

TOUR & DINNER MEETING:

Hilltop Heritage Elementary

MAY 14, 2024



Mass Timber and Schools

BOILING IT DOWN TO FOUR KEY QUESTIONS

What is Unique about Designing with Mass Timber?

What is Unique about Building with Mass Timber?

How do you Make Mass Timber Pencil?

Why Build a School with Mass Timber?



Moderator



Craig Curtis

Director of Emerging
Building Technologies,
Mithun

Panelists



Dean Lewis
P.E., S.E.

Director of Mass
Timber and
Prefabrication,
Skanska USA
Building Inc.



Sam Comer
P.E, Assoc. DBIA

Vice President,
Cornerstone



Joe Mayo
AIA, LEED AP

Associate Principal,
Mahlum



Taylor Cabot
LEED AP

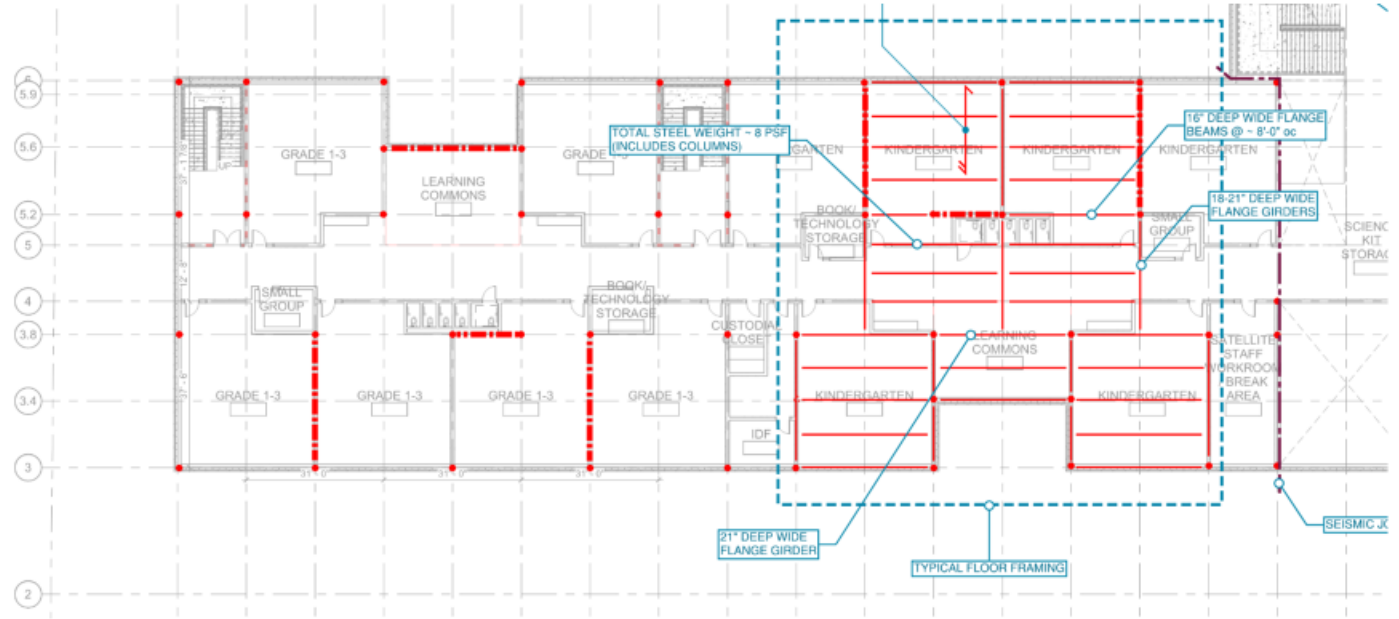
Preconstruction
Manager,
TIMBERLAB



What is Unique about Designing with Mass Timber?

Commit Early

Steel Design



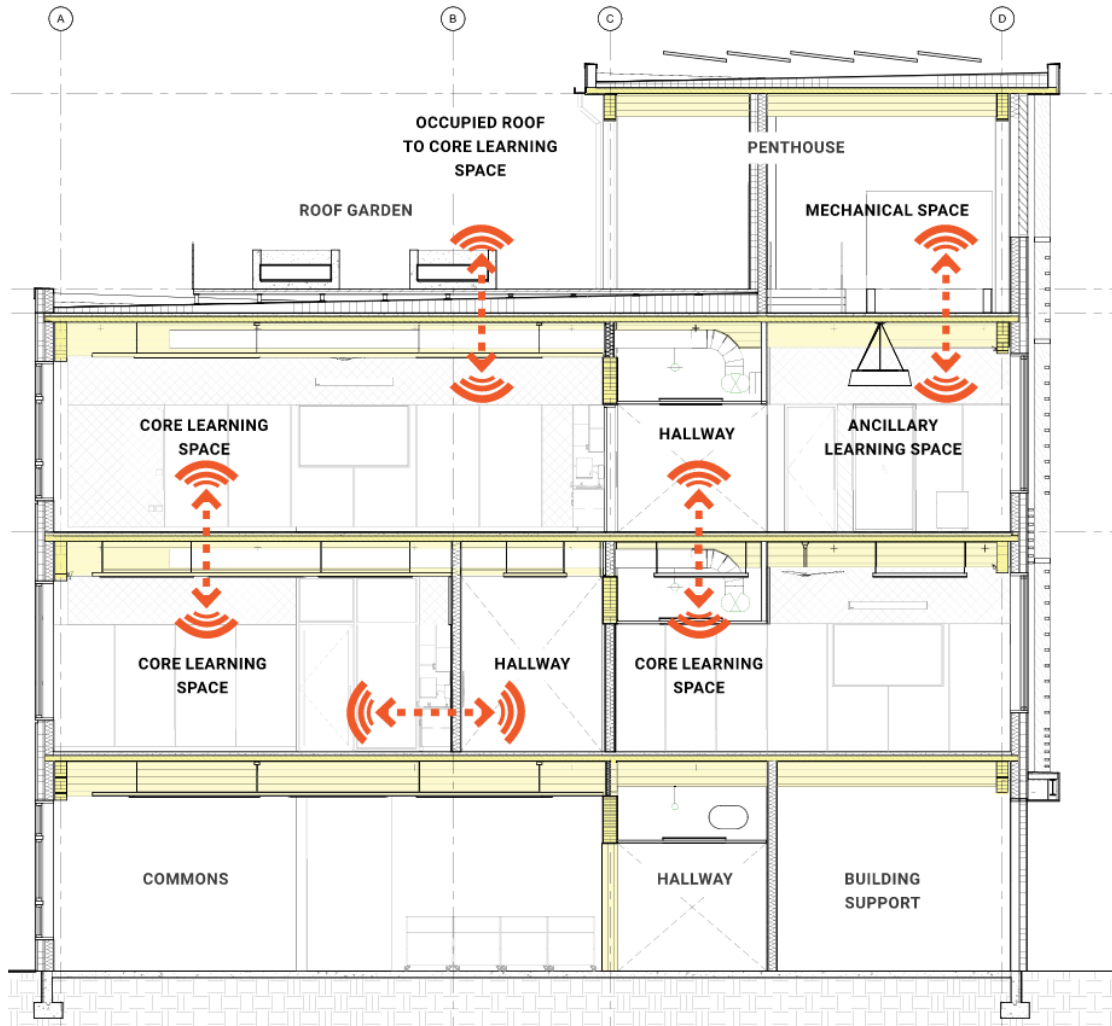
Timber Design



Acoustic Performance

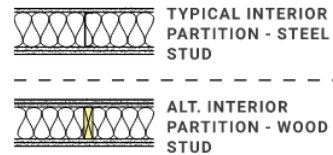
WA State Assembly Standards

ARUP



Space	Adjacency	Minimum STC Rating Required for Single or Composite Wall and Floor-Ceiling Assemblies	Minimum IIC Rating Required for Floor-Ceiling Assemblies Separating a Core Learning Space (below) from an Adjacent Space (above)
Core Learning Space	Core Learning Space	50	45 (Applies without carpeting)
	Restroom	53	45 (Applies without carpeting)
	Office, Conference Room	45 (50 if "acoustic privacy" required)	45 (Applies without carpeting)
	Corridor, Stairs	45	45 (Applies without carpeting)
	Music Room, Music Performance Space, Auditorium, Mechanical Room, Cafeteria, Gymnasium, Indoor Pool	60	45 (Applies without carpeting)
	Spaces with High-Impact Activity (e.g. Gym, Dance Studio)	60	65-70 (Applies without carpeting)

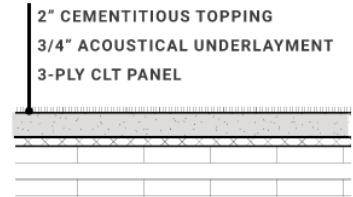
INTERIOR NON-BEARING WALL PARTITIONS - PLAN VIEW



INTERIOR WALL PARTITION AT SHEAR CLT WALLS - PLAN VIEW



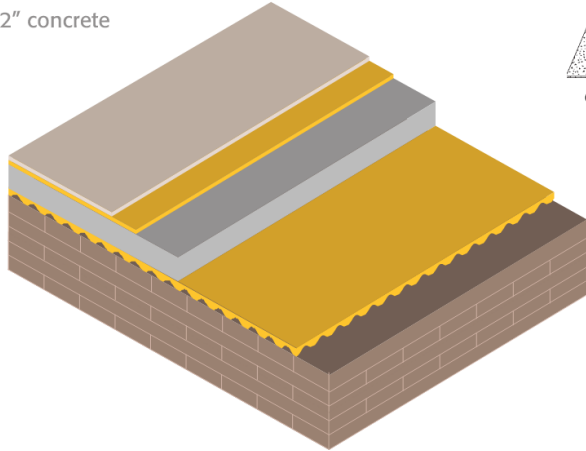
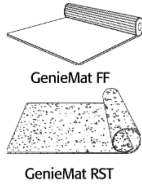
ACOUSTIC FLOOR ASSEMBLY - SECTION VIEW



5-Ply CLT with Concrete Topping and Exposed Ceiling

Minimal floor build-up height with 2" concrete topping on 3/8" GenieMat FF10

Type IV-B



51
STC

50
IIC

K5952.02

- 3/16" in Luxury Vinyl Tile/Plank
- GenieMat RST02
- 2" Concrete Topping
- GenieMat FF10
- 6 7/8" CLT (5-ply)

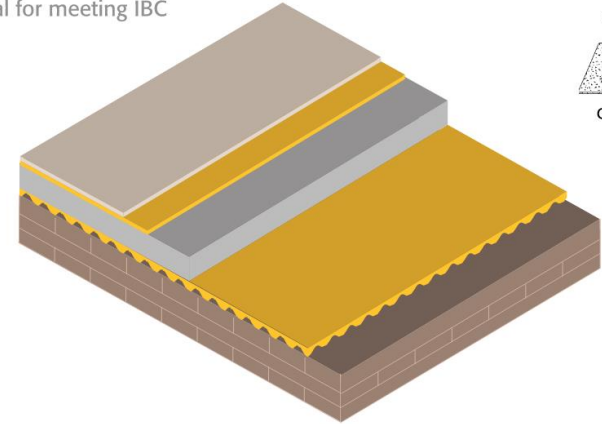
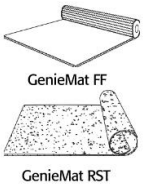
For assembly section details, please contact your local Pliteq team.

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Thin 3-PLY CLT for Multi-Family

GenieMat FF25 beneath the topping provides lasting low frequency performance, critical for meeting IBC code requirements

Type IV-C/HT



52
STC

51
IIC

P2557.07

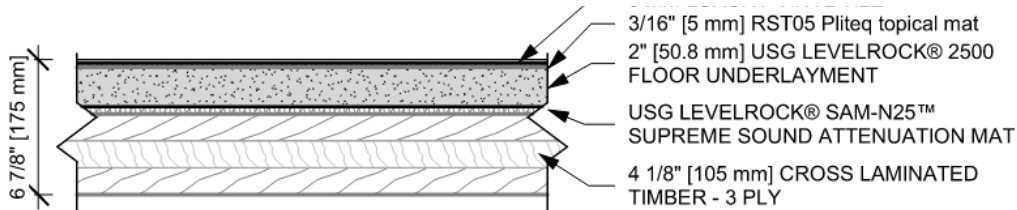
- 3/16" Luxury Vinyl Tile/Plank
- GenieMat RST05
- 3" Concrete Topping
- GenieMat FF25
- 4" CLT (3-Ply)

For assembly section details, please contact your local Pliteq team.

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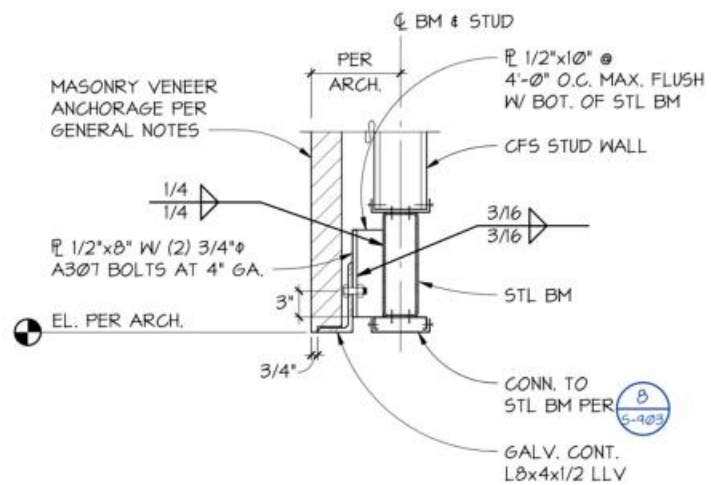
3 PLY CLT with 5 mm LVT STC = 50 IIC = 50



Masonry

3010
ALKI ELEMENTARY SCHOOL





TYPICAL HOLLOW STRUCTURAL SECTION BEAM AT LINTEL ANGLE

SECTION

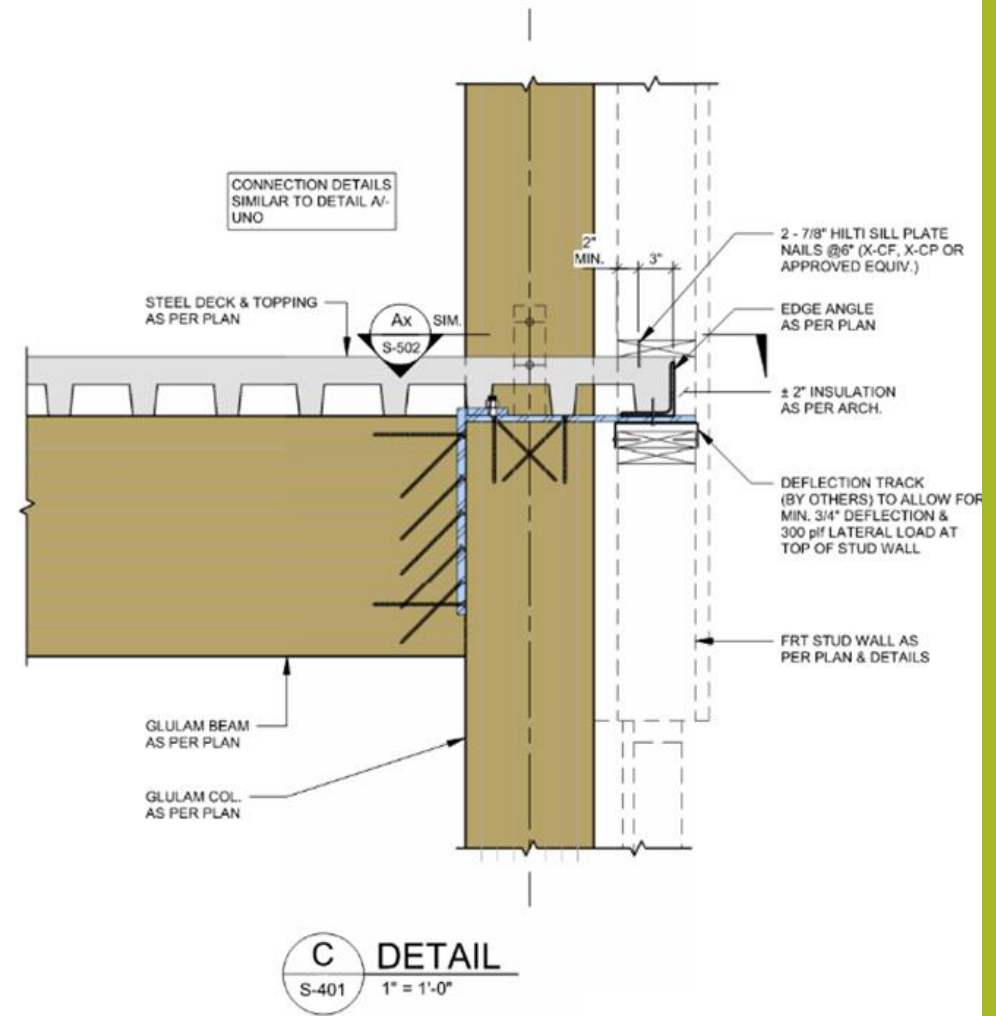
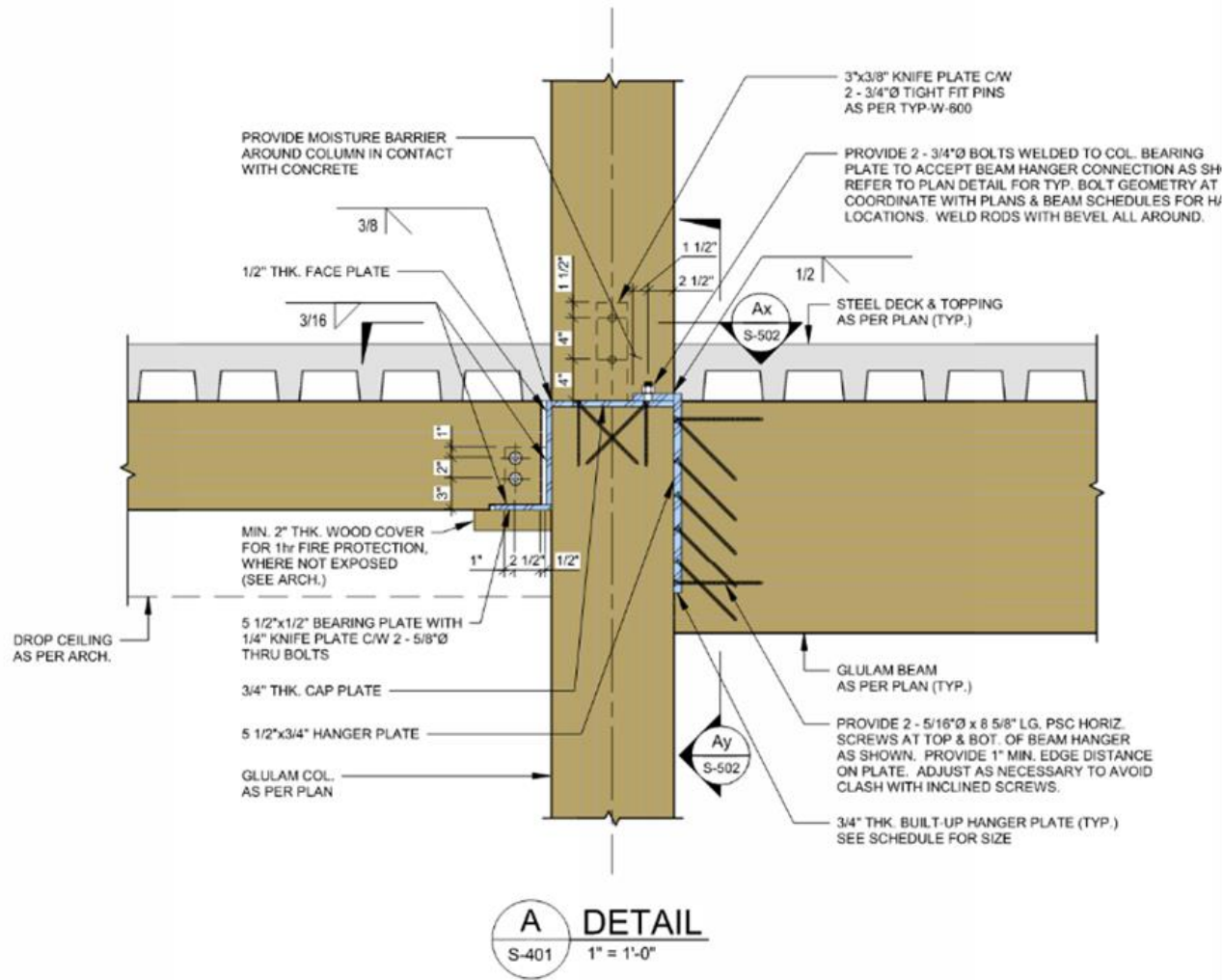
1" = 1'-0"



FASPS (going 4 stories)

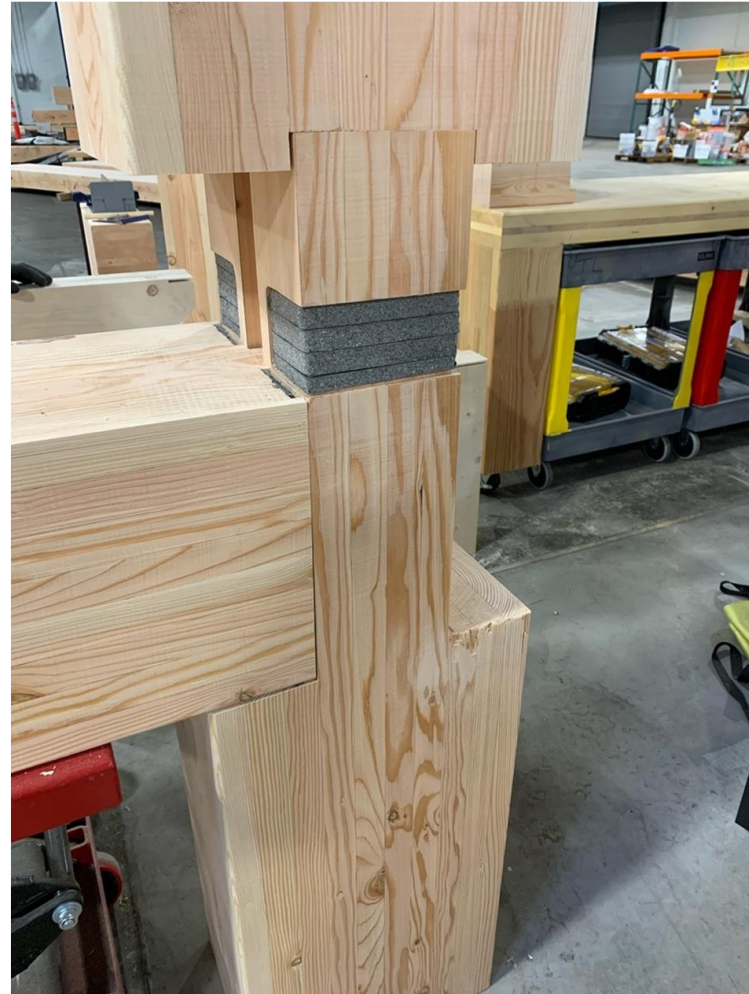
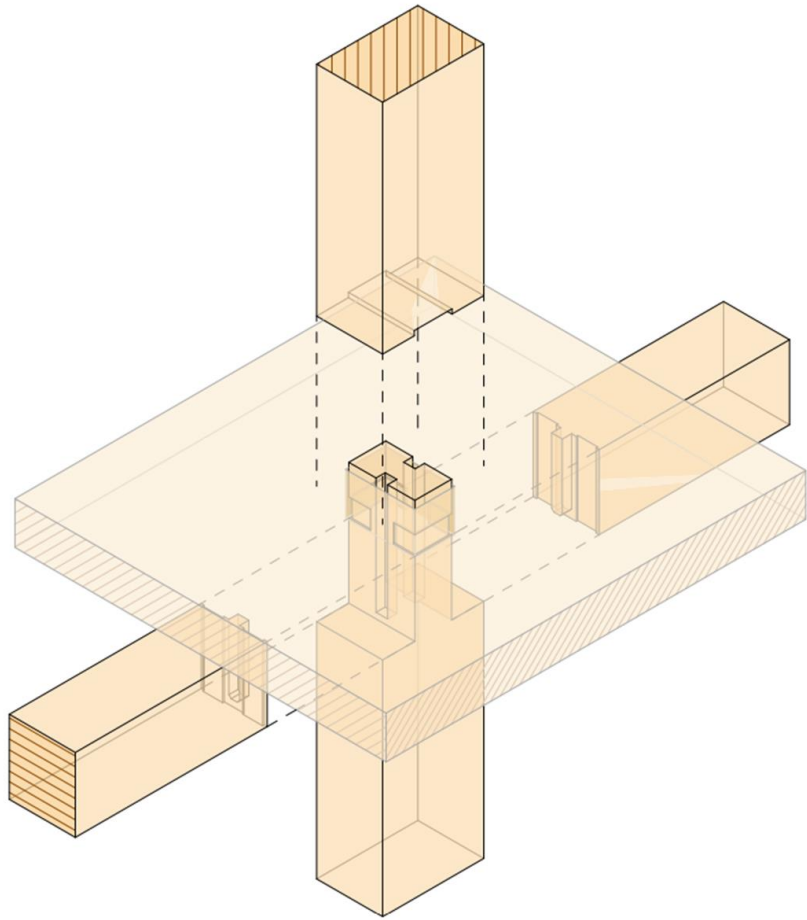


Hybrid construction / fire



DESIGNED FOR DISASSEMBLY

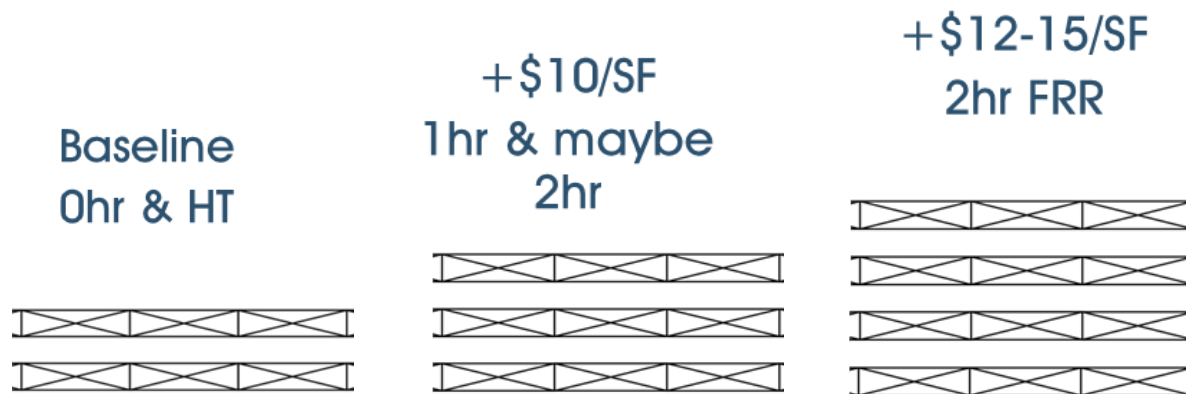
2 hour permitted wood to wood connection



TYPES, RATINGS, EXPOSURE

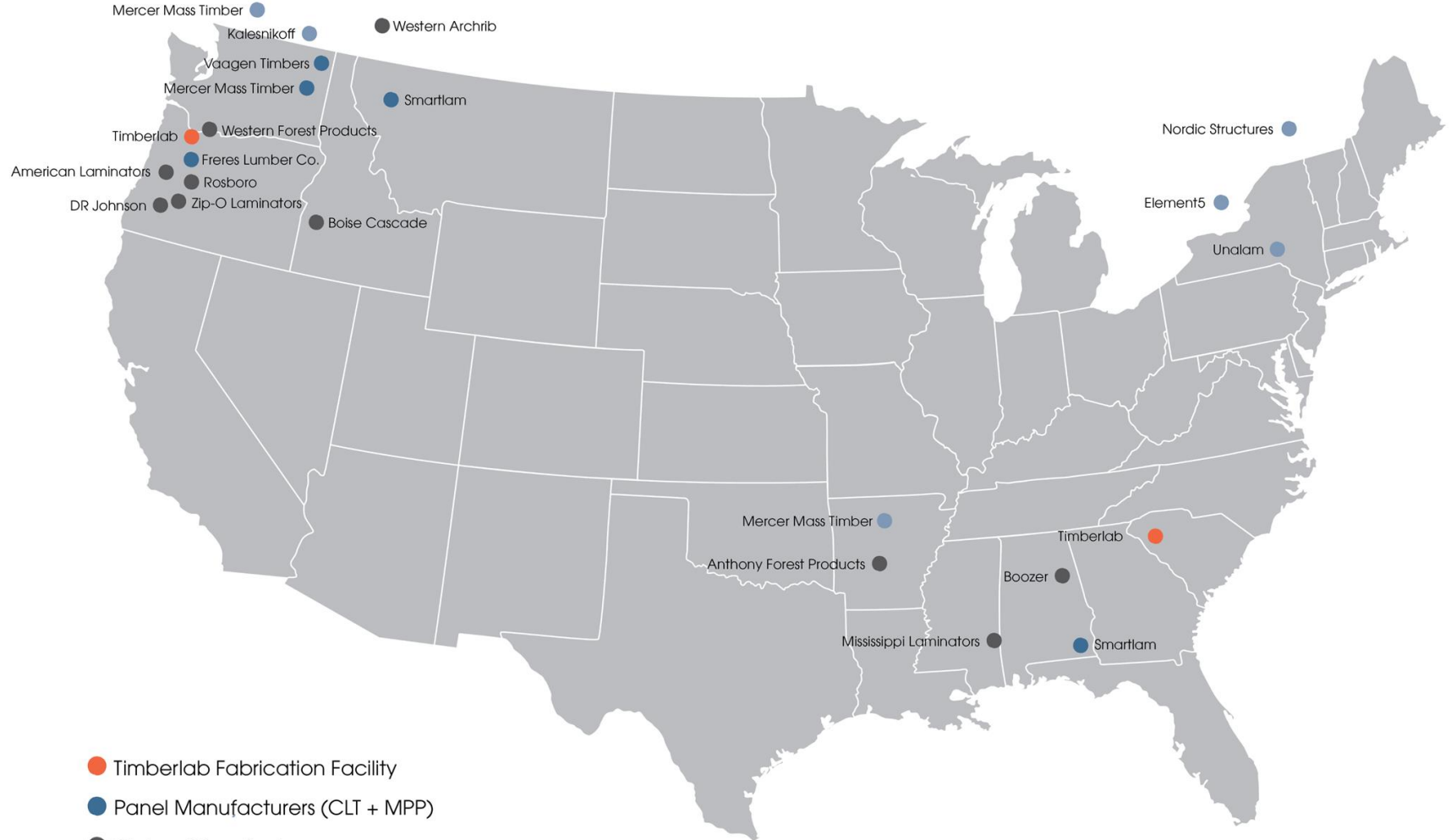
TABLE 601
Fire Resistance Rating Requirements for Building Elements (Hours)

Building Element	I-A	I-B	III-A	III-B	IV-A	IV-B	IV-C	IV-HT	V-A	V-B
Primary Structural Frame	3*	2*	1	0	3*	2	2	HT	1	0
Ext. Bearing Walls	3*	2*	2	2	3*	2	2	2	1	0
Int. Bearing Walls	3*	2*	1	0	3*	2	2	1/HT	1	0
Floor Construction	2	2*	1	0	2	2	2	HT	1	0
Roof Construction	1.5*	1*	1	0	1.5*	1	1	HT	1	0
Exposed Mass Timber Elements					None	20-40%	Most	All		All



*These values can be reduced based on certain conditions in IBC 403.2.1, which do not apply to Type IV buildings.

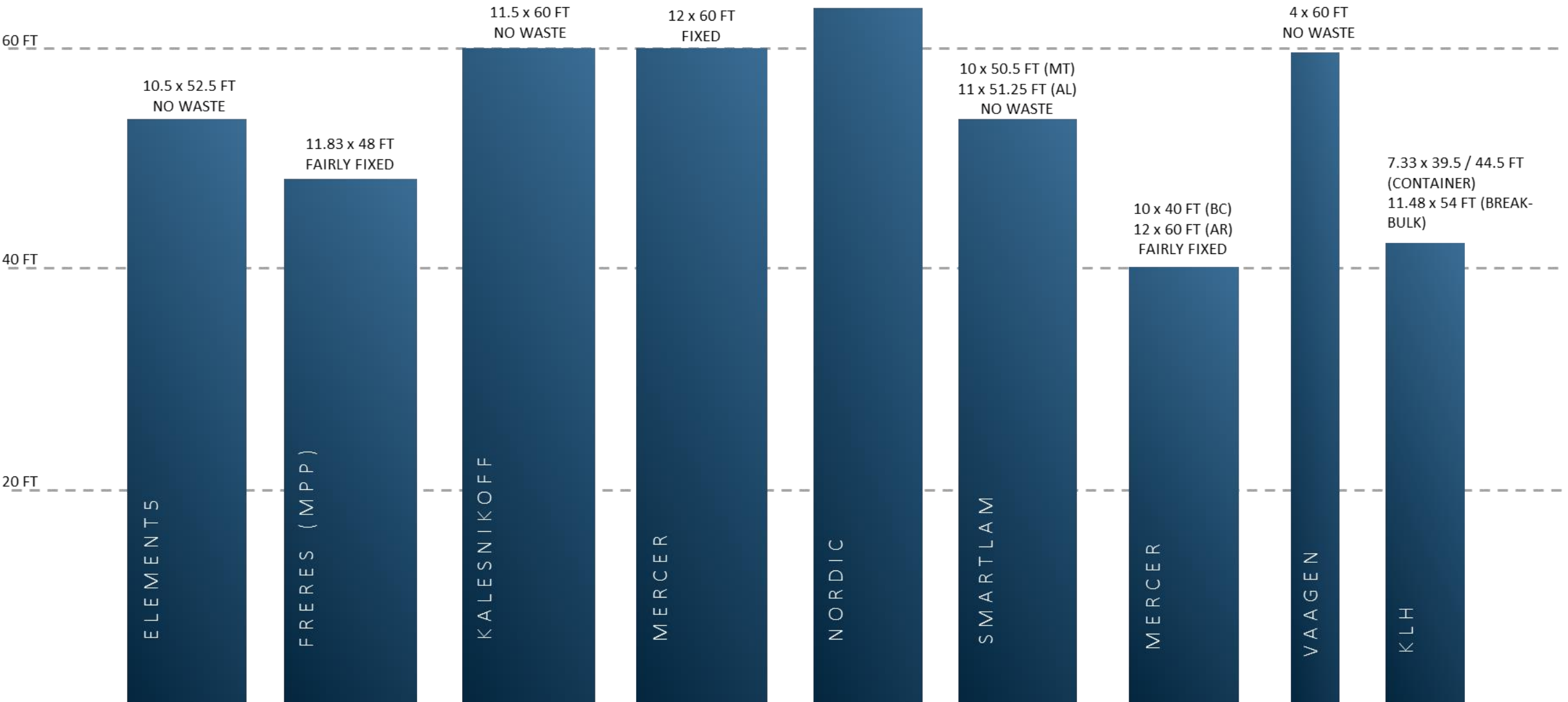
SUPPLIERS



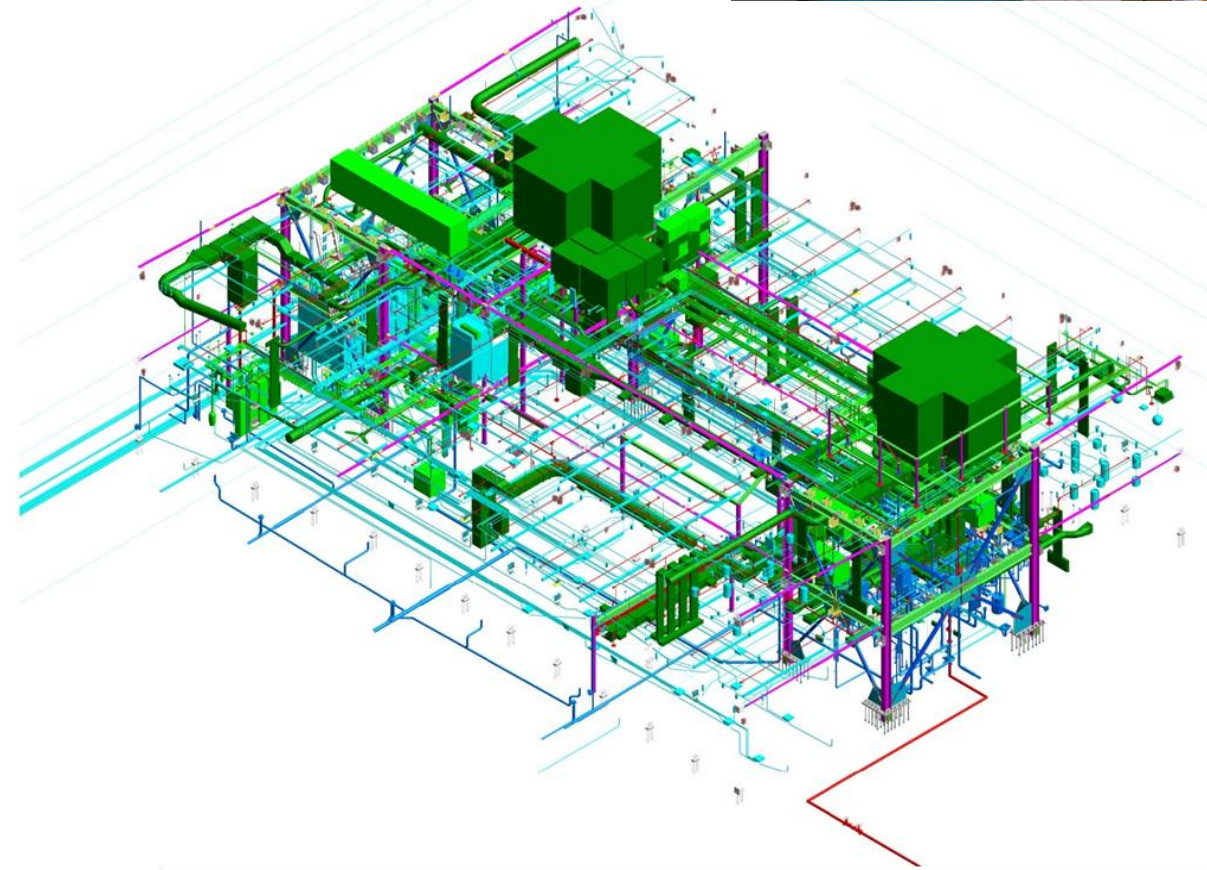
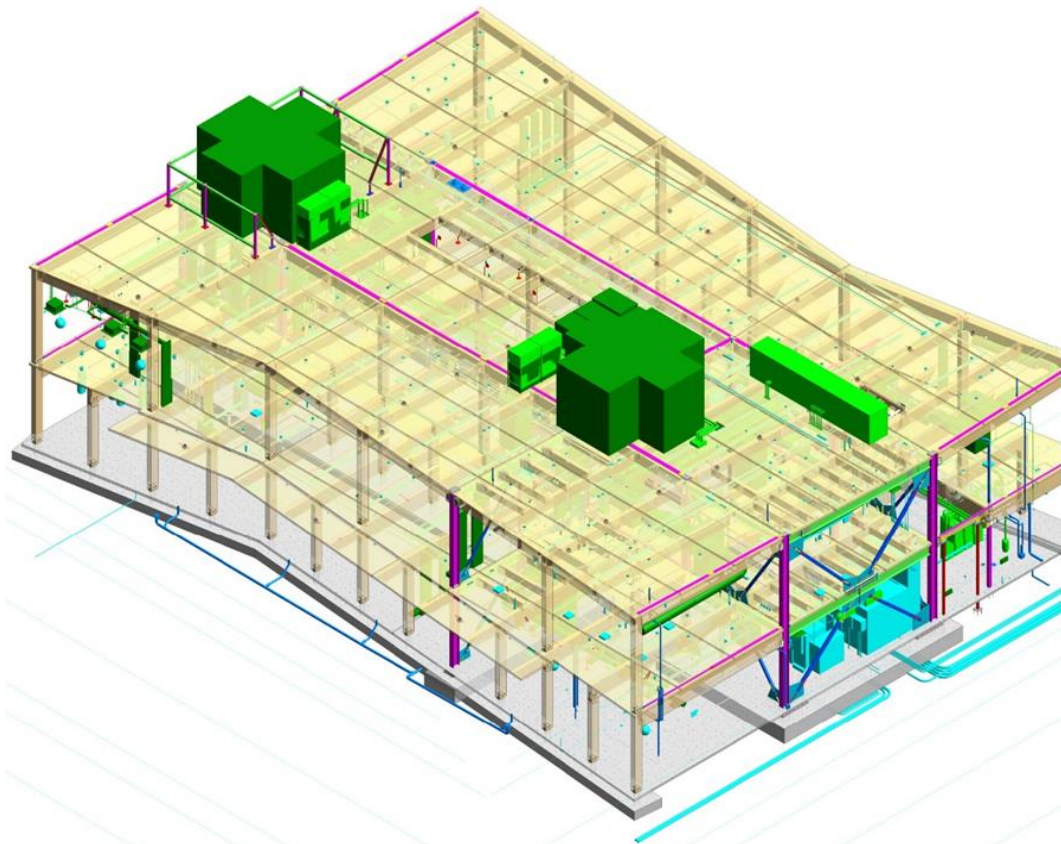
- Timberlab Fabrication Facility
- Panel Manufacturers (CLT + MPP)
- Glulam Manufacturers
- CLT & Glulam Manufacturers

- European Manufacturers:**
- Binderholz (Austria)
 - Hasslacher Norica Timber (Austria)
 - KLH (Austria)
 - Wiehag Timber Construction (Austria)

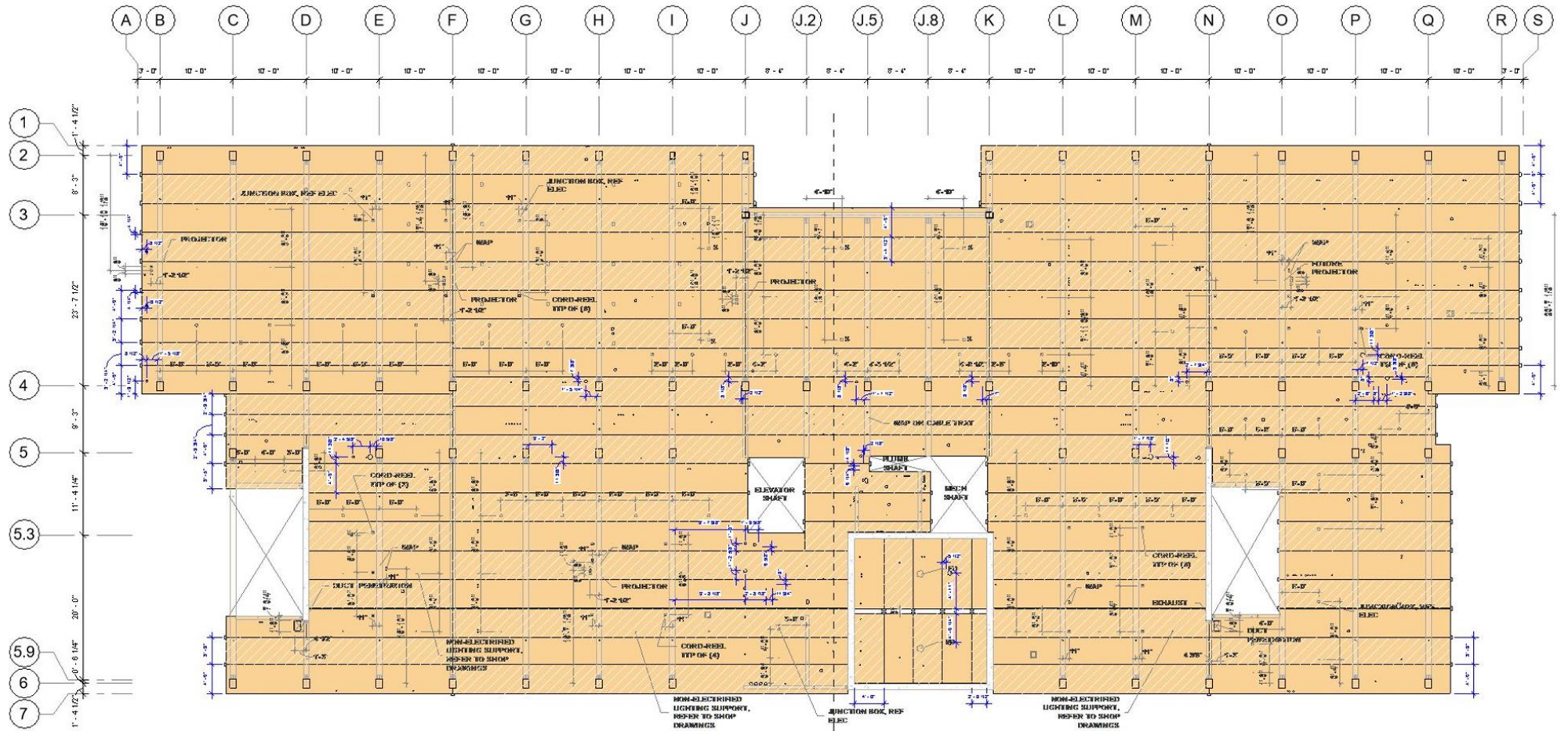
PANEL SIZING



MEPF COORDINATION

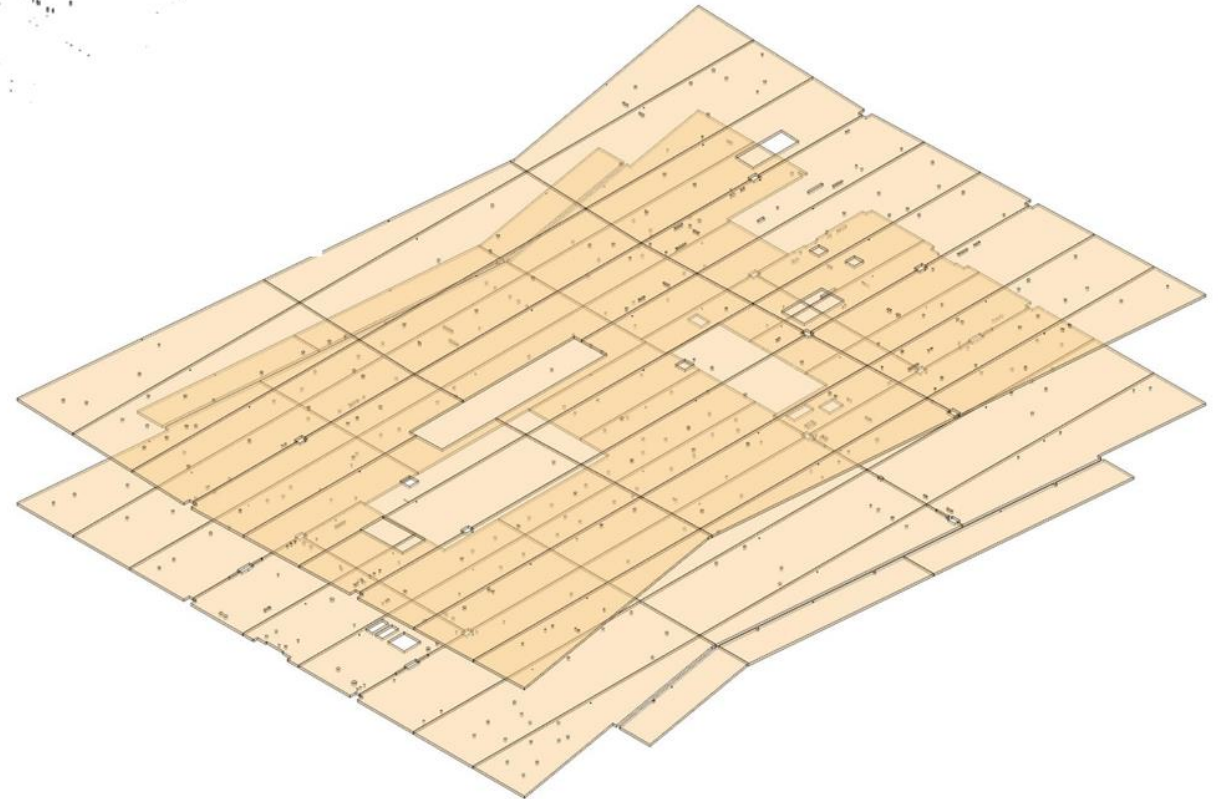
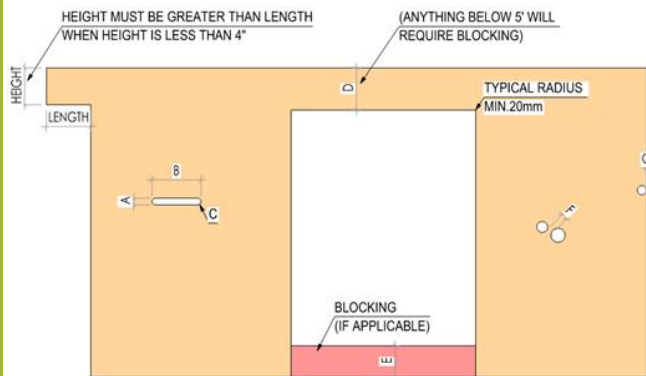
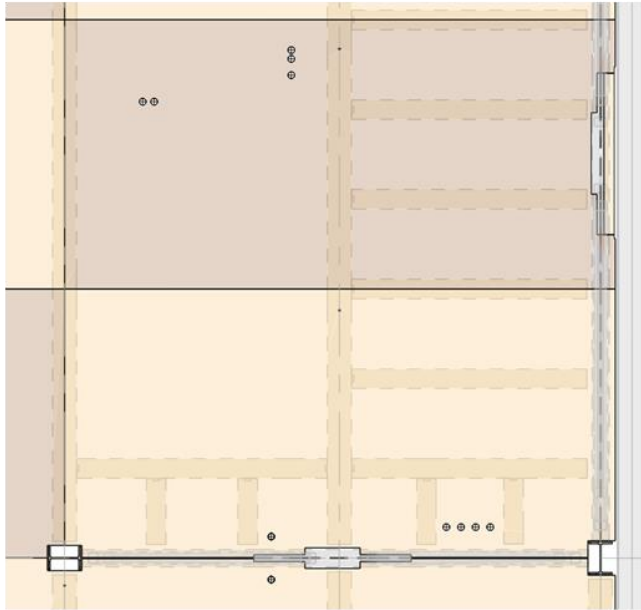


MEPF INTEGRATION

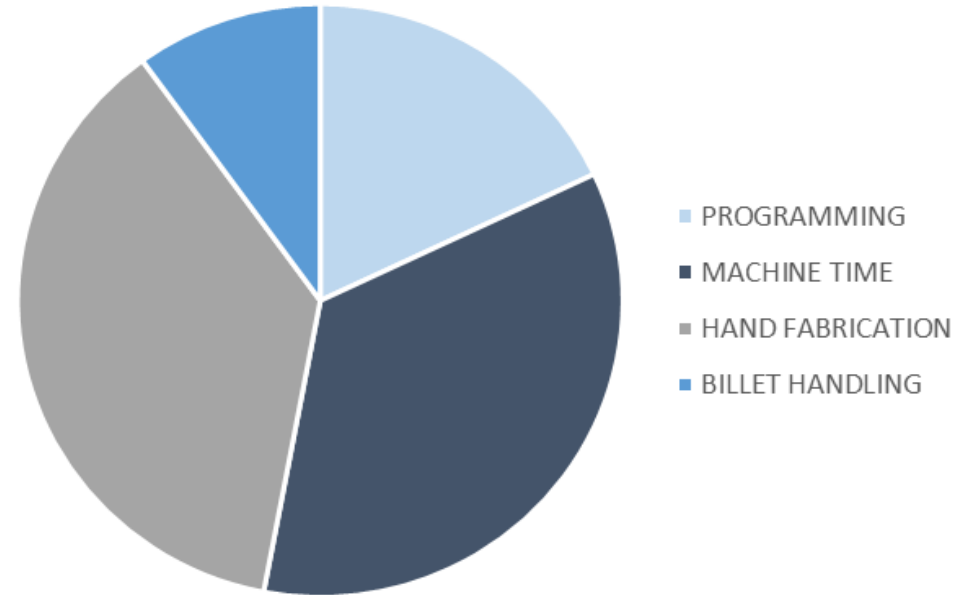
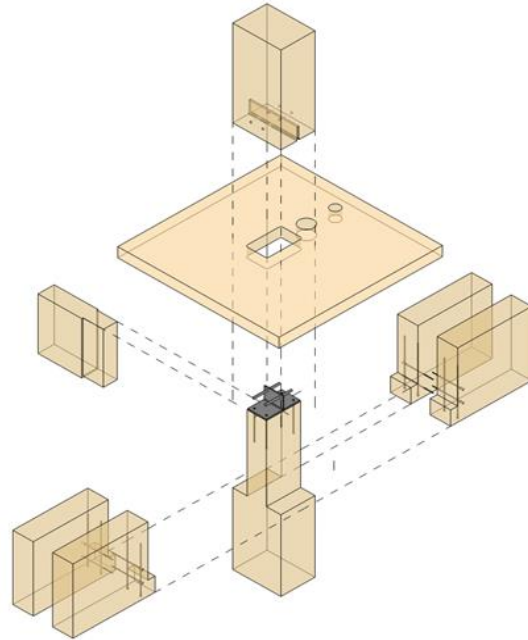


② LEVEL 2 CLT PANEL LAYOUT
1/8" = 1'-0"

PANEL LAYOUTS AND MEPF PENETRATIONS



MONITORING DESIGN EFFICIENCY



LIVE OAK BANK

ADVANTAGES:

- FLAT ROOF STRUCTURE
- REPEATABLE ELEMENTS
- REDUCED FIELD INSTALL TIME

CHALLENGES:

- BEARING GEOMETRY (INCREASED MACHINING TIME)

PART QTY: 956

What is Unique about Designing with Mass Timber

- Modeling starts earlier
- The more design is developed the more accuracy in planning & estimation
- Engage subs earlier
- Mass timber lead time is not driven by mass timber

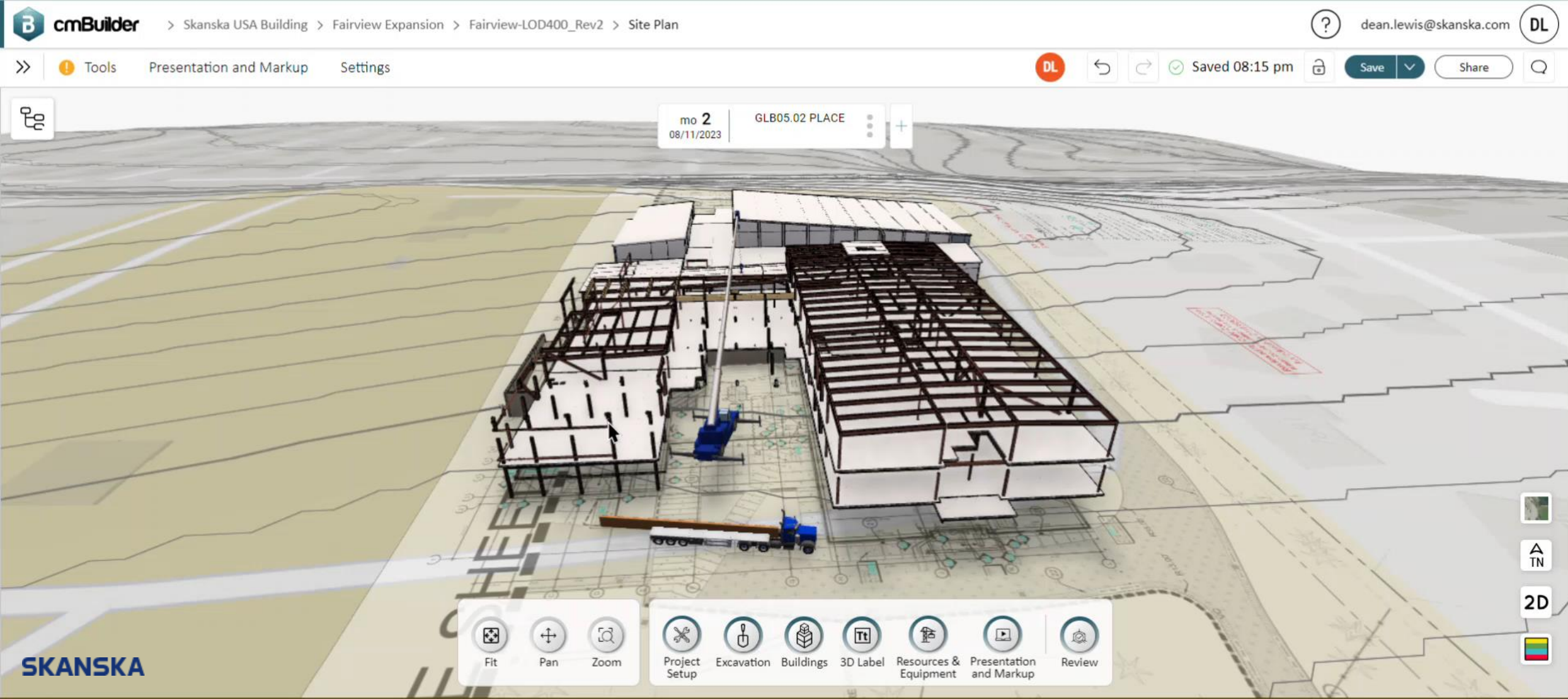


From design to install



What is Unique about Designing with Mass Timber

- 4D planning due to model accuracy



Which will serve your project best?

Design-Bid-Build

- GC selected based on lowest price
- Best for simple, straight-forward projects
- Owner is intermediary between designer and contractor
- Owner assumes risk for errors and omissions

GC/CM

- Collaborative management between owner, architect, and contractor
- Good for complex projects or occupied facilities
- Involves complex scheduling, phasing, coordination

Progressive Design-Build

- PDB team selected based on qualifications, design solution, and guaranteed cost proposal
- Project benefits from efficiency and innovation
- Procurement Flexibility





What is Unique about Building with Mass Timber?

Mass Timber Logistics

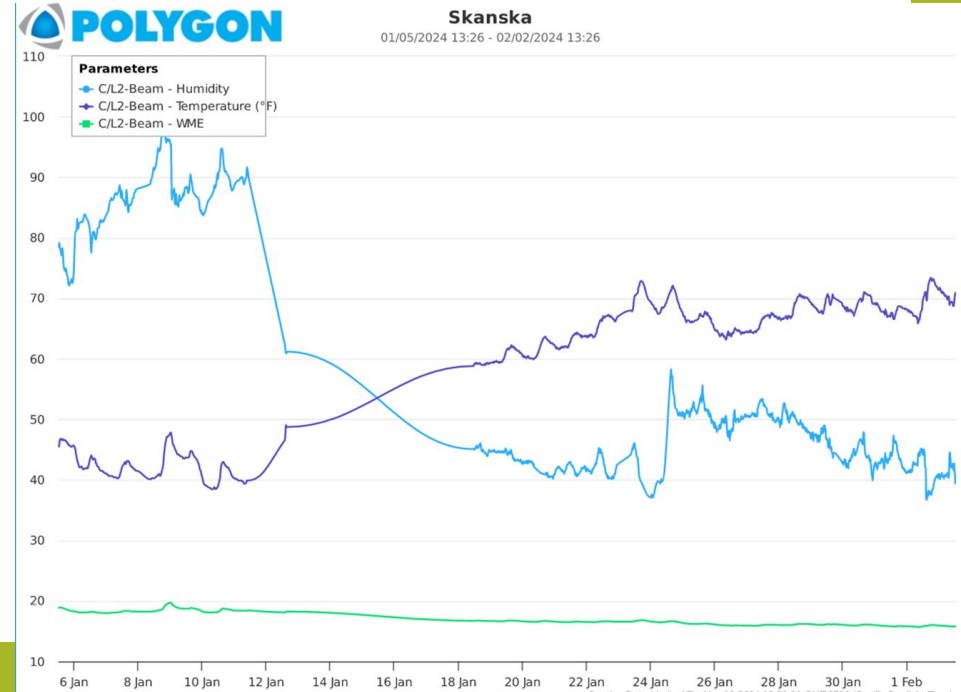


Mass Timber Logistics



What is Unique about building with Mass Timber

- Water management & Building Acclimation
 - Tracking material from factory->Site->to building
 - Controlling moisture during construction
 - Factory applied sealers & membranes
 - Integrating site applied products
 - Planning for extremes (snow/ice, wind blown rain)
- Building Acclimation
 - Temporary heat & humidification systems
 - Building monitoring
 - Schedule finishes with normalized building



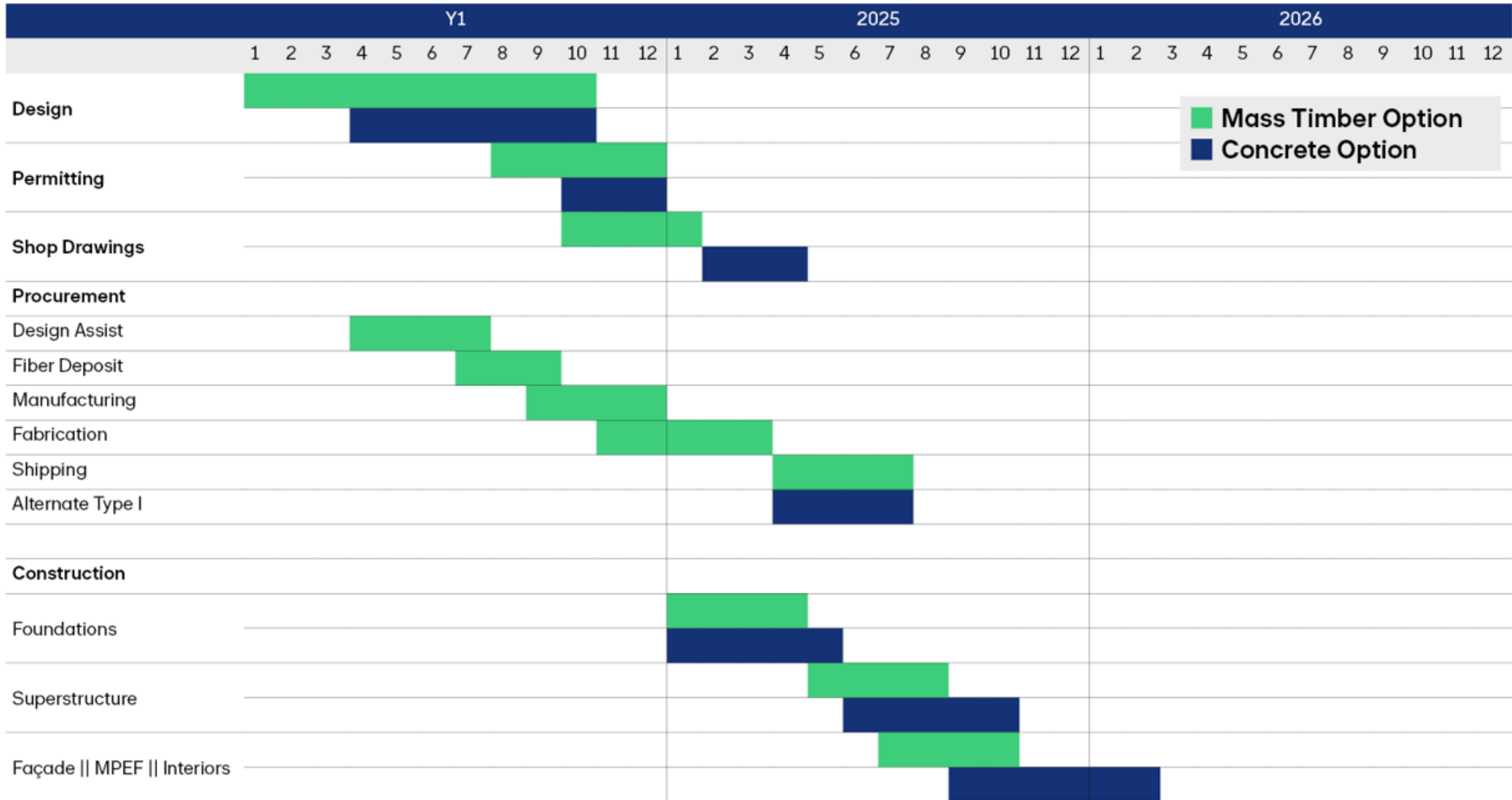
What is Unique about building with Mass Timber

Prefabrication & Coordination with other trades

- Mass timber projects are not 100% mass timber
- Requires coordination with other trades
- Trade sequencing
- Faster workable area
- 30% more deck turnover



Schedule Comparison





How Do You Make Mass Timber Pencil?

Cost Drivers

Building Type and Codes

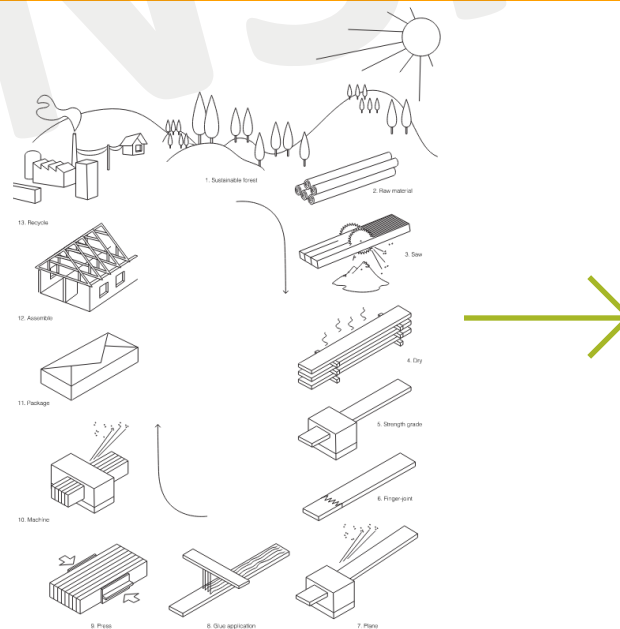
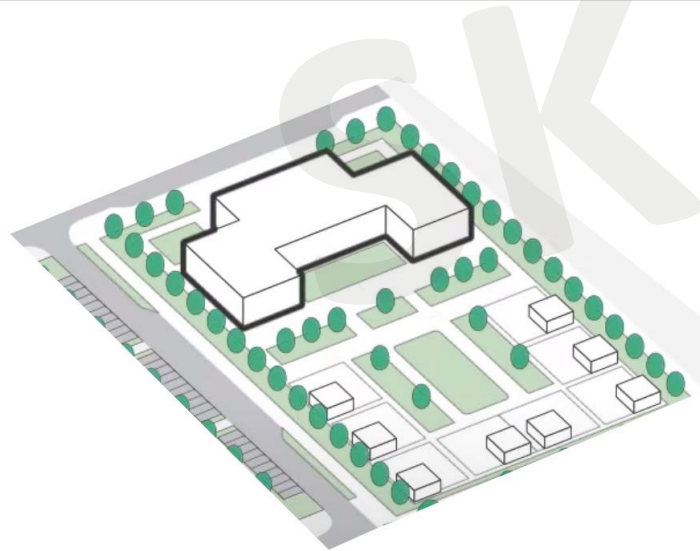
- City/Jurisdiction adopted code
- Building area
- Building height
- Number of stories

Supply Chain

- Fiber type
- Local or global sourcing
- Forest certification
- Project delivery method

Building Mass and Layout

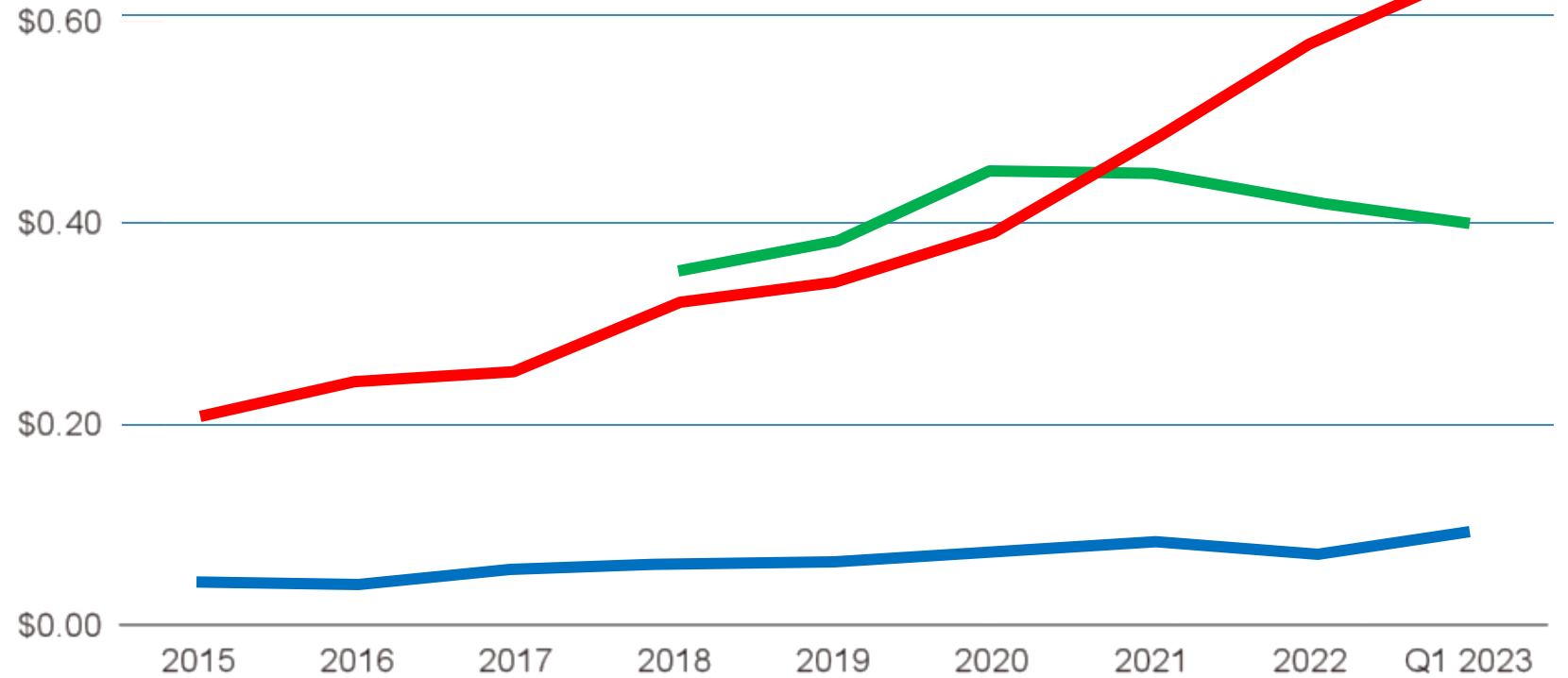
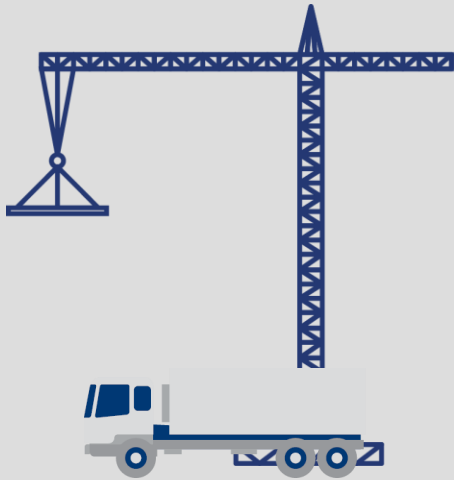
- Floor plate and grid
- Floor to floor heights
- Lateral system
- MEPF integration



Insuring Mass Timber

Current Market Conditions/Rate by Construction Type

Builder's Risk—
Combustible Rates
Over Time



— Combustible — Non-Combustible — Mass Timber

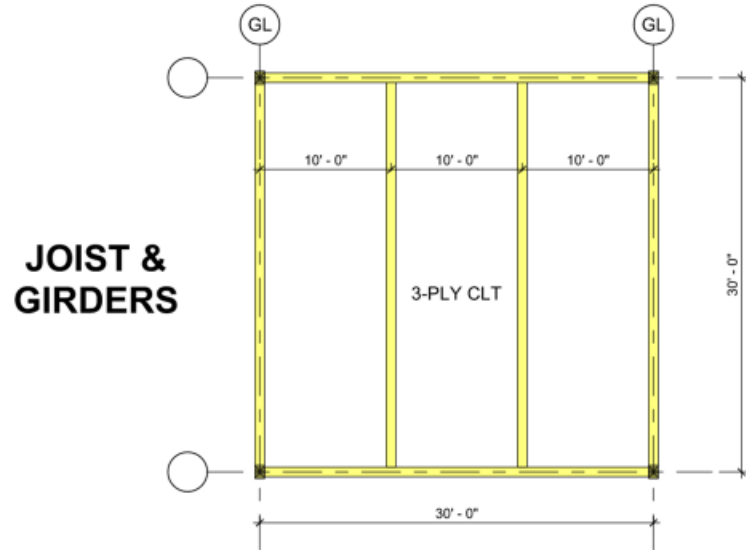
Current Insurance Market

- ✓ Limited insurance and capacity
- ↓ Projects below \$25 million can use one carrier
- ↑ Projects above \$25 million require multiple carriers
- 🕒 Significant time for underwriting on each project.
- 💡 Educate carriers needs project by project
- 🔗 Leverage buying power, better pricing and terms by working with a builder that purchases a lot of builder's risk



Grids

BASELINE 30X30 GRID



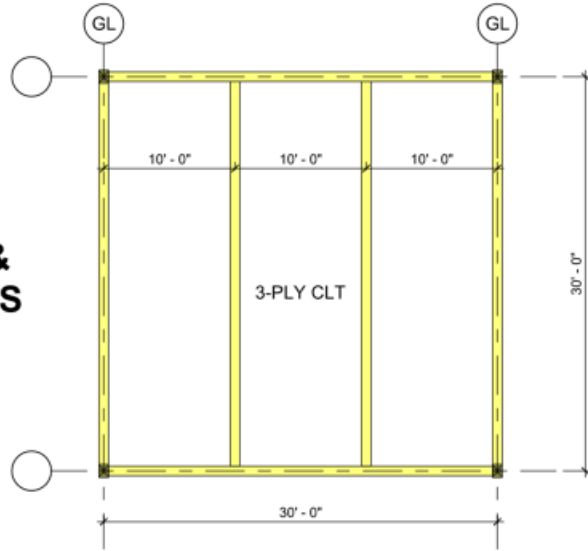
900 SF

- 4 COLUMNS
- 4 GIRDERS
- 2 PURLINS
- 10 PICKS
(100 SF PER PICK)

Grids

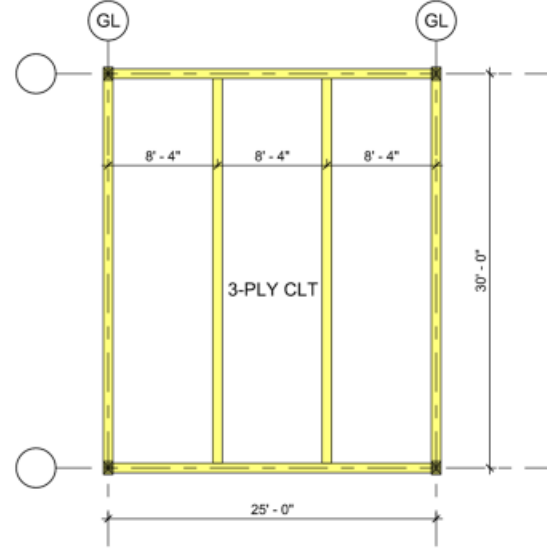
JOIST &
GIRDERS

**BASELINE
30X30 GRID**



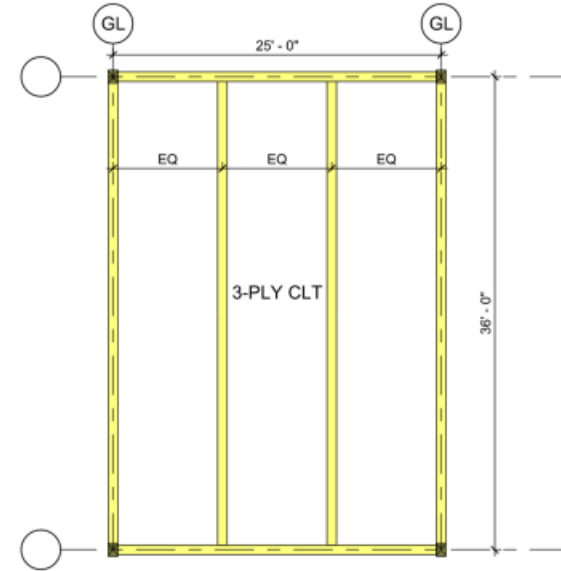
- 900 SF
- 4 COLUMNS
- 4 GIRDERS
- 2 PURLINS
- 10 PICKS
(100 SF PER PICK)

**OPTION 1
25X25 GRID
+13% WOOD VOLUME**



- 750 SF
- 4 COLUMNS
- 4 GIRDERS
- 2 PURLINS
- 10 PICKS
(75 SF PER PICK)

**OPTION 2
25X36 GRID
+12% WOOD VOLUME**

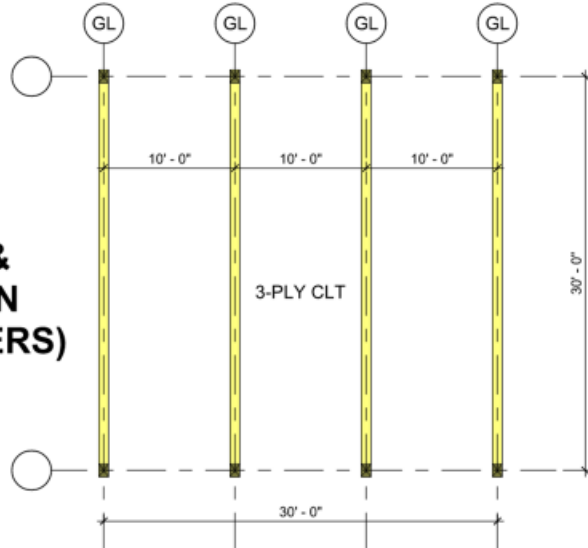


- 900 SF
- 4 COLUMNS
- 4 GIRDERS
- 2 PURLINS
- 10 PICKS
(100 SF PER PICK)

Grids

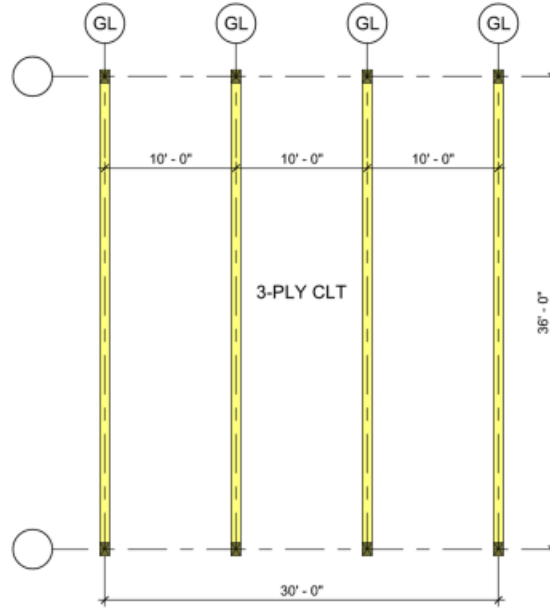
OPTION 4
30X10 GRID
- 31% WOOD VOLUME

**JOIST &
COLUMN
(NO GIRDERS)**



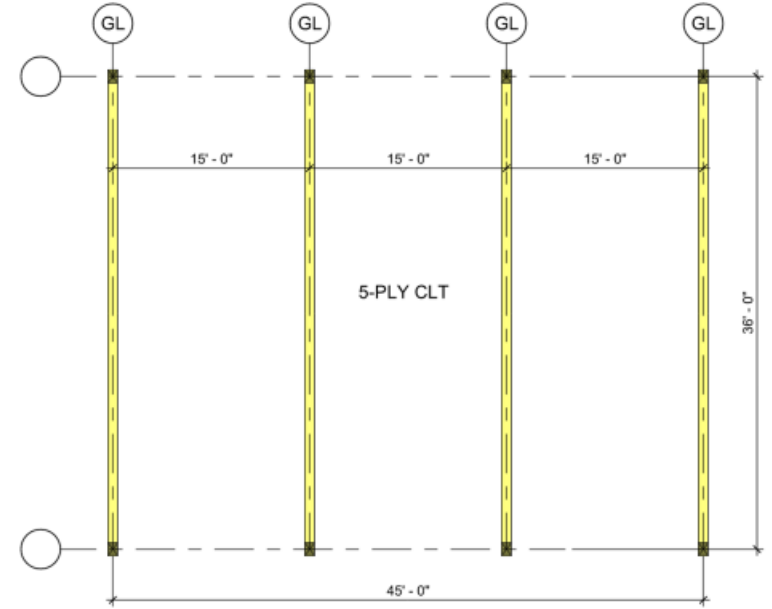
- 900 SF
- 8 COLUMNS
 - 0 GIRDERS
 - 4 JOISTS
 - 12 PICKS
(75 SF PER PICK)

OPTION 5
36X10 GRID
- 16% WOOD VOLUME



- 1,080 SF
- 8 COLUMNS
 - 0 GIRDERS
 - 4 JOISTS
 - 12 PICKS
(90 SF PER PICK)

OPTION 6
25X36 GRID
- 31% WOOD VOLUME

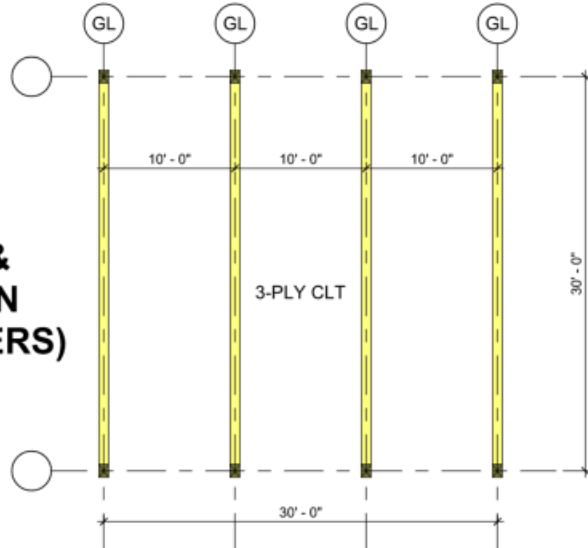


- 1,620 SF
- 8 COLUMNS
 - 0 GIRDERS
 - 4 JOISTS
 - 12 PICKS
(135 SF PER PICK)

Grids

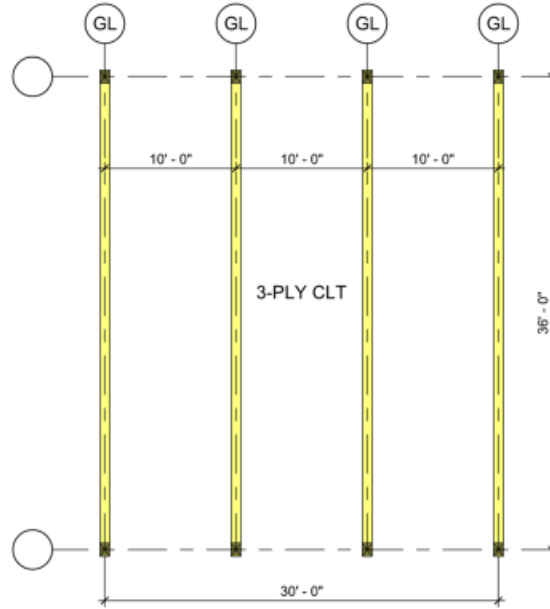
OPTION 4 30X10 GRID - 31% WOOD VOLUME

JOIST &
COLUMN
(NO GIRDERS)



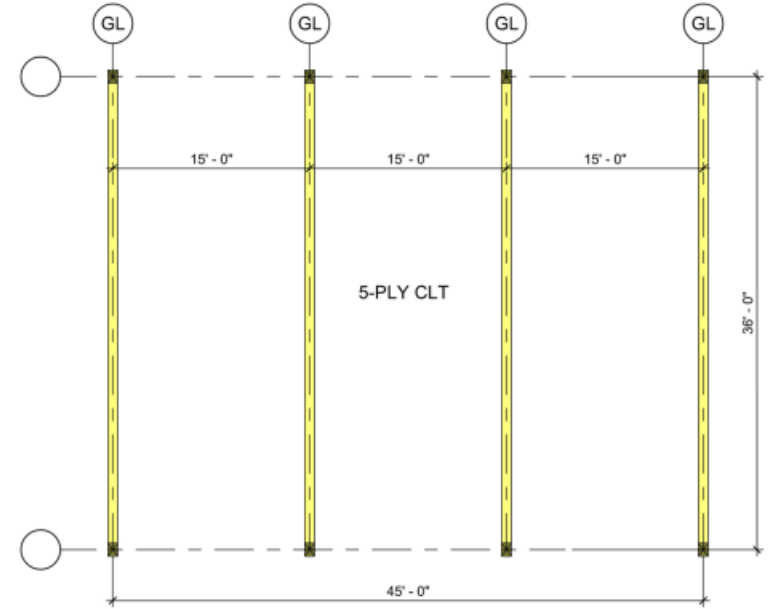
- 900 SF
- 8 COLUMNS
 - 0 GIRDERS
 - 4 JOISTS
 - 12 PICKS
(75 SF PER PICK)

OPTION 5 36X10 GRID - 16% WOOD VOLUME



- 1,080 SF
- 8 COLUMNS
 - 0 GIRDERS
 - 4 JOISTS
 - 12 PICKS

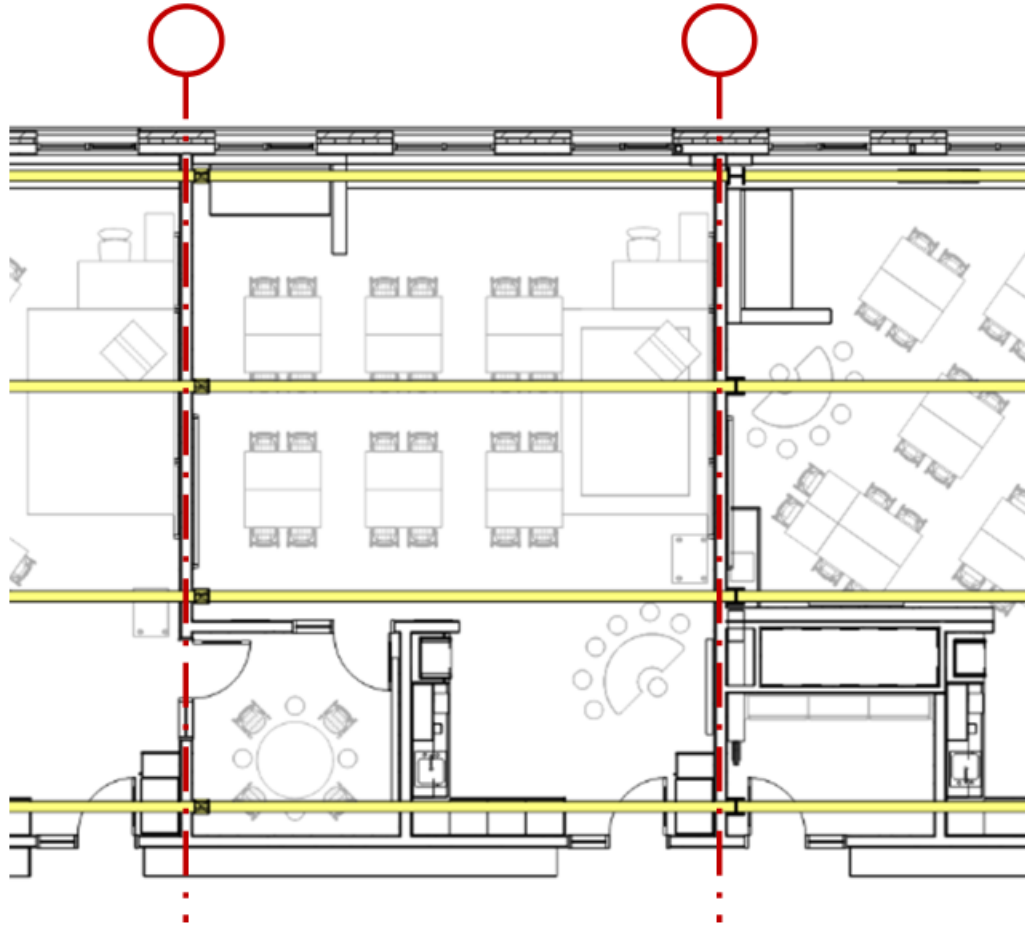
OPTION 6 25X36 GRID - 31% WOOD VOLUME



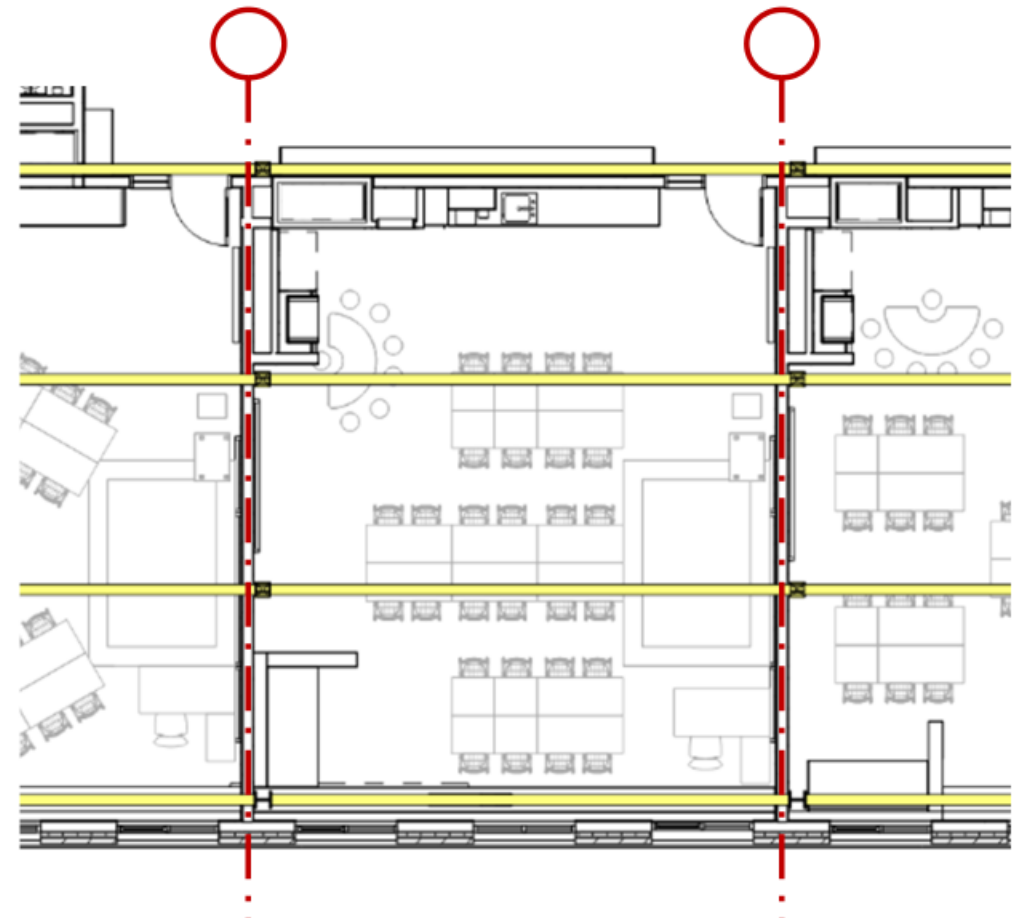
- 1,620 SF
- 8 COLUMNS
 - 0 GIRDERS
 - 4 JOISTS
 - 12 PICKS



Alki ES Grid: 11 x 28



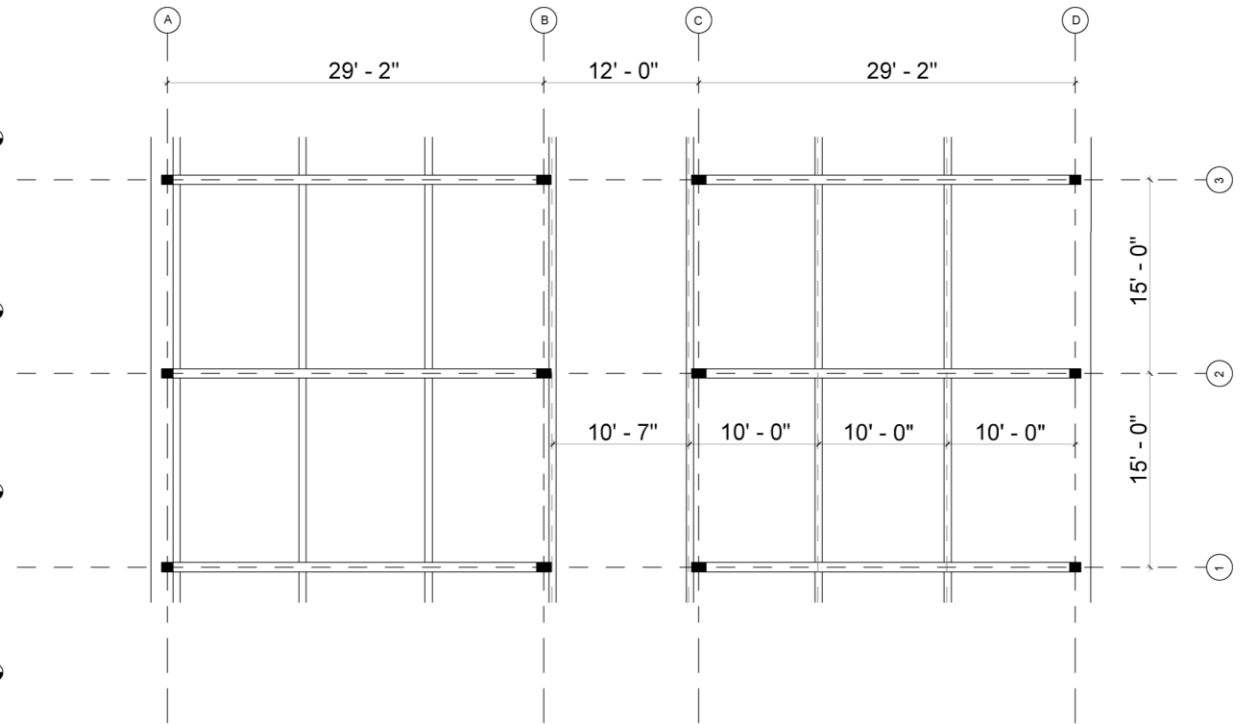
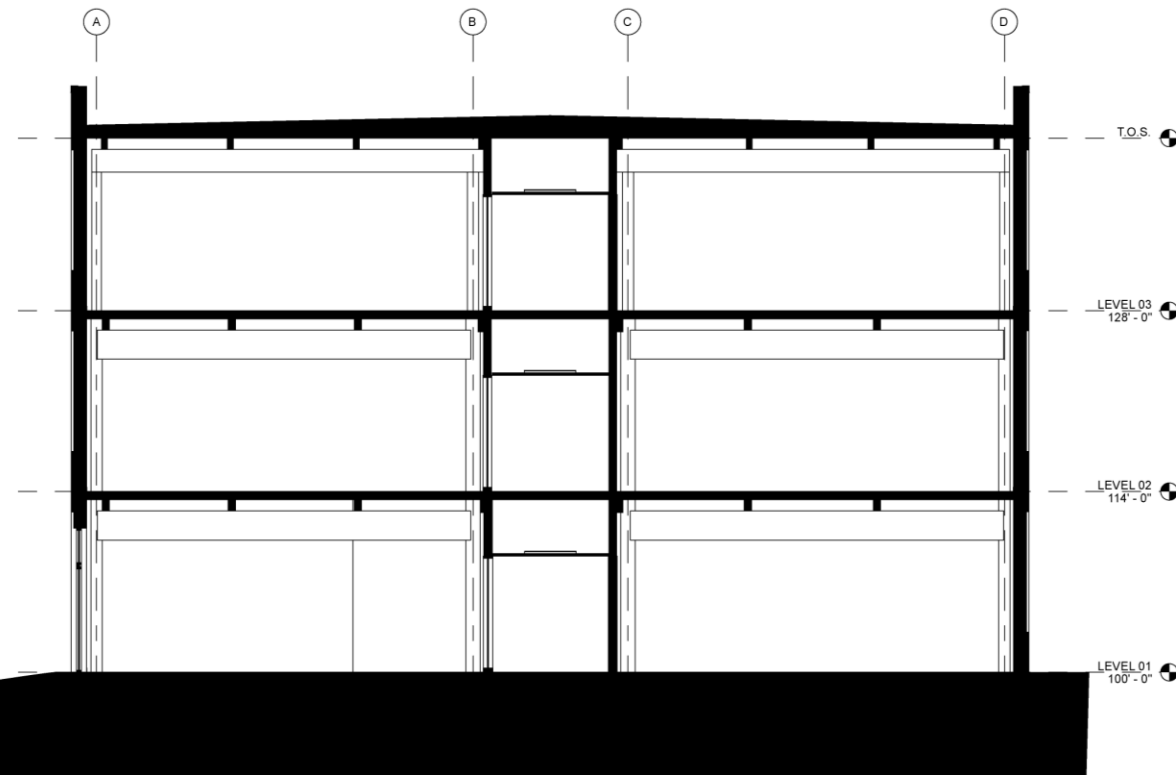
Grade 1-3 Classroom
~750 sf + 100 sf shared

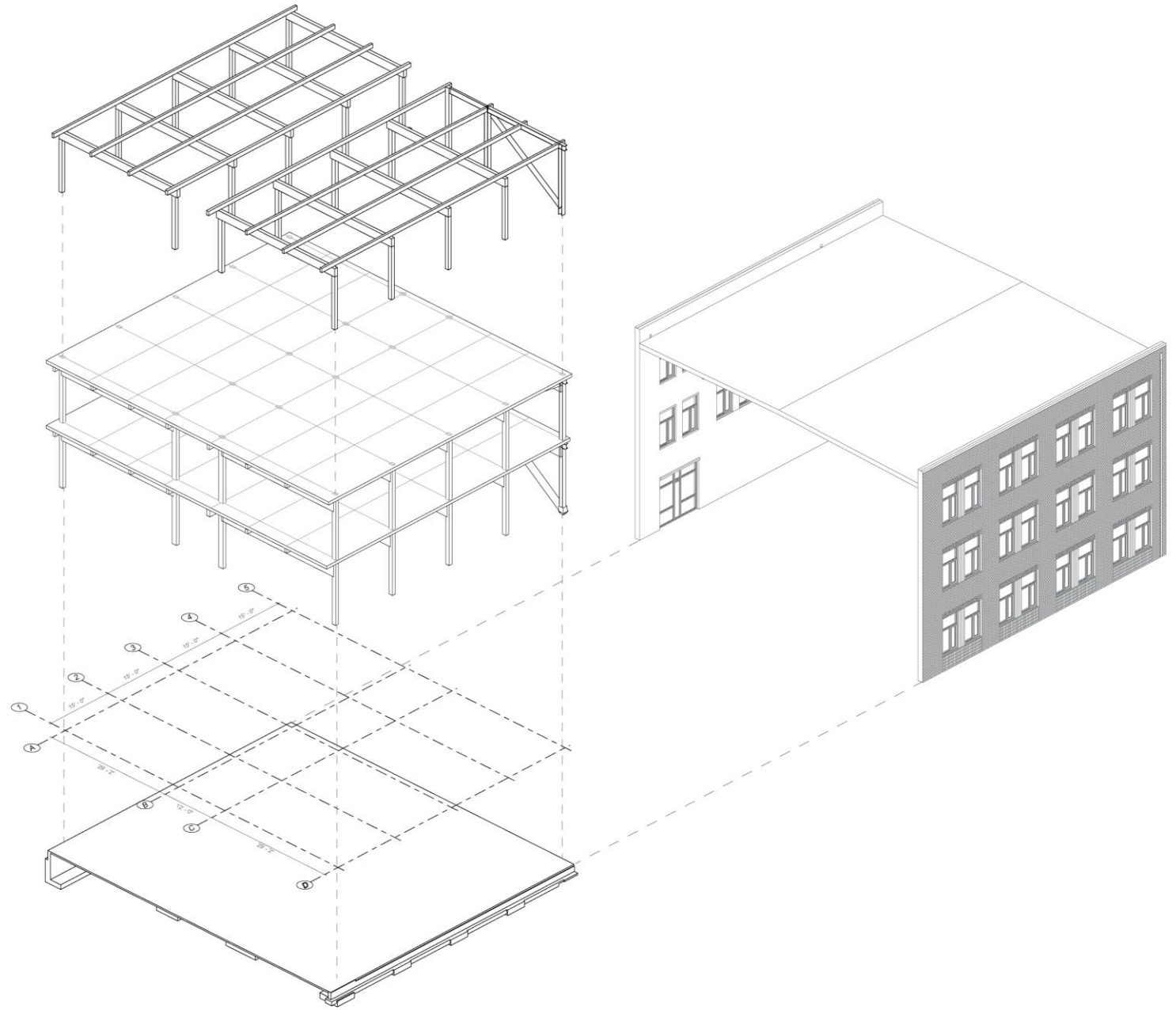


Grade 4-5 Classroom
~800 sf



High School 10 Grid: ~30x30







OSU RAY HALL – BEND OREGON

RAY HALL STATS

STRUCTURE

50,000 GSF

Type III-B

Glulam Post and Beam

3ply CLT

Concrete lateral systems

HIGHLIGHTS

10' x 32' Grid

Labs, classroom, offices

Unrated primary structure

1 HR exterior walls

Net Zero ready

SOURCING

Vaagen CLT Panels

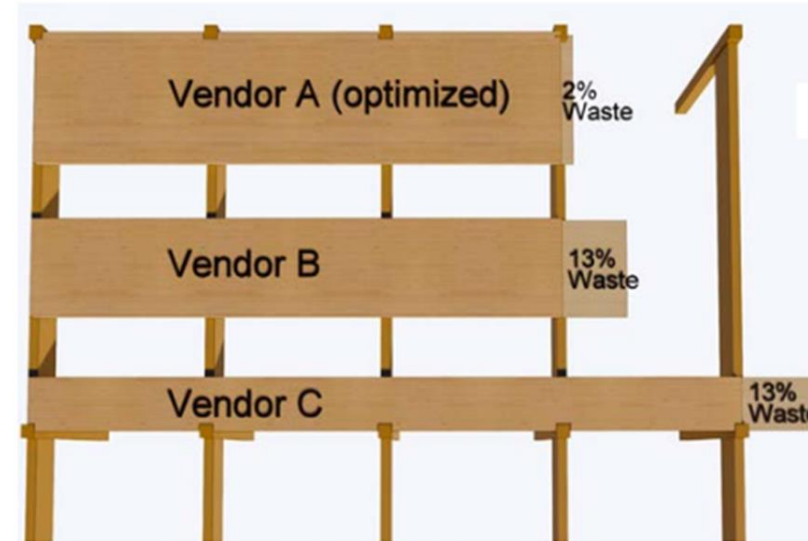
Restoration forestry practices

Zip-o-Laminators Glulam

100% Tribal sourced lamstock

Full transparency for sourcing

WOOD FIBER AND WASTE & EFFICIENCY



VENDOR B OPTIMIZED (15' SPAN)

- | • Installation Cost/SF: | • Manufacturing Cost/SF: |
|-------------------------|--------------------------|
| • Vendor A - \$\$ | • Vendor A - \$\$\$ |
| • Vendor B - \$ | • Vendor B - \$ |
| • Vendor C - \$\$\$ | • Vendor C - \$\$ |

VENDOR A OPTIMIZED (13'4" SPAN)

- | • Installation Cost/SF: | • Manufacturing Cost/SF: |
|-------------------------|--------------------------|
| • Vendor A - \$ | • Vendor A - \$ |
| • Vendor B - \$\$ | • Vendor B - \$\$ |
| • Vendor C - \$\$\$ | • Vendor C - \$\$ |

GRIDS AND WOOD FIBER EFFICIENCY

COLUMN SPACING V. MATERIAL VOLUME

5 PLY PANEL WITH 13'-4" O.C. COLUMN SPACING

CLT BY VOLUME (APPROX):

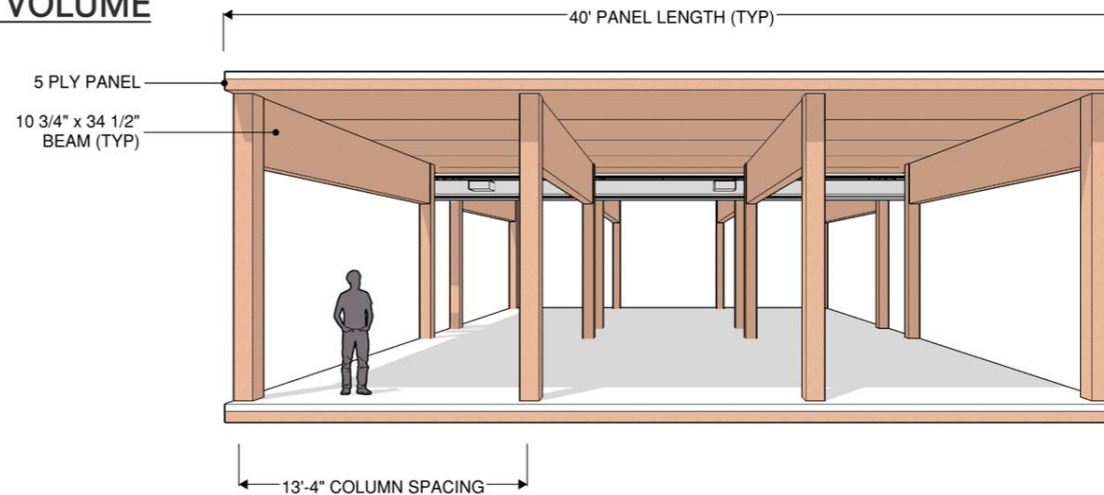
30,070 CUBIC FT

FRAMING BY VOLUME (APPROX):

10,670 CUBIC FT

TOTAL WOOD VOLUME (APPROX):

40,740 CUBIC FT



3 PLY PANEL WITH 10'-0" O.C. COLUMN SPACING

CLT BY VOLUME (APPROX):

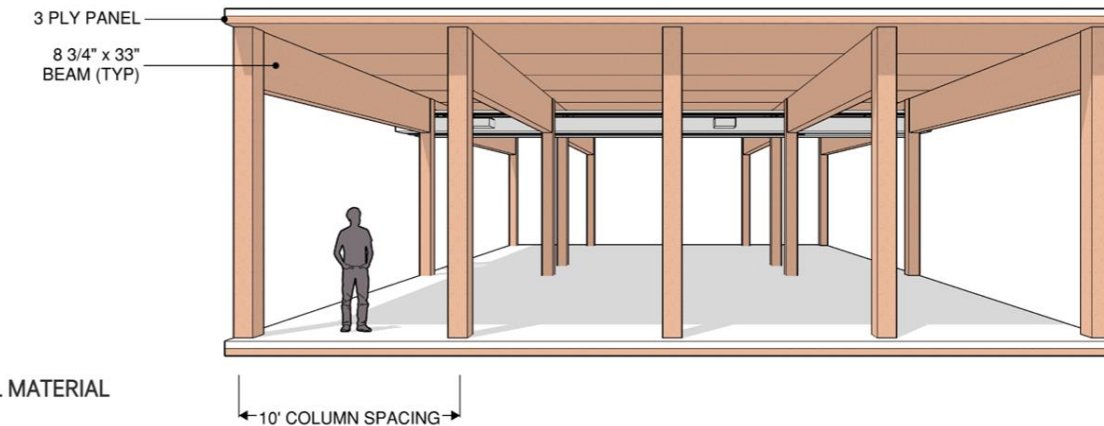
18,700 CUBIC FT

FRAMING BY VOLUME (APPROX):

11,750 CUBIC FT

TOTAL WOOD VOLUME (APPROX):

30,450 CUBIC FT



25-30% REDUCTION IN STRUCTURAL MATERIAL



SCOPE	TARGET MODEL		East Bar, Demo Paine		East Bar, Demo Paine		East Bar, Demo Paine		East Bar, Demo Paine		East Bar, Demo Paine		East Bar, Demo Paine		COMMENTS
	BASELINE (ALL STEEL)		Premium 1A (Hybrid)		DLT OPTION A		Premium 1B (All Timber)		Premium 1C (Steel 5 Stories)		Premium 1D (Timber 5 Stories)				
	Classroom Bldg		Classroom Bldg	24,000	Classroom Bldg	24,000	Classroom Bldg	24,000	Classroom Bldg	24,000	Classroom Bldg	24,000	Classroom Bldg	24,000	
	Gym Bldg		Gym Bldg	6,000	Gym Bldg	6,000	Gym Bldg	6,000	Gym Bldg	6,000	Gym Bldg	6,000	Gym Bldg	6,000	
Total New		30,000		30,000		30,000		30,000		30,000		30,000			
Total Reno		-		-		-		-		-		-			
Description	Amount	\$/SF	Amount	\$/SF	Amount	\$/SF	Amount	\$/SF	Amount	\$/SF	Amount	\$/SF	Amount	\$/SF	
BUILDING			\$ 13,156,645	\$ 438.55	\$ 13,432,090	\$ 447.74	\$ 13,443,945	\$ 448.13	\$ 14,090,283	\$ 469.68	\$ 13,666,358	\$ 455.55	\$ 14,775,650	\$ 492.52	Blended rate (\$400/sf @ Bldg, \$440/sf @ Gym LESS CLADDING)
03 Concrete	\$ 480,000	\$ 16.00	\$ 480,000	\$ 16.00	\$ 480,000	\$ 16.00	\$ 480,000	\$ 16.00	\$ 480,000	\$ 16.00	\$ 480,000	\$ 16.00	\$ 480,000	\$ 16.00	
04 Masonry	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	Included in Division 07 (\$72.5/sf TVD)
05 Metal	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	
06 Wood, Plastic and Composites	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	
07 Thermal and Moisture Protection	\$ 2,702,150	\$ 89.00	\$ 2,582,150	\$ 85.00	\$ 2,702,150	\$ 89.00	\$ 2,597,150	\$ 85.50	\$ 2,702,150	\$ 89.00	\$ 2,702,150	\$ 89.00	\$ 2,657,150	\$ 87.50	
Cladding	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	
Roofing	\$ 332,150	\$ 10.00	\$ 332,150	\$ 10.00	\$ 332,150	\$ 10.00	\$ 332,150	\$ 10.00	\$ 332,150	\$ 10.00	\$ 332,150	\$ 10.00	\$ 332,150	\$ 10.00	
Insulation/Flashing/Sealants/Etc.	\$ 270,000	\$ 9.00	\$ 270,000	\$ 9.00	\$ 270,000	\$ 9.00	\$ 270,000	\$ 9.00	\$ 270,000	\$ 9.00	\$ 270,000	\$ 9.00	\$ 270,000	\$ 9.00	
Fireproofing	\$ 150,000	\$ 5.00	\$ 30,000	\$ 1.00	\$ 150,000	\$ 5.00	\$ 45,000	\$ 1.50	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 105,000	\$ 3.50	
08 Openings	\$ 720,000	\$ 24.00	\$ 720,000	\$ 24.00	\$ 720,000	\$ 24.00	\$ 720,000	\$ 24.00	\$ 720,000	\$ 24.00	\$ 720,000	\$ 24.00	\$ 720,000	\$ 24.00	
09 Finishes	\$ 1,500,000	\$ 50.00	\$ 1,500,000	\$ 50.00	\$ 1,438,800	\$ 50.00	\$ 1,500,000	\$ 50.00	\$ 1,500,000	\$ 50.00	\$ 1,500,000	\$ 50.00	\$ 1,500,000	\$ 50.00	
10 Specialties	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	
11 Equipment	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	\$ 150,000	\$ 5.00	
12 Furnishings	\$ 240,000	\$ 8.00	\$ 240,000	\$ 8.00	\$ 240,000	\$ 8.00	\$ 240,000	\$ 8.00	\$ 240,000	\$ 8.00	\$ 240,000	\$ 8.00	\$ 240,000	\$ 8.00	
14 Conveying System	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	\$ 285,000	\$ 9.50	
21 Fire Suppression	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	\$ 180,000	\$ 6.00	
23 Mechanical	\$ 2,310,000	\$ 77.00	\$ 2,310,000	\$ 77.00	\$ 2,310,000	\$ 77.00	\$ 2,310,000	\$ 77.00	\$ 2,310,000	\$ 77.00	\$ 2,310,000	\$ 77.00	\$ 2,310,000	\$ 77.00	
26 Electrical	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	\$ 1,950,000	\$ 65.00	
STRUCTURE			\$ 2,024,495	\$ 67.48	\$ 2,419,940	\$ 80.66	\$ 2,372,995	\$ 79.10	\$ 3,063,133	\$ 102.10	\$ 2,534,208	\$ 84.47	\$ 3,688,500	\$ 122.95	
BRB Brace Frames - Steel	\$ 432,000	\$ 14.40	\$ 558,000	\$ 18.60	\$ 432,000	\$ 14.40	\$ 432,000	\$ 14.40	\$ 486,000	\$ 16.20	\$ 560,000	\$ 18.67	\$ 630,000	\$ 21.00	
BRB Brace Frames - BRBs	\$ 144,000	\$ 4.80	\$ 144,000	\$ 4.80	\$ 144,000	\$ 4.80	\$ 144,000	\$ 4.80	\$ 144,000	\$ 4.80	\$ 144,000	\$ 4.80	\$ 144,000	\$ 4.80	
BRB Brace Frames - Erection	\$ 103,500	\$ 3.45	\$ 119,025	\$ 3.97	\$ 103,500	\$ 3.45	\$ 103,500	\$ 3.45	\$ 103,500	\$ 3.45	\$ 134,550	\$ 4.49	\$ 134,550	\$ 4.49	
Steel Framing	\$ 884,000	\$ 29.47	\$ 329,000	\$ 10.97	\$ 884,000	\$ 29.47	\$ 302,400	\$ 10.08	\$ 302,400	\$ 10.08	\$ 1,193,360	\$ 39.78	\$ 427,636	\$ 14.25	
Steel Decking w/ Concrete Topping	\$ 368,865	\$ 12.30	\$ 368,865	\$ 12.30	\$ 225,365	\$ 7.51			\$ -	\$ -	\$ 465,238	\$ 15.51	\$ -	\$ -	
Steel Roof Decking	\$ 92,130	\$ 3.07	\$ 92,130	\$ 3.07	\$ 92,130	\$ 3.07			\$ -	\$ -	\$ 37,060	\$ 1.24	\$ -	\$ -	
Timber Framing			\$ -	\$ -	\$ 808,920	\$ 26.96			\$ 733,320	\$ 24.44	\$ -	\$ -	\$ 1,058,400	\$ 35.28	
CLT Decking w/ Topping			\$ -	\$ -	\$ -	\$ -	\$ 492,000	\$ 16.40	\$ 999,097	\$ 33.30	\$ -	\$ -	\$ 999,097	\$ 33.30	Includes Acoustic Mat
CLT Roof Decking			\$ -	\$ -	\$ -	\$ -			\$ 294,816	\$ 9.83	\$ -	\$ -	\$ 294,816	\$ 9.83	
DEMO EXISTING BUILDING			\$ 323,125	\$ 19.29	\$ 323,125	\$ 19.29	\$ 323,125	\$ 19.29	\$ 323,125	\$ 19.29	\$ 323,125	\$ 19.29	\$ 323,125	\$ 19.29	
ON SITE SCOPE			\$ 1,646,245	\$ 54.87	\$ 1,646,245	\$ 54.87	\$ 1,646,245	\$ 54.87	\$ 1,646,245	\$ 54.87	\$ 1,646,245	\$ 54.87	\$ 1,646,245	\$ 54.87	Includes 1,000bcy EW, other improvements reduced 50% from SD estimate
OFF SITE ROW SCOPE			\$ 432,130	\$ 14.40	\$ 432,130	\$ 14.40	\$ 432,130	\$ 14.40	\$ 432,130	\$ 14.40	\$ 432,130	\$ 14.40	\$ 432,130	\$ 14.40	Assumes same scope as previous SD
Total Building Cost of Work (COW)	\$ 15,564,672		\$ 15,558,145	\$ 518.60	\$ 15,833,590	\$ 527.79	\$ 15,845,445	\$ 528.18	\$ 16,491,783	\$ 549.73	\$ 16,067,857	\$ 535.60	\$ 17,177,149	\$ 572.57	
Hoisting & Access	\$ 350,000	LS	\$ 350,000	LS	\$ 350,000	LS	\$ 350,000	LS	\$ 350,000	LS	\$ 350,000	LS	\$ 350,000	LS	This will vary depending on final outcome of building height, site grading etc.
Labor Markup	\$ 132,300	15.00%	\$ 132,244	15.00%	\$ 134,586	15.00%	\$ 134,686	15.00%	\$ 140,180	15.00%	\$ 136,577	15.00%	\$ 146,006	15.00%	
GCCM Risk Contingency	\$ 311,293	2.00%	\$ 311,163	2.00%	\$ 316,672	2.00%	\$ 316,909	2.00%	\$ 329,836	2.00%	\$ 321,357	2.00%	\$ 343,543	2.00%	
Design & Estimating Contingency	\$ 389,117	2.50%	\$ 388,954	2.50%	\$ 395,840	2.50%	\$ 396,136	2.50%	\$ 412,295	2.50%	\$ 401,696	2.50%	\$ 429,429	2.50%	
Escalation	\$ 933,880	6.00%	\$ 933,489	6.00%	\$ 950,015	6.00%	\$ 950,727	6.00%	\$ 989,507	6.00%	\$ 964,071	6.00%	\$ 1,030,629	6.00%	
Total Cost of Work (COW)	\$ 17,681,262		\$ 17,673,994	\$ 589.13	\$ 17,980,702	\$ 599.36	\$ 17,993,903	\$ 599.80	\$ 18,713,600	\$ 623.79	\$ 18,241,559	\$ 608.05	\$ 19,476,756	\$ 649.23	
Staffing & General Conditions	\$ 3,760,000	LS	\$ 3,760,000	LS	\$ 3,760,000	LS	\$ 3,760,000	LS	\$ 3,760,000	LS	\$ 3,760,000	LS	\$ 3,760,000	LS	
(MACC) Subtotal	\$ 21,441,262		\$ 21,433,994	\$ 714.47	\$ 21,740,702	\$ 724.69	\$ 21,753,903	\$ 725.13	\$ 22,473,600	\$ 749.12	\$ 22,001,559	\$ 733.39	\$ 23,236,756	\$ 774.56	
GCCM FEE	\$ 696,841	3.25%	\$ 696,605	3.25%	\$ 706,573	3.25%	\$ 707,002	3.25%	\$ 730,392	3.25%	\$ 715,051	3.25%	\$ 755,195	3.25%	
(TCC) Total	\$ 22,138,103		\$ 22,130,599	\$ 737.69	\$ 22,447,275	\$ 748.24	\$ 22,460,904	\$ 748.70	\$ 23,203,992	\$ 773.47	\$ 22,716,609	\$ 757.22	\$ 23,991,950	\$ 799.73	
B&O Tax - State	\$ 92,316	0.42%	\$ 92,285	0.42%	\$ 93,605	0.42%	\$ 93,662	0.42%	\$ 96,761	0.42%	\$ 94,728	0.42%	\$ 100,046	0.42%	
B&O Tax - City of Seattle	\$ 49,147	0.22%	\$ 49,130	0.22%	\$ 49,833	0.22%	\$ 49,863	0.22%	\$ 51,513	0.22%	\$ 50,431	0.22%	\$ 53,262	0.22%	
Insurance - Gen Liability	\$ 122,866	0.56%	\$ 122,825	0.56%	\$ 124,582	0.56%	\$ 124,658	0.56%	\$ 128,782	0.56%	\$ 126,077	0.56%	\$ 133,155	0.56%	
Bond	\$ 126,187	0.57%	\$ 126,144	0.57%	\$ 127,949	0.57%	\$ 128,027	0.57%	\$ 132,263	0.57%	\$ 129,485	0.57%	\$ 136,754	0.57%	
Builder's Risk Insurance (TBD)	\$ 221,381	1.00%	\$ 221,306	1.00%	\$ 224,473	1.00%	\$ 224,609	1.00%	\$ 232,040	1.00%	\$ 227,166	1.00%	\$ 239,920	1.00%	
Total Cost (GMP)	\$ 22,750,000		\$ 22,742,289	\$ 758.08	\$ 23,067,717	\$ 768.92	\$ 23,081,724	\$ 769.39	\$ 23,845,350	\$ 794.85	\$ 23,344,497	\$ 778.15	\$ 24,655,088	\$ 821.84	

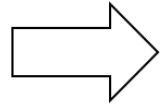




Why Build a School With Mass Timber?

BENEFITS OF MASS TIMBER ASSEMBLY

PREFABRICATION



Increased speed of construction

Quiet to erect

Minimal waste on-site

Small installation crew

Safer worksite



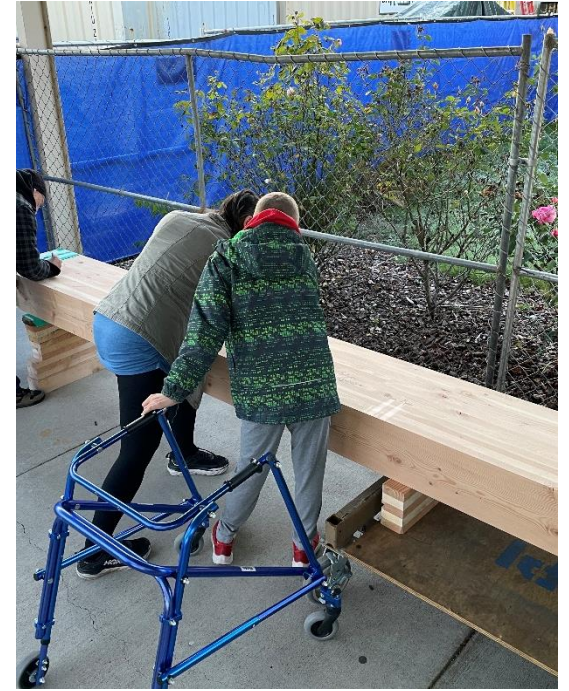
MASS TIMBER ASSEMBLY



Mass timber is trucked to site as required typically 1-3 trucks a day to keep a steady flow of materials



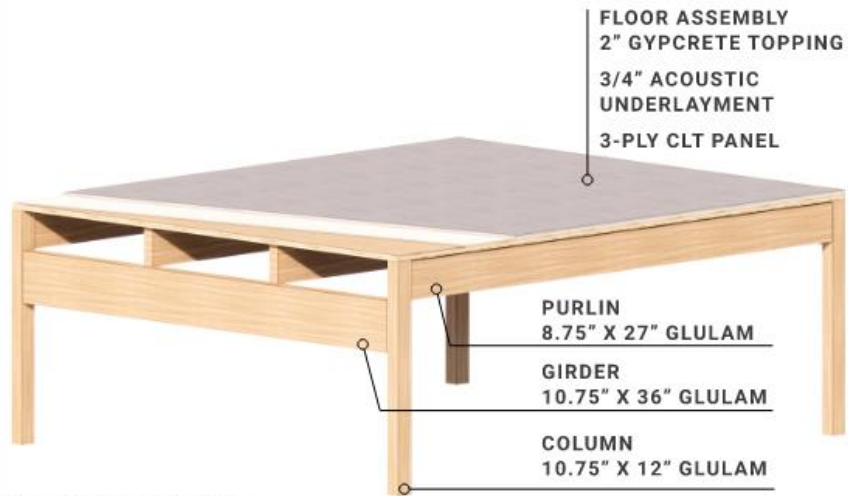
Crews are usually small between 6-12 depending on the project size.



WHY BUILD A SCHOOL WITH MASS TIMBER

Embodied Carbon

Material: Mass Timber Option



Mass Timber Structural Bay

ASSEMBLY: CLT FLOOR

2-INCH GYPCRETE TOPPING LAYER

Tally Definition: Self-leveling cementitious underlayment or fiber cement underlayment board.

3/4-INCH ACOUSTIC MAT

Tally Definition: Polycarbonate cellular plastic, sheet, solid sheet stock. The weight of the material was taken from USG SAM-N75 Sound Attenuation Mat (28 lbs. per 125 sq. Ft. Roll). *

3-PLY CLT FLOOR PANEL (4-1/8-INCH THICK)

Tally Definition: Cross-laminated timber (generic) beams inclusive of adhesive and wood finish.

STRUCTURAL LOAD-BEARING FRAME: GLT POST & BEAM

GLUED LAMINATED TIMBER COLUMNS, PURLINS AND BEAMS

Tally Definition: Glue laminated timber (Glulam) Architectural-grade structural glue-laminated timber (AWC EPD), composed of softwood which has been end-joined, laminated, and planed. Entry inclusive of factory-applied sealer.

Material: Steel Option



Steel Structural Bay

ASSEMBLY: STEEL FLOOR

COMPOSITE METAL DECK AND CONCRETE FILL

Tally Definition: Structural Concrete 2-inch concrete topping plus volume of concrete filling flutes. Structural concrete (4000 psi) with 30% slag and low rebar reinforcement. 30% of the concrete volume (5-inch total slab depth including deck) was subtracted to account for flutes in the composite steel deck.

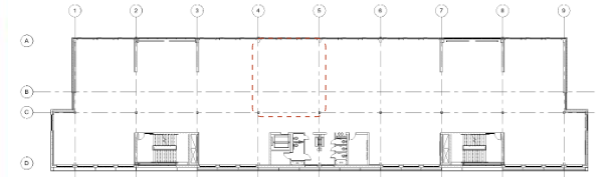
Tally Definition: Steel Deck

3-inch, 18-gauge composite galvanized steel decking with no fireproofing or finish.

STRUCTURAL LOAD-BEARING FRAME: STEEL POST & BEAM FRAME

WIDE FLANGE COLUMNS AND BEAMS

Tally Definition: Hot rolled steel, wide flange W shape with no fireproofing or finish.

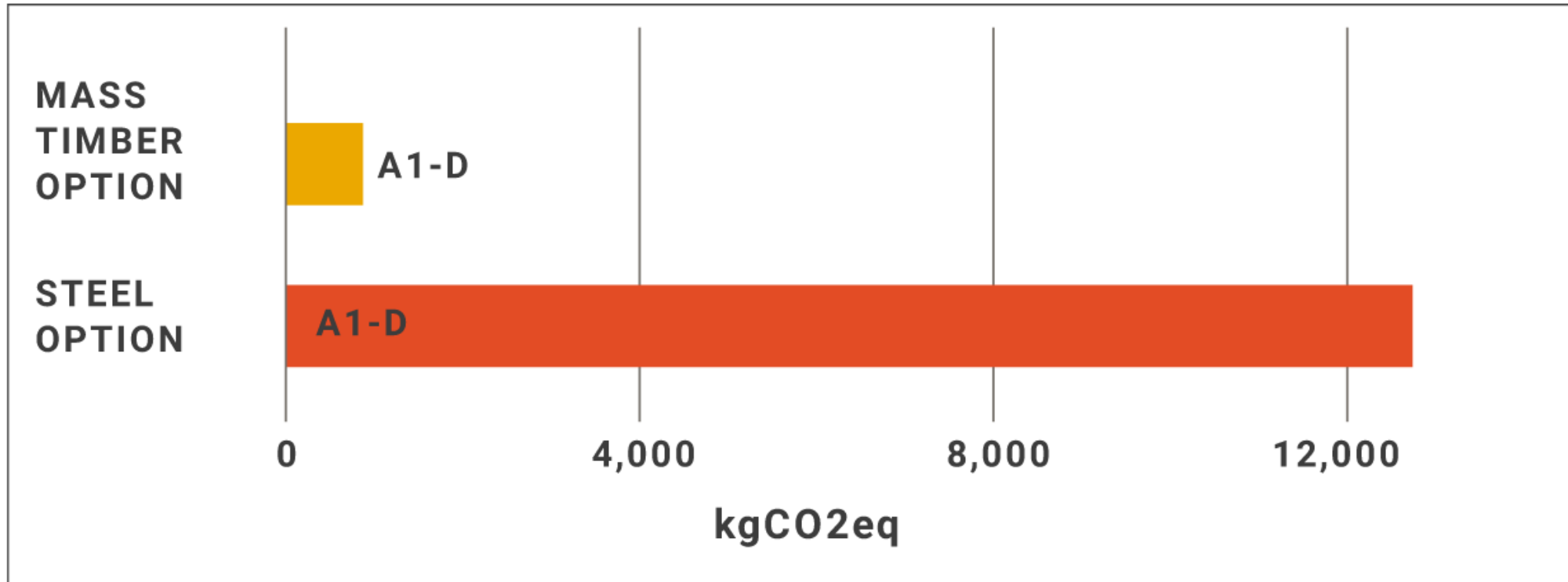


ABOVE: Location of Typical Bay



Embodied Carbon

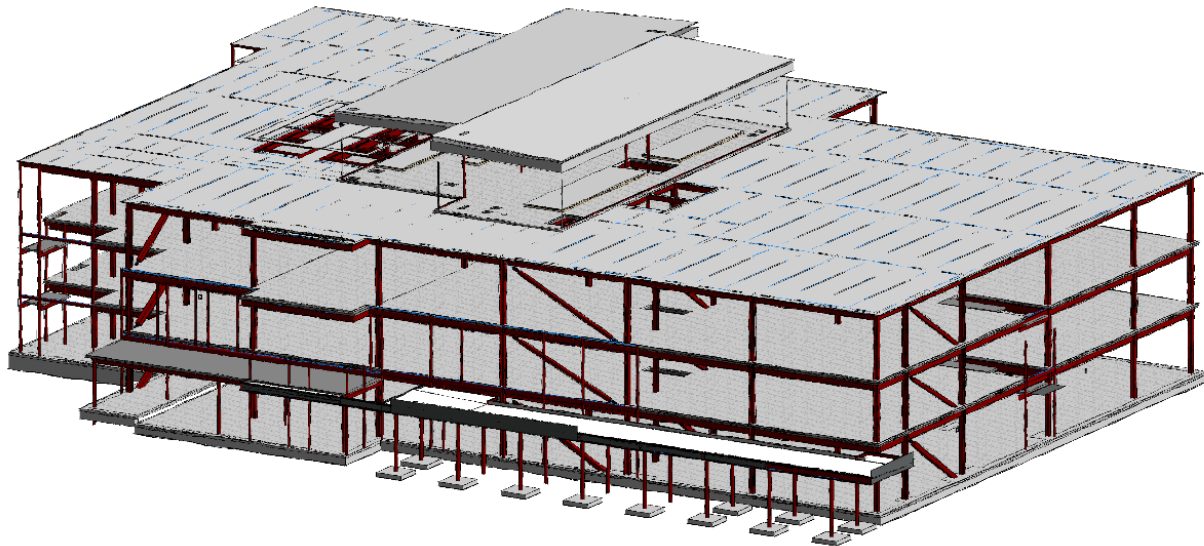
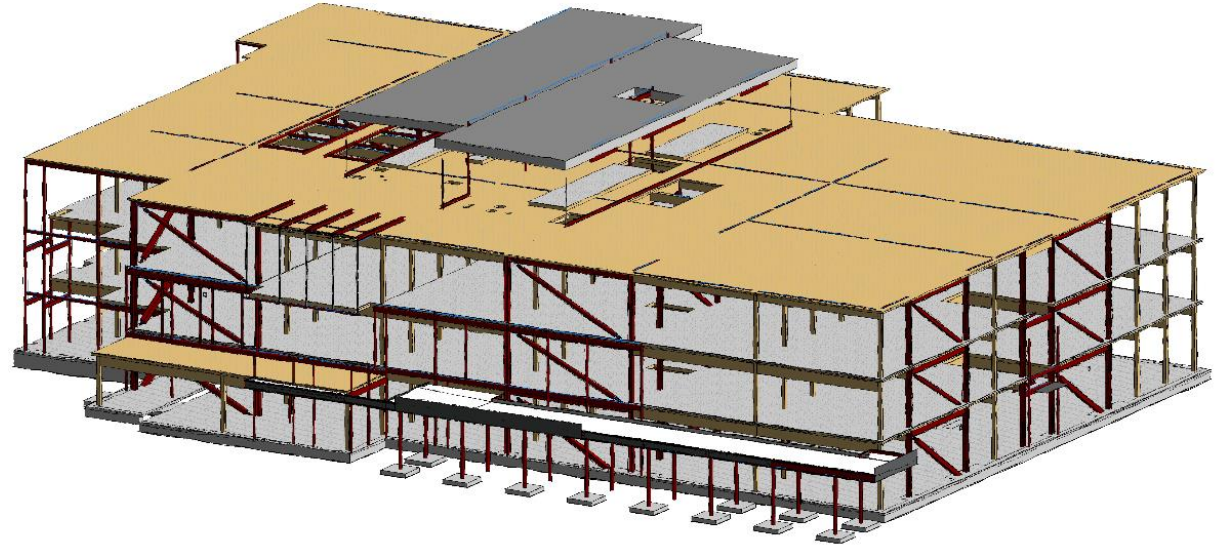
Embodied Carbon Comparison



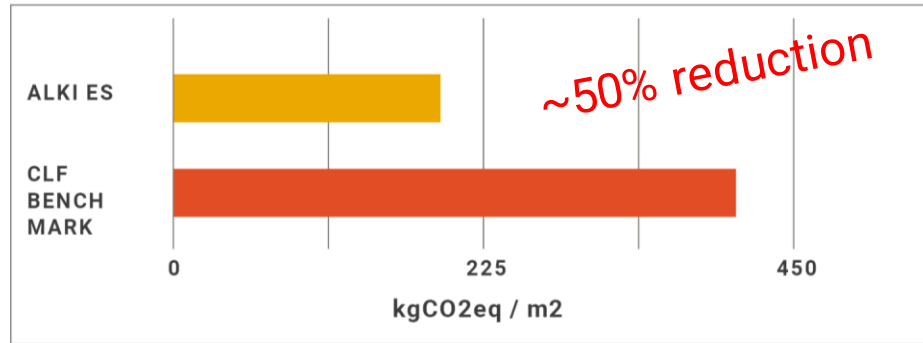
Tally Life Cycle Global Warming Potential [GWP] Modules A1-D (Includes Biogenic Carbon)

While not all working forests in the U.S. are part of a sustainable certification system, annual national reporting in accordance with the United Nations Framework Convention of Climate Change (UNFCCC) indicates increasing and/or stable forest carbon stocks in the U.S. Because of this, project teams may choose to include biogenic carbon in their LCA studies.

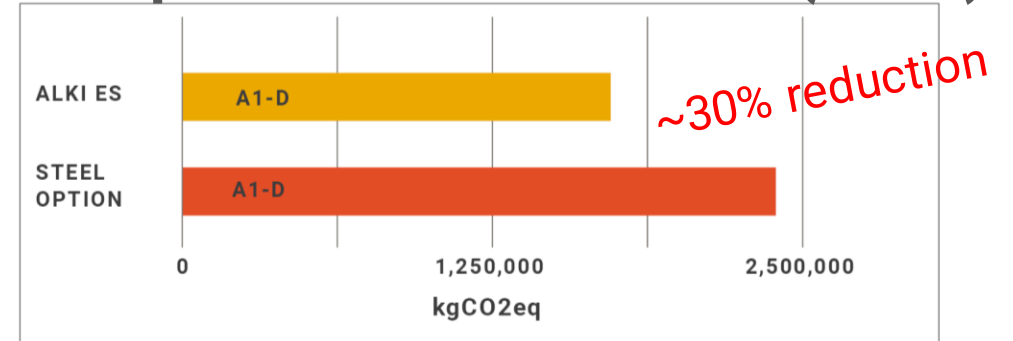
Embodied Carbon: Whole building LCA



Embodied Carbon: Compare to CLF 2017 Benchmark

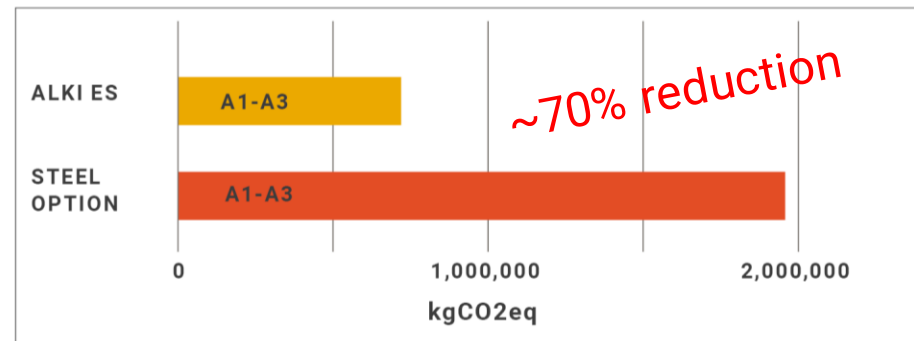


Embodied Carbon: Compare to Steel Baseline (A1-D)



Tally Life Cycle Global Warming Potential [GWP] Modules A1-D (Includes Biogenic Carbon)

Embodied Carbon: Compare to Steel Baseline (A1-A3)



Tally Life Cycle Global Warming Potential [GWP] Modules A1-A3 (Includes Biogenic Carbon)



Biophilia



Biophilia



QUESTIONS?

What is Unique about Designing with Mass Timber

- Moving design decisions forward [Joe]
 - Carry the steel and the timber design
 - Are you carrying multiple designs through SD and through DD
 - How fire and acoustics work together
 - Focus on building type & understanding implications of fire ratings
 - Deciding where to use timber (hybrid at French School, metal deck over Glulam)
 - LOD 400 BIM – VDC [Taylor]
 - Lead time of timber it really depends on MEPP
 - Getting the other subs on board and getting them up to speed in order to get to LOD 400 on the mass timber suppliers. Trying to get all the penetrations incorporated.
 - May have to bring in more sophisticated subtrades.
- PROJECT DELIVERY METHOD [Sam]
- Avoiding design-bid-build.

What is Unique about Building with Mass Timber

- Precon – detailing, supply chain [TAYLOR]
- Building on an active campus site
 - Managing logistics flow [TAYLOR]
 - CLT classroom buildings [JOE]
- Crew size, speed, getting trades in early, just in time logistics [Sam]
- Water management [Dean]
 - Still need work to get all of the little ancillary details to a suitable level
 - Hilltop heritage was sloped metal roof and how it made water management that much more controlled.
 - No plywood splines at the roof

How to make a mass timber project pencil

- Builders Risk premium – plan for it [Dean, Sam]
 - Coordinated packages for insurance carriers
 - Multiple carriers
 - Current trend
- Minimize wood volume [Taylor, Joe]
 - CLT package vs GL package
 - Allow for competition
 - THE GRID
 - Project Type
- Project Sequencing [Dean]
 - Timber efficiency
 - Follow on trade coordination
- Overall building costs [Sam]

Why Build a School with Mass Timber

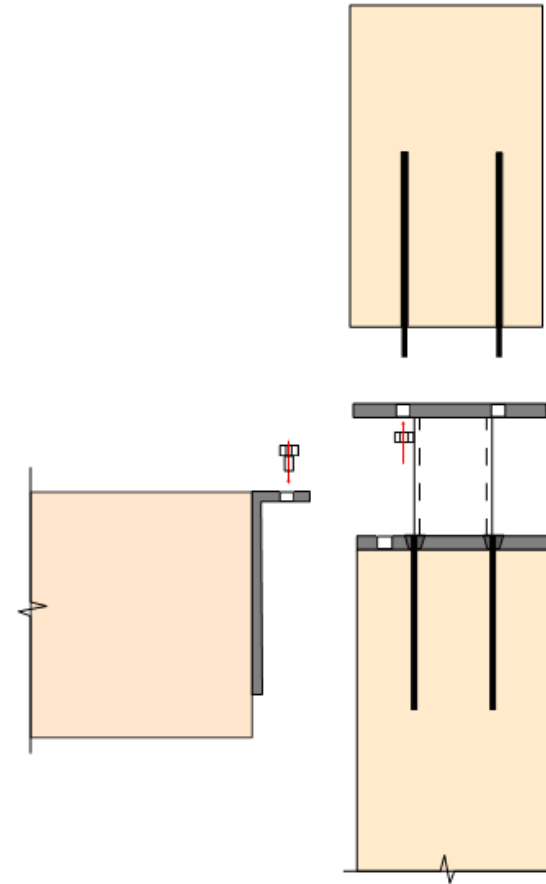
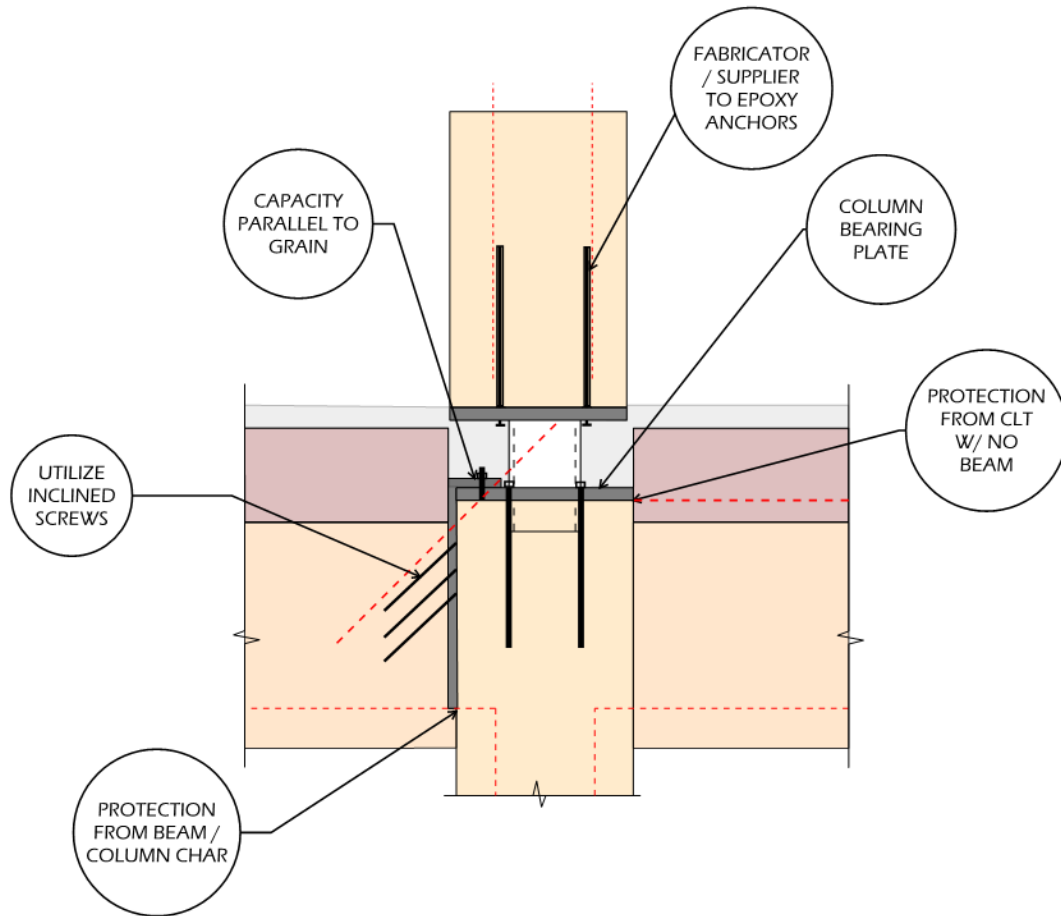
- Carbon impact reduction [Joe]
- Speed of construction, reduced site impact, quiet [Taylor, Dean]
 - Hard to quantify but such a good point to bring up to the owner
- Local Industry engagement [Joe]
- Aesthetic & Biophilia [Joe]
 - Students and staff: research re stress reduction, increase in creativity, test scores
 - It would be interesting to hear from others on what is driving projects is it the aesthetics, the story, locally sourcing, is it the carbon.
 - Put together list of projects that are completed and underway

LOCAL WOOD: Connection to Place / Identity



IMAGES: INTERFOR MILL

Disassembly



Prefabrication



Occupied site

