- 2x4, 3x4, 2x6 & 2x8
- When wall framing exceeds 20' in height special orders may be required.
- NDS has a slenderness requirement for studs (l/d<50).
- For a load bearing stud that means 2x4 L < 14'-7'' ALWAYS

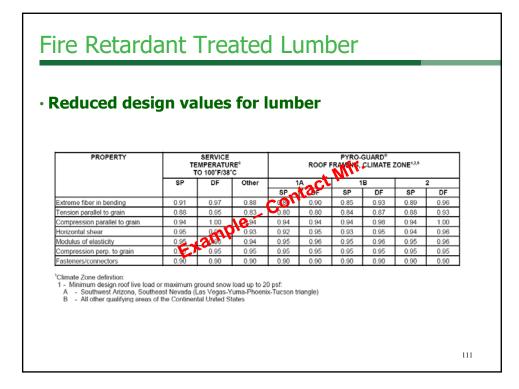


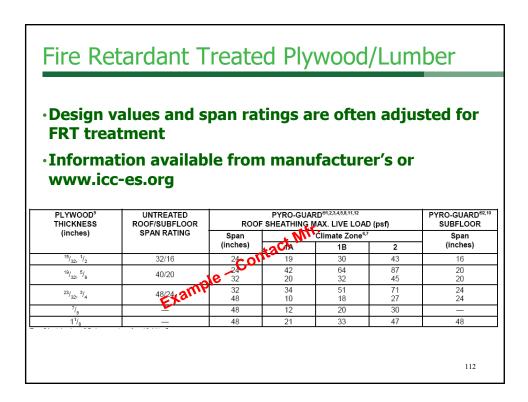
107



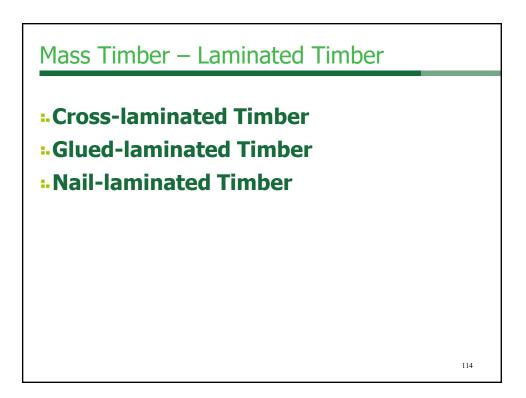




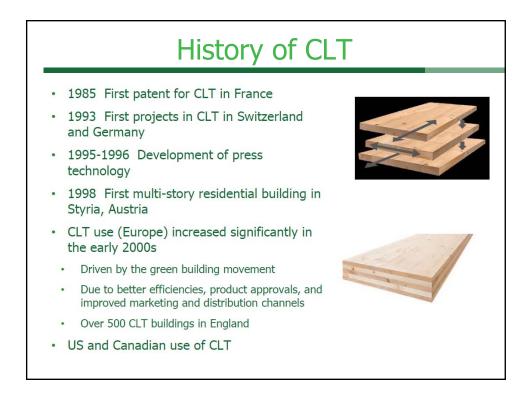


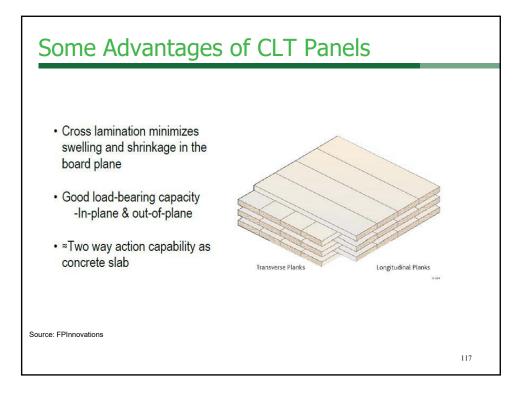








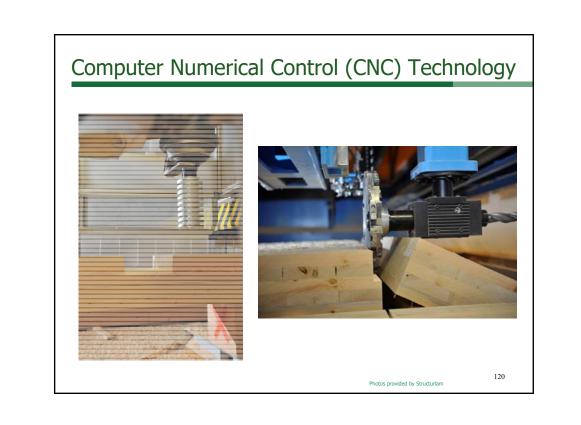




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MK6 Enlarge picture. This is a new style of presenting that is impactful and I'm trying to incorporate into AWC although it can't always be done because of the type of content we have. Michelle Kam-Biron, 1/8/2017





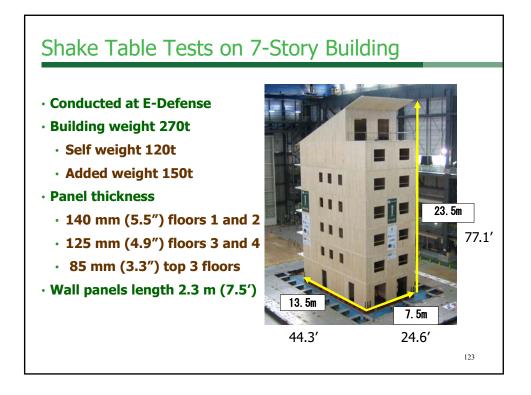
MK5

Slide 120

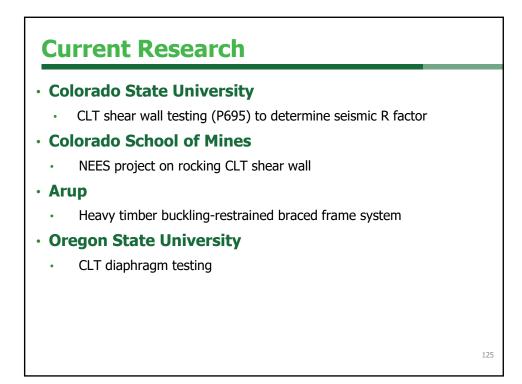
MK5 sldie seems crowded. Michelle Kam-Biron, 1/8/2017

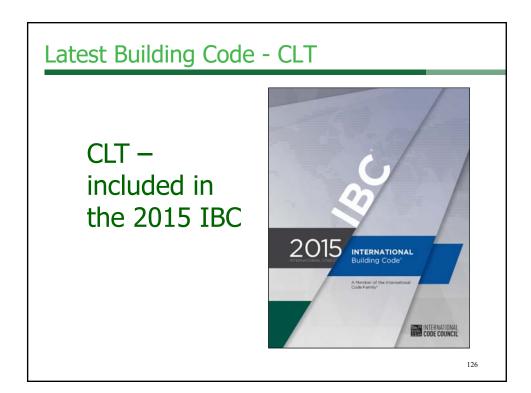












Where is CLT called out in IBC 2015?

Type IV Construction

93517# |sh#Y #W |sh#Y #Erqvvxxfwrq#Khdy |# behu/KW, ###kdv#|sh#r # frqvvxxfwrq#g#z k Ek#kh# {wulrutz dow#th#r #grqfrp exveedu# p dwhudow#dqg#kh#gwhulrutz>tgbj #dop hqw#th#r #vrdg#rutoip bdwhg# z rrg#z kxrxv#Erqfhddog#vsdfhv1#Wkh#ghvdbv#r #W |sh#Y #Erqvvxxfwrq# vkdo#Erp sd #z kk#kh#sury1/Eqv#r #k1/#hfwdrq1#E1##hvdugdqv#uhdwhg# z rrg#dp bj #Erp sd bj #z kk#Vhfwdrq1#63615#kkdo#eh#shop khg#z kk p# h{whulrutz do#tvyhp echv#z kk#l#Gkrxu#dwgj #ru#bvv1#I {wulrutz dow?# frp sd bj #z kk#Vhfwdrq#531715#kkdo#dovr#eh#shop khg1 P bj xp #vrdg#dz q#grp bdo#g b qvPrqv#th#thx1hg#ru#vvxfwxhv# exb#xvbj #W |sh#Y #ErqvvxxfwTq#KW, #Eru#joxhg0oip bdwhg#b hp ehuv# wh#htx1yddoqw#hw#blkhg#z byw#dq#ghswkv#Eruhvsrqg bj #x#kh# p bj xp #grp bdo#z bw#dqg#ghswkv#Eruhvsrqg bj #x#kh# dv#vshflihg#g#Wdedo#935171#Eurv#bjb_bdwhg#b ehu#FOW,#gb_hqvIrqv# xvhg#b#k1v#hfwlrq#bh#fwkd&pb_hqvIrqv1

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CLT in IBC 2015

Code modifications to Ch. 23 Wood and Ch. 2 Definitions

2303.1.4 Structural glued cross laminated timber. Cross-laminated timbers shall be manufactured and identified as required in ANSI/APA PRG 320-2011.

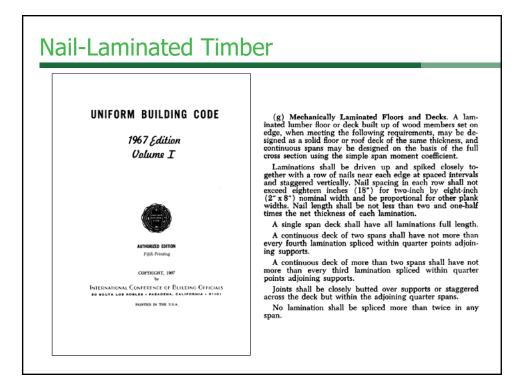
<u>CROSS-LAMINATED TIMBER.</u> A prefabricated engineered wood product consisting of at least three layers of solid-sawn lumber or *structural composite lumber* where the adjacent layers are cross-oriented and bonded with structural adhesive to form a solid wood element.

Code modifications to Ch. 35 Referenced Standards

ANSI or APA ANSI/APA PRG 320-2011 Standard for Performance-Rated Cross-Laminated Timber

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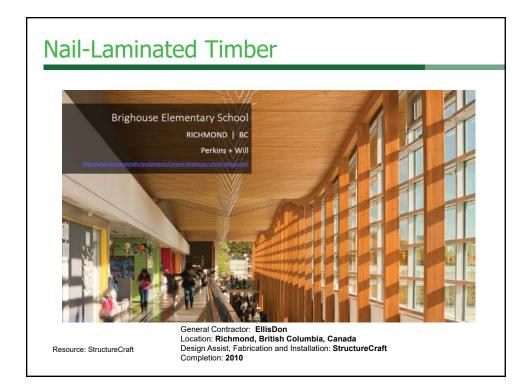


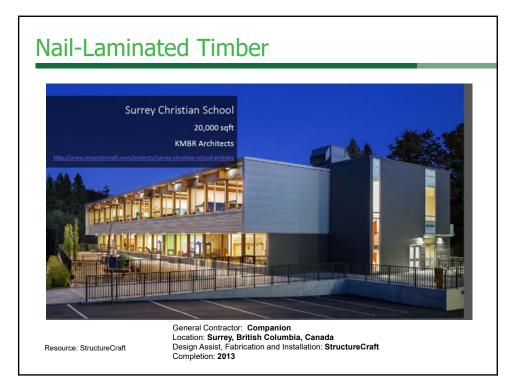
Nail-Laminated Timber

- 2304.8.3 Mechanically laminated decking. Mechanically laminated decking shall comply with Sections 2304.8.3.1 through 2304.8.3.3.
- **2304.8.3.1 General.** Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.
- **2304.8.3.2 Nailing.** The length of nails connecting laminations shall not be less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center (o.c.) or less, side nails shall be installed not more than 30 inches (762 mm) o.c. alternating between top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) o.c., side nails shall be installed not more top and bottom edges and staggered one-third of the spacing in adjacent each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) o.c. or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) o.c., alternate laminations shall be toenailed to every support.

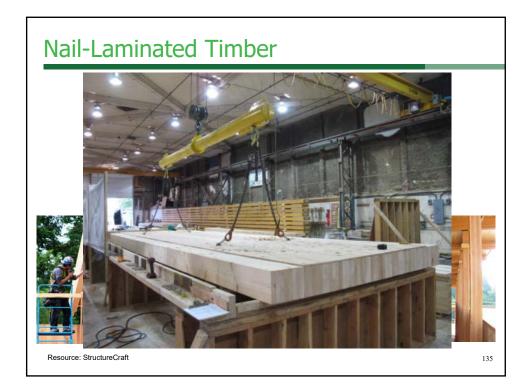
• **2304.8.3.3 Controlled random pattern.** There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on at least two supports with end joints in these two courses occurring on alternate supports. A maximum of seven intervening courses shall be permitted before this pattern is repeated.







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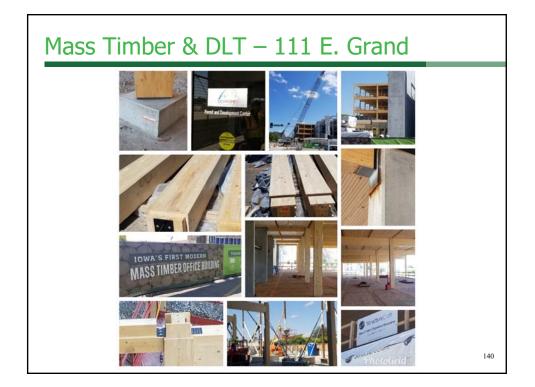


Nail Laminated Timber Handbook • Get the latest information on NLT issues Architecture • Fire • Structure • Enclosures • Supply & Fabrication • Construction & Installation • **Erection Engineering** • kws=22zzzz1hwkbnzrrg1frp2zheirup2grzgordg0go0kdggerrn 136











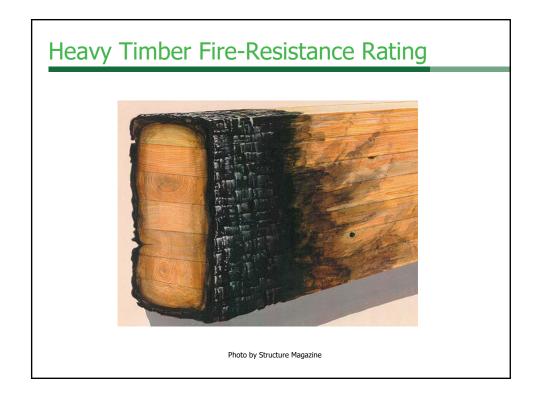


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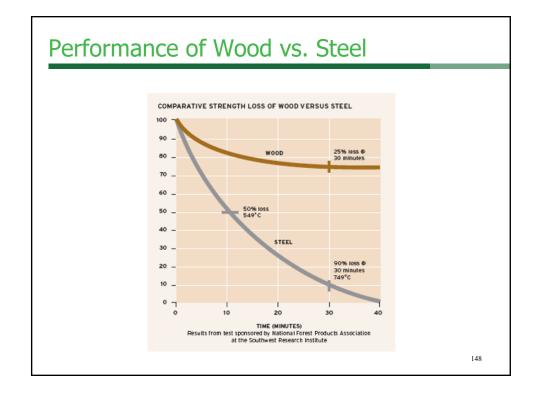




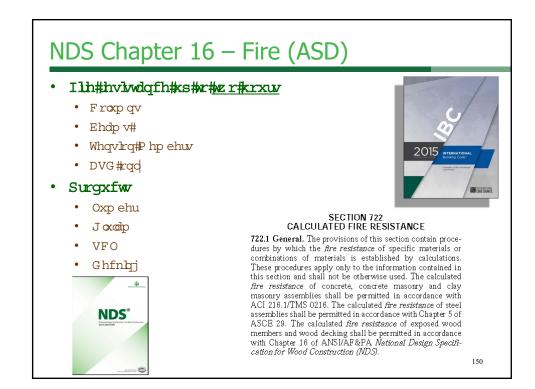


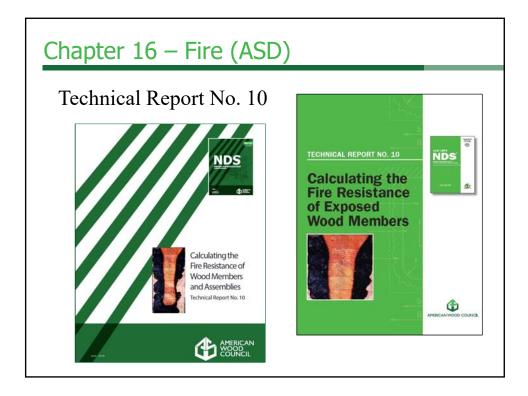
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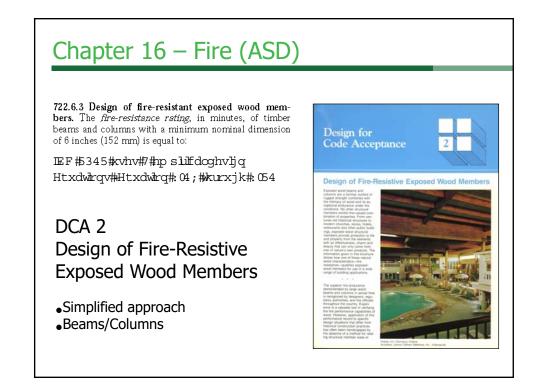
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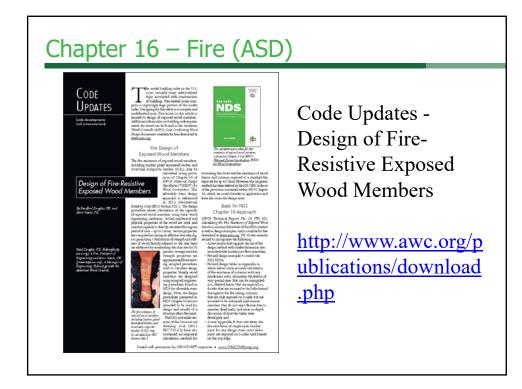


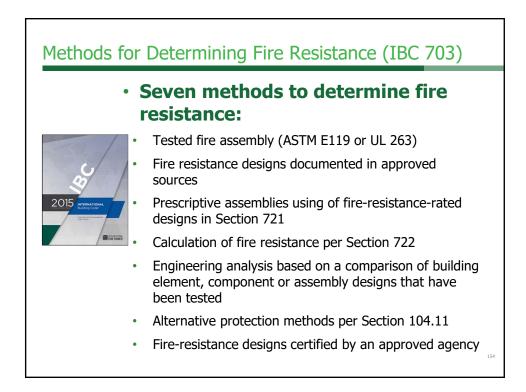












HT vs. Fire Resistance Rating

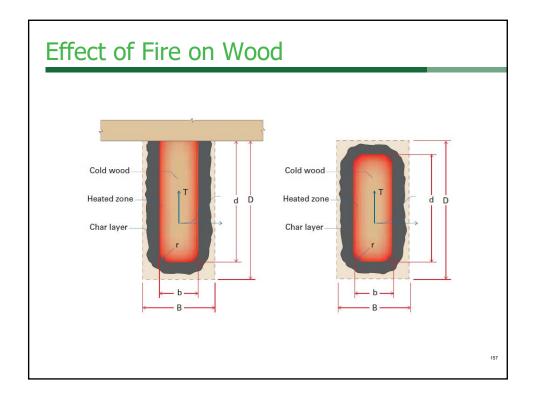
Type IV Construction

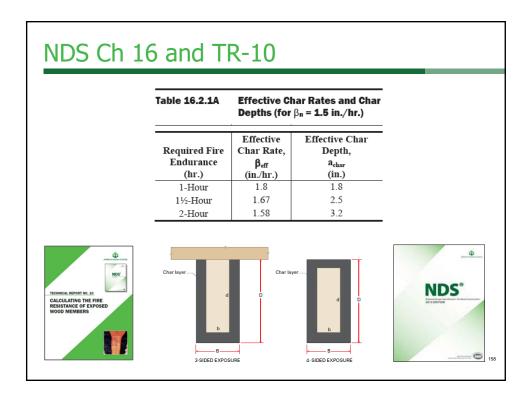
 Structural framework: prescribed minimum sizes The wood structural elements are assumed to have inherent fire-resistance due to their required minimum dimensions (no fire-resistance rating is required except for exterior walls).

• III and V Construction

· Prescribed fire-resistance requirements

Calculated Fire Resistance SECTION 722 CALCULATED FIRE RESISTANCE **FIRE DESIGN** 722.1 General. The provisions of this section contain procedures by which the *fire resistance* of specific materials or **OF WOOD** combinations of materials is established by calculations. MEMBERS NDS 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 Effective Char Ra 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 Specifi*to the CLT with cation for Wood Construction (NDS). Technical Report 10 includes more NDS' details, background and commentary on the methods found in NDS chapter 2015 16. Chapter 16 of NDS provides for design up to 2 hours.





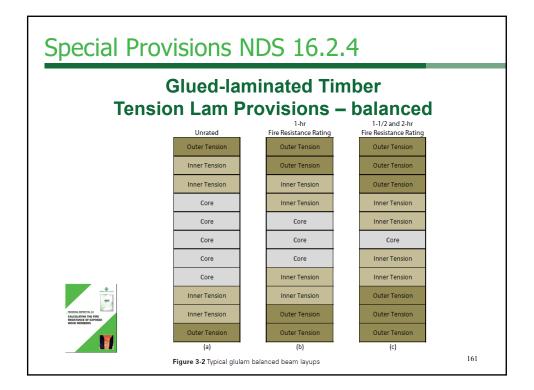
Calculated Fire Resistance – NDS Ch 16

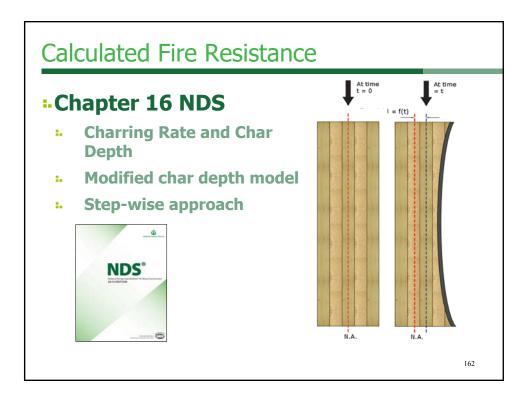
16.2.4 Special Provisions for Structural Glued Laminated Timber Beams

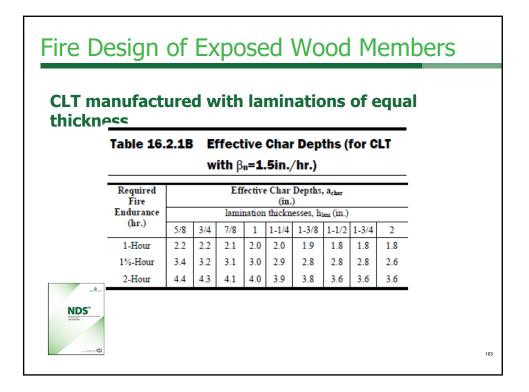
For structural glued laminated timber bending members given in Table 5A and rated for 1-hour fire endurance, an outer tension lamination shall be substituted for a core lamination on the tension side for unbalanced beams and on both sides for balanced beams. For structural glued laminated timber bending members given in Table 5A and rated for $1\frac{1}{2}$ - or 2-hour fire endurance, 2 outer tension laminations shall be substituted for 2 core laminations on the tension side for unbalanced beams and on both sides for balanced beams.

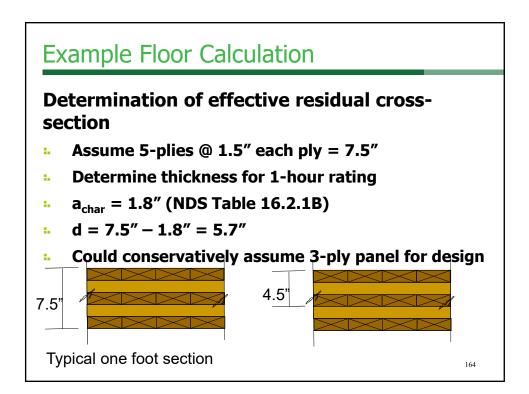
159

Special Provisions NDS 16.2.4 **Glued-laminated Timber** Tension Lam Provisions – unbalanced layup 1-1/2 and 2-hr 1-hr Fire Resistance Rating Unrated Fire Resistance Rating Outer Compression Outer Compression Outer Compression Inner Compression Inner Compression Inner Compression Core Inner Tension Core Core Inner Tensior Inner Tension Inner Tension Inner Tensior Outer Tension Inner Tension Outer Tension Outer Tension Outer Tension Outer Tension Outer Tension (a) (b) (c) 160 Figure 3-1 Typical glularn unbalanced beam layups







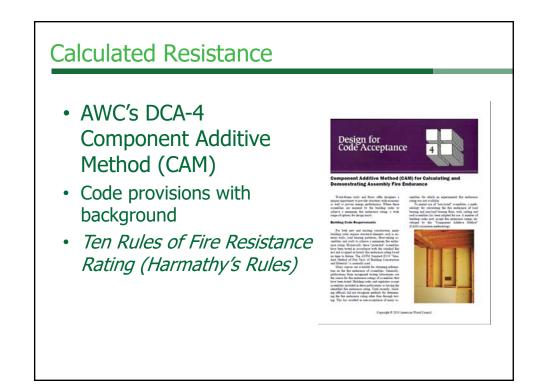


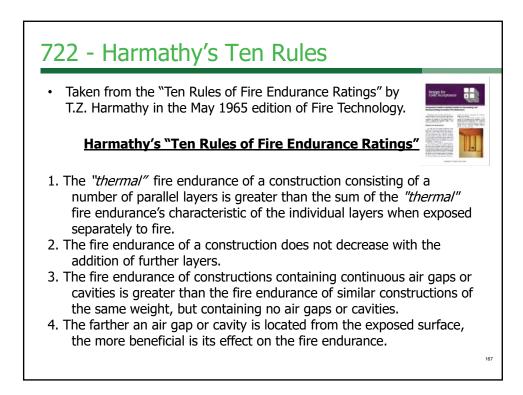
Calculated Fire Resistance

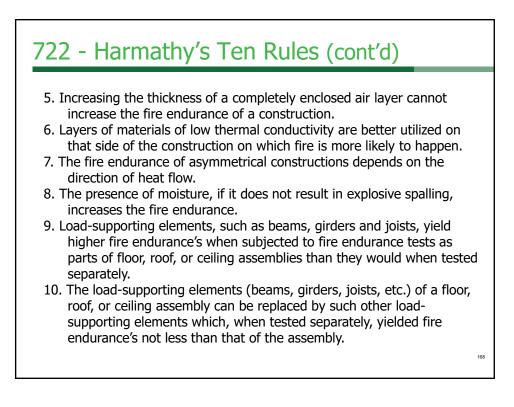
Component Additive Method (IBC 722.6)

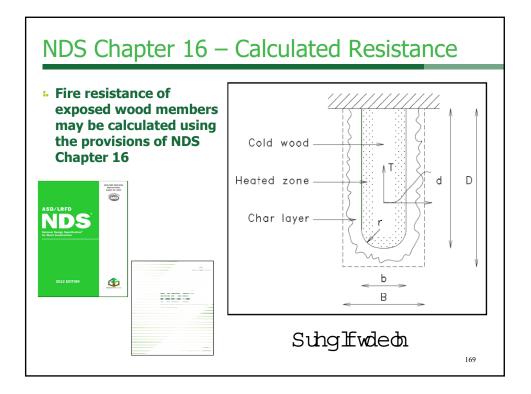
- Additional time added for framing and insulation
- Method allowed for floors, walls and roofs
- Up to one hour rating

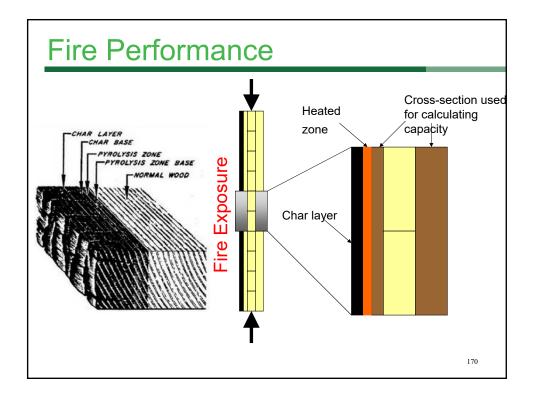
DESCRIPTION OF FINISH	TIME®(minutes) 5 10 15	
³ / _s -inch wood structural panel bonded with exterior glue		
¹⁵ / ₃₂ -inch wood structural panel bonded with exterior glue		
¹⁹ / ₃₂ -inch wood structural panel bonded with exterior glue		
3/8-inch gypsum wallboard	10	
¹ /2-inch gypsum wallboard	15	
5/8-inch gypsum wallboard	30	
¹ / ₂ -inch Type X gypsum wallboard	25	
⁵ / ₈ -inch Type X gypsum wallboard	40	
Double ³ / ₈ -inch gypsum wallboard	25	
$\frac{1}{2}-inch + \frac{3}{8}-inch$ gypsum wallboard	35	
Double ¹ / ₂ -inch gypsum wallboard	40	



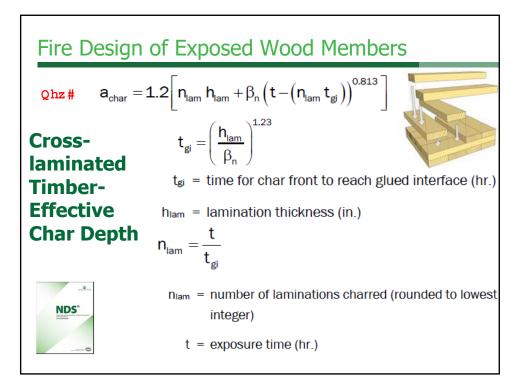


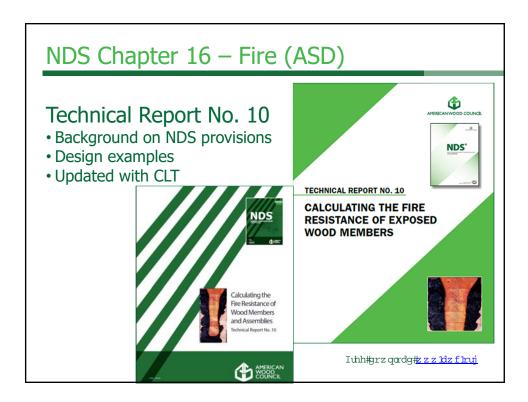






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Fire Test

ASTM E119 Fire Endurance Test

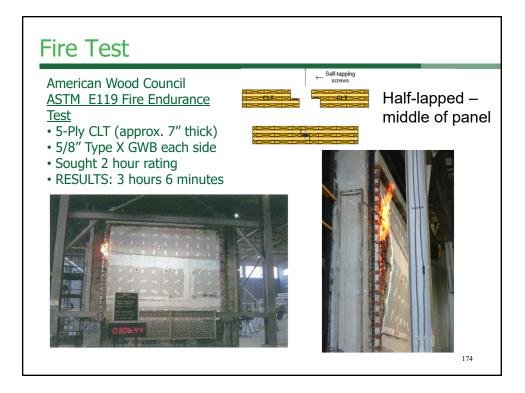
- 5-Ply CLT (approx. 7" thick)
- 5/8" Type X GWB each side
- Sought 2 hour rating

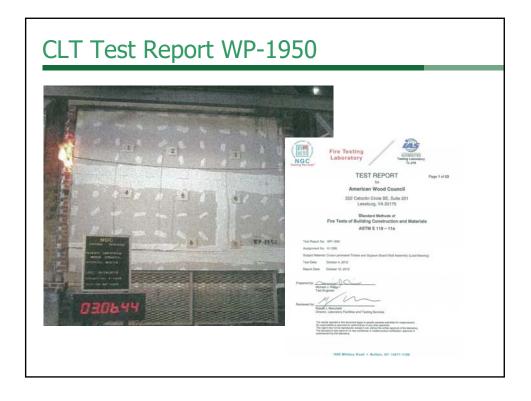
Highly Successful CLT Fire Test

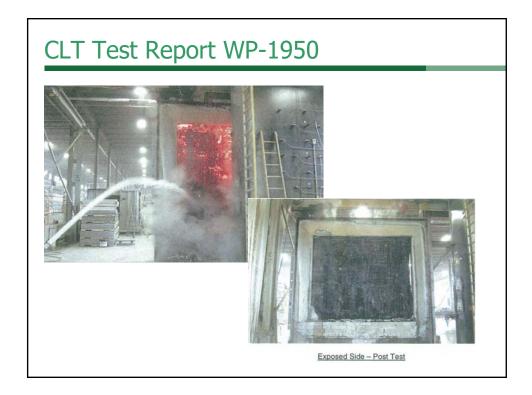
Highly Successful CLT Fire Test As part of a project to produce a U.S. design manual for cross-laminated timber (CLT), AWC conducted a very successful ASTM ETIS fire endurance test on a CLT wall at NGC Testing Services in Buffalo, NY. The wall, consisting of a 5-ph CLT (approximately 7-inches thick), was covered on each side with a single layer of 5/8" Type X gypsum wallboard. The wall was loaded to the maximum attainable by the test equipment, although it remained significantly below the full design strength of the CLT specimen. It was then exposed to a standard fire that reaches over 1800 degrees Fahrenheit in the first 90 minutes of exposure. While only seeking a 2-hour rating, as required by the targeted building code provisions, the test specimen lasted 3 hours 6 minutes. This may open up additional possibilities in a few specialized locations where a 3-hour fire resistance rating might be required. The test cuminated nearly a month of intense planning and cooperation by the North American wood products industry to get the test run in advance of the recent ICC hearings where an AWC-proposed code change to specifically recognize CLT was approved.



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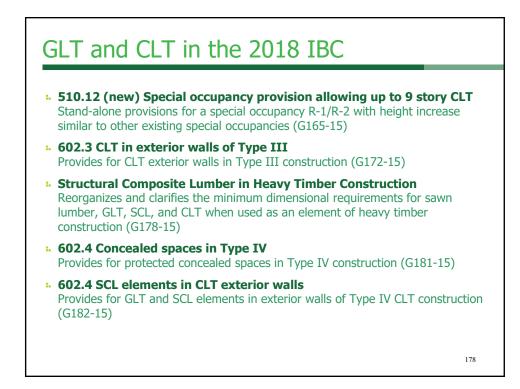


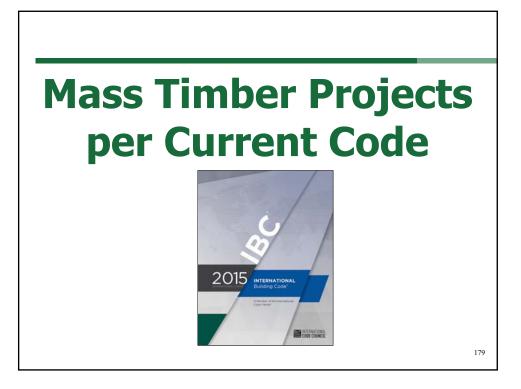


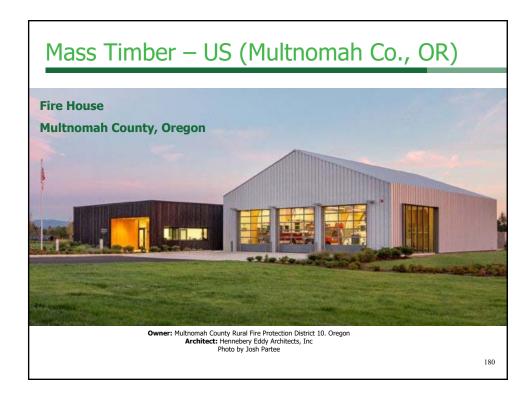


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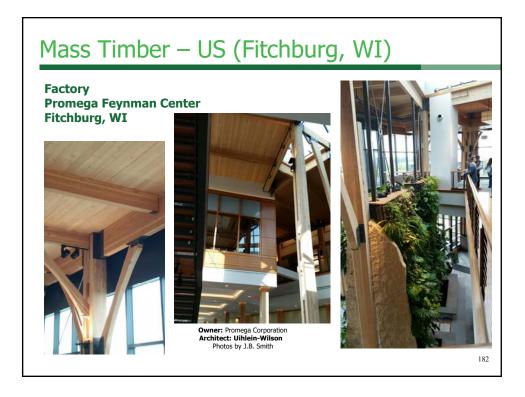








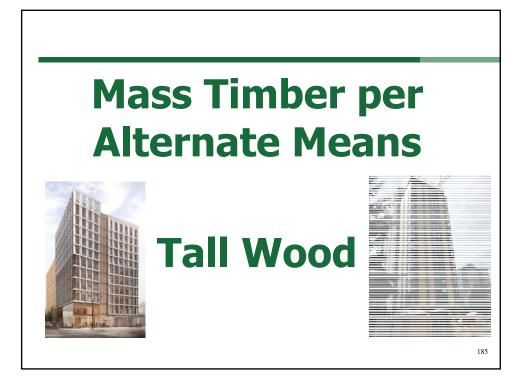




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US Projects

Framework

- Portland, Oregon
 - 12 Story
 - Received building permit in June 2017 and is anticipated to be the tallest wood building in US when completed.
 - Street-level retail, office, workforce housing and community space
 - U.S. Tall Wood Building Prize Competition winner *

http://www.nextportland.com/2016/07/21/framework-dz1/

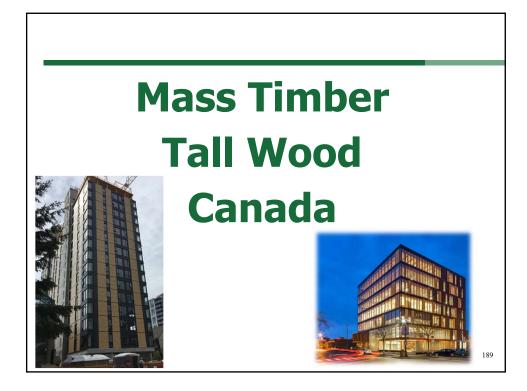


Photo provided by Next Portland

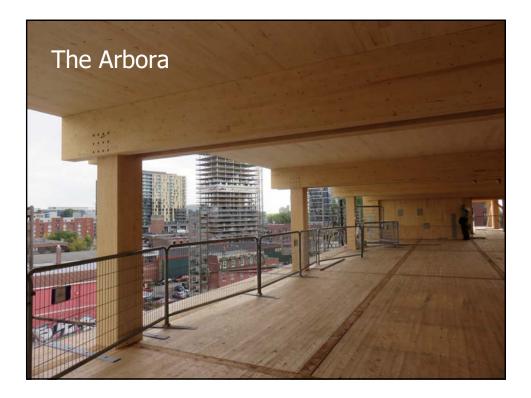
* Sponsored by the U.S. Department of Agriculture, the Softwood Lumber Board and the Binational Softwood Lumber Council

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Canadian Projects

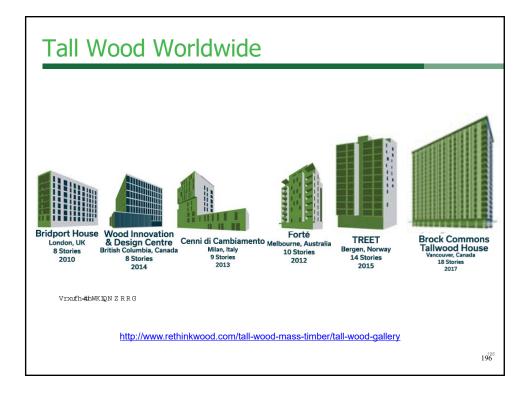
The Wood Innovation and Design Centre

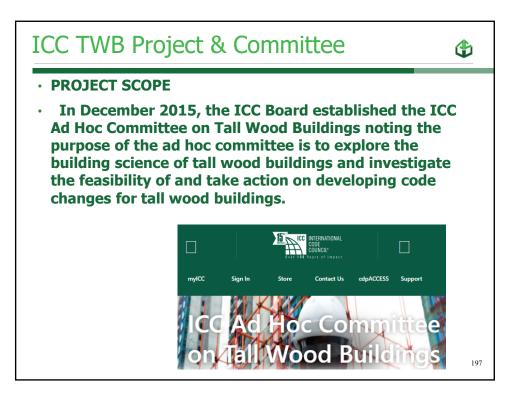
- Prince George, British Columbia, Canada
 - 8 Stories
 - Office and education space

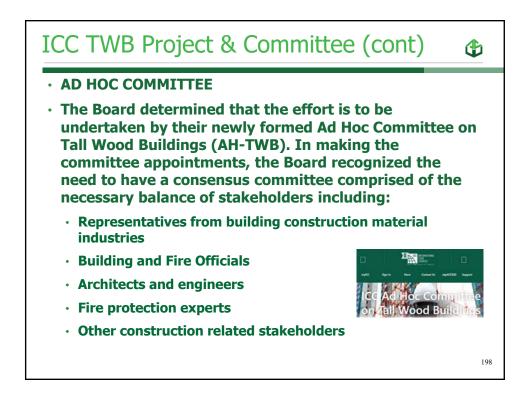


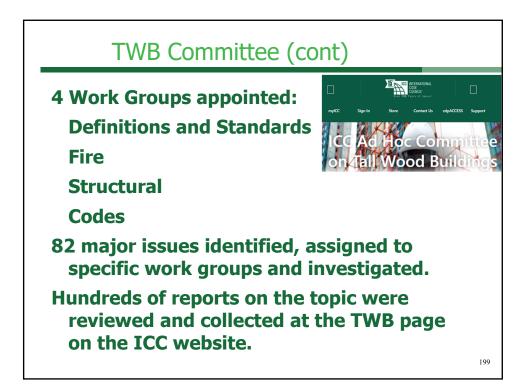


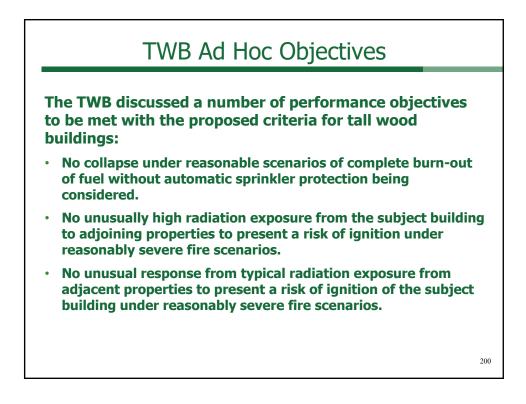


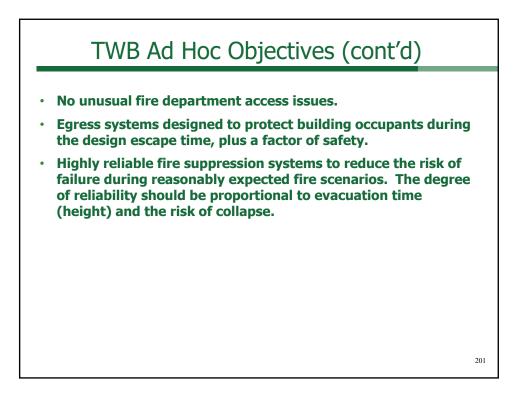


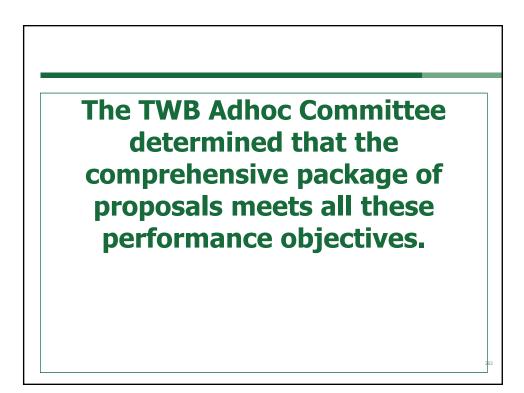


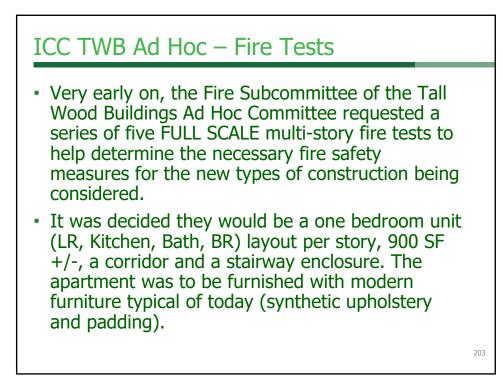


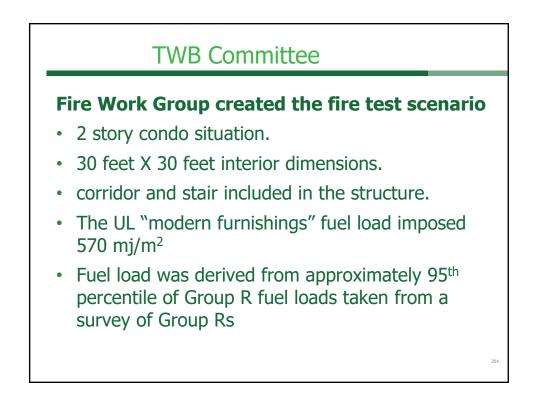


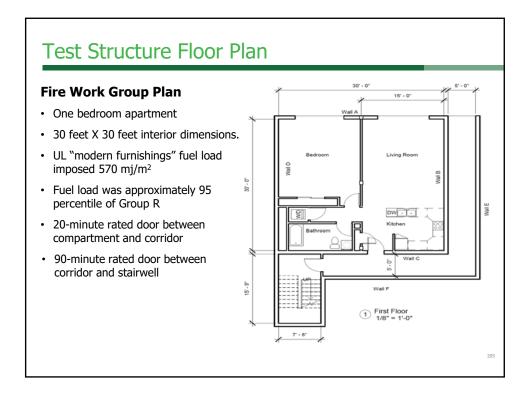












Test	Description	Date
Test 1	All mass timber surfaces protected with 2 layers of 5/8" Type X GWB	5/23/17
Test 2	30% of CLT ceiling area in living room and bedroom exposed	5/31/17
Test 3	Two opposing CLT walls exposed – one in bedroom and one in living room (there is a partition wall)	6/20/17
Test 4	All mass timber surfaces fully exposed in bedroom and living room. Sprinklered – normal activation	6/27/17
Test 5	All mass timber surfaces fully exposed in bedroom and living room (except bathroom). Sprinklered – 20 min delayed activation	6/29/17

Two-Story Fire Tests

- Purpose: Perform tests of realistic fire scenarios applicable to tall wood construction in order to <u>evaluate occupant and</u> <u>firefighter tenability</u> for egress and suppression efforts, and to provide data necessary to <u>guide further development of</u> <u>relevant code and standard provisions</u>.
- Conducted at U.S. government facilities
- Supervised by U.S. Forest Product Laboratory staff



ICC TWB Ad Hoc – Fire Tests

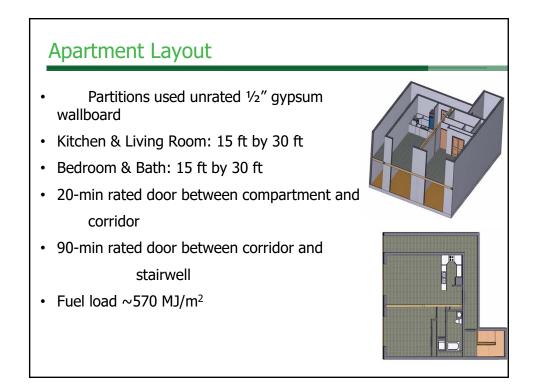
- All tests conducted at the Federal Bureau of Alcohol, Tobacco, Firearms & Explosives Testing Laboratory in Maryland.
- 400 channels of data collection resulting in millions of data points.



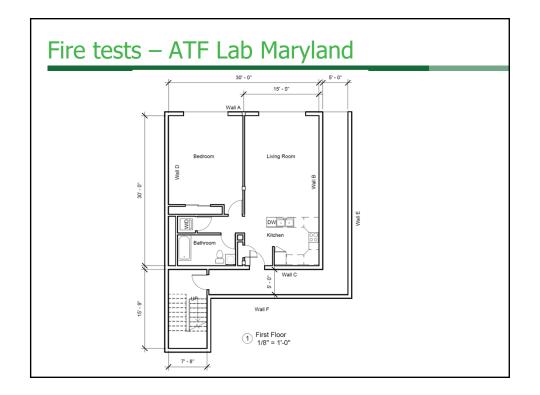


Two-Story Structure

- Two Stories, one apartment per level
- Each apartment: 30 ft by 30 ft
- Ceiling height: 9 ft
- 5-ply CLT
 - Douglas-fir Larch species group
 - Lamination Thickness: 1.375 inches
 - CLT Thickness: 6.875 inches
 - Polyurethane Adhesive
- Corridor around each apartment and a stairwell



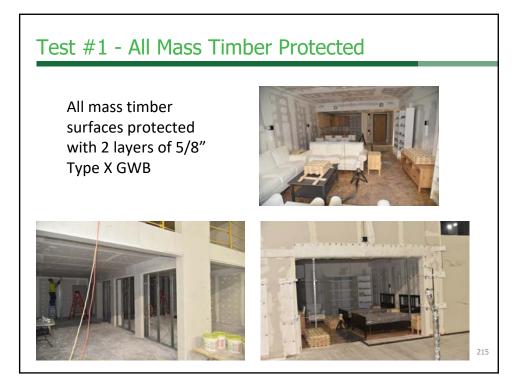




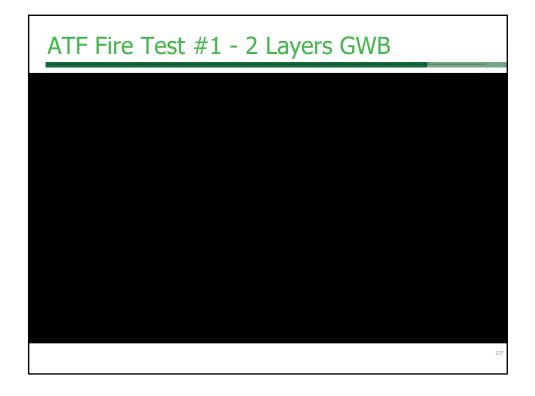
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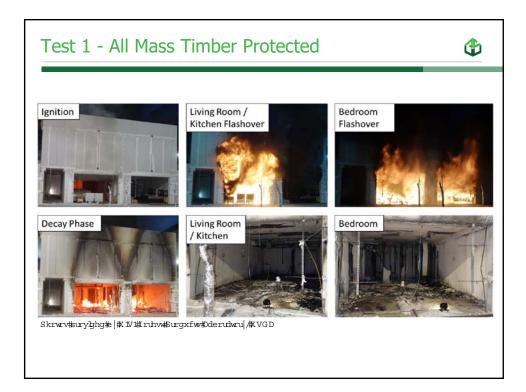




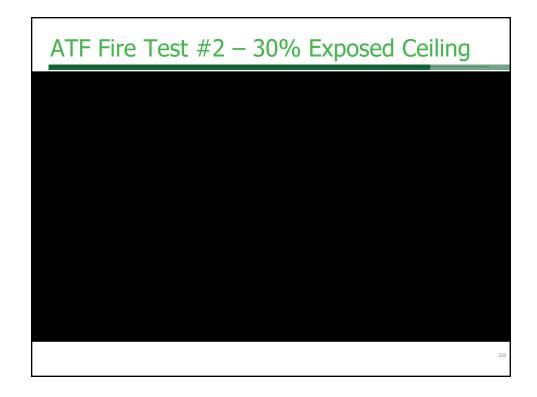


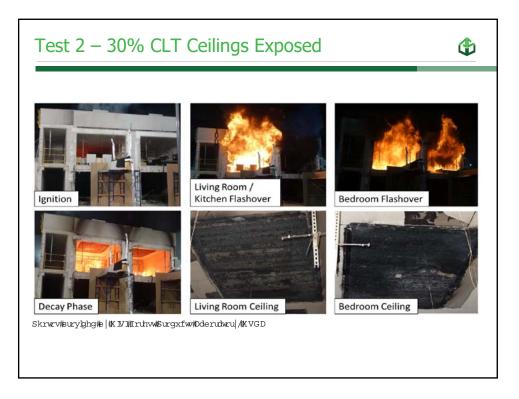


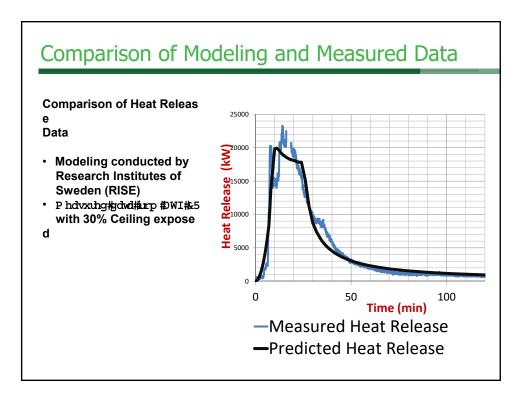


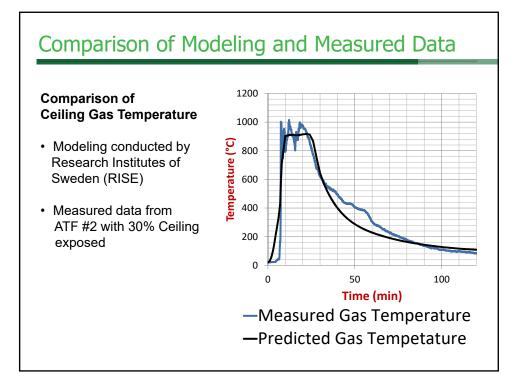






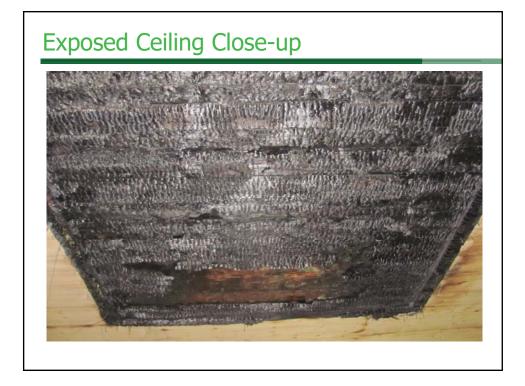


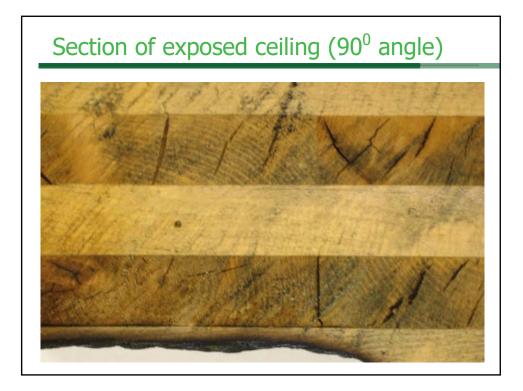


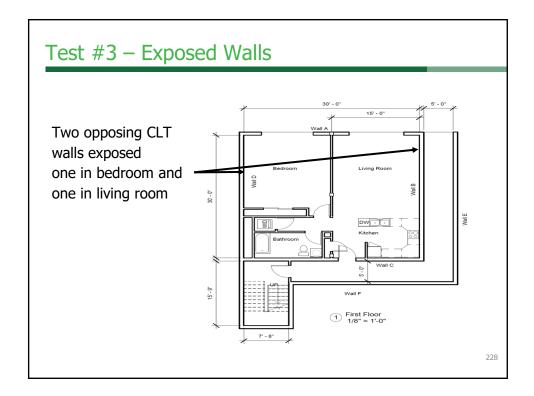


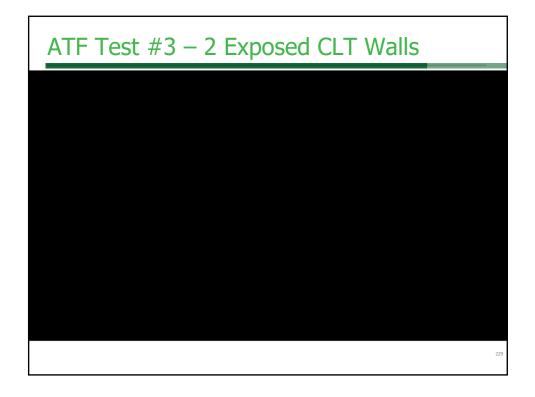






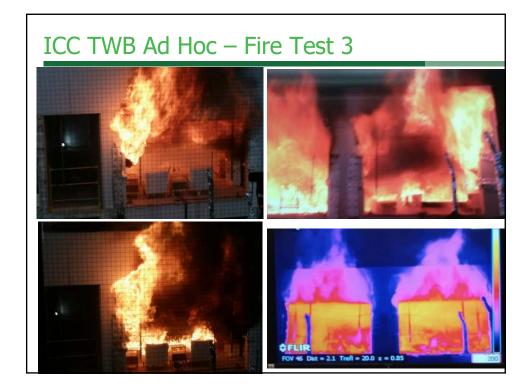


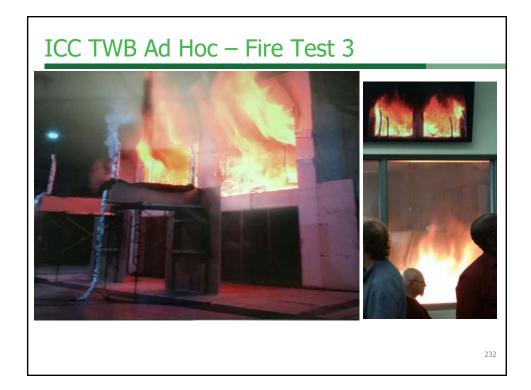






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ICC TWB Ad Hoc – Fire Test 4 and 5

Test 4 - As noted earlier, all wood surfaces above the floor were exposed and the entire space protected by a sprinkler system using sidewall sprinklers. The fire caused the sprinkler system to activate at approximately 3 minutes and the system extinguished the fire.

Test 5 – The same as Test 4 except the fronts were filled with fixed tempered glass in metal frames to replicate patio doors. At 17 minutes into the fire, one panel (3'x7' +/-) was broken open to simulate an open patio door. The sprinkler system was delayed 20 minutes from the time of sprinkler fusing (approx. 23 minutes from start of fire) to replicate a system that was inoperative until being charged by the arrival of the Fire Department. The sprinkler system extinguished the fire.



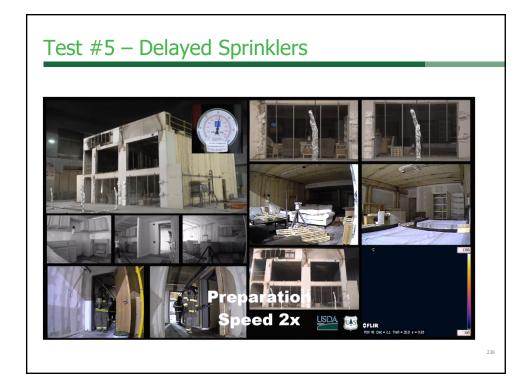
Test #5 – Delayed Sprinklers

All mass timber surfaces <u>fully exposed</u> in bedroom and living room.

Sprinkler – activation delayed for 20 minutes after smoke detector activation...approximately 23-1/2 minutes from ignition

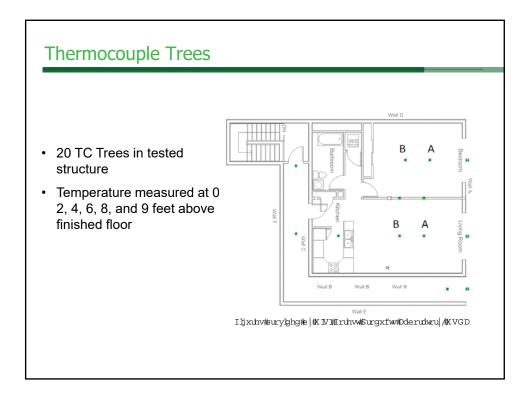


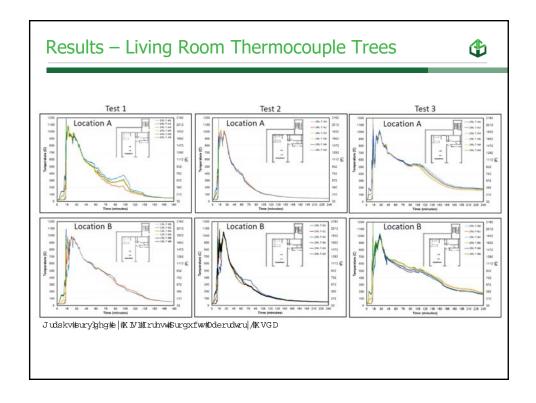


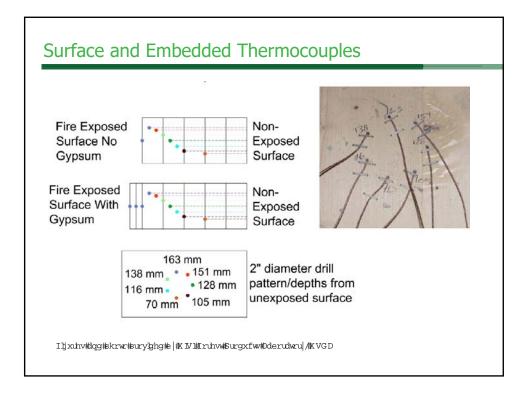


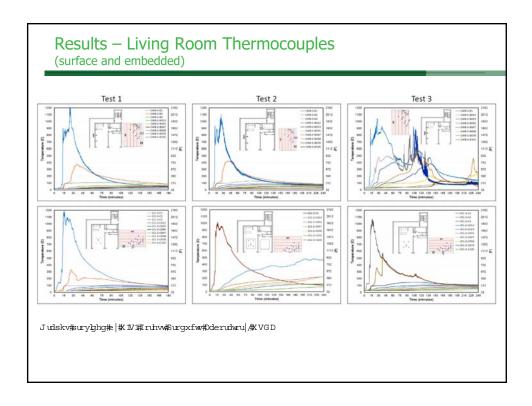


			Time After Ignition	(mm:ss)	
Test No.	Flashover (6000C) Living Room	Flashover (6000C) Bedroom	Flames in Hallway	Compartment door Fails	Sprinkler Activation
4 4 ^w irru	13:27	17:20	26:51	57:46	N/A
5 5® inru	11:42	17:20	30:38	63:59	N/A
6 5 ⁴⁹ irru	12:37	17:00	13:06 (door frame installation error)	29:42 (door frame installation error)	N/A
7 4 [™] iarru	-	-	-	-	2:37
8 4 ^{we} iarru	-	-	-	-	23:00











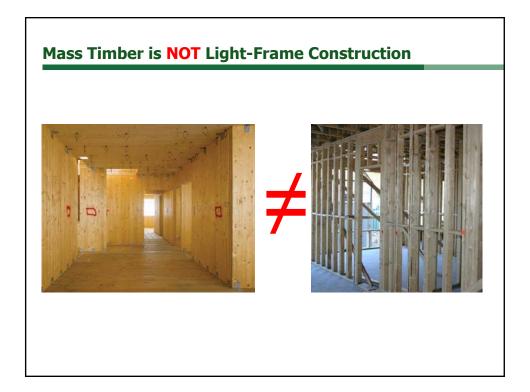


Answer

Mass(ive) Timber was initially envisioned to be an umbrella term for wood members meeting the minimum dimensions of Heavy Timber in the current IBC, but will also be tied to specific fire-resistance ratings for wall, floor and roof assemblies.

 Mass Timber: Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross section dimensions of Type IV construction.

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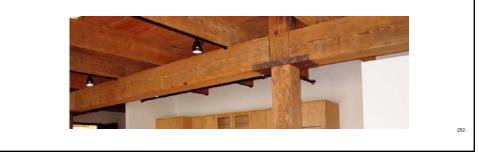
Question

How is Heavy Timber different than Mass Timber?

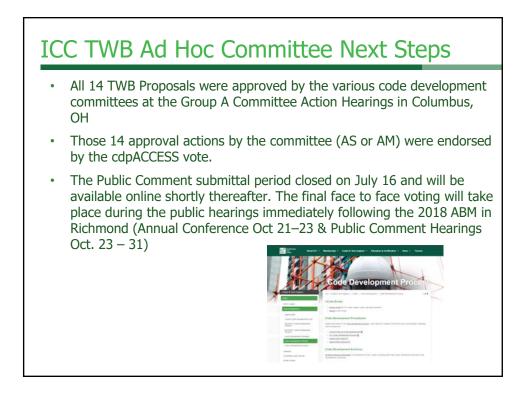


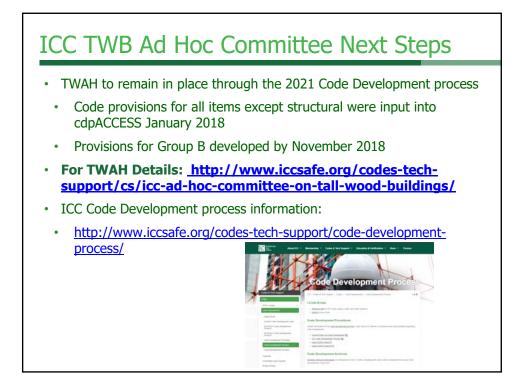
Heavy Timber typically relies on the dimensions and detailing to provide an intrinsic but undetermined level of fire resistance....

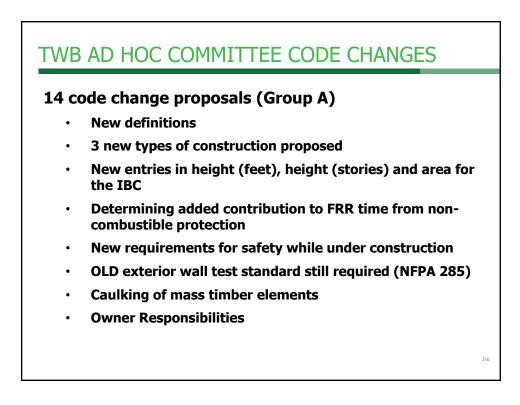
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- G108-18: Section 602.4 Type of Construction; Approved As Modified (AM) by modifications DiGiovanni 1 & 2
- **FS5-18**: Section 703.8 Performance Method; Approved As Submitted (AS)
- FS81-18: Section 722.7 Ratings Installation; Approved AM by modification DiGiovanni 1
- **FS6-18**: Section 703.9 Sealants at Edges; Approved AS (note: Modification DiGiovanni 1 was ruled out of order due to formatting, but it was recommended that the modification be considered for a future proposal by the ad hoc committee).

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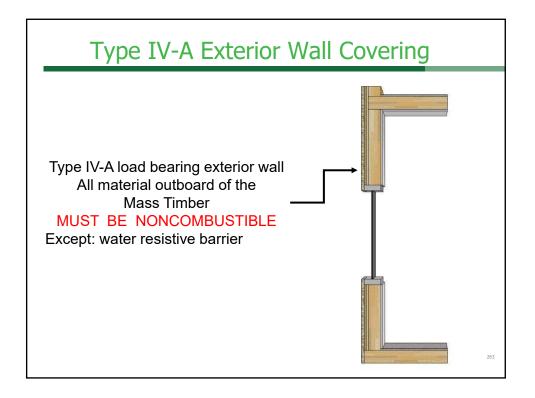
- **FS73-18:** Chapter 7 Section 718.2.1 Fireblocking Material; Approved AS
- G28-18: Section 403.3.2 High Rise Sprinkler Water Supply; Approved AS
- F88-18: Section 701.6 Owners Responsibility; Approved AS
- **F266-18:** Section 3308.4 of the IFC Fire Safety During Construction; Approved AM by modification DiGiovanni 2
- G75-18: Table 504.3; Approved AM by modification DiGiovanni 1

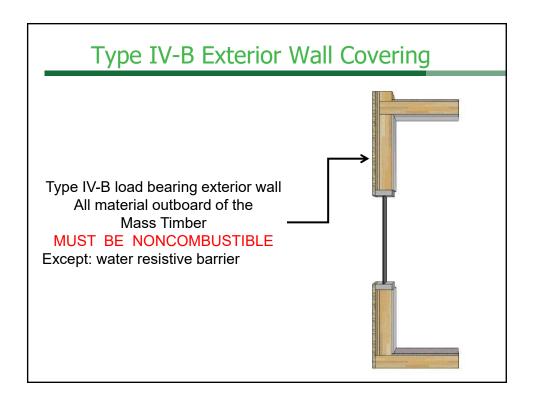


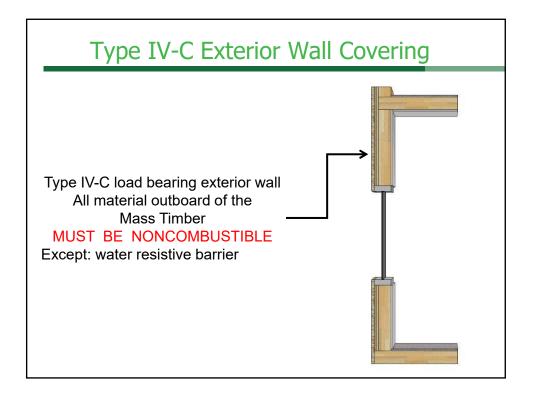
				TAE	BLE 6	601						
	TYP	TYPE I TYPE II TYPE III TYPE III				TYPE IV	IV TYPE V					
BUILDING ELEMENT	A	В	A	В	Α	в	A	B	<u> </u>	нт	Α	В
Primary structural frame ^f (see Section 202)	3ª	2ª	1	0	1	0	<u>3ª</u>	<u>2</u> ^a	<u>2</u> ^a	HT	1	0
Bearing walls Exterior ^{e, f} Interior	3 3ª	2 2ª	1	0	2 1	2	<u>3</u> <u>3</u>	<u>2</u> 2	<u>2</u> <u>2</u>	2 1/HT	1	0
Nonbearing walls and partitions Exterior		See Table 602										
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	<u>0</u>	<u>0</u>	<u>0</u>	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	<u>2</u>	<u>2</u>	2	нт	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2 ^b	1 ^{b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	<u>1 1/2</u>	<u>1</u>	1	нт	1 ^{b, c}	0

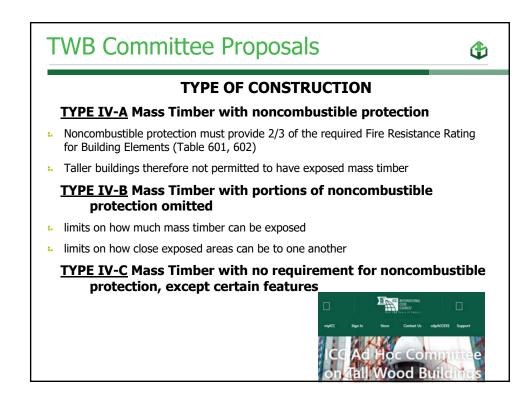
				TAE	BLE 6	01						
BUILDING ELEMENT	ТҮР	EI	TYP	EII	TYP	E III			TYPE IV		TYP	PEV
	A	в	Α	в	Α	В	A	B	<u>c</u>	HT	Α	В
Primary structural frame ^f (see Section 202)	3 ^a	2ª	1	0	1	0	<u>3</u> ^a	<u>2</u> ^a	<u>2</u> ^a	HT	1	0
Bearing walls Exterior ^{e, f} Interior	3 3 ^a	2 2ª	1	0	2 1	2 0	<u>3</u> <u>3</u>	<u>2</u> 2	<u>2</u> <u>2</u>	2 1/HT	1	0
Nonbearing walls and partitions Exterior		See Table 602										
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	<u>0</u>	0	<u>0</u>	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	2	2	2	нт	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2 ^b	1 ^{b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	<u>1 1/2</u>	1	1	HT	1 ^{b, c}	0

		<u>TABLE 602</u>		
FIRE SEPARATION DISTANCE = X(feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H	OCCUPANCY GROUP F-1, M, S-1	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U
X<5 ^b	ALL	3	2	1
5 <u><</u> X<10	IA, <u>IVA</u>	3	2	1
	Others	2	1	1
10 <u><</u> X<30	IA, IB <u>, IVA, IVB</u>	2	1	1 ^c
	IIB, VB	1	0	0
	Others	1	1	1 ^c
X>30	ALL	0	0	0









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V			V]
V				1
Y	-		Y	1
1			 T.	1
1				
7				

Type of Construction IV-C

Building Elem	<u>ent</u>
Maximum Height	85'
Number of Stories	4 - 9
Exposed Mass Timber	Fully Exposed
Sprinklers	Yes
Primary Frame FRR	2 hours
Floor FRR	2 hours
Stairs Tower	Mass Timber
FRR from Non-combustibles	0 hours
Concealed Spaces	OK if Protected
Floor topping	No requirement

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	_			_		
				La	Building Eler	nents
Ī	The state			H-m	Maximum Height	180′
	III I		11	r m	Number of Stories (except H's)	6 - 12
					Exposed Mass Timber	Partially
					Sprinklers	Yes
				L - U	Primary Frame FRR	2 hours
				P	Floor FRR	2 hours
		/		P	Fire Resistance from Non-cor	n 80 minutes
					Stairs Tower	Mass Timber
	27	1	/			OK if Protected
	27		/	/	Concealed Spaces	
	\vee	V	/		Floor topping	Noncombustible

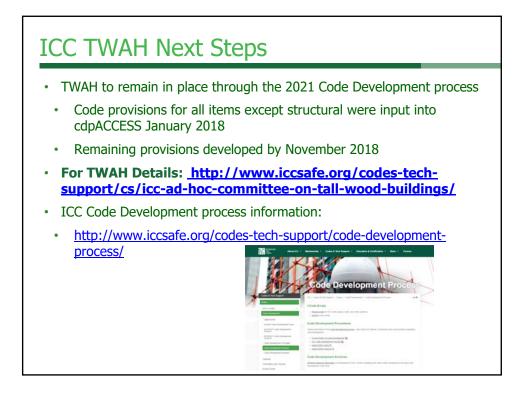
Type of Construction	IV-A
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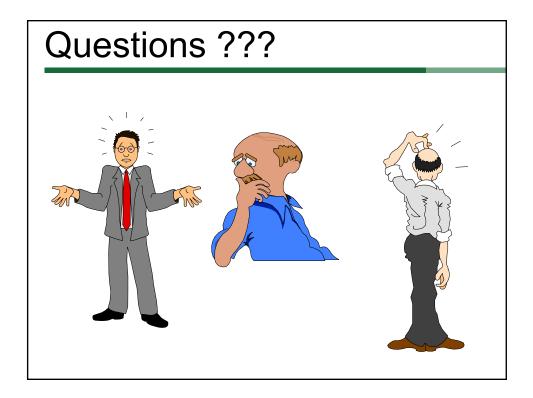
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111		1		1	
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<u>р</u> -	1 1		1	t	A A A
E.	11		11		Y
P-	1	1	1	t	-
E.	T		1	V	1
V	VT		1	1	-
E.	2.		1	1	
1	V	V	17	V	1
V	12.	7	7	V	1
V	V	V	V	V	-

Building Eleme	ents
Maximum Height	270′
Number of Stories (except H's)	9 - 18
Exposed Mass Timber	Fully Protected
Sprinklers	Yes
Primary Frame FRR	3 hours
Floor FRR	3 hours
Fire Resistance from Non-com	120 minutes
Stairs Tower	Non-combustible
Concealed Spaces	Permitted
Floor Topping	Noncombustible
	26

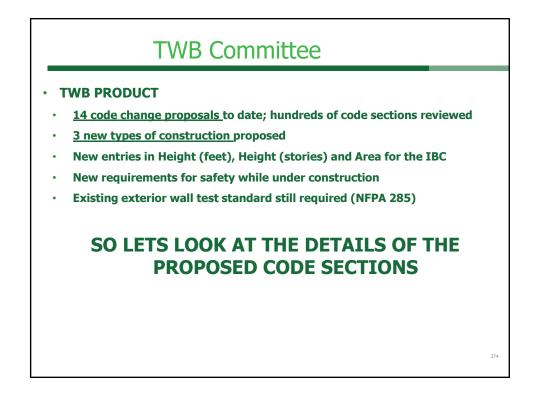


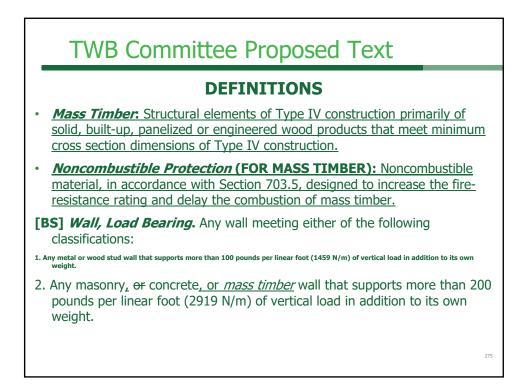
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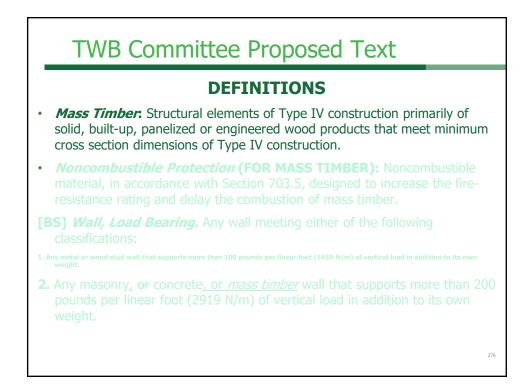


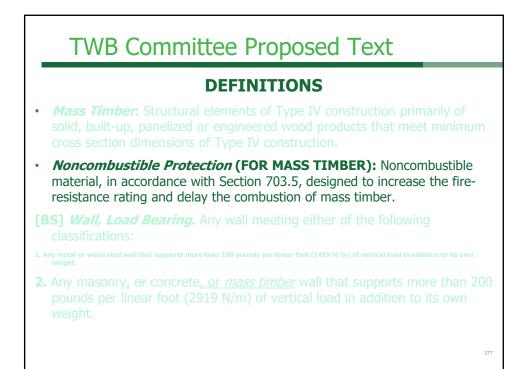


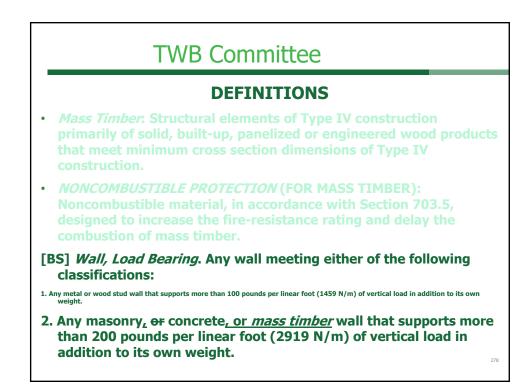


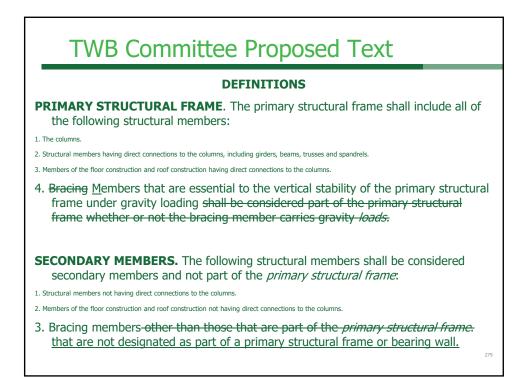


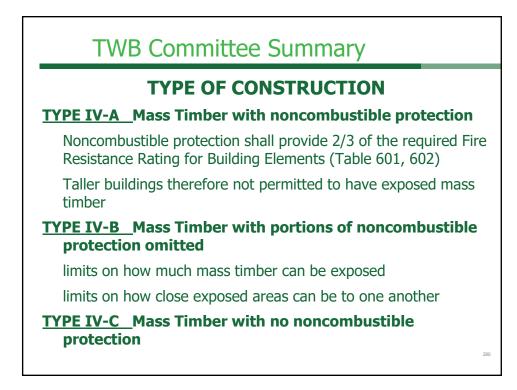












TWB Committee Summary

TYPE OF CONSTRUCTION

<u>TYPE IV-A</u> Mass Timber with noncombustible protection

Noncombustible protection shall provide 2/3 of the required Fire Resistance Rating for Building Elements (Table 601, 602)

Taller buildings therefore not permitted to have exposed mass timber

<u>TYPE IV-B</u> Mass Timber with portions of noncombustible protection omitted

limits on how much mass timber can be exposed

limits on how close exposed areas can be to one another

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<u>TYPE IV-C</u> Mass Timber with no noncombustible protection

TWB Committee Summary

TYPE OF CONSTRUCTION

<u>TYPE IV-A</u> Mass Timber with noncombustible protection

Noncombustible protection shall provide 2/3 of the required Fire Resistance Rating for Building Elements (Table 601, 602)

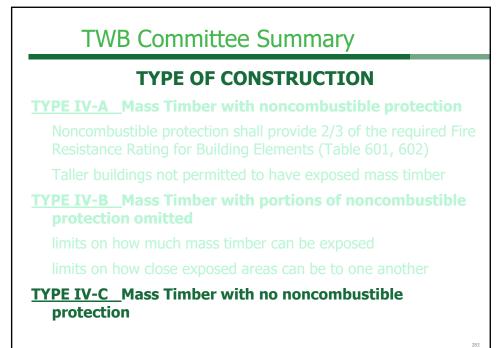
Taller buildings not permitted to have exposed mass timber

<u>TYPE IV-B</u> Mass Timber with portions of noncombustible protection omitted

limits on how much mass timber can be exposed

limits on how close exposed areas can be to one another

<u>TYPE IV-C</u> Mass Timber with no noncombustible protection



				TAE	BLE 6	<u>601</u>						
	TYP	TYPE I TYPE II TYPE III					TYPE IV TYPE			PEV		
BUILDING ELEMENT	Α	в	Α	В	Α	В	A	B	<u>c</u>	нт	Α	В
Primary structural frame ^f (see Section 202)	3ª	2 ^a	1	0	1	0	<u>3ª</u>	<u>2</u> ^a	<u>2</u> ^a	HT	1	0
Bearing walls Exterior ^{e, f} Interior	3 3ª	2 2ª	1	0	2 1	2 0	<u>3</u> <u>3</u>	<u>2</u> 2	<u>2</u> <u>2</u>	2 1/HT	1	0
Nonbearing walls and partitions Exterior		See Table 602										
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	<u>0</u>	<u>0</u>	<u>0</u>	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	<u>2</u>	<u>2</u>	2	нт	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2 ^b	1 ^{b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	<u>1 1/2</u>	<u>1</u>	1	нт	1 ^{b, c}	0

				TAE	BLE 6	01						
BUILDING ELEMENT	ТҮР	EI	TYP	PE II	TYP	E III			TYPE IV		TYP	PEV
	A	в	Α	В	Α	В	A	B	<u>c</u>	HT	Α	В
Primary structural frame ^f (see Section 202)	3 ^a	2ª	1	0	1	0	<u>3</u> ^a	<u>2</u> ^a	<u>2</u> ^a	HT	1	0
Bearing walls Exterior ^{e, f} Interior	3 3 ^a	2 2ª	1	0	2 1	2 0	<u>3</u> <u>3</u>	<u>2</u> 2	<u>2</u> <u>2</u>	2 1/HT	1	0
Nonbearing walls and partitions Exterior						See	Table	602				
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	<u>0</u>	0	Ō	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	2	2	2	нт	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2 ^b	1 ^{b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	<u>1 1/2</u>	1	1	НТ	1 ^{b, c}	0

		<u>TABLE 602</u>		
		TADLE 002		
FIRE SEPARATION DISTANCE = X(feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H	OCCUPANCY GROUP F-1, M, S-1	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U
X<5 ^b	ALL	3	2	1
5 <u><</u> X<10	IA, <u>IVA</u>	3	2	1
	Others	2	1	1
10 <u><</u> X<30	IA, IB <u>, IVA, IVB</u>	2	1	1 ^c
	IIB, VB	1	0	0
	Others	1	1	1 ^c
X <u>></u> 30	ALL	0	0	0

TWB Committee Thoughts

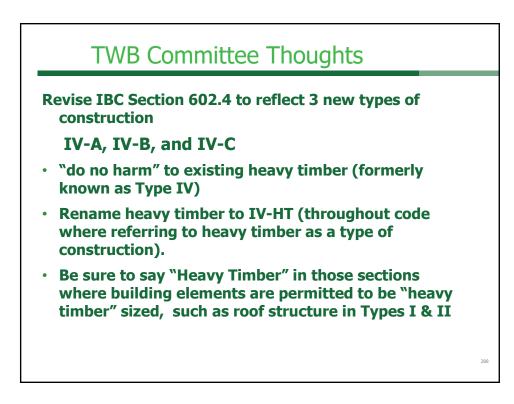
TYPE OF CONSTRUCTION

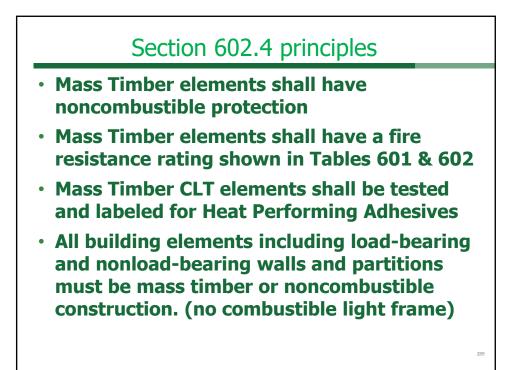
Each Type of Construction based upon test conditions in at least one of the 5 fire tests at ATF

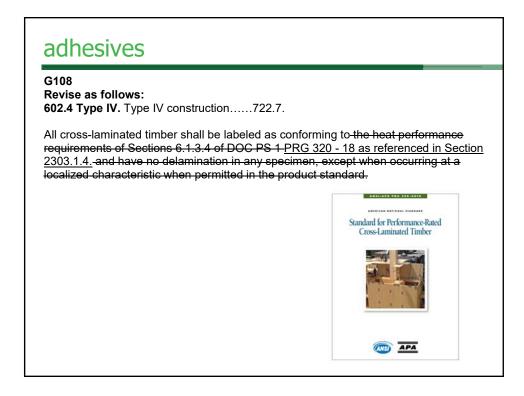
Fire Test Plan developed by the Fire Work Group

Test Plan included testing of various "generic" connections as recommended by the Structural Work Group

Both panel mass timber (CLT) and other mass timber (glulam beams and columns) were tested.



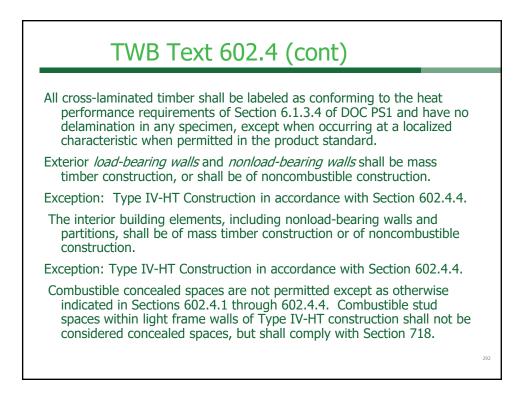


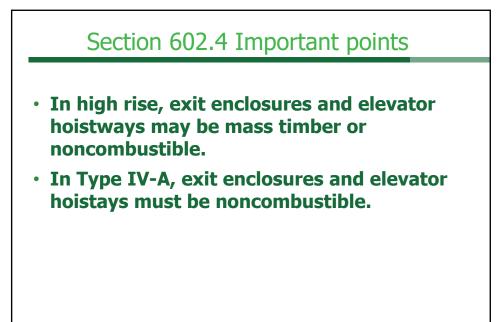


TWB Proposal Text

602.4 Type IV. Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have *fire resistance ratings* in accordance with Table 601. Mass timber elements shall meet the fire resistance rating requirements of this section based on either the fire resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2 or 703.3. The minimum dimensions and permitted materials for building elements shall comply with the provisions of this section and Section 2304.11. Mass timber elements of Types IV A, IV B and IV C construction shall be protected with noncombustible protection applied directly to the mass timber in accordance with Sections 602.4.1 through 602.4.3. The time assigned to the noncombustible protection shall be determined in accordance with Section 703.8 and comply with 722.7.

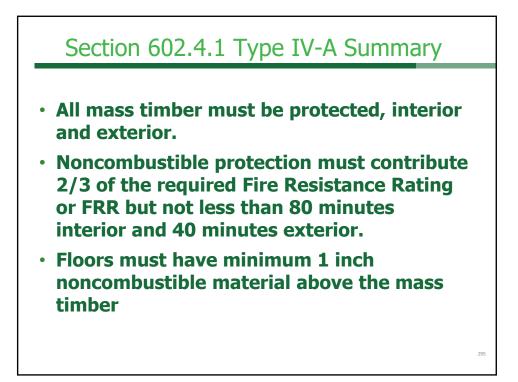
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TWB Text 602.4 (cont)

In buildings of Type IV-A, B, and C, construction with an occupied floor located more than 75 feet above the lowest level of fire department access, up to and including 12 stories or 180 feet above grade plane, mass timber interior exit and elevator hoistway enclosures shall be protected in accordance with Section 602.4.1.2. In buildings greater than 12 stories or 180 feet above grade plane, interior exit and elevator hoistway enclosures shall be constructed of non-combustible materials.



				TYPE IV		-
BUILDING ELEMENT	-	A	B	<u>c</u>	нт	-
Primary structural frame ^f (see Section 202)	-	<u>3ª</u>	<u>2</u> ^a	<u>2ª</u>	HT	-
Bearing walls Exterior ^{e, f} Interior	-	$\frac{3}{3}$	2	$\frac{2}{2}$	2 1/HT	-
Nonbearing walls and partitions Exterior		Table	602		Prote	nbustible ection
Nonbearing walls and partitions Interior ^d		<u>0</u>	<u>0</u>	<u>0</u>		uired vide 2/3
Floor construction and associated secondary members (see Section 202)		2	2	<u>2</u>	HT	-
Roof construction and associated secondary members (see Section 202)		<u>1 1/2</u>	1	1	HT	-

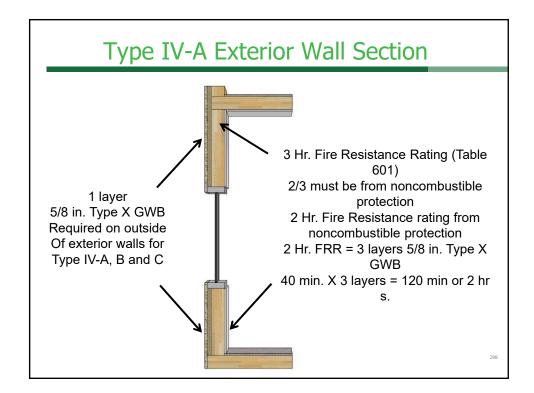
TWB Committee Proposal

Table 722.7.1(a) Protection Required From Noncombustible Covering Material

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

Table 722.7.1(b) Protection Provided By Noncombustible Covering Material

Noncombustible Protection	Protection Contribution (minutes)
¹ / ₂ inch Type X Gypsum Board	30
5/8 inch Type X Gypsum Board	40



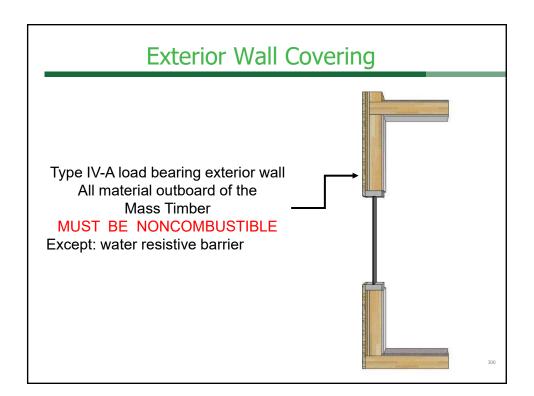
TWB Type IV-A Text cont'd

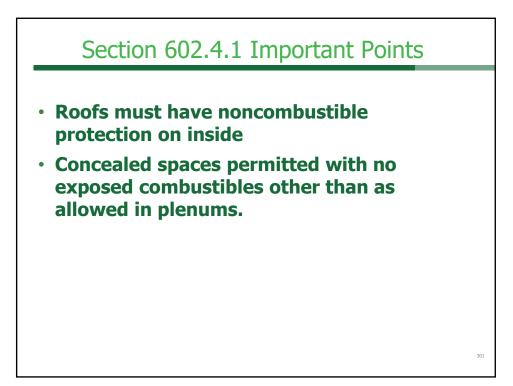
Type IV-A

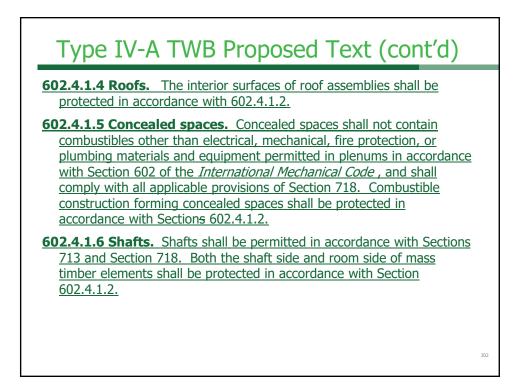
602.4.1.1 Exterior Protection. The outside face of exterior walls of mass timber construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a)). All components of the **exterior wall covering**, shall be of noncombustible material except water resistive barriers having....

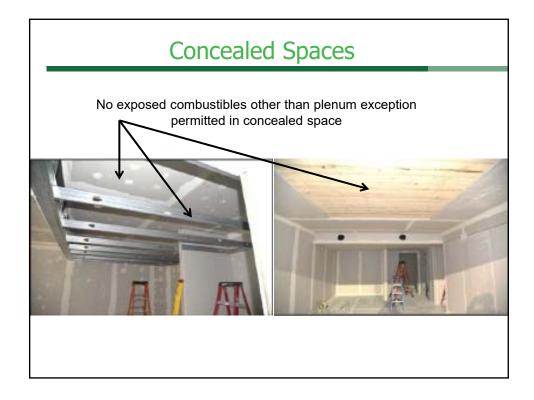
Definition of Exterior wall covering: A material or assembly of materials applied on the exterior side of *exterior walls for the purpose of providing a weather-resisting barrier*, insulation or for aesthetics, including but not limited to, *veneers*, *siding*, *exterior insulation and finish systems*, *architectural trim and embellishments such as cornices*, *soffits*, facias, gutters and leaders.

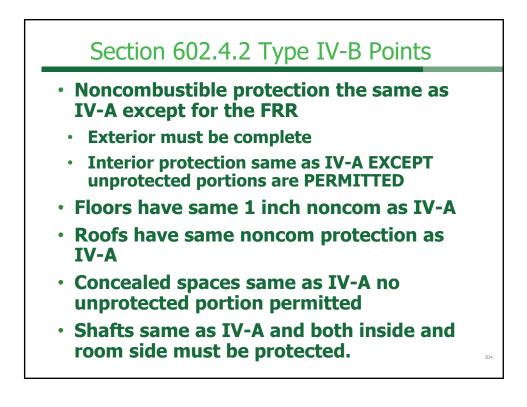
- **602.4.1.2 Interior Protection.** Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.5.
- **602.4.1.2.1 Protection time.** Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(a), but not less than 80 minutes.
- **602.4.1.3 Floors.** The floor assembly shall contain a noncombustible material not less than one inch in thickness above the mass timber.











Type IV-B TWB Committee Proposed Text

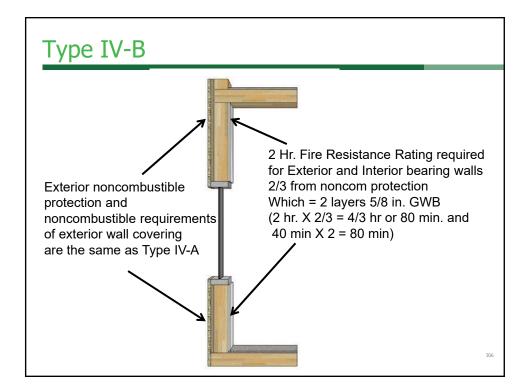
Type IV-B

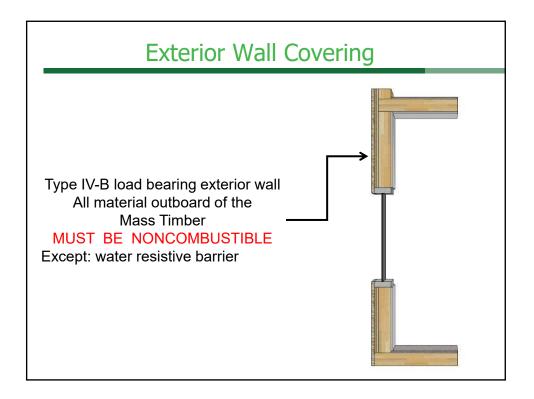
602.4.2.1 Exterior Protection. The outside face of exterior walls of mass timber construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a). All components of the *exterior wall covering*, shall be of noncombustible material except water resistive barriers having

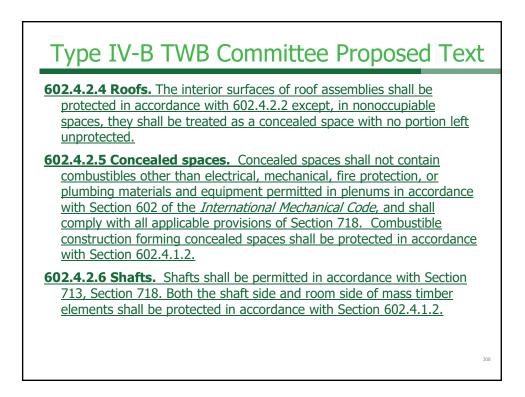
602.4.2.2 Interior Protection. Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected, as required by this section, with materials complying with Section 703.5.

MORE ON THIS PROTECTION REQUIREMENT TO FOLLOW

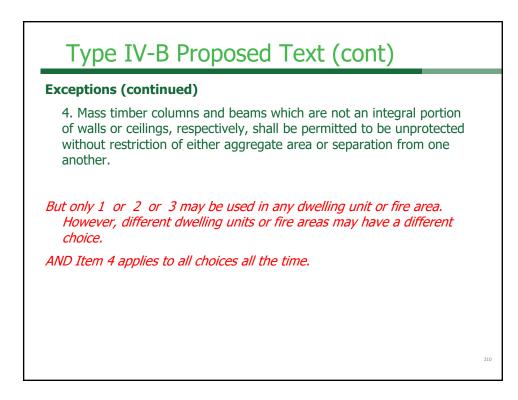
602.4.2.3 Floors. The floor assembly shall contain a noncombustible material not less than one inch in thickness above the mass timber.

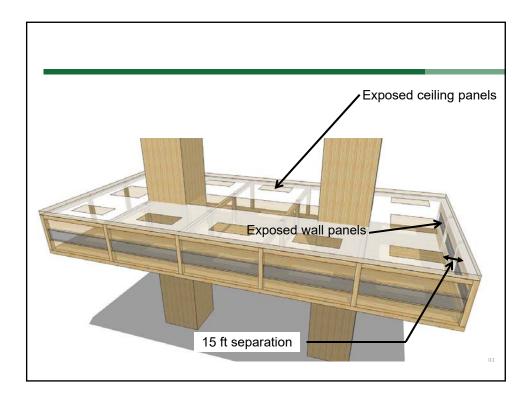


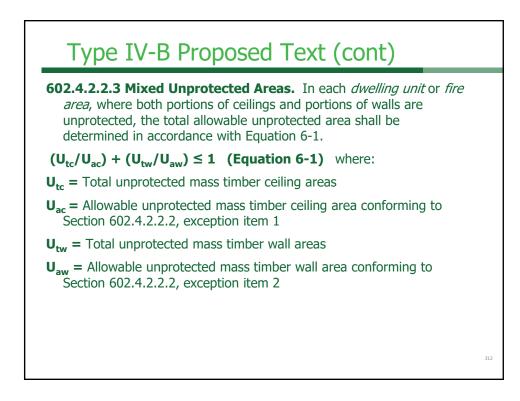




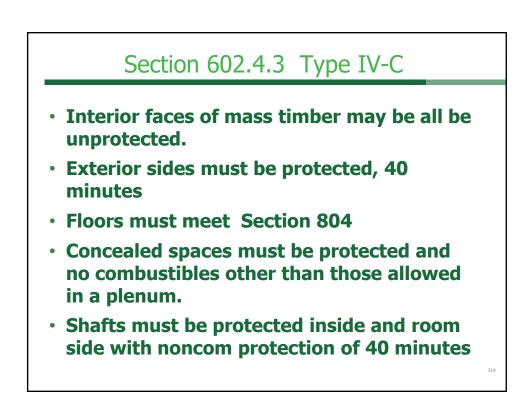
Type IV-B TWB Committee Proposed Text 602.4.2.2.2 Protected Area. All interior faces of all mass timber elements shall be protected in accordance with Section 602.4.2.2.1, including the inside faces of exterior mass timber walls and mass timber roofs. Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following: 1 Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20% of the floor area in any dwelling unit or fire area; or 2 Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40% of the floor area in any dwelling unit or fire area; or 3 Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with section 602.4.2.2.3.







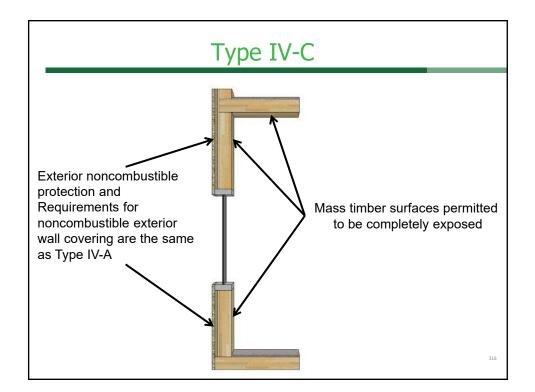
DECOMPATION OF A CONTRACT OF



Type IV-C TWB Committee Text

Type IV-C

- **602.4.3.1 Exterior Protection.** The exterior side of walls of combustible construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a). All components of the exterior wall covering, shall be of noncombustible material except water resistive barriers having a peak heat release rate of less than 150kW/m²
- **602.4.3.2 Interior Protection**. Mass timber elements are permitted to be unprotected.
- **602.4.3.3 Floors.** Floor finishes in accordance with Section 804 shall be permitted on top of the floor construction.
- **602.4.3.4 Roofs.** Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

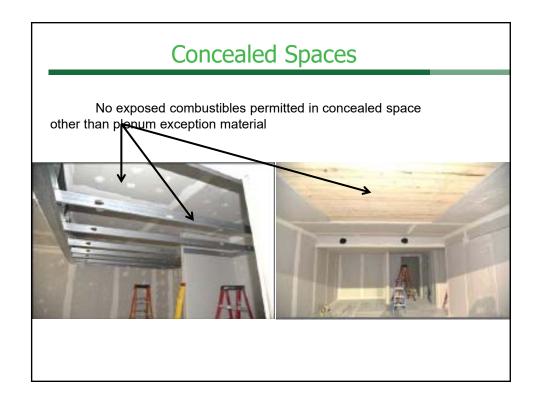


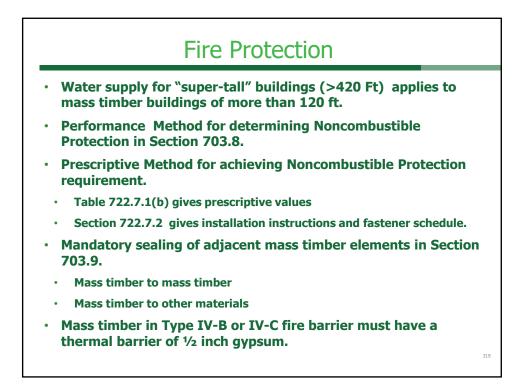
TWB Committee

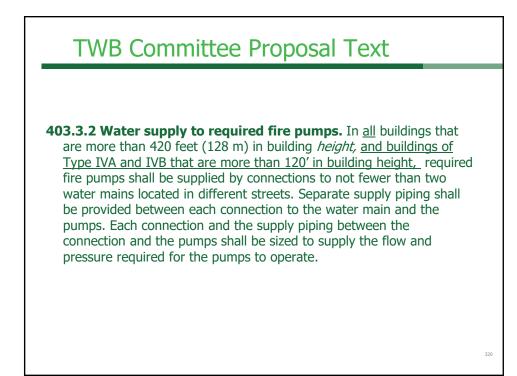
602.4.3.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *International Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a).

602.4.3.6 Shafts. Shafts shall be permitted in accordance with Section 713 and Section 718. Shafts and elevator hoistway and interior exit stairway enclosures shall be protected with noncombustible protection with a minimum assigned time of 40 minutes as determined in Section 722.7.1(a), on both the inside of the shaft and the outside of the shaft.

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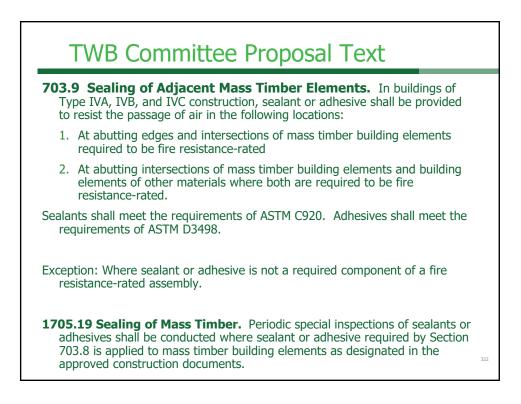


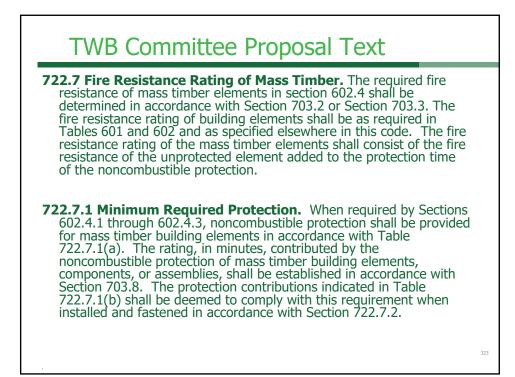


TWB Committee Proposal Text

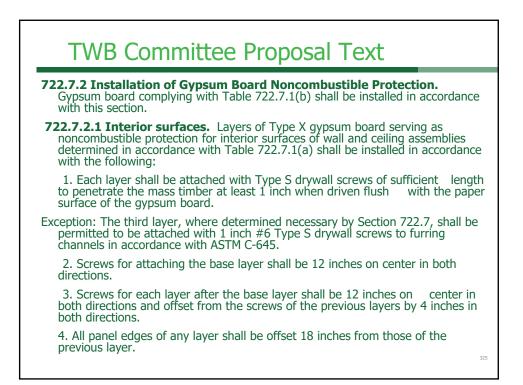
- **703.8 Determination of Noncombustible Protection time contribution.** The time, in minutes, contributed to the fire resistance rating by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E 119 or UL 263.
- **703.8.1** Test assembly 1 shall be without protection, and test assembly 2 shall contain the representative noncombustible protection. The test assemblies shall be identical in construction, loading, and materials, other than the noncombustible protection. The two test assemblies shall be tested to the same criteria of structural failure. The noncombustible protection time contribution shall be determined by subtracting the fire resistance time, in minutes, of test assembly 1 from the fire resistance time, in minutes, of test assembly 2.
- **703.8.2** The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

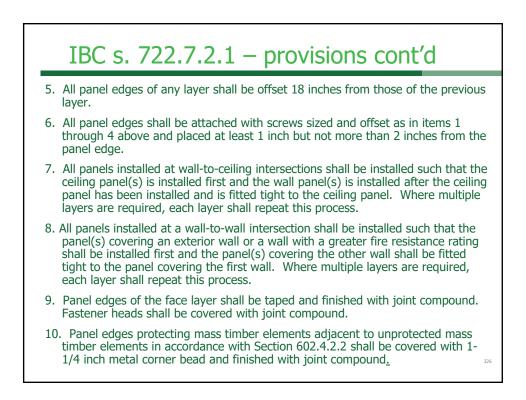
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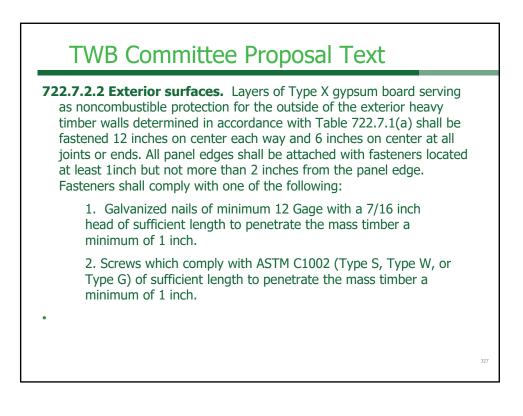


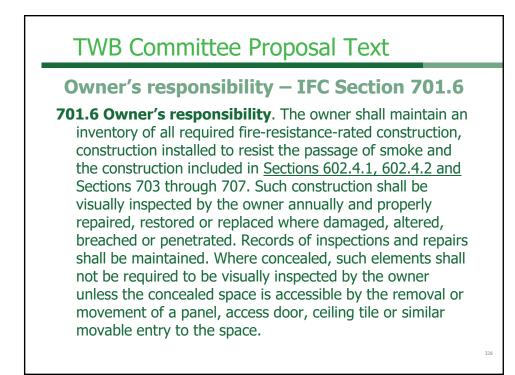


	Proposal Text
able 722.7.1(a) Protection Require	d From Noncombustible Covering Materi
Fire Resistance Rating of Building	Minimum Protection Required from
Element (tables 601 and 602) (hours)	Noncombustible Protection (minutes)
1	40
2	80
3 or more	120
Noncombustible Protection	Protection Contribution (minutes)
¹ / ₂ inch Type X Gypsum Board	30
5/8 inch Type X Gypsum Board	40









TWB Committee Proposal Text

FIRE RESISTANCE RATED SEPARATION

Chapter 5 (Modify as shown below)

508.4.4 Separation. Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.

508.4.4.1 Construction. Required separations shall be *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. <u>Mass timber elements serving as fire barriers or horizontal assemblies in Type IV-B or IV-C construction shall be separated from the interior of the building with an approved thermal barrier consisting of a minimum of ½ gypsum wallboard or a noncombustible equivalent.</u>

TWB Committee

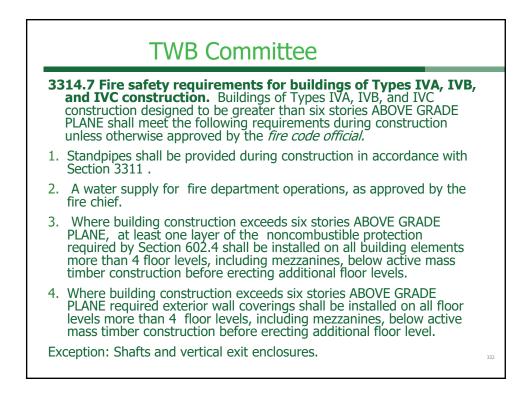
FIRE RESISTANCE RATED SEPARATION

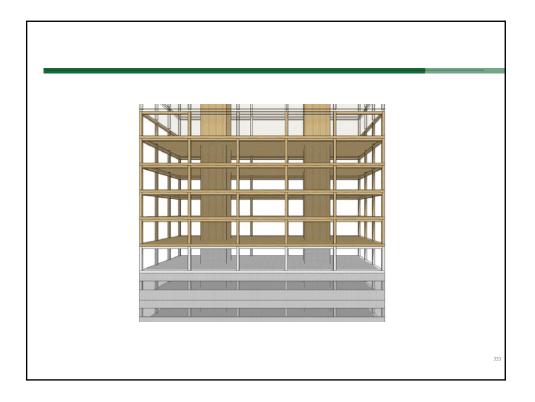
509.4.1.1 Type IV-B and IV-C construction. Mass timber elements serving as fire barriers or a horizontal assembly in Type IV-B or IV-C construction shall be separated from the interior of the building with an approved thermal barrier consisting of a minimum of ½ gypsum wallboard or a noncombustible equivalent.

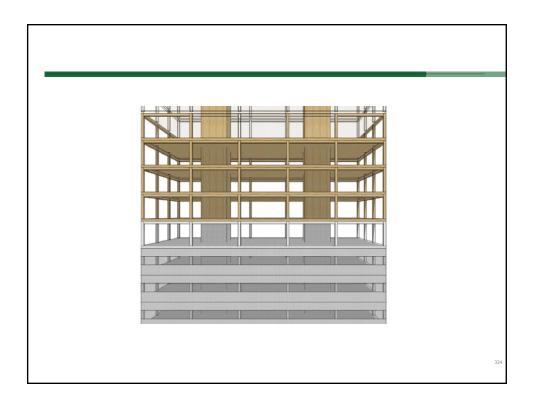
509.4.1 Separation. Where Table 509 specifies a fire-resistance- rated separation, the incidental uses shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both. Construction supporting 1-hour fire barriers or horizontal assemblies used for incidental use separations in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code."

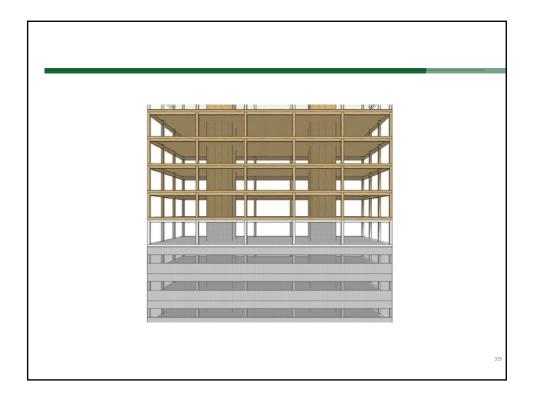
Fire Protection in IFC

- Owner is responsible to visually inspect all fire resistance rated construction and keep a record.
- Type IV A, B and C greater than 6 stories needs, during construction:
 - Standpipes in accordance with 3313
 - Water supply for fire department operations.
 - 1 layer of noncom protection, if required, on all mass timber more than 4 stories below active work floor.
 - Exterior wall coverings on all floor levels more than 4 levels below work floor. Includes Mezz.





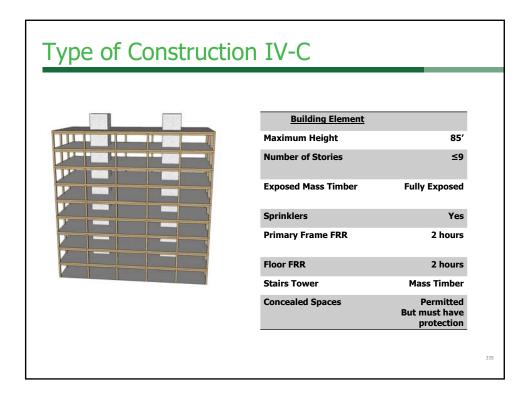


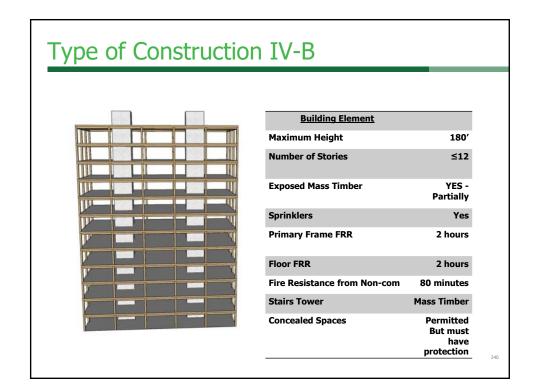


	Type of Constr	uction Comparison	
Feature	Type IVA	Type IVB	Type IVC
Description of new Type IV types	100 % Noncombustible (NC) protection on all surfaces of Mass Timber (MT)	•	except: shafts, concealed spaces, and outside of exterior walls.
Permitted Materials			
structural building elements	MT or NC	MT or NC	MT or NC
Nonloadbearing Exterior Walls	MT or NC	MT or NC	MT, NC
Nonloadbearing Interior Walls	MT or NC	MT or NC	MT, NC
Shaft and Exit Enclosures			
Highrise* to 12 stories or 180 feet: *see IBC definition of highrise	NC or MT protected with 2 (or 3 when 3 hr FRR) layers of 5/8" type X;	•	NC or MT protected with one layer of 5/8" type X gypsum each side of shaft or enclosure.
Above 12 stories or 180 feet:	NC	Not Permitted	Not Permitted

Interior Protection			
	3 layers of 5/8" type X gypsum 2 layers of 5/8" type X gypsum 1 layer of 5/8" type X gypsum	Limited exposed MT elements must have same FRR but done	All MT is allowed to be exposed except for 1 layer of 5/8" type : on outside surfaces of exterior walls, inside and outside of shafts and exit enclosures, and i concealed spaces.
Exterior Protection			
	Minimum of 1 layer of 5/8" type X gypsum	Minimum of 1 layer of 5/8" type X gypsum	Minimum of 1 layer of 5/8" typ X gypsum

	TWB Com		
Floor Surface	1 inch of NC protection	1 inch of NC protection	No protection required
Roof	No NC protection on exterior roof surface, 2 layers of 5/8" type X gypsum on interior roof surfaces.	No NC protection on exterior roof surface, 2 layers of 5/8" type X gypsum on inside of roof deck.	No protection on roof surface o inside of roof deck is required (unless concealed space).
Concealed Spaces	No exposed MT in concealed spaces. NC protection in concealed spaces.	No exposed MT in concealed spaces. NC protection in concealed spaces.	No exposed MT in concealed spaces. One layer of 5/8" type of gypsum NC protection in concealed spaces.
Table 601, FRR			
Primary frame or			
bearing Wall: Floors: Roof:	3 hr FRR; 2 hr FRR; 1.5 hr FRR;	2 hr FRR; 2 hr FRR; 1 hr FRR;	2 hr FRR; 2 hr FRR; 1 hr FRR;
Fire Resistance Rating trade off	NO FRR reduction for sprinkler in 403.3.2.1	NO FRR reduction for sprinkler in 403.2.1	NO FRR reduction for sprinkler i 403.2.1





Type of Construction	on IV-A	_
	Building Element	
	Maximum Height	270′
	Number of Stories	≤18
	Exposed Mass Timber	NONE - Fully Protected
	Sprinklers	Yes
	Primary Frame FRR	3 hours
	Floor FRR	3 hours
	Fire Resistance from Non-com	120 minutes
	Stairs Tower	Non- combustible
	Concealed Spaces	Permitted But must have protection.

		Commi			
	TABLE 504.4 - ALLO	WABLE NUMBER C	F STORIES ABOVI	E GRADE PLANE	_
	NS=Nonsprinklerd S= Sprinklered	Type IV-A	Type IV-B	Type IV-C	Type IV-H
A-1	NS	3	3	3	3
A-1	S	2	6	4	4
A-2	NS	3	3	3	3
A-2	S	18	12	6	4
A-3	NS	3	3	3	3
A-3	S	18	12	6	4
A-4	NS	3	3	3	3
A-4	S	18	12	6	4
A-5	NS	1	1	1	1
A-5	S	UL	UL	UL	UL
в	NS	5	5	5	5
в	S	18	12	2	6
E	NS	3	3	3	3
E	S	9	<u>6</u>	4	4
F-1	NS	3	3	3	3
P-1	S	10	<u>7</u>	5	5
F-2	NS	5	5	5	5
F-2	S	12	8	6	6
H-1	NS	NP	NP	NP	NP
H-1	S	1	1	1	1
	NS	1	1	1	1
H-2	S	2	2	2	2

		Commi	Hee		
		comm			
н-з	NS	3	3	3	3
n-3	S	4	4	4	4
H-4	NS	5	5	5	5
H-4	s	8	Z	6	6
H-5	NS	2	2	2	2
H-S	S	3	3	3	3
1-1	NS	4	4	4	4
(1)	s	10	_7	5	5
1-1	NS	3	3	3	3
(2)	s	10	6	4	4
1-2	NS	NP	NP	NP	NP
1-2	s	Z	5	1	1
1-3	NS	2	2	2	2
1-3	S	Z	5	3	3
1-4	NS	3	3	3	3
1-4	s	2	6	4	4
	NS	4	4	4	4
M	s	12	8	6	5
R-1	NS	4	4	4	4
R-1	s	18	12	8	5
0.2	NS	4	4	4	4
R-2	s	18	12	8	5
R-3	NS	4	4	4	4
R-3	s	18	12	5	5
R-4	NS	4	4	4	4
R-4	S	18	_12	5	5
anare di	NS	4	4	4	4
S-1	S	10	Z	5	5
	NS	4	4	4	4
S-2	S	12	8	5	5
55	NS	4	4	4	4
U	S	9	6	5	5





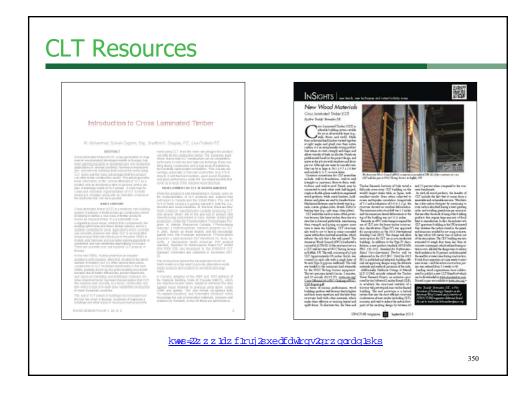
	ALLOWABLE BUILD		Table				CRAF		ura, d				
	ALLOWADLE DOILL		light	INTE	LIA			OF CON		TION			
						- '	TPE	JF CON	SINUC	HON			
Occupancy	SEE	_ п			TYPE III			TYPE IV			TYPE V		
Classification	FOOTNOTES												
		A	В	A	В	Α	В	<u>A</u>	B	Ē	HT	A	В
	NS ^{b, d}	UL	160	65	55	65	55	65	65	65	65	50	40
A, B, E, F, M, S, U	S	UL	180	85	75	85	75	270	180	85	85	70	60
	NS ^{c, d}	UL	160	65	55	65	55	120	90	65	65	50	40
H-1, H-2, H-3, H-5	S	UL						_					
	NS ^{c, d}	UL	160	65	55	65	55	65	65	<u>65</u>	65	50	40
H-4	S NS ^{d, e}	UL	180	85	75	85	75	140	100	85	85	70	60
	NS ^{6, 2}	UL	160		-	65	55	<u>65</u>	<u>65</u>	65	65	50	40
I-1 Condition 1, I-3	NS ^{d, e, f}	UL	180 160	85 65	75	85	75	180	120	<u>85</u>	85	70 50	60 40
I-1 Condition 2, I-2	S	UL	180	85	55	65	55	65	<u>65</u>	<u>65</u>	65	70	60
1-1 Condition 2, 1-2	NS ^{d, g}	UL	160	65	55	65	55	65	65	65	65	50	40
1-4	s	UL	180	85	75	85	75	270	180	85	85	70	60
	NS ^d	UL	160	65	55	65	55	65	65	65	65	50	40
R ^h	\$13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	270	180	85	85	70	60

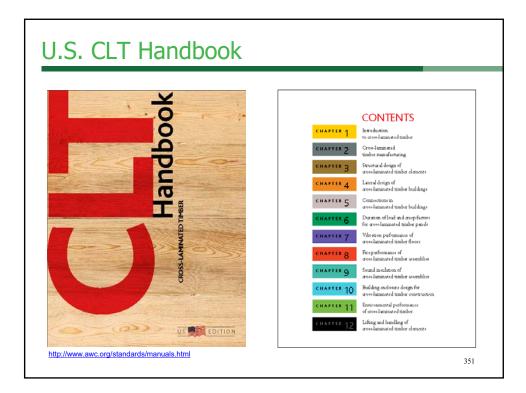
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		- 1 \	NR	CO	mm	nitte	ee				
			۵		E AREA Fa	Table actor (A _t =N	506.2 IS, S1, SM)	in SQUAR	E FEET		
Use Group	NS - non sprklrd S1 -1 story sprnklrd SM - >1 story sprklrd	Type I-A	Type I-B	Type II-A	Type II-B	Type IV-A	Type IV-B	Type IV-C	Туре IV-НТ	Type V- A	Type V- B
	NS	UL	UL	15,500	8,500	45,000	30,000	18,750	15,000	11,500	5,500
A-1	S1	UL	UL	62,000	34,000	180,000	120,000	75.000	60,000	46,000	22,000
A-1	SM	UL	UL	46,500	25,500	135,000	90,000	56,250	45,000	34,500	16,500
	NS	UL	UL	15,500	9,500	45,000	30,000	18,750	15,000	11,500	6,000
A-2	51	UL	UL	62,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
A-2	SM	UL	UL	46,500	28,500	135,000	90,000	56,250	45,000	34,500	18,000
	NS	UL	UL	15,500	9,500	45,000	30,000	18,750	15,000	11,500	6,000
A-3	51	UL	UL	62,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
A-3	SM	UL	UL	46,500	28,500	135,000	90,000	56,250	45,000	34,500	18,000
	NS	UL	UL	15,500	9,500	45,000	30,000	18,750	15,000	11,500	6,000
A-4	S1	UL	UL	62,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
A.4	SM	UL	UL	46,500	28,500	135,000	90,000	56,250	45,000	34,500	18,000
	NS NS										
A-5	51	UL	UL	UL	UL	<u>UL</u>	UL	UL	UL	UL	UL
N-3	SM										
	NS	UL	UL	37,500	23,000	108,000	72,000	45,000	36,000	18,000	9,000
в	S1	UL	UL	150,000	92,000	432,000	288,000	180,000	144,000	72,000	36,000
в	SM	UL	UL	112,500	69,000	324,000	216,000	135,000	108,000	54,000	27,000
	NS	UL	UL	26,500	14,500	76,500	51,000	31,875	25,500	18.500	9,500

		1 \	ND	CO		nitte	ee				
Use Group	NS - non sprklrd S1 -1 story sprnklrd SM - >1 story	Type I-A	Type I-8	Type II-A	Type II-B	<u>Type</u> <u>IV-A</u>	<u>Type</u> <u>IV-B</u>	<u>Type</u> <u>IV-C</u>	Type IV-HT	Type V- A	Type V- B
	sprklrd S1	UL	UL	106,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
E	SM	UL	UL	79,500	43,500	229,500	<u>153,000</u>	<u>95,625</u>	76,500	55,500	28,500
	NS	UL	UL	25,000	15,500	100,500	67,000	41,875	33,500	14,000	8,500
F-1	S1	UL	UL	100,000	62,000	402,000	268,000	167,500	134,000	56,000	34,000
1-1	SM	UL	UL	75,000	46,500	301,500	201,000	125,625	100,500	42,000	25,500
	NS	UL	UL	37,500	23,000	151,500	101,000	63,125	50,500	21,000	13,000
F-2	S1	UL	UL	150,000	92,000	606,000	404,000	252,500	202,000	84,000	52,000
1.7	SM	UL	UL	112,500	69,000	454,500	303,000	189,375	151,500	63,000	39,000
H-1	NS ^c S1	21,000	16,500	11,000	7,000	10,500	10,500	10,500	10,500	7,500	NP
H-2	NS ^C S1 SM	21,000	16,500	11,000	7,000	<u>10,500</u>	<u>10,500</u>	<u>10,500</u>	10,500	7,500	3,000
H-3	NS ^C S1 SM	UL	60,000	26,500	14,000	25,500	<u>25,500</u>	25,500	25,500	10,000	5,000
	NS	UL	UL	37,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500
	51	UL	UL	150,000	70,000	288,000	216,000	162,000	144,000	72,000	26,000
H-4	SM	UL	UL	112,500	52,500	216,000	162,000	121,500	108,000	54,000	19,500
	NS	UL	UL	37,500	23,000	72,000	54,000	40,500	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	288,000	216,000	162,000	144,000	72,000	36,000
H-5	SM	UL	UL	112,500	69,000	216,000	162,000	121,500	108,000	54,000	27,000

_			T\	NB	Со	mn	nitte	ee			_		
		NS	UL	55,000	19,000	10,000	54,000	36,000	18,000	18,000	10,500	4,500	
		S1	UL	220,000	76,000	40,000	216,000	144,000	72,000	72,000	42,000	18,000	
	1-1	SM	UL	165,000	57,000	30,000	162,000	108,000	54,000	54,000	31,500	13,500	
		NS	UL	UL	15,000	11,000	36,000	24,000	12,000	12,000	9,500	NP	
		S1	UL	UL	60,000	44,000	144,000	96,000	48,000	48,000	38,000	NP	
	1-2	SM	UL	UL	45,000	33,000	108,000	72,000	36,000	36,000	28,500	NP	
		NS	UL	UL	15,000	10,000	36,000	24,000	12,000	12,000	7,500	5,000	
	1-3	S1	UL	UL	45,000	40,000	144,000	96,000	48,000	48,000	30,000	20,000	
	1-3	SM	UL	UL	45,000	30,000	108,000	72,000	36,000	36,000	22,500	15,000	
		NS	UL	60,500	26,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000	
	1-4	S1	UL	121,000	106,000	52,000	306,000	204,000	102,000	102,000	74,000	36,000	
	1-4	SM	UL	181,500	79,500	39,000	229,500	153,000	76,500	76,500	55,500	27,000	
		NS	UL	UL	21,500	12,500	61,500	41,000	25,625	20,500	14,000	9,000	
	м	S1	UL	UL	86,000	50,000	246,000	164,000	102,500	82,000	56,000	36,000	
		SM	UL	UL	64,500	37,500	184,500	<u>123,000</u>	76,875	61,500	42,000	27,000	
	R-1	NS S13R	UL	UL	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000	
		\$1	UL	UL	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000	
		SM	UL	UL	72.000	48,000	184,500	123,000	76,875	61,500	36,000	21,000	
		NS			. 2,000	,	10.1000	1101000	10/010	01/000			
		S13R	UL	UL	24,000	16,000	<u>61,500</u>	41,000	25,625	20,500	12,000	7,000	
	R-2	\$1	UL	UL	96.000	64,000	246,000	164,000	102,500	82.000	48,000	28.000	
		SM	UL	UL	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000	
		NS S13D			. 2,000	10,000	101,000	123,000	10,013	01,000	22,000	22,000	
	R-3	\$13R	UL	UL	UL	UL	<u>UL</u>	<u>UL</u>	<u>UL</u>	UL	UL	UL	
		S1 SM											
		NS S13D	UL	UL	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000	
	R-4	\$13R	1										
		\$1	UL	UL	96,000	64,000	246,000	164.000	102.500	82,000	48,000	28,000	34
		SM	UL	UL	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000	



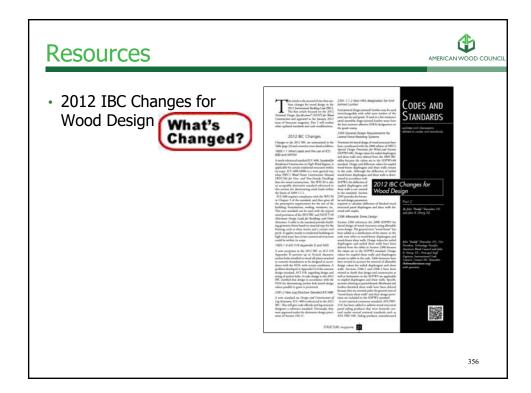








Framing Member	Design Reference	Product Standard
Sawn lumber	NDS	USDOC PS20
Structural Glued Laminated Timber	NDS	ANSI A190.1 & ASTM D3737
Prefabricated Wood I-Joists	NDS and ER	ASTM D5055
Structural Composite Lumber	NDS and ER	ASTM D5456
Wood Structural Panels	NDS and ER	USDOC PS1 & PS2
Cross Laminated Timber	ER	ANSI/APA PRG 320



urces		AME
Summary of Changes to 2012 IBC.		
IBC Section	Standard or topic	Modification
1609.1.1 Determination of wind loads	AWC 2012, Wood Frame Construction Manual (WFCM) for One- and Two-Family Dwellings	Updated standard
	ICC 600 Standard for Residential Construction in High-Wind Regions	Updated standard
1905.1.9 ACI 318, Section D.3.3	ACI 318-11 Appendix D	Permits NDS anchor bolt design
2301.2 General design requirements	AWC WFCM 2012	Updated standard
	ICC-400-12 Log Structure Standard	Updated standard
2301.1.1.2 End-jointed lumber	End-jointed lumber	New heat resistant adhesive designation
2303.1.4 Wood structural panels 2304.6.2 Interior paneling	DOC PS 1-09 and PS 2-10 for Plywood and Wood-based Structural-use Panels	Updated standards
2305 Lateral Force Resisting System	AWC 2008 Special Design Provisions for Wind and Seismic (SDPWS)	Removed code criteria duplicated in 2008 SDPWS
2306 Allowable stress design	AWC 2008 SDPWS	Removed code criteria duplicated in 2008 SDPWS
2306.1 Allowable stress design	AWC NDS-2012	Updated standard
reference standards	AITC 113-10 Standard glulam dimensions	Updated standard
	AITC 117-10 Softwood glulam	Updated standard
	APA PRP-210 plywood siding	New standard
2306.1.1 Joists and Rafters	AWC Span Tables for Joists and Rafters 2012	Updated standard
2307 Load and resistance factor design	AWC 2008 SDPWS	Removed code criteria duplicated in 2008 SDPWS
2307.1 Load and resistance factor design reference standards	AWC NDS-2012	Updated standard
2308.2.1 Nominal design wind speed greater than 100 mph (3-second gust)	AWC WFCM 2012	Updated standard
2308.12.4 Braced wall line sheathing	Braced wall line requirements for seismic design categories D and E	Table 2308.12.4 revised and new section 2308.12.4.1 added

