

# MASS TIMBER HYBRID HOUSING IN DENVER

## DESIGN OF CIRRUS

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Presented by Chris Kendall, PE



*Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.*

# OUTLINE

1. CONSTRUCTION TYPE IIIA FLOOR TO WALL INTERFACE COMPARISON
2. ACOUSTICS
3. STRUCTURAL DESIGN
4. CONSTRUCTION DETAILS
5. ADVANTAGES OF MASS TIMBER HYBRID RELATIVE TO STANDARD LIGHT FRAME
6. OPPORTUNITIES FOR EXPANDED SERVICES



CIRRUS

287

88

73

6

Irving St

1st Ave

# Cirrus

Multi Unit Residential

232,000 square feet

Type III-A Wood Construction

Over 200,000 square feet of Type I-A  
concrete

Architect: Kattera & Davis Partnership

Structural Engineer: KL&A

General Contractor: Kattera

Mass Timber Supplier: Kattera



# Cirrus



292 Residential Units  
Building encompasses 2 courtyards  
Includes rooftop amenity  
Multiple two-story spaces including  
fitness and club room  
Building separation joint above podium



# CONSTRUCTION TYPE

**TABLE 601**  
**FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)**

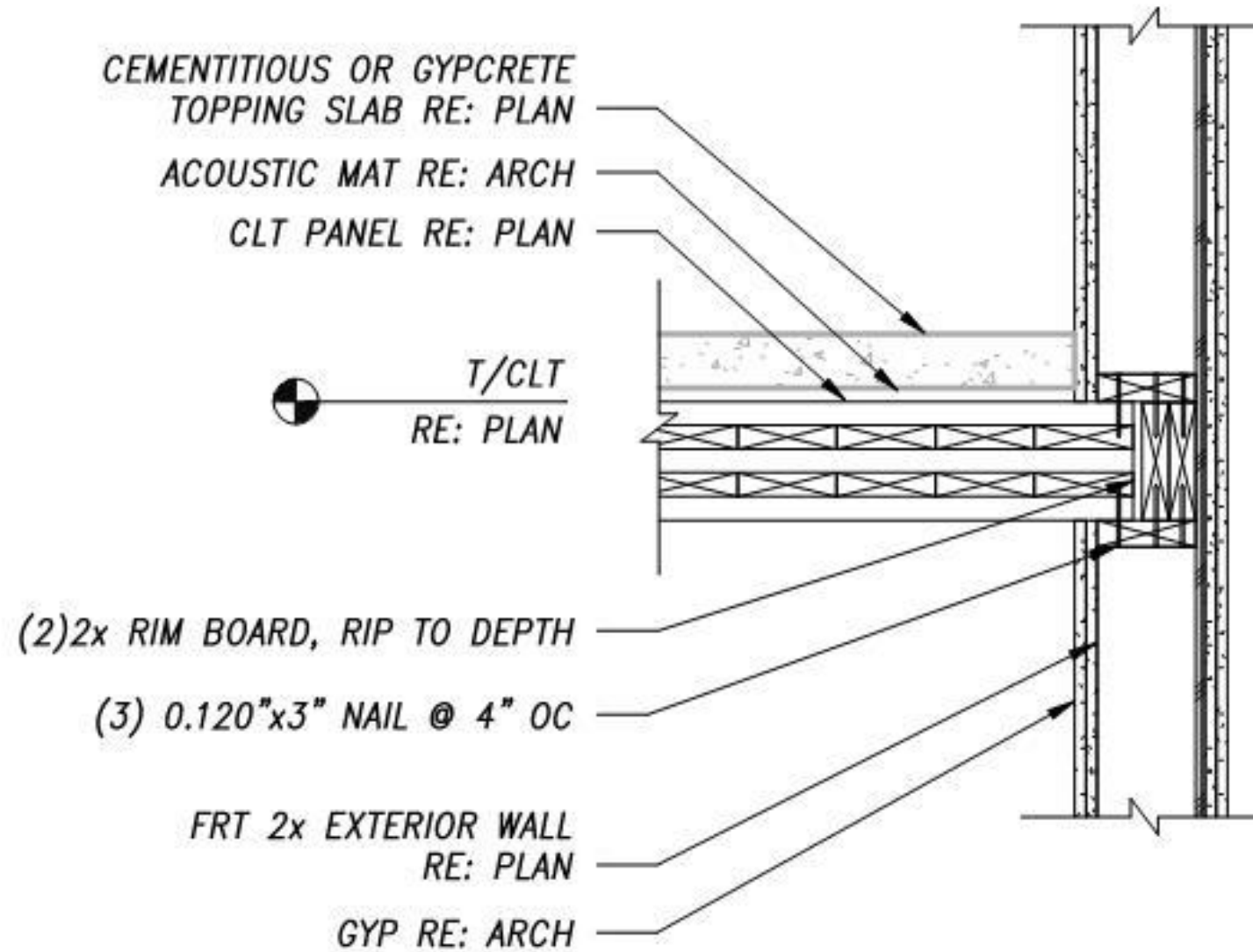
BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame <sup>f</sup> (see Section 202)	3 <sup>a, b</sup>	2 <sup>a, b</sup>	1 <sup>b</sup>	0	1 <sup>b</sup>	0	HT	1 <sup>b</sup>	0
Bearing walls									
Exterior <sup>e, f</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions							See Section 2304.11.2		
Interior <sup>d</sup>	0	0	0	0	0	0		0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2 <sup>b</sup>	1 <sup>b, c</sup>	1 <sup>b, c</sup>	0 <sup>c</sup>	1 <sup>b, c</sup>	0	HT	1 <sup>b, c</sup>	0

For SI: 1 foot = 304.8 mm.

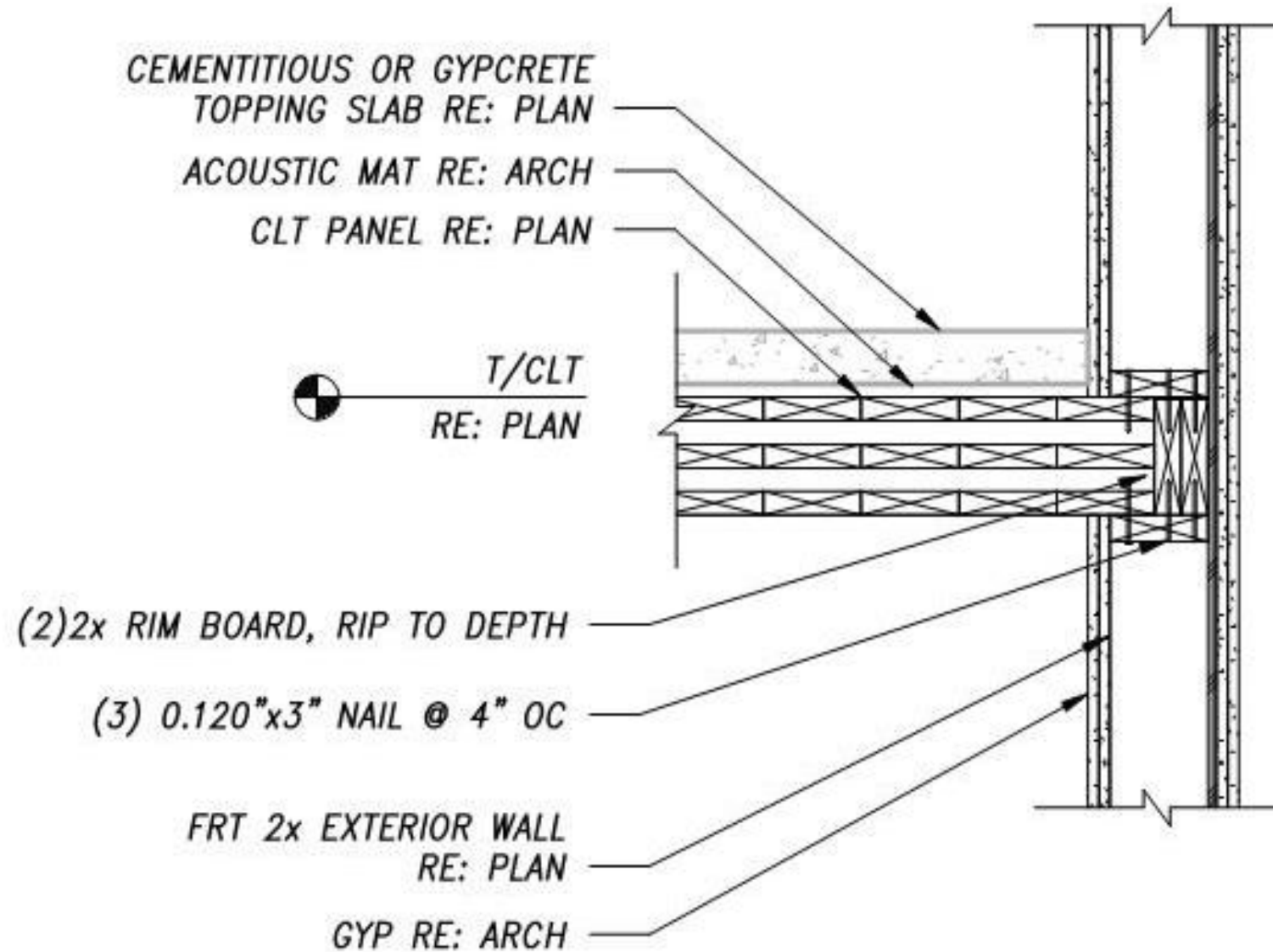
- a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
- b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
- c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed where a 1-hour or less fire-resistance rating is required.
- d. Not less than the fire-resistance rating required by other sections of this code.
- e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
- f. Not less than the fire-resistance rating as referenced in Section 704.10.

# WOOD WALLS IN TYPE III CONSTRUCTION

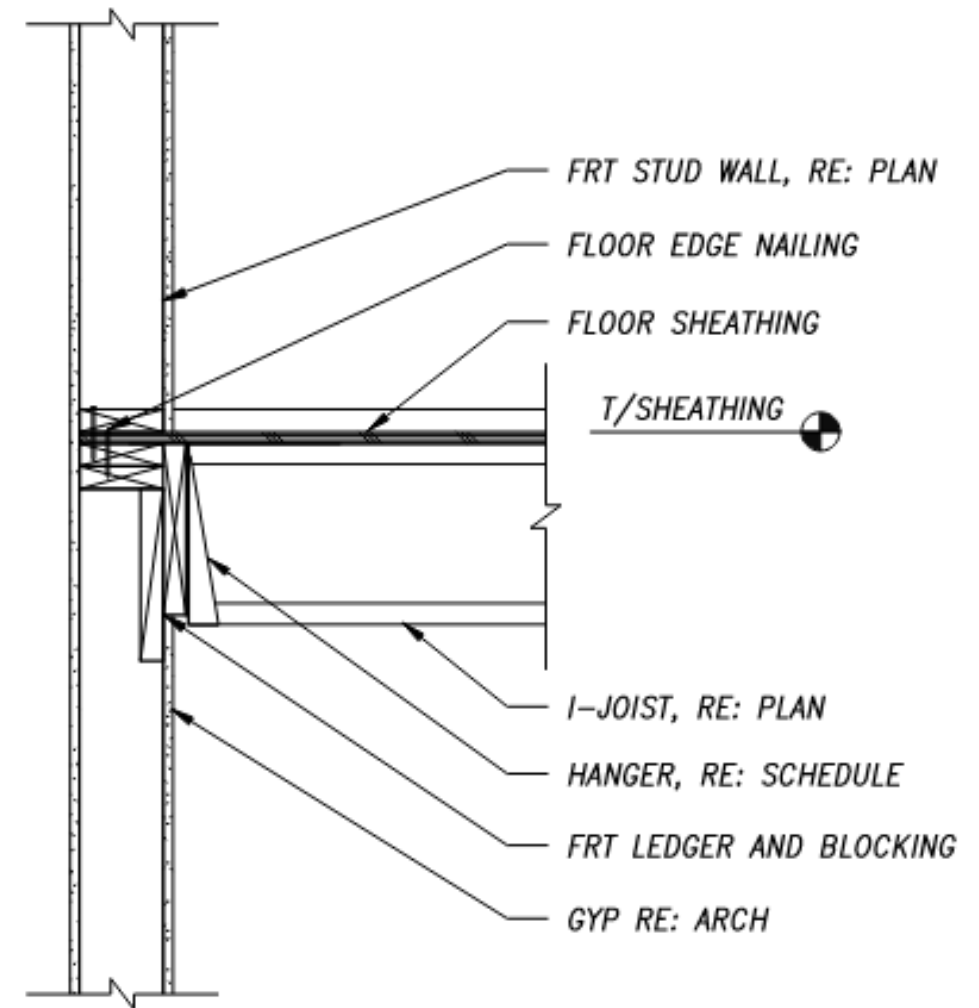
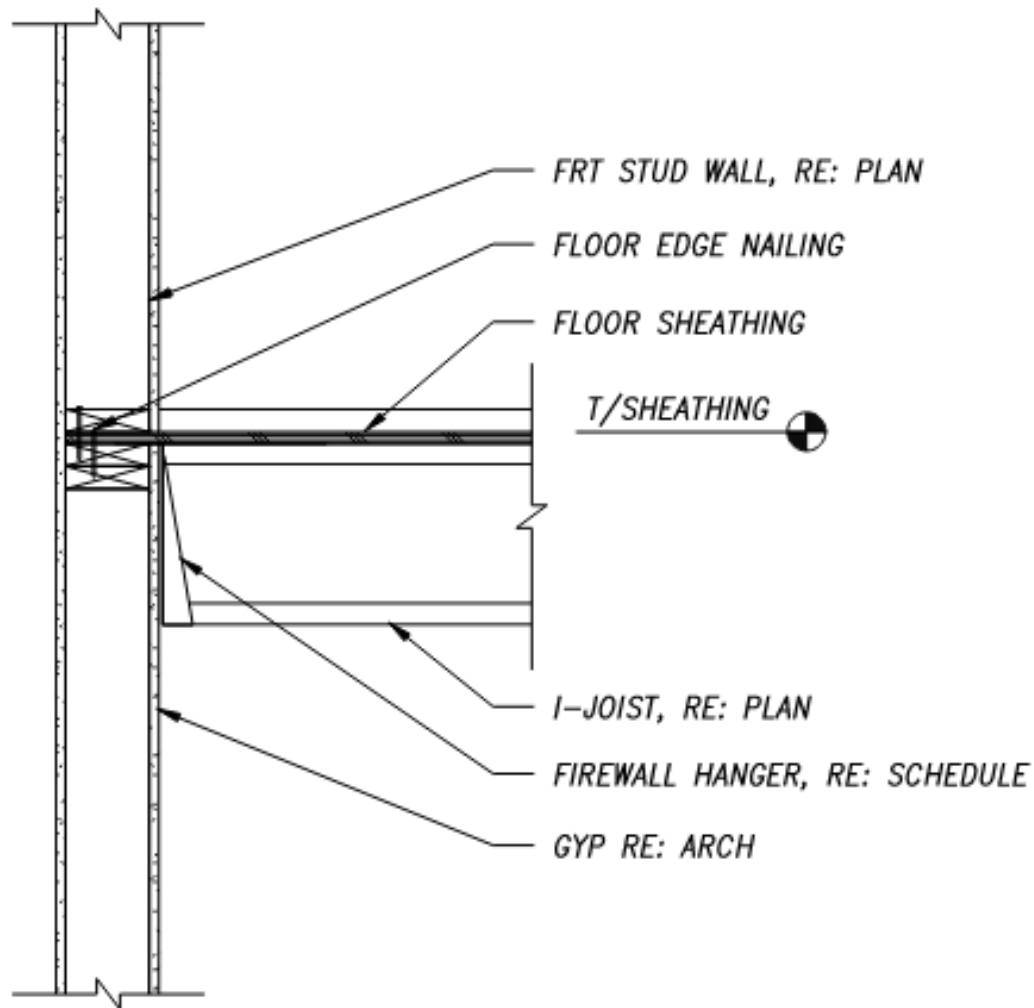
**602.3 Type III.** Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing and sheathing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.



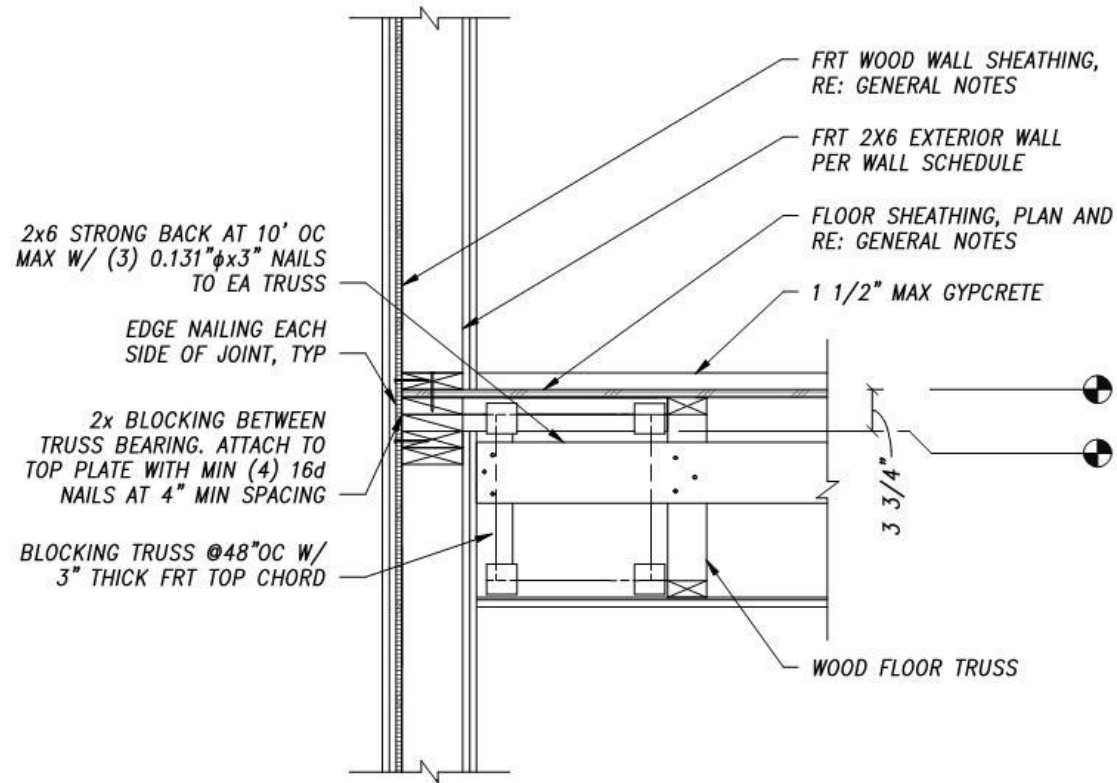
**TYPE IIIA FLOOR TO WALL INTERFACE: CLT BEARING ON WALL**



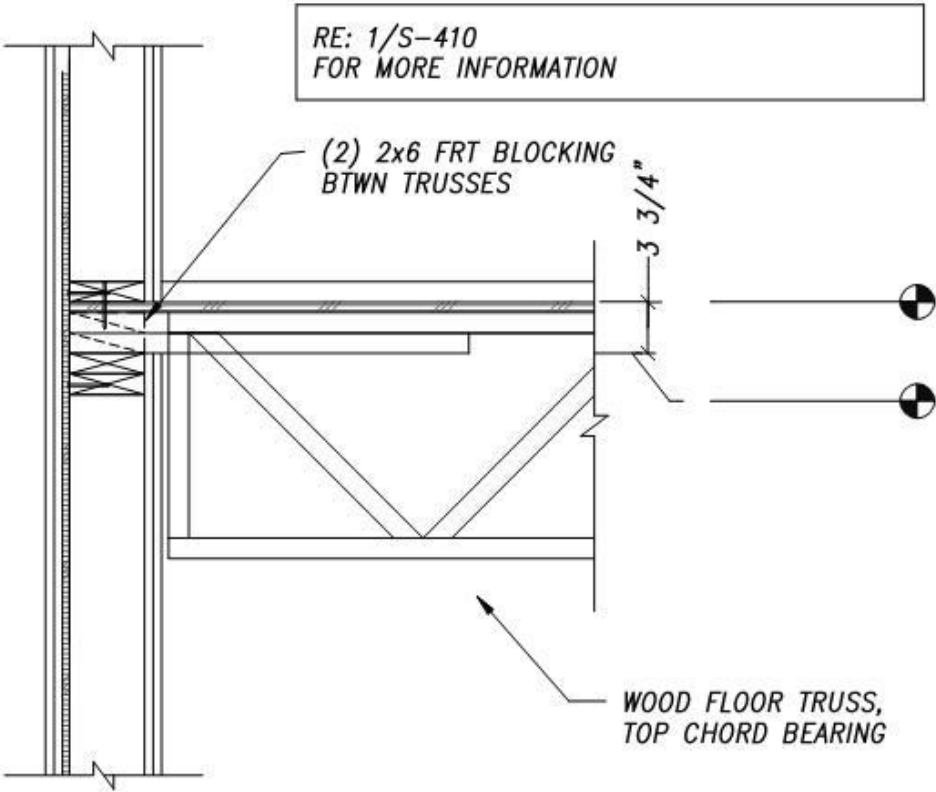
**TYPE IIIA FLOOR TO WALL INTERFACE:  
CLT SPANNING PARALLEL TO WALL**



**TYPE IIIA FLOOR TO WALL INTERFACE: WOOD JOISTS**

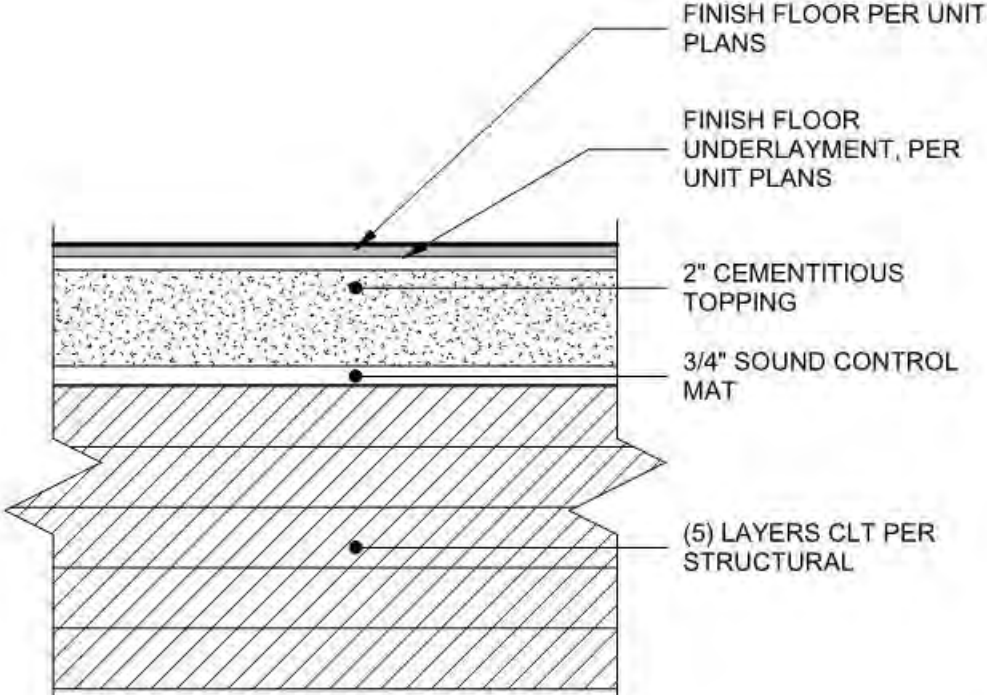


**TYPE IIIA FLOOR TO WALL INTERFACE:  
WOOD TRUSSES PARALLEL TO WALL**



**TYPE IIIA FLOOR TO WALL INTERFACE:  
WOOD TRUSSES BEARING ON WALL**

# ACOUSTICS CIRRUS FLOOR ASSEMBLY

<div><div>F 801 1</div><div>TYPICAL CLT FLOOR</div></div>				<p>IIC NOTES: TO COMPLY WITH IBC IIC REQUIREMENTS, PROVIDE THE FOLLOWING, OR APPROVED EQUAL:</p> <ul style="list-style-type: none"><li>• FINISH FLOOR: 3.5 MM MARMOLEUM SHEET TILE OR 4 MM ARMSTRONG NATURAL CREATIONS LUXURY VINYL TILE OR OTHER 4MM THICK CUSHIONED-VINYL TILE</li><li>• FINISH FLOOR UNDERLAYMENT: 2-MM UNDERLAYMENT: ARMSTRONG QUIETCOMFORT OR PLITEQ GENIEMAT RST02 OR ECORE QTSCU</li><li>• 2 INCH CEMENTITIOUS TOPPING MAXXON GYP-CRETE</li><li>• 10 MM SOUND CONTROL MAT MAXXON ENKASONIC HP OVER</li><li>• CLT PER STRUCTURAL</li></ul>
FIRE RATING:	1			APPR:
IIC RATING	50			
STC RATING:	51-52			
ASSY LISTING:	IBC 703.3	<p>NOTES:</p> <p>CLT MANUFACTURED TO APA/PRG 320. FIRE RESISTANCE DEMONSTRATED THROUGH ASTM E 119 FIRE TEST PER IBC SECTION 703.3.</p> <p>ASSEMBLY AS SHOWN DEPICTS THICKNESS FOR BROADLOOM CARPET FLOOR FINISH WITH CARPET PAD</p>		

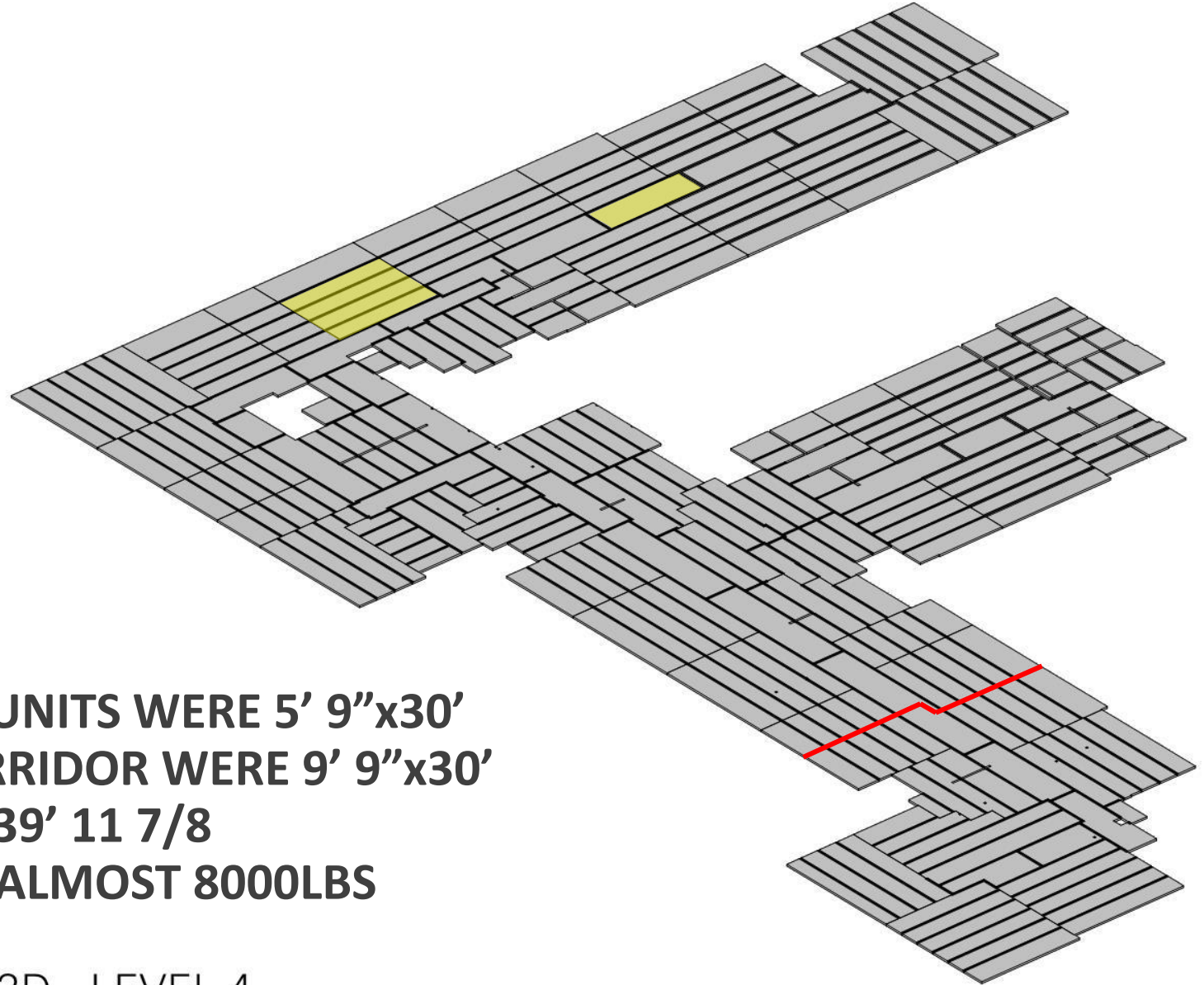
# ACOUSTICS

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



CLT Panel	Concrete/Gypsum Topping	Acoustical Mat Product Between CLT and Topping	Finish Floor	STC <sup>1</sup>	IIC <sup>1</sup>	Source
CLT 5-ply (6.875")	1-1/2" gypsum	0.35" (9mm) closed-cell foam	None	50	41	20
	1-1/2" concrete	None	None	49	28	20
		0.35" (9mm) closed-cell foam		53	36	
		0.5" wood fiberboard		52	35	
		0.75" recycled fabric felt		59	42	
		0.5" rubber nuggets on foil		53	46	
		0.315" (8 mm) shredded rubber mat		52	38	
		0.67" (17 mm) shredded rubber mat		54	44	
		0.39" (10 mm) Tar Boards	None	54	36	68
			Eng Wood on 2 mm closed cell foam	53	47	
		1/2" Insonomat	None	56	48	
			Eng Wood on 2 mm closed cell foam	55	51	
		0.35" (9 mm) Owens Corning QuietZone closed cell foam	None	54	39	
			Eng Wood on 2 mm closed cell foam	52	48	
	2" Gyp-Crete®	Maxxon Acousti-Mat® 3/8 Premium	None	52	38	22
			Carpet	50	66	
			LVT	52	44	
			Linoleum sheet flooring	51	48	
		11 mm Maxxon Enkasonic HP	Linoleum sheet flooring	51	53	
			LVT	52	51	
	2" Levelrock® Brand 2500	Pliteq GenieMat™ FF25	LVT on GenieMat RST05	53	51	2
			Eng Wood on GenieMat RST02	53	49	31
		USG SRB on USG SAM N25 Ultra	None	51 <sup>6</sup>	42 <sup>6</sup>	62
			LVT	51 <sup>6</sup>	47 <sup>6</sup>	63
			LVT Plus	51 <sup>6</sup>	51 <sup>6</sup>	14
			Eng Wood	50 <sup>6</sup>	48 <sup>6</sup>	64
			Carpet + Pad	50 <sup>6</sup>	66 <sup>6</sup>	65
			Ceramic Tile	52 <sup>6</sup>	48 <sup>6</sup>	66

# CLT LAYOUT



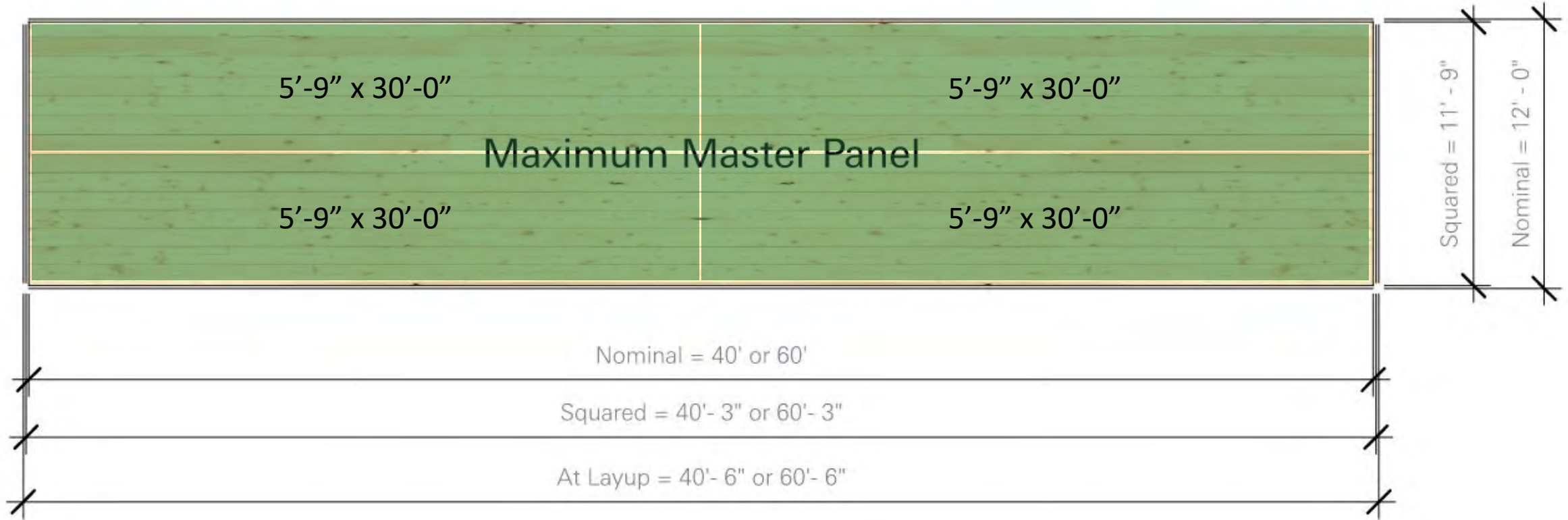
**1,190 CLT PANELS**

**AVG SIZES FOR PANELS OVER UNITS WERE 5' 9"x30'**

**AVG SIZES FOR PANELS IN CORRIDOR WERE 9' 9"x30'**

**LARGEST PANELS WERE 9' 9"x39' 11 7/8**

**OUR HEAVIEST PANELS WERE ALMOST 8000LBS**

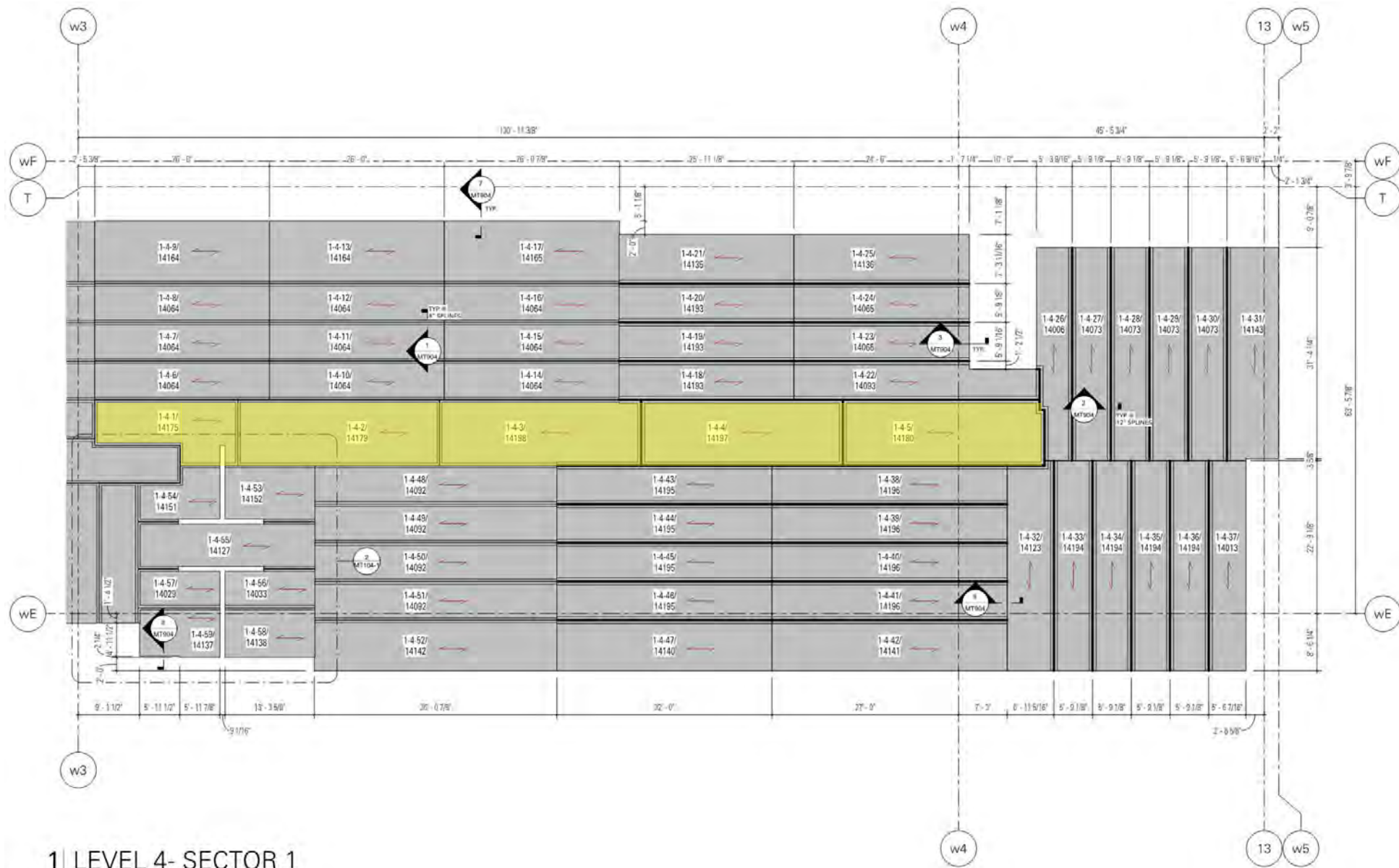


## EFFICIENT USE OF CLT PRESS



**EFFICIENT USE OF CLT PRESS**

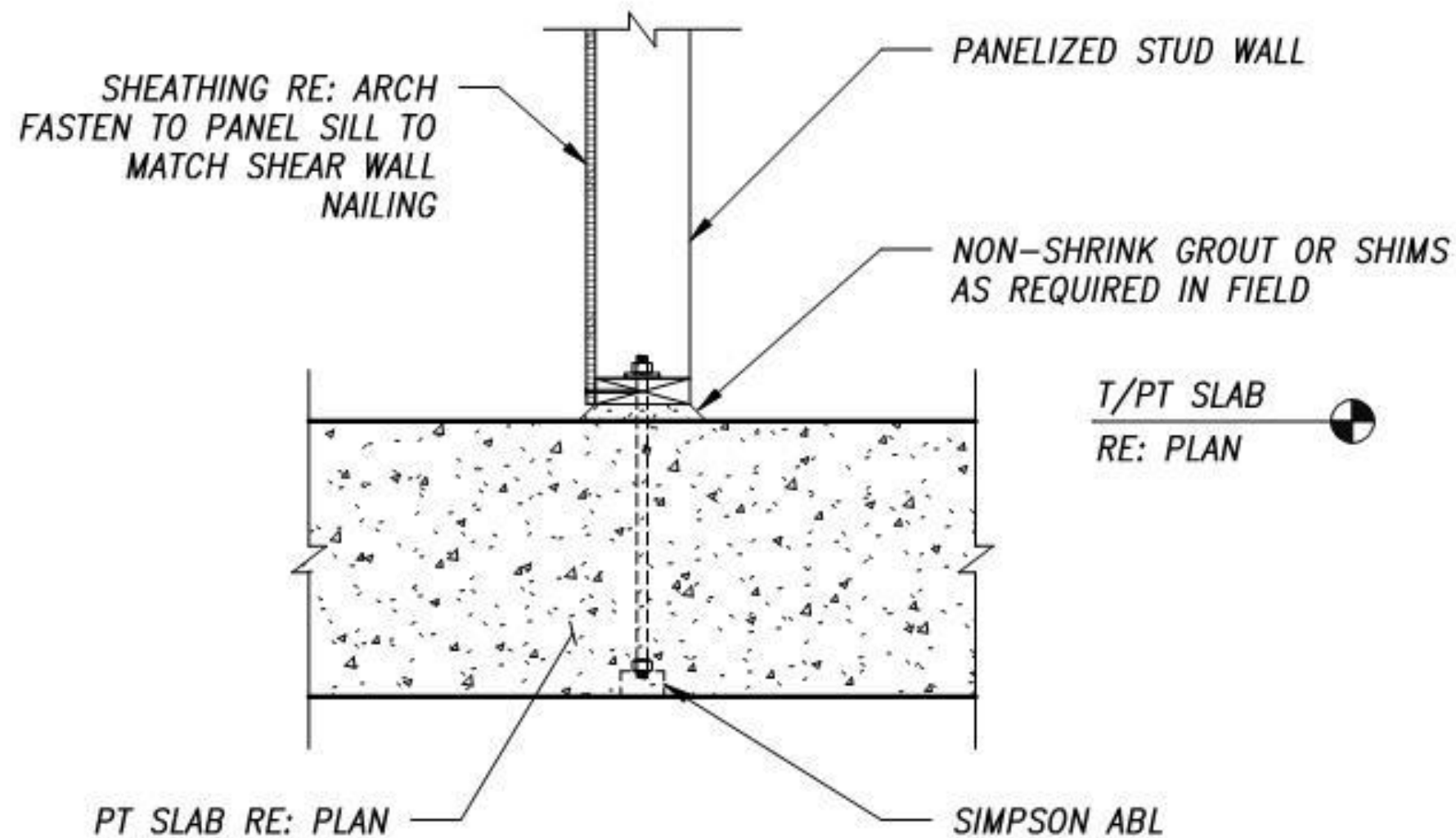
# PANEL ORIENTATION



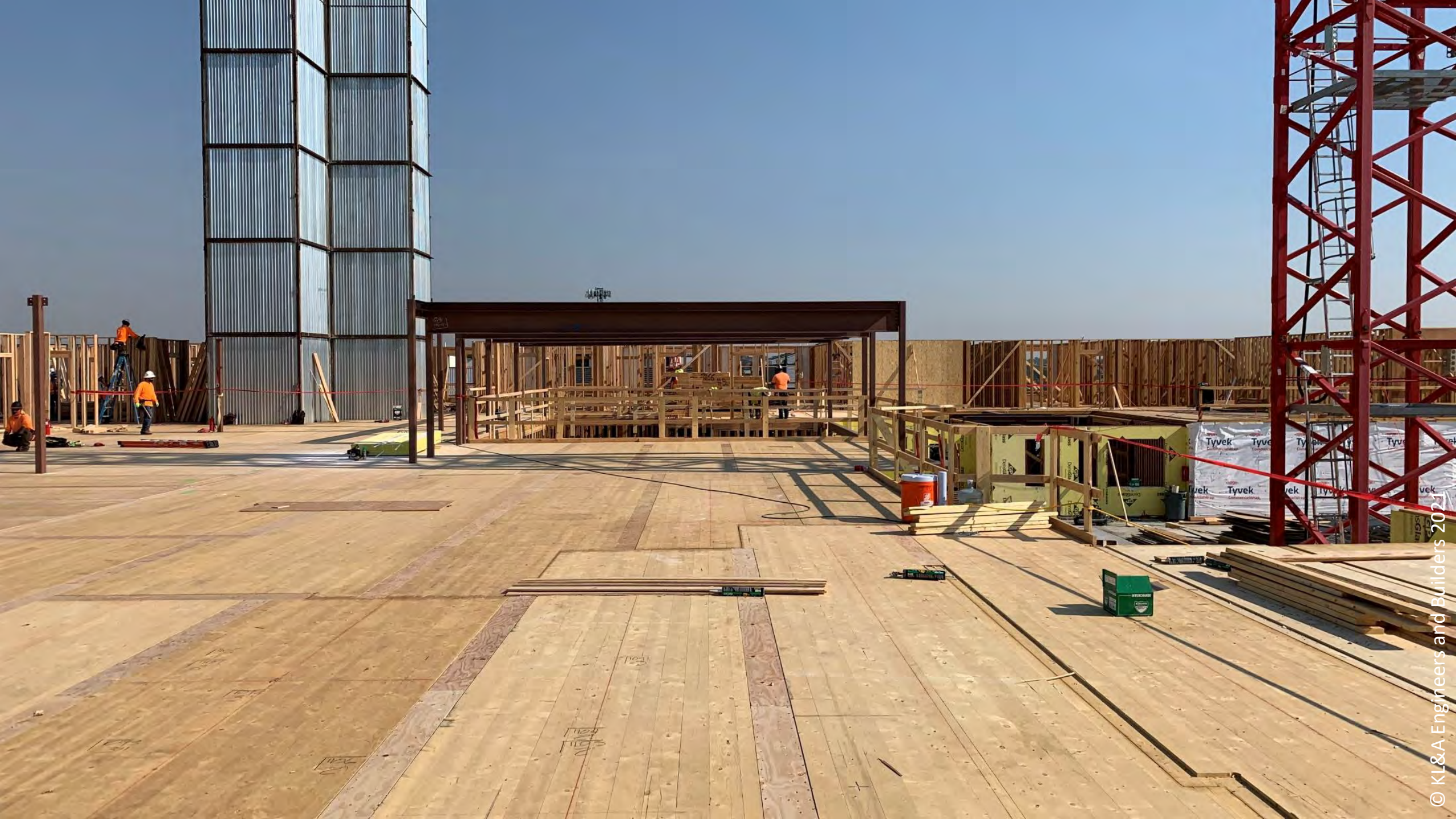
1 LEVEL 4- SECTOR 1  
MT104-1 3/32" = 1'-0"



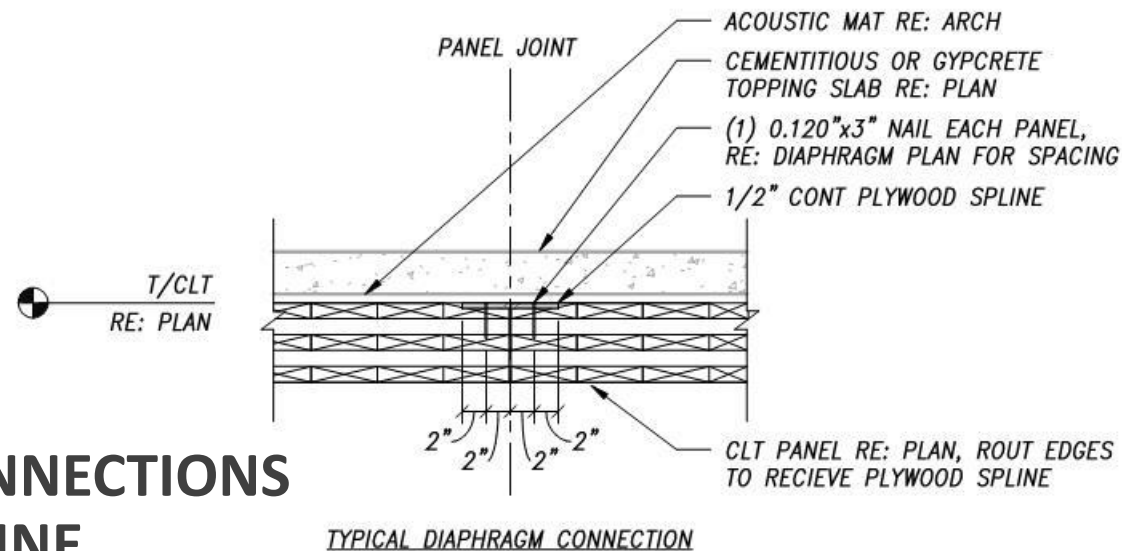
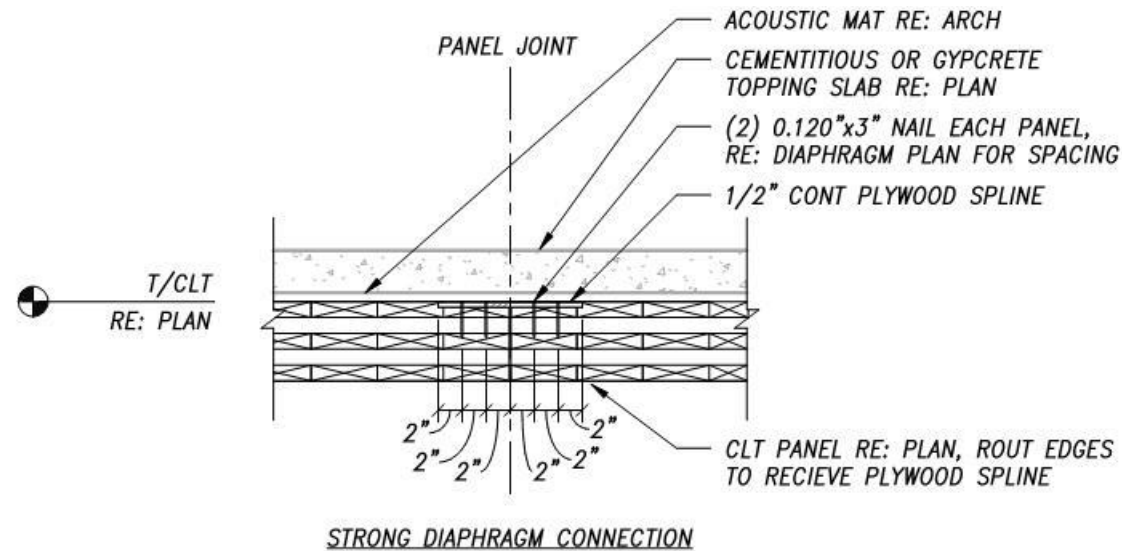
# CONSTRUCTION DETAILS



WOOD WALL TO PODIUM DETAIL (NOT USED)

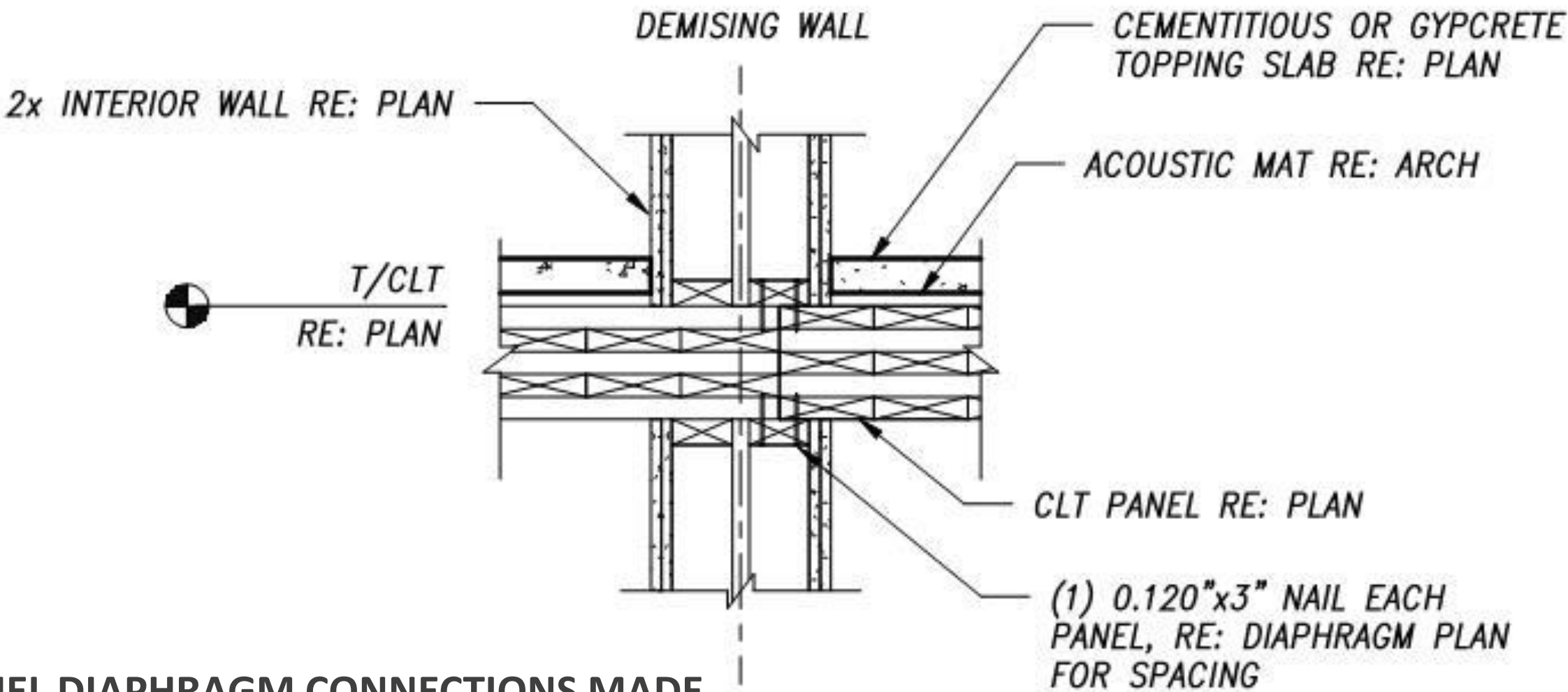


# CONSTRUCTION DETAILS



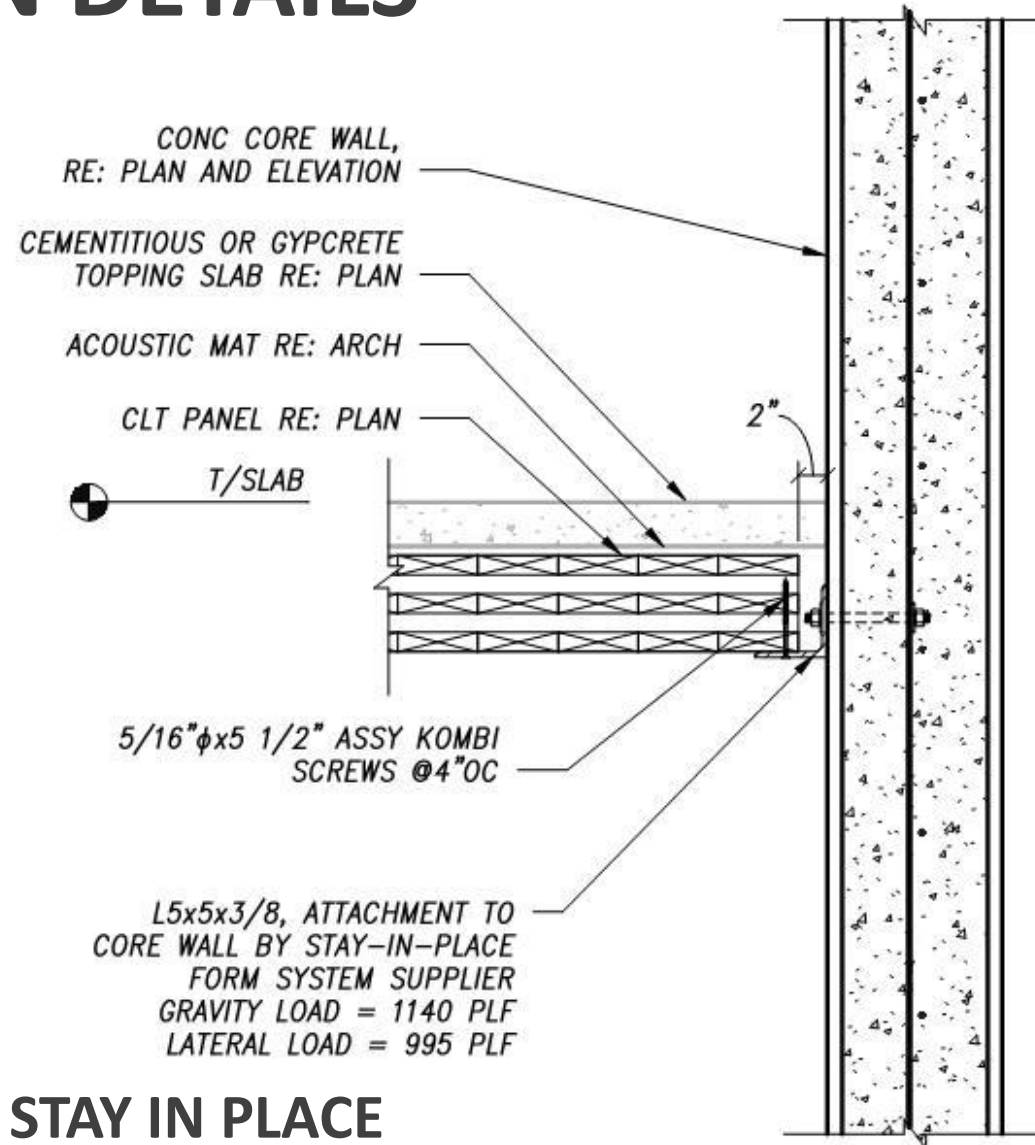
## PANEL DIAPHRAGM CONNECTIONS WITH TRADITIONAL SPLINE

# CONSTRUCTION DETAILS



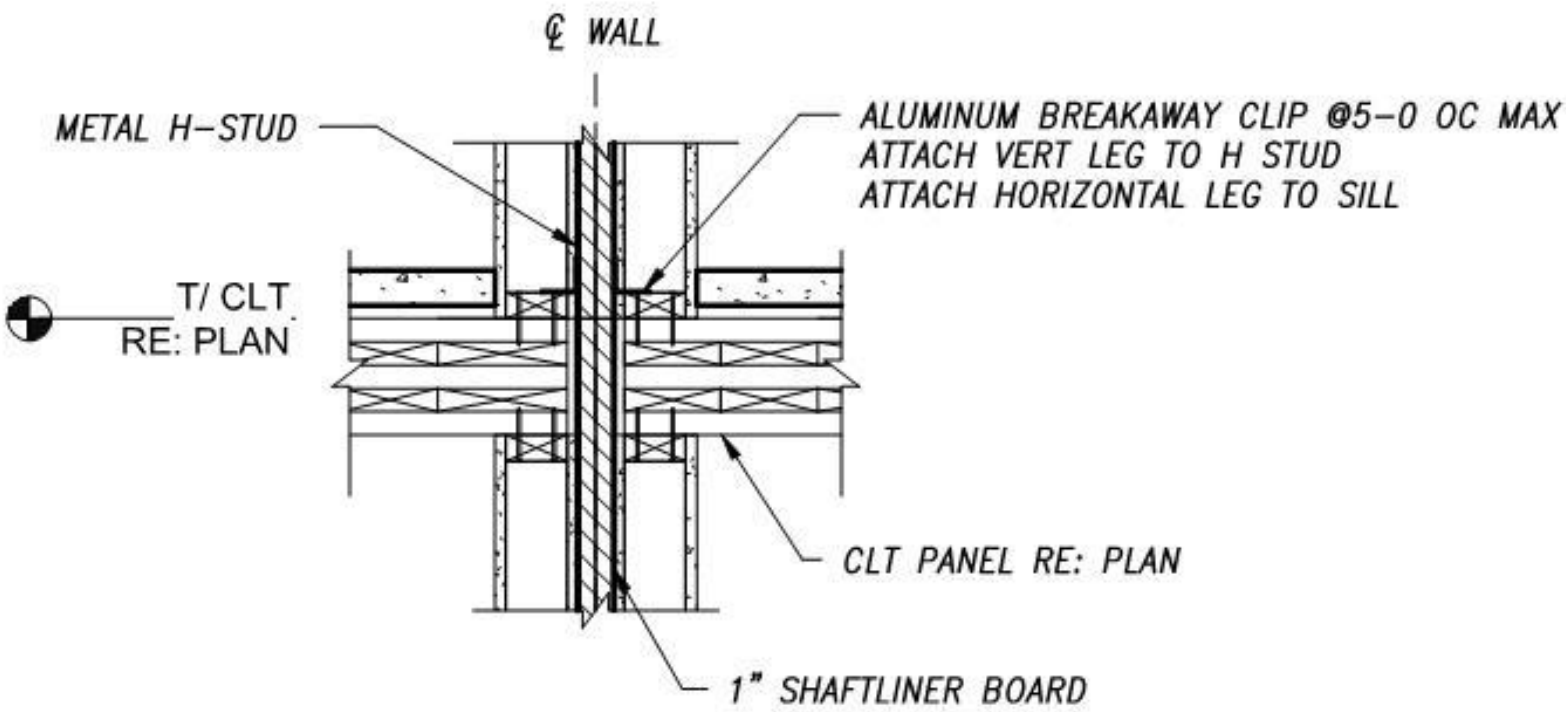
PANEL DIAPHRAGM CONNECTIONS MADE USING WALL TOP AND BOTTOM PLATES

# CONSTRUCTION DETAILS



## PANEL CONNECTIONS TO STAY IN PLACE CONCRETE FORM SYSTEM

# CONSTRUCTION DETAILS



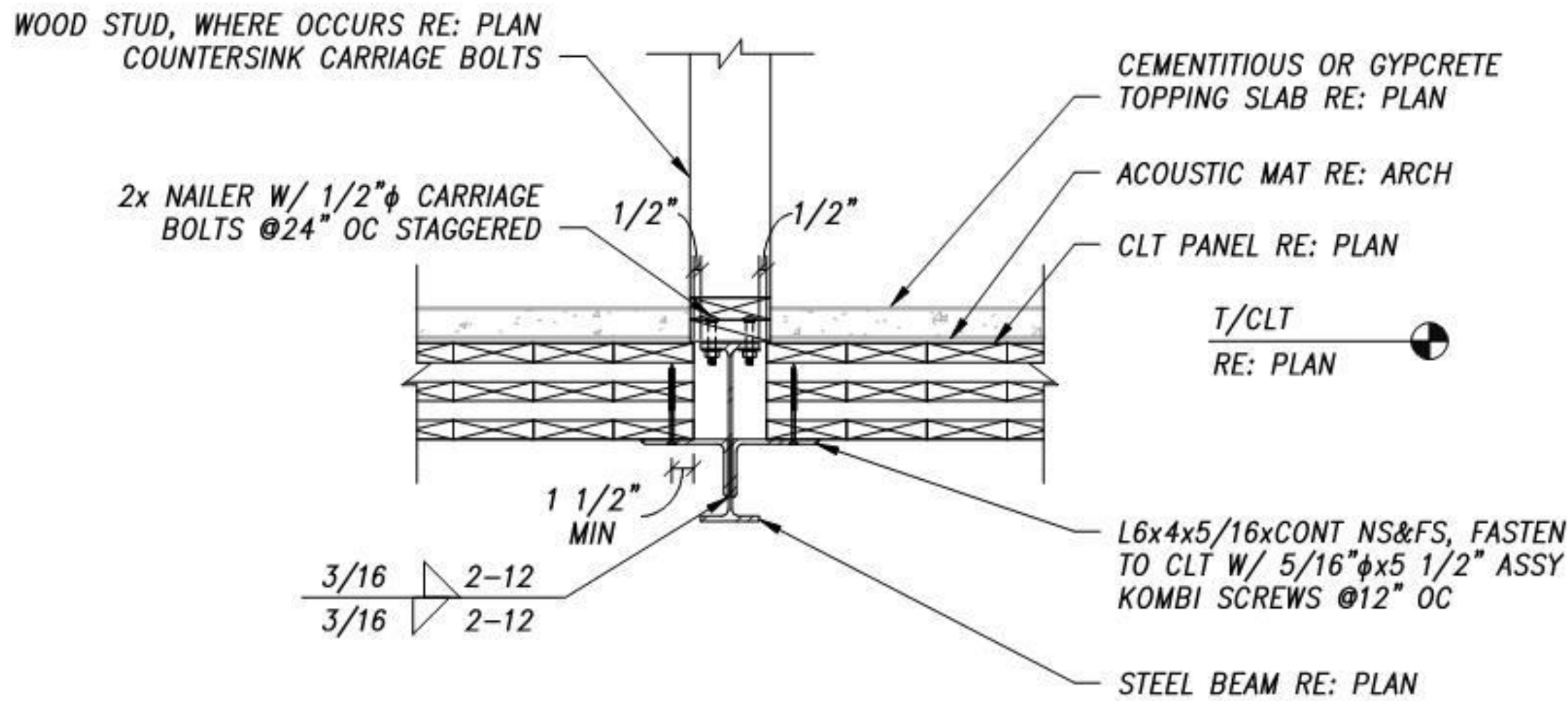
## BUILDING FIRE SEPARATION JOINT







# CONSTRUCTION DETAILS



CLT TO UPTURNED STEEL BEAM



**KATERRA**









# MASS TIMBER HYBRID BENEFITS

## SPEED

1. 230,000 SQUARE FEET OF WOOD CONSTRUCTION FRAMED IN 17 WEEKS (13,640 SQUARE FEET PER WEEK)
2. 7 WEEKS FASTER THAN ORIGINALLY SCHEDULED AND 11-12 WEEKS FASTER THAN STICK BUILT ON SITE

## SAFETY

1. FACTORY BUILT WOOD WALLS AND CLT SAVE AT LEAST 50% OF LABOR ON SITE
2. SHEATHING AND TRUSSES ARE TWO OF THE MORE DANGEROUS ACTIVITIES IN WOOD FRAMING AND ARE ELIMINATED WITH WALL PANELS AND CLT

## REDUCED WASTE

1. FRAMING WASTE IS REDUCED ON SITE AND IS LIMITED TO TEMPORARY BRACING AND GUARDRAILS WHICH ARE REUSED ON MULTIPLE FLOORS

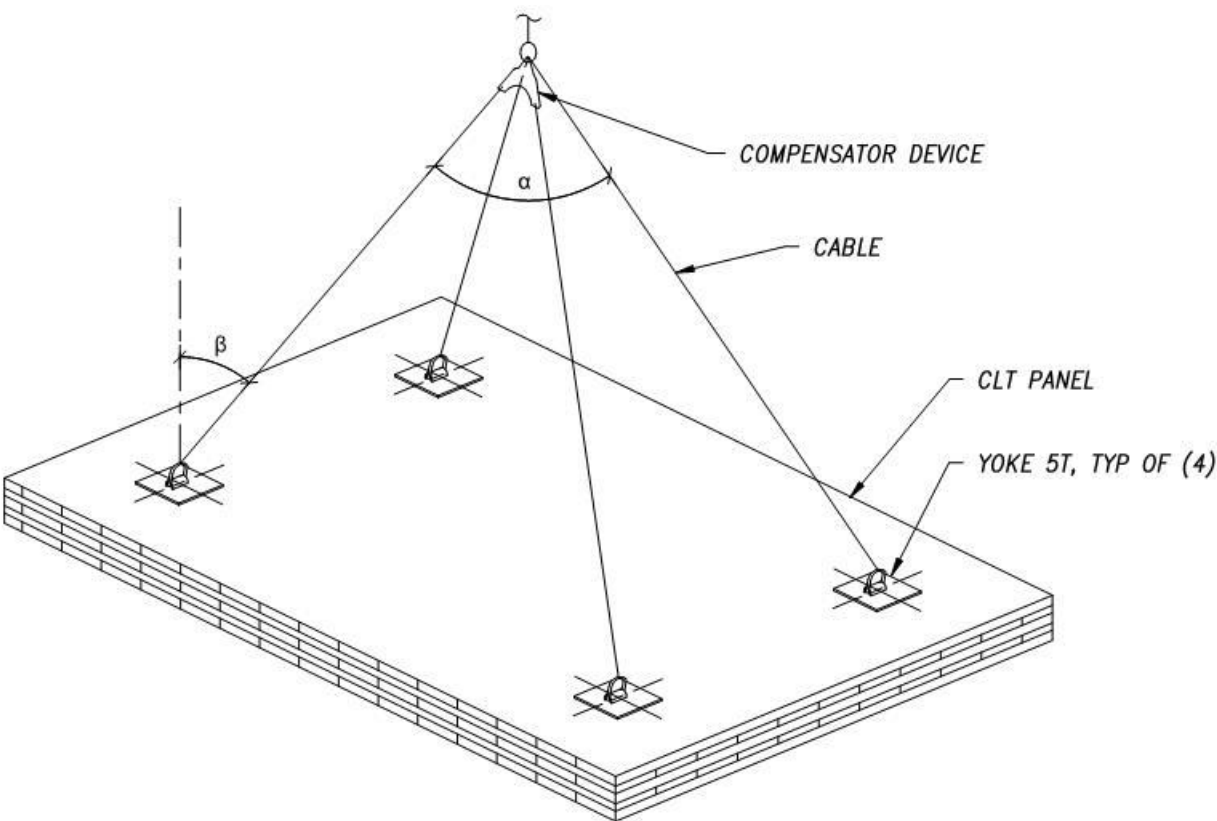
# MASS TIMBER HYBRID

1. REDUCED FLOOR STRUCTURE DEPTH FOR SIMILAR SPANS
2. INCREASED SPEED OF CONSTRUCTION OVER STANDARD LIGHT FRAME
3. IMPROVED SAFETY
4. SIMPLIFIED FLOOR TO WALL INTERFACE
5. EXPOSED CLT PROVIDES UNIQUE AESTHETIC

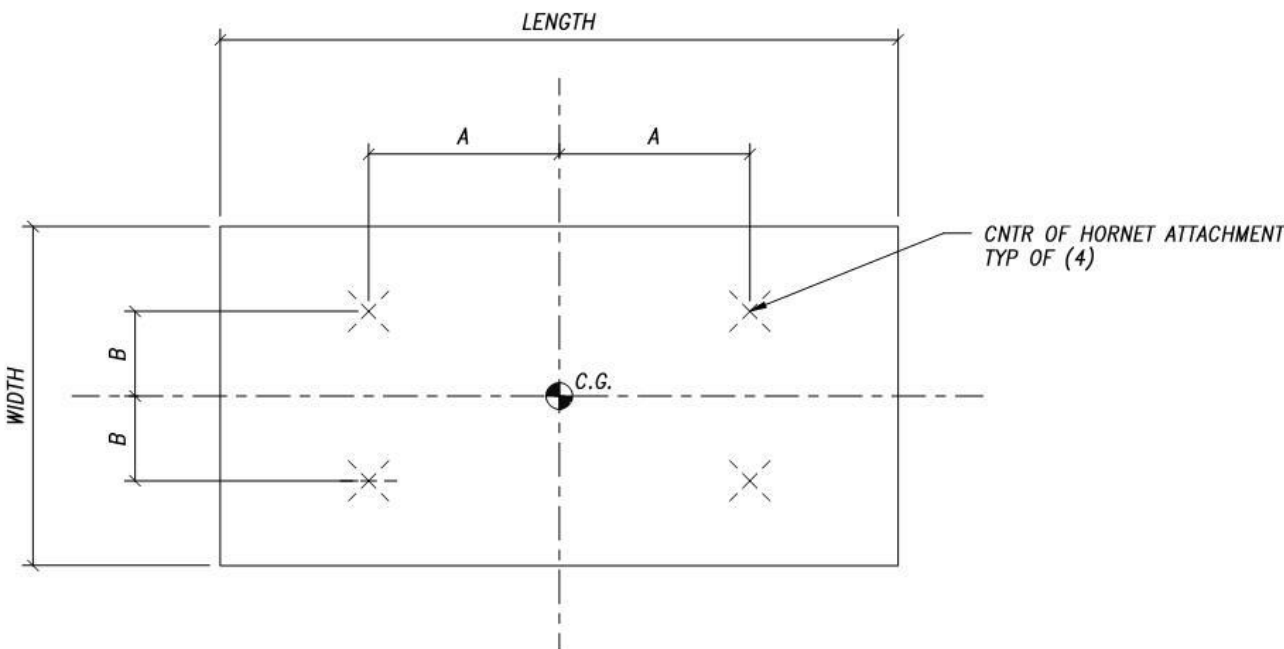
# STANDARD LIGHT FRAME

1. MORE CONVENTIONAL
2. LESS COORDINATION REQUIRED
3. SIMPLE FIELD MODIFICATION IF NEEDED
4. LESS EXPENSIVE ON A MATERIAL BASIS

# EXPANDED SERVICES

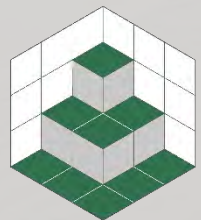


- NOTE:
- 1. ANGLE  $\alpha$  = 60° MAX
  - 2. ANGLE  $\beta$  = 30° MAX AT EACH ANCHOR
  - 3. A COMPENSATOR DEVICE MUST BE USED TO EQUALLY DISTRIBUTE LOAD TO ALL (4) CABLES.
  - 4. RE: 4/S-100 FOR LOCATIONS OF RIGGING ATTACHMENTS. RIGGING ATTACHMENTS TO BE MYTICON YOKE 5T W/ (4) 1/2"φx6 1/4" ASSY KOMBI SCREWS. REUSE SCREWS ONCE.



RECTANGULAR PANELS			
LENGTH	A	WIDTH	B
< 10'	2'-0"	< 6'	1'-0"
< 15'	3'-0"	< 7'	2'-0"
< 20'	4'-6"	< 10'	2'-6"
< 25'	6'-0"		
< 30'	7'-6"		
< 35'	9'-0"		
< 40'	10'-6"		
< 50'	12'-6"		

# THANK YOU!



***KL&A***  
Engineers & Builders

**Chris Kendall (EOR)**

[ckendall@klaa.com](mailto:ckendall@klaa.com)