Cost - Construction - Schedules

PRESENTATION 1

WESTERN WOOD STRUCTURES

Presentation Topics (20 min)

1 **OUR TEAM TODAY**

Mike & Wilson Intro

2 **COST – THE BIG QUESTION**

Owners, GC's, and Design teams first question in the process is how much $$$?

3 **SCHEDULE**

What's the process and how long is this going to take ?

4 **CONSTRUCTION**

What are the major Gotchas to avoid /covered in 3&4

5 **QUESTIONS**

???

1 OUR TEAM TODAY

Project Manager

Mike Dyer (VP)

- 1983 Oregon State BS Construction Engineering Management
- 37 Years of Experience Mass Timber and Steel Erection
- Past President of Structural Roof Erectors Association
- Not afraid of anything ….I have 3 daughters

Mass Timber Sales Specialist

Wilson Antoniuk

- 2001 Boise State University -BS Engineering
- 22 Years of Experience Mass Timber and engineered wood
- Mathematics adjunct professor at BSU
- Vice President of Structural Engineers Association of Idaho
- 4 amazing kids

COST – LOOKING FOR THE EASY BUTTON?

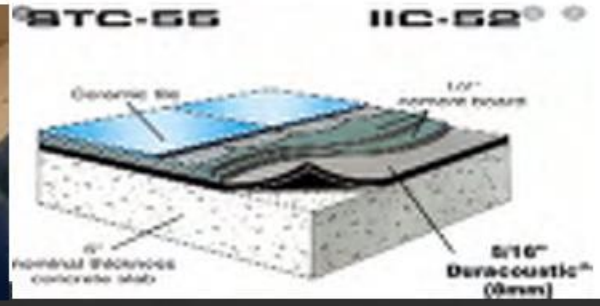
How much does a car cost ? ☺

2 COST – DEFINE THE SCOPE

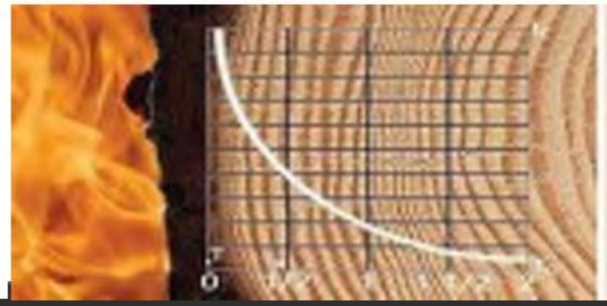
STEP 1 : START BY ASKING QUESTIONS

- Why are you considering use Mass Timber?
- What are the goals of the client or the design team?
- Who's idea is this and is it worth considering?
- If Mass Timber – What's the scope?

General Rule of Thumb COST: 80% Material / 20% Labor



$$f_n = \frac{1}{2\pi} \cdot \sqrt{\frac{K}{M_c}}$$



2 COST – WHAT TYPE OF BUILDING SYSTEM

STEP 2 : START ASKING MORE QUESTIONS

What materials and what system?

1. Post, Beam, and Plate
2. Post and Plate
3. Hybrid

2.

3.

1.

2 COUNTY OFFICE BUILDING #3

REDWOOD CITY, CA

SKIP TO STEP 10: ANSWER $54/SQFT FIRST NET ZERO CIVIC MASS TIMBER

Passed Step 1 + 2 :

- Sustainability / Embodied Carbon
- Aesthetics
- Schedule
- Comparable price to Steel

2 COUNTY OFFICE BUILDING #3 LONG ANSWER: $XX.XX

REDWOOD CITY, CA

STEP 3-10: ADD IT UP

Equipment				
	17010	Forklift		
	17010	P/up - Delivery		
	17020	Boom Lifts		
	17020	P/up - Delivery		
	17025	Scissor Lifts		
	17025	P/up - Delivery		
	17035	Crane Rental		
	17040	Scaffolding Rental		
	17045	Shoring		
	17050	Small Tool Rental		
	17055	Tools		
	17057	Calibration of Test Euipment		
	17060	Job Shack Rental		
	17061	Storage Rental		
	17062	Dumpster Rental		
	17063	Toilet Facilities		
	17064	Panel Brace Rent		
	17065	Telephones		
	17067	Disposal		
	17070	Gas & oil		
	17086	Inspection Costs		
	17090	Sub-Contract Outside Services		
	17875	Small purchases		
	17900	Field Labor - Equip/Other misc		

Field Labor - General			
	10001	Preliminary Site Visit	
	10030	Labor- Travel	
	10040	Field Welding	
	10045	Prep & Layout	
	10190	Unload & Sort	
	10200	Supervision	
	10220	Equipment Operator	
	10230	Clean-Up	
	10240	Mobilize	
	10245	Demobilization	
	10260	Safety Meeting	
	10900	Labor misc.	
	10920	Back Charge Work	
Field Labor - Roof/Floor			
	11010	Install Anchor Bolts	
	11012	Field Welding	
	11020	Install Columns	
	11030	Install Ledgers	
	11035	Install Nailer	
	11040	Install Hangers	
	11110	Install Glulams	
	11125	Fabricate Sawn Lumber	
	11126	Install Sawn	
	11135	Install CLT	

Engineering Services			
	1010	Engineering	
	1010	Site Visits	
	1020	Engineering - Outside Services	
	1030	Detailing	
	1040	Shop Detailing - Outside Services	
	1050	Project Engineering	
	1900	Engineering misc.	

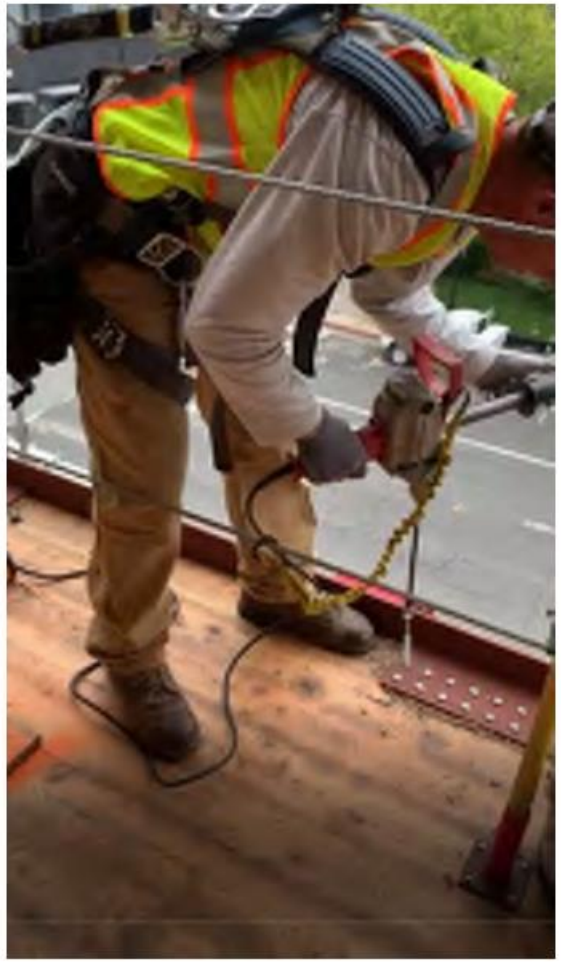
Materials			
Glulam	2010	5.125x12	TC
CLT	2015		
	2060	Press Treat GL	
	2080	Fabrication - Outside WWS	
	2900	Glulam Misc	
Sawn	3005	Sawn	
	3060	Press Treat	
	3080	Fabrication - Outside WWS	
	3205	Decking	
	3210	Wood Plugs	
	3300	Plywood	
	3320	OSB	
	3900	Wood Products Misc	

2 COUNTY OFFICE BUILDING #3

REDWOOD CITY, CA

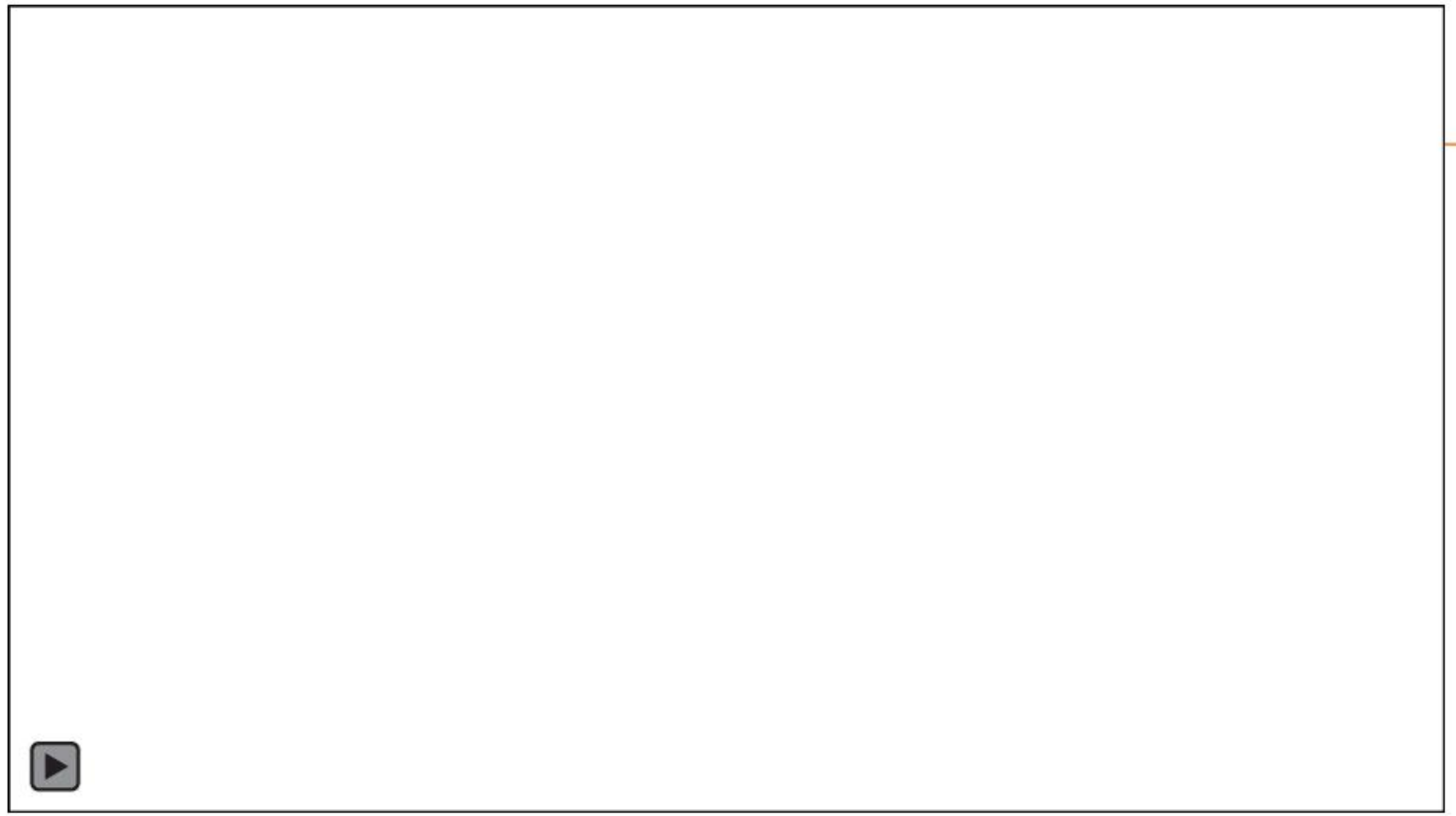
2 COUNTY OFFICE BUILDING #3

REDWOOD CITY, CA



2 COUNTY OFFICE BUILDING #3

REDWOOD CITY, CA



VE STORIES ARE ABUNDANT

- Sitka Spruce Panels qualified
- Nails vs Screws for spline connections
- SFI vs FSC Certification

2 SHILEY MARCOS CENTER OF DESIGN AND INNOVATION

UNIVERSITY OF PORTLAND, PORTLAND OREGON

INTER-DISCIPLINARY COLLABORATION SPACES FOR STUDENTS

Passed Step 1 + 2 :

- Sustainability / LEED Gold
- Higher Education / Innovation Center
- Aesthetics

2 SHILEY MARCOS CENTER OF DESIGN AND INNOVATION

Anthony Timberlands Center for Design and Materials Innnovation

University of Arkansas

ANSWER $xxx/SQFT

CRAZY DESIGNS COST MORE ☺

NAU SKYDOME

NORTHERN ARIZONA UNIVERSITY

ANSWER $xxx/SQFT

3 DESIGN / MASS TIMBER CONSTRUCTION SCHEDULE

Initial Thoughts

- Construction Schedule
  - Allow **9 months** from award to delivery of first material
  - Allow 20 working days per level (1month) 20,000 sqft per level

- Draft of Mass Timber Schedule
  - 7/1/23 - 10/1/23 Design Assist Schedule (3 months)
  - 8/15/23- 9/15/23 Bidding and Award (1 month)
  - 9/15/23- 12/21/23 Shop Drawings & Submittals (3 months)
  - 1/14/24 Submittals Returned
  - 1/30/24 3D Model into Production
  - 2/28/24 GLB Billets into Manufacturing
  - 2/30/24 Erection Drawings Complete
  - 3/30/24 GLB Fabrication
  - 4/30/24 CLT Manufacturing
  - 6/30/24 First Delivery to jobsite of GLB / CLT
  - 7/10/24 Construction Start
  - 11/10/24 Mass Timber Structure (Substantial Completion)

LAKE | FLATO

EDCI ENGINEERS

WESTERN WOOD STRUCTURES

Hennebery Eddy Architects

MONTANA STATE UNIVERSITY

SWANK ENTERPRISES

THANK YOU!

ANSWER $71/SQFT

Feel free to reach out Wilson@wwsi.com

(208) 861-3160

EVOLUTION + INNOVATION: WOOD, CONSTRUCTION, COST, SCHEDULE

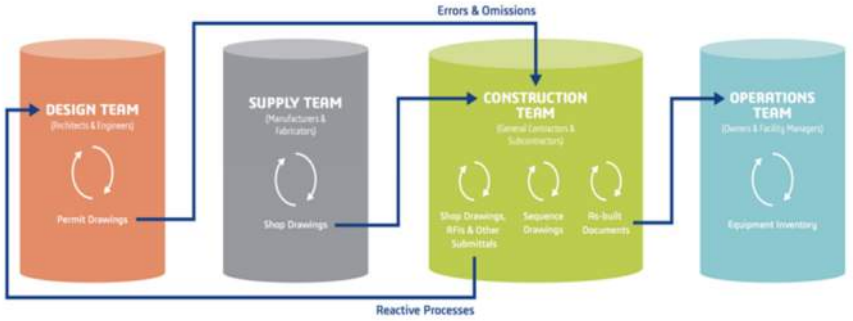
AIA Seattle Mass Timber Committee
November 14th, 2023

PRESENTATION 2

PEOPLE ARE CONNECTED TO WOOD

SWINERTON

SILHOUETTE TABLE OVER SILOS - COLLABORATION

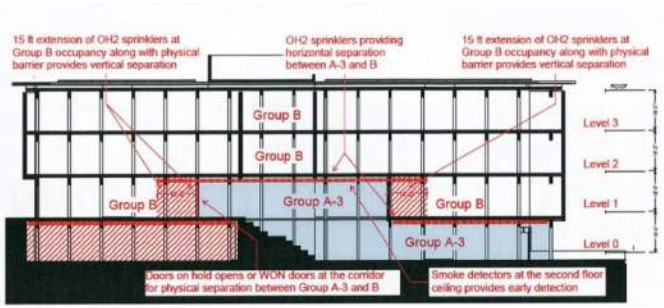


SWINERTON

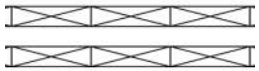
TABLE 601

Fire Resistance Rating Requirements for Building Elements (Hours)

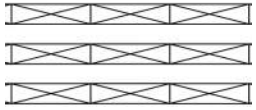
Building Element	I-A	I-B	III-A	III-B	IV-A	IV-B	IV-C	IV-HT	V-A	V-B
Primary Structural Frame	3*	2*	1	0	3*	2	2	HT	1	0
Ext. Bearing Walls	3*	2*	2	2	3*	2	2	2	1	0
Int. Bearing Walls	3*	2*	1	0	3*	2	2	1/HT	1	0
Floor Construction	2	2*	1	0	2	2	2	HT	1	0
Roof Construction	1.5*	1*	1	0	1.5*	1	1	HT	1	0
Exposed Mass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



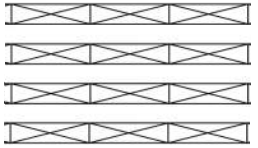
Baseline
0hr & HT



+$10/SF
1hr & maybe 2hr

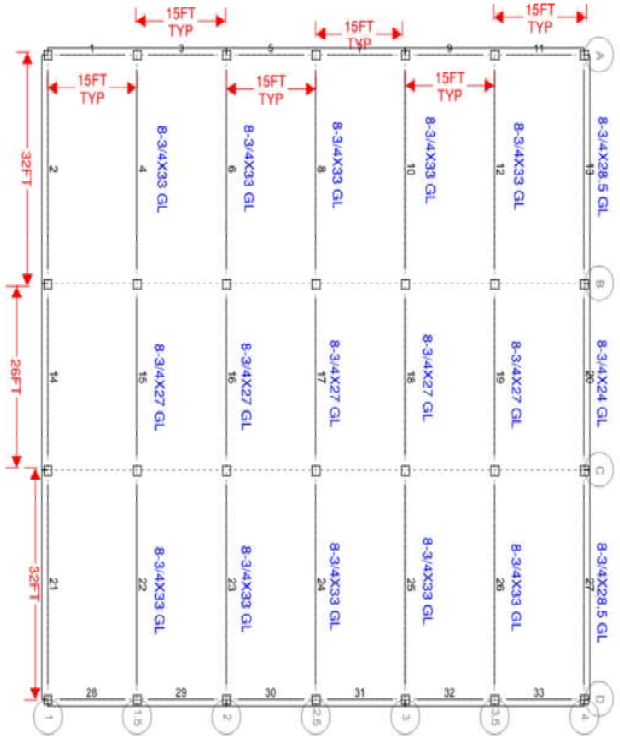


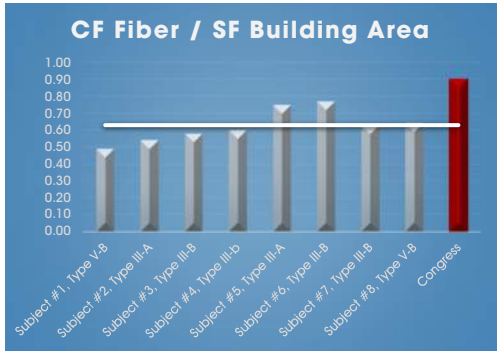
+$15/SF
2hr FRR

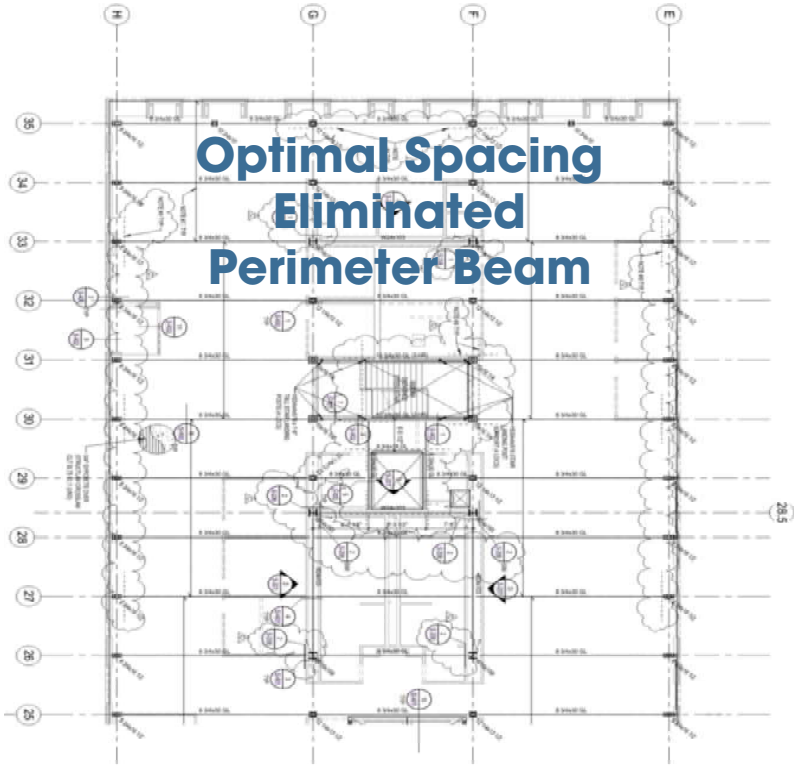


SWINERTON

MASS TIMBER IS NOT STEEL OR CONCRETE

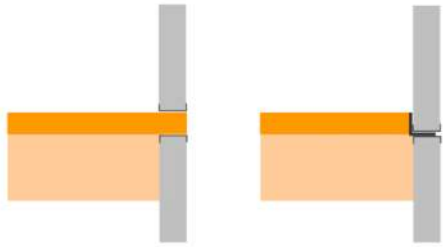


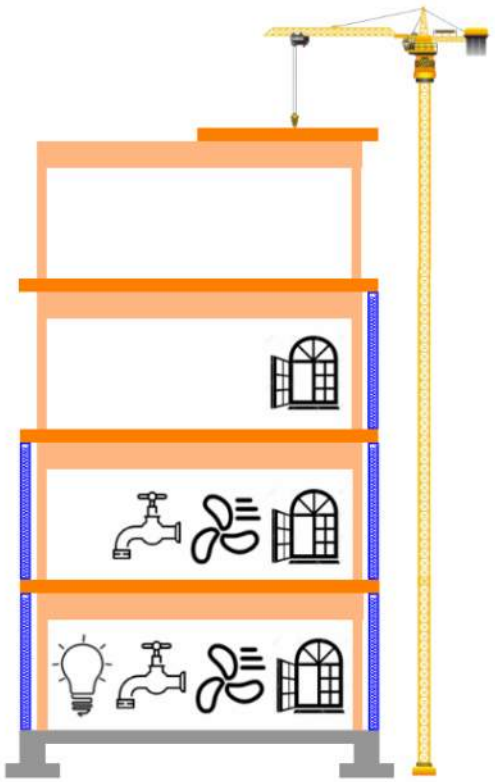




SWINERTON

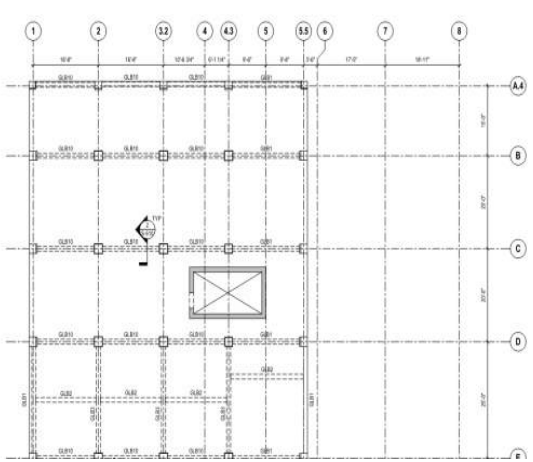
STRUCTURAL BENEFITS IN MASS TIMBER



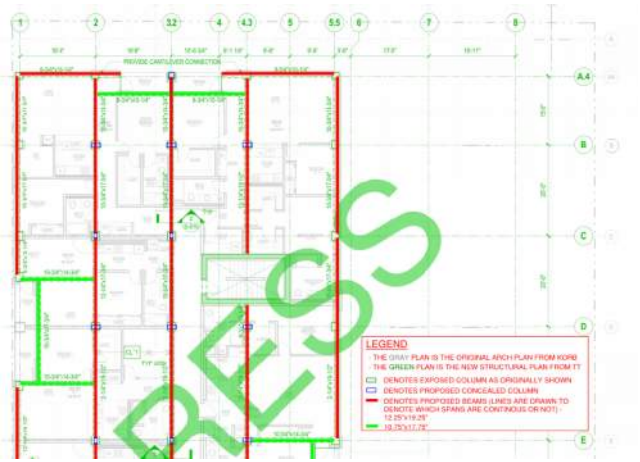


SWINERTON

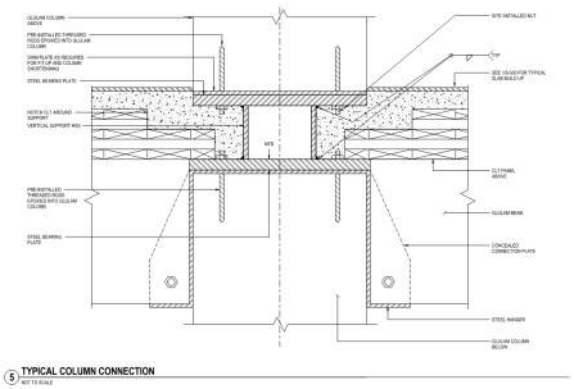
EFFICIENT STRUCTURAL SOLUTIONS



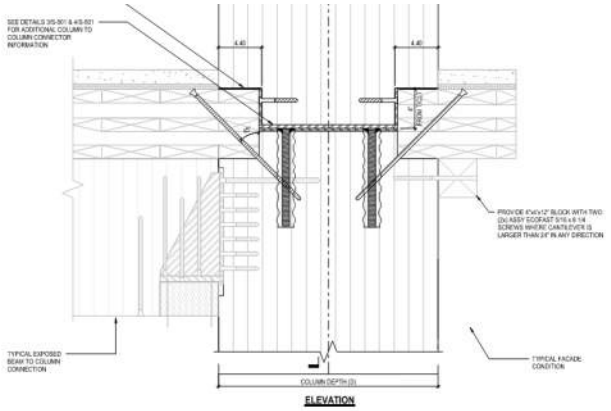
Typical Span 20’; Max Span 25’



Typical Span 16’-8”; Max Span 19’



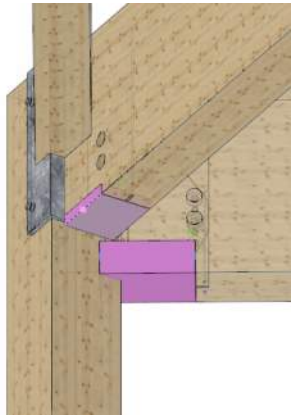
Complex Steel, CNC, Fire Testing



Reduced Steel, Simplified, Encapsulation

SWINERTON

MANUFACTURING APPROACH

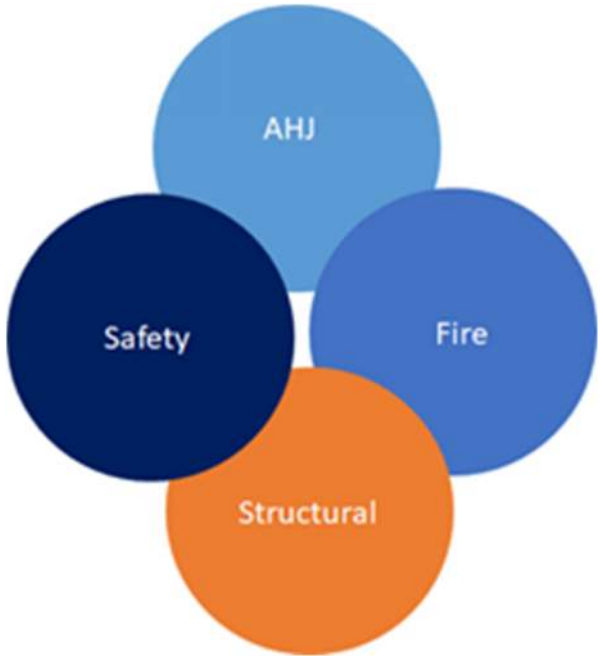


+ Dimensional Certainty
+ Interface with Other Materials
+ Building Systems Integration

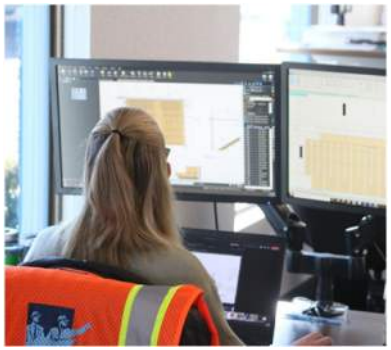
= BIM for Fabrication
= Kit of Parts Delivery

SWINERTON

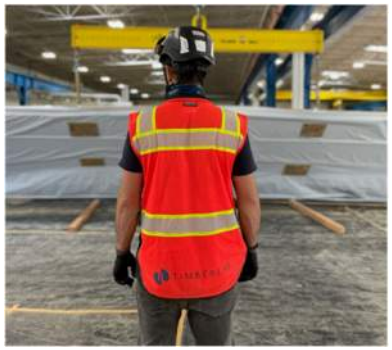
APPROACH TO OVERCOME OBSTACLES



TIMBER ENGINEERING

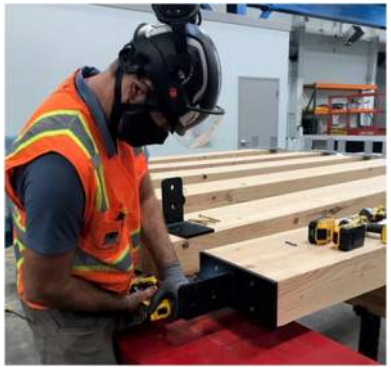


VIRTUAL CONSTRUCTION



PROCUREMENT

FABRICATION



PREFABRICATION

ASSEMBLY

SWINERTON

PROCUREMENT CONSIDERATIONS: SUPPLY INTELLIGENTLY

	CLT	PRG-320	Glulam	Restoration	FSC	3D Modeling	CNC Fab	Hardware Install
TIMBERLAB					●	●	●	●
STRUCTURLAM	●	●	●		●	●	●	●
VAAGEN	●	●		●			●	●
SMARTLAM	●	●	outsourced		●	●	CLT only	
DRJ	●	●	●		●	●	CLT only	outsourced
NORDIC STRUCTURES	●	●	●		●	●	●	●
KALESNIKOFF	●	●	●		●	●	●	●
KLH	●	●			●	●	CLT only	
binderholz	●	●	●			●	●	●
storaenso	●		●		●	●	●	
HASSLACHER NORICA TIMBER	●		●		●	●	●	●
WiEHAG			●		●	●	●	●
Calvert			●		●			
American Laminators			●		soon		limited	
			●		soon			
western archrib			●			●	●	●

SWINERTON

EUROPEAN VS. NORTH AMERICAN SUPPLY

EUROPEAN SUPPLY

CONS
- Exchange Rate Risk
- Jurisdictional Approval
- Logistics & Transport
- Bigger / Thicker Elements

PROS
- Experience & Quality
- Lower Costs
- Fiber Cost is Less Volatile

NORTH AMERICAN SUPPLY

CONS
- Higher Cost
- Fiber Escalation Risk
- Experience
- Production & Manufacturing Limitations

PROS
- Reduced Procurement Timeline
- Jurisdictional Approval
- Competitive Pricing
- Ease of Procurement

SHIPPING & LOGISTICS

- Find the Right Logistics Partner
- Allow Time to Stock-Pile Materials
- Consider International + Domestic Shipping
- Original Shipping Route May Change
- Understand Duties & Added Transportation Costs

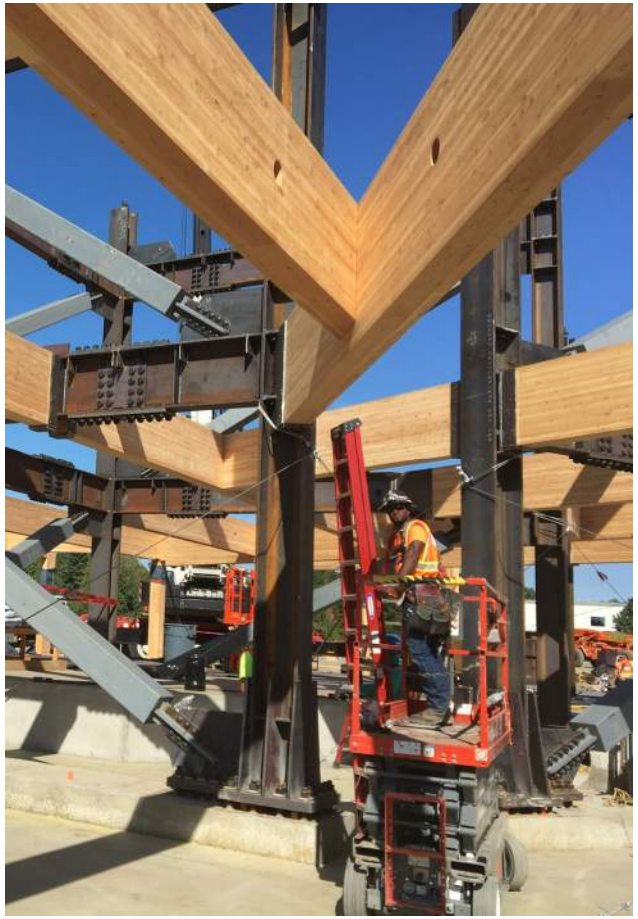
SWINERTON

INTEGRATED APPROACH TO MASS TIMBER

mass /mas/ **tim·ber** /'timber/ **in·te·gra·tor** /'in(t)e,grader/

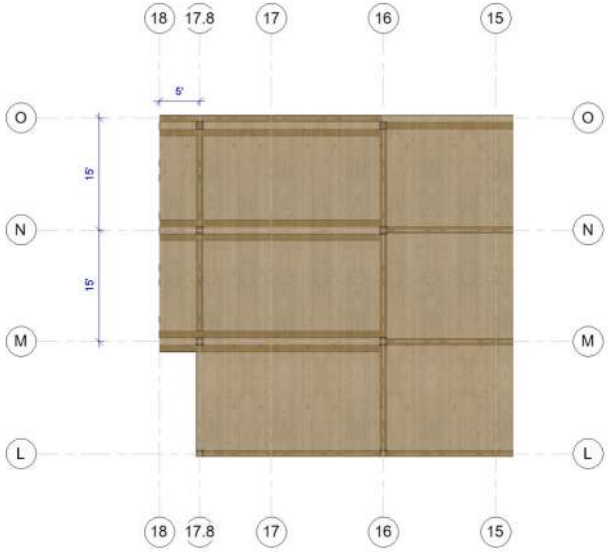
Our goal is to innovate, educate, and alleviate pinch points in the mass timber industry, through strategic deployment of essential services, experience, and knowledge that are not widely available in the market in order to advance the incorporation of engineered wood products in the built environment.

	Timber Eng.	Virtual	CLT	Glulam	Fabrication	Prefabrication	Installation	Innovation
First Tech FCU	EQUILIBRIUM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM		CLT Diaphragm, Largest When Built, 4% Cheaper / 4 Months Faster Than Steel
Harder Mech HQ	AAI		DRJ	DRJ				City of Portland, Redesign from T&G Decking to CLT for Savings, Rotating Panel Layout
Wingspan	NISHKIAN MENNINGER	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM		Angled Connections, Fire Treatment of Wood, Large Format Beams
Hidden Creek	kpff		KLH	Calvert	VAAGEN	VAAGEN		18-Foot Cantilevers, 92- Foot Clear Spans, Complex Supply Solution
PDX TCORE	kpff		Frores LUMBER CO., INC.					80-Foot Curved Glulam Beams without Splices, Cassette Construction, Complex Logistics
Beaverton PS	kpff	STRUCTURLAM	STRUCTURLAM	STEEL	STRUCTURLAM	N/A		Concrete/Steel/CLT Structural Integration, SafRig Fall Arrest System
Lincoln City	kpff	STRUCTURLAM	STRUCTURLAM	STEEL	STRUCTURLAM	N/A		Vertical CLT Wall System
Kresge Res.	Holmes		KLH	HASSLACHER NORICA TIMBER				Panelized Light Wood Frame Load Bearing
UO KCASI	Holmes		DRJ	DRJ				Several Mass Timber Feature Stairs, Complex Integration of Mass Timber Structure
OSU-C			VAAGEN Frores LUMBER CO., INC.					Alternative Means and Methods (AMM) to Achieve Type IIIb, Net Zero Energy
Heartwood			KALESNIKOFF					First Type IVC in Seattle, 2-Hour Fire Adequacy with Continuous Char Calculation
Ascent	Thornton Tomasetti		KLH	WIEHAG	WIEHAG	WIEHAG		25-Story, Tallest Mass Timber, European Glulam Approval, 3-Hour Fire Tested Glulam
	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM	STRUCTURLAM		Installation Only (at Scale)
Kresge ACAD			STRUCTURLAM					Fabrication of Complex Geometries, Point Cloud Survey of Tree Canopies to Inform Installation



SWINERTON

EQUIPPING THE ARCHITECT

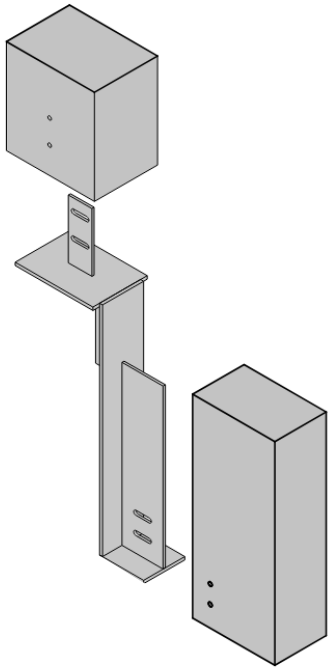


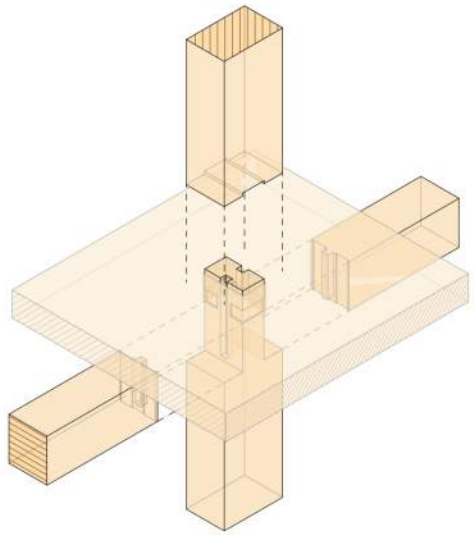
Ground Floor Experiences

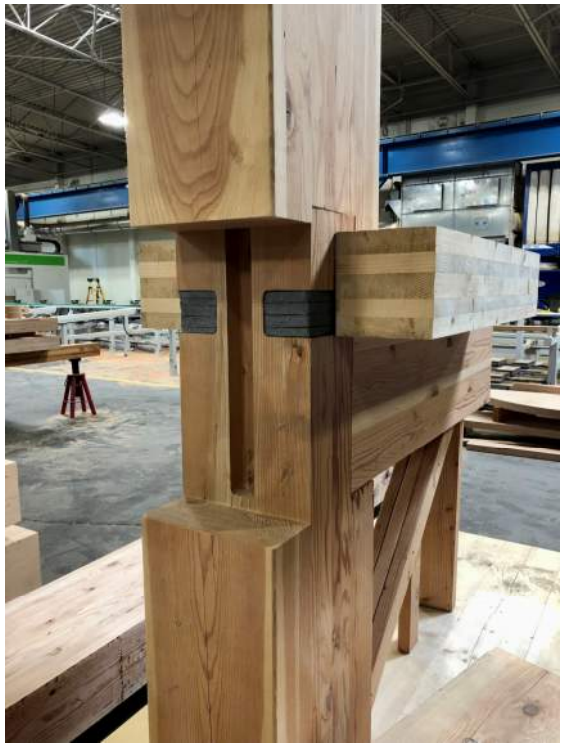
Parking

SWINERTON

CONNECTIONS: ALIGN SOLUTION WITH GOALS



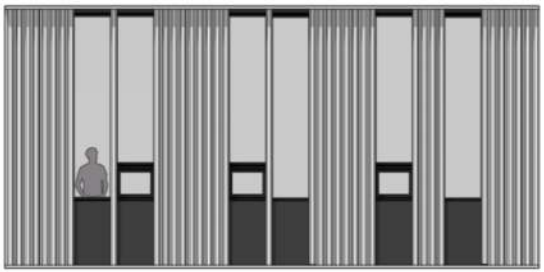




SWINERTON

HOLISTIC SOLUTIONS: ENVELOPE DESIGN | HVAC SYSTEM

SOUTH ORIENTATION
31% GLAZING



HEATING AND COOLING SYSTEM OPTIONS

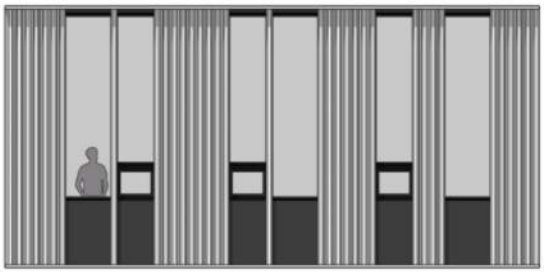
RADIANT PANELS

HYDRONIC FAN POWERED BOXES

VARIABLE REFRIGERANT FLOW

VARIABLE AIR VOLUME

SOUTH ORIENTATION
35% GLAZING



HEATING AND COOLING SYSTEM OPTIONS

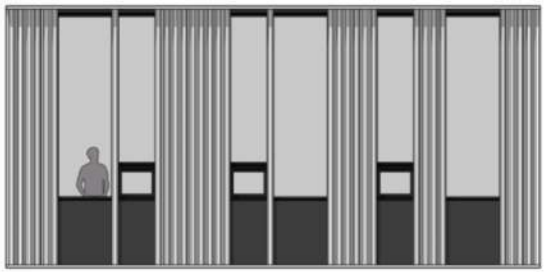
~~RADIANT PANELS~~

HYDRONIC FAN POWERED BOXES

VARIABLE REFRIGERANT FLOW

VARIABLE AIR VOLUME

SOUTH ORIENTATION
39% GLAZING



HEATING AND COOLING SYSTEM OPTIONS

~~RADIANT PANELS~~

~~HYDRONIC FAN POWERED BOXES~~

VARIABLE REFRIGERANT FLOW

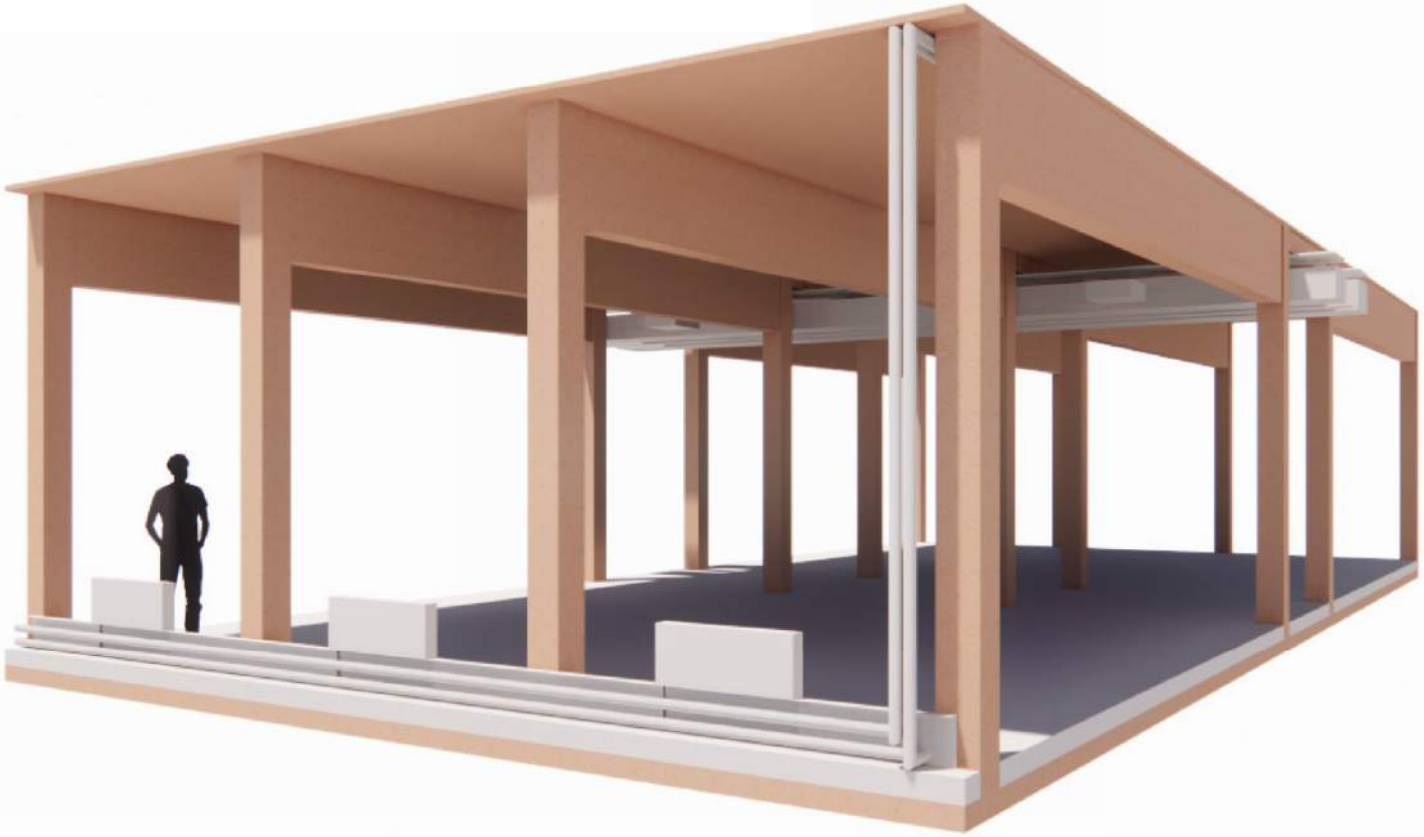
VARIABLE AIR VOLUME

POSITIVE OPERATIONAL ENERGY IMPACT

NEGATIVE GLOBAL WARMING POTENTIAL IMPACT

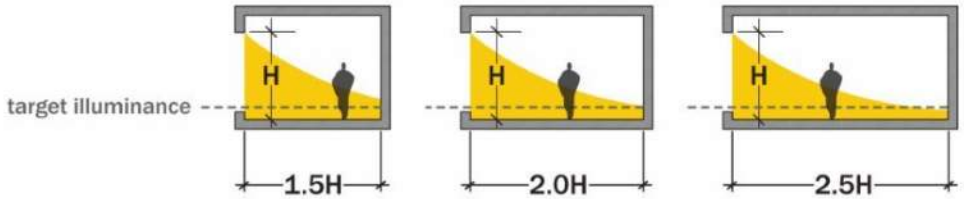
SWINERTON

HOLISTIC SOLUTIONS: STRUCTURE | HVAC SYSTEM



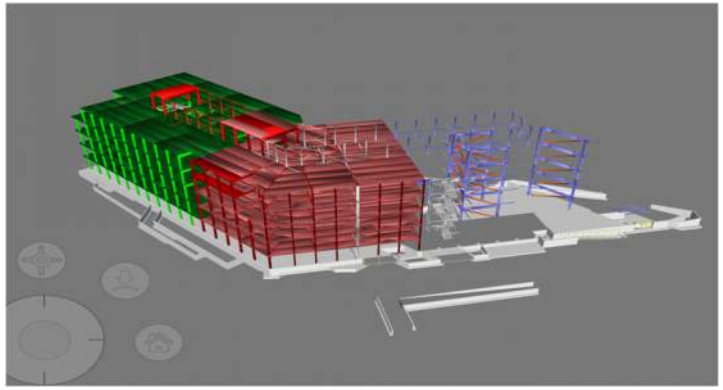
SWINERTON

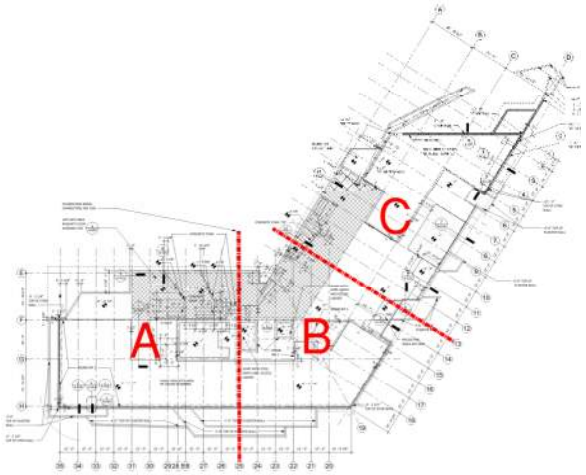
HOLISTIC SOLUTIONS: STRUCTURE | DAYLIGHT



SWINERTON

SCHEDULE OPPORTUNITIES





Built-In-Place
167,000 SF

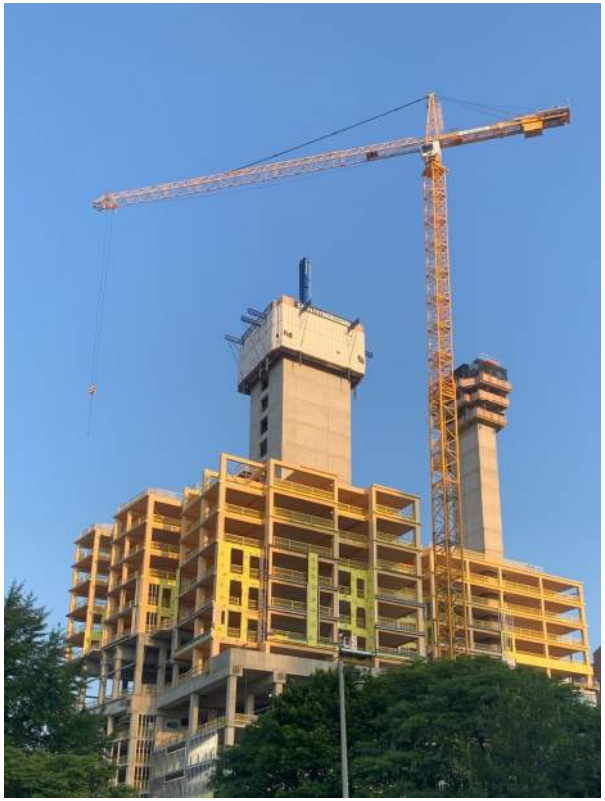
Field Crew of 35
6 Months

Prefabricated
157,000 SF

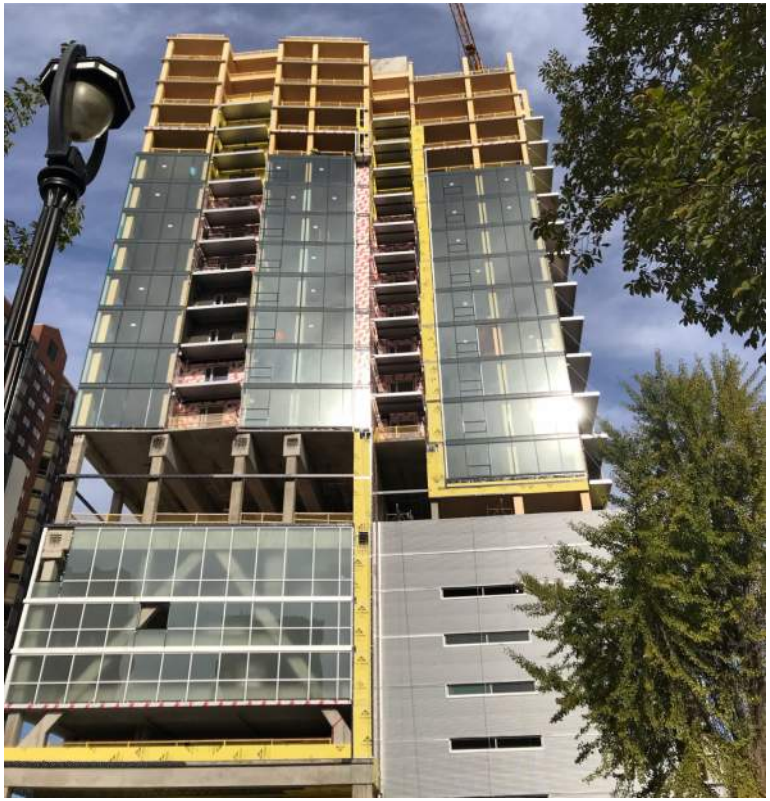
Field Crew of 7
3 Months

SWINERTON

MASS TIMBER CONSIDERATIONS IN HIGH-RISE CONSTRUCTION



Lateral vs. Mass Timber Speed



Building Envelope Strategy

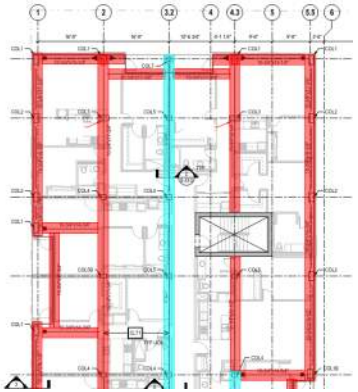
Balcony Material & Attachments

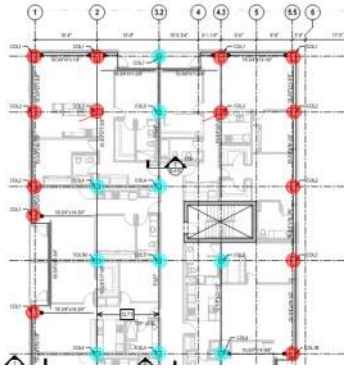
SWINERTON

SITE LOGISTICS / SPEED OF CONSTRUCTION

SWINERTON

FIRE STRATEGY / PERFORMANCE BASED DESIGN



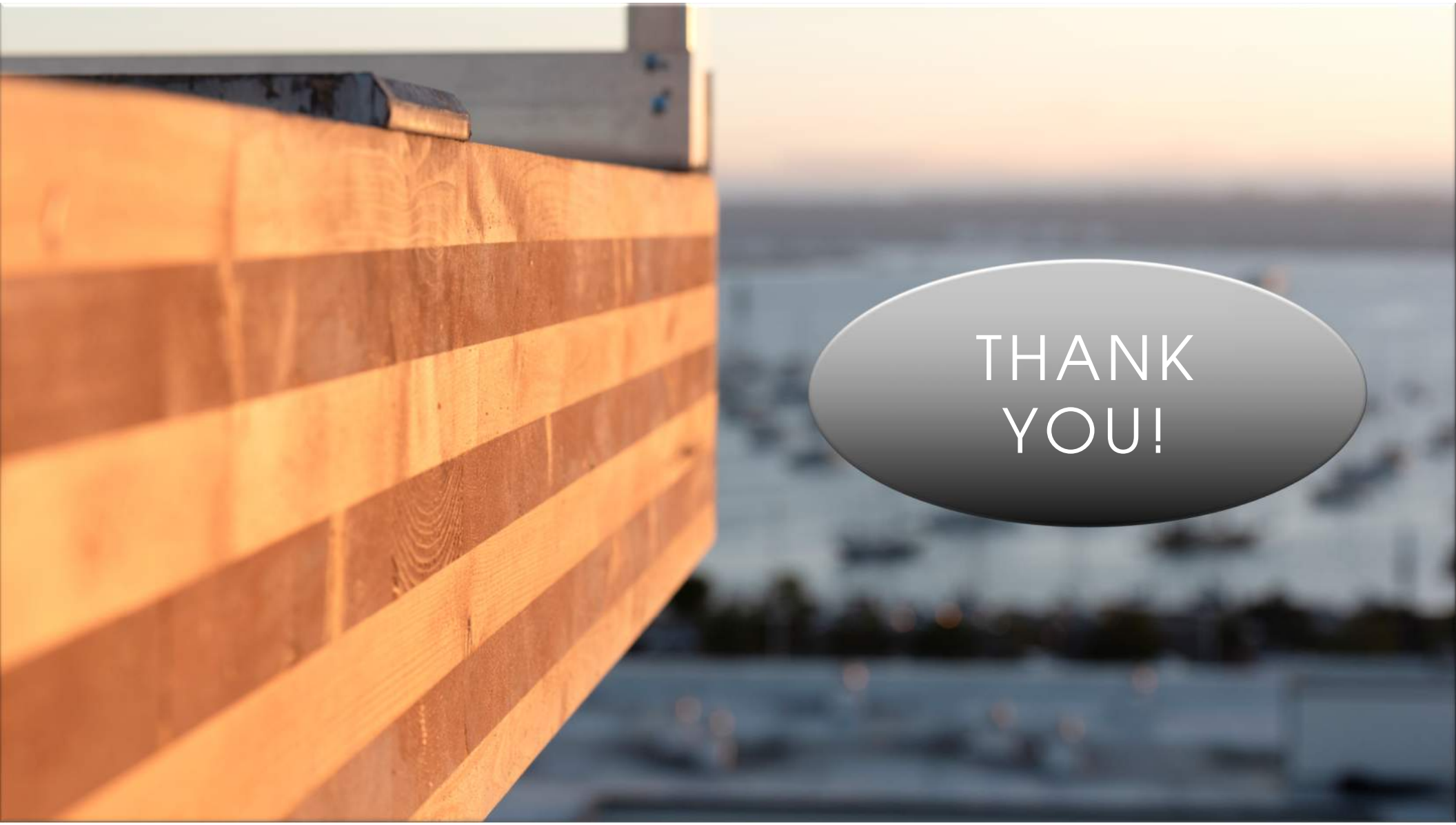


Strategic Encapsulation (Blue) vs. Exposure (Red)

2 Hour FRR Panel Test

3 Hour FRR Column Test

SWINERTON


THANK
YOU!

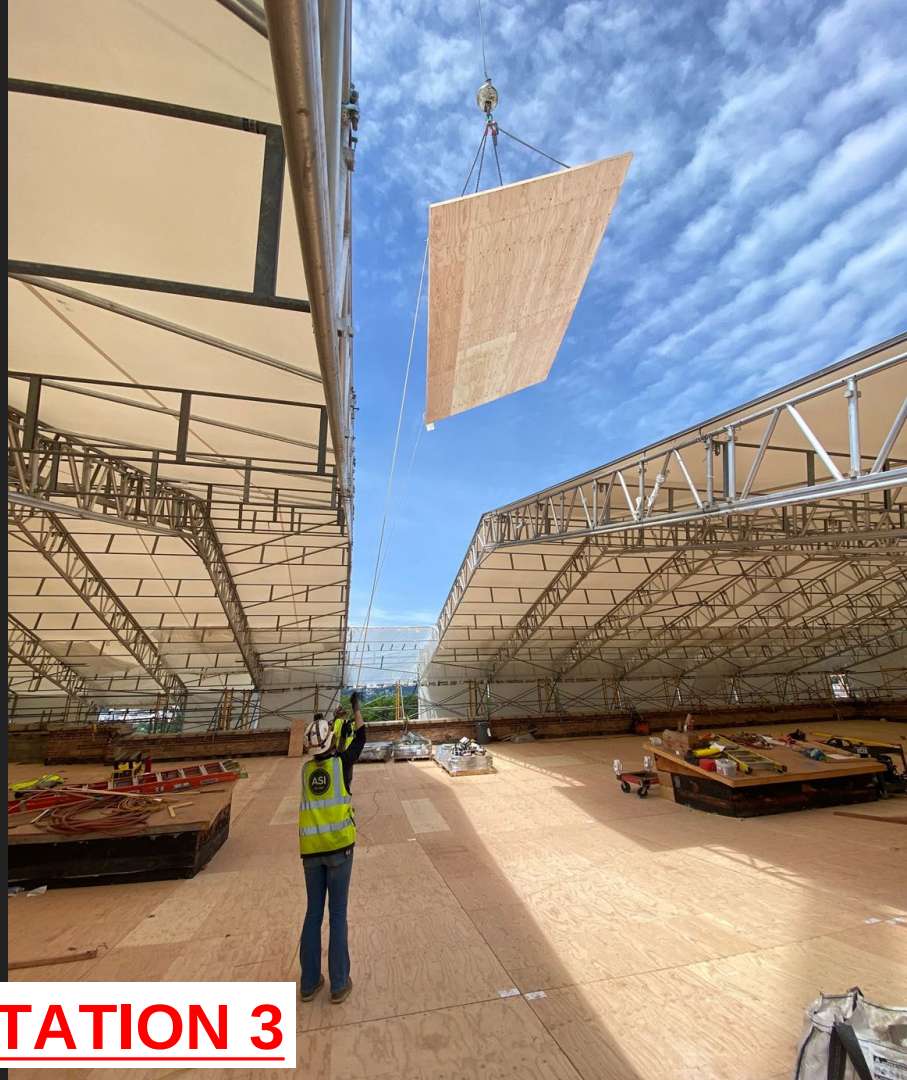
MT Construction Schedules

(Tricks for speeding up construction to save money)

Brad Nile, AIA

Andersen Construction

PRESENTATION 3




BENSON POLYTECHNIC SCHOOL

Schedule wins from past projects:

1. Efficiency from start of timber to roof complete.
2. Highly repetitive and efficient structural layout and detailing.
3. Full integration of MEP systems for rapid installation.
4. Early start of MEP systems.

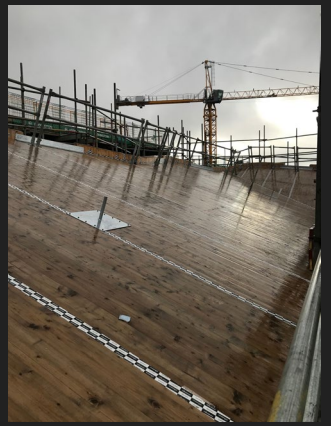
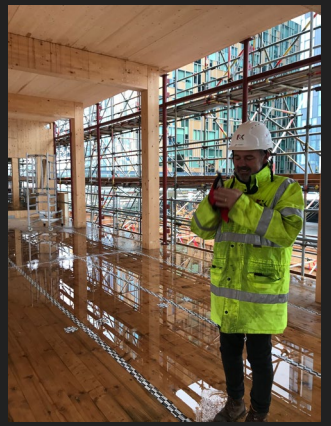
But don’t forget the “Mass Timber Essentials”...

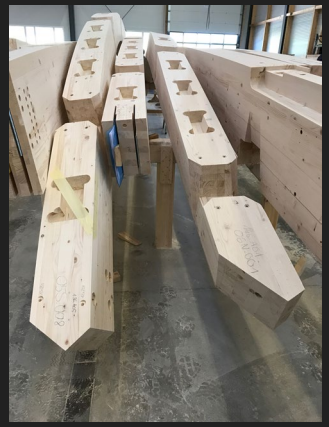
1. Manage pre-construction time.
    - Precon Schedule and TIMBER WORKSHOPS
    - Coordination, modeling, procurement (No late changes.)
2. Model Everything.
    - Un-modeled elements stop work.
3. Optimize details.
    - Tolerance and efficiency
4. Integrate MEP systems early.
    - Vertical, trunk and branch distribution of ALL system.
5. Execute a Moisture Management Plan.
    - Shop, install, site, dry-out, touch up.

And always…learn from EVERYWHERE

BC, England, Holland, Switzerland, Italy



Learning from EVERYWHERE

Finland…from 2023 to 1949

Case Study 1 - OSU Emmerson Wood Products Lab

Efficiency from start of timber to roof complete.

October 2018

October 12, 2018

November 12, 2018

And 4 months later…April 11, 2018
Ready for equipment installation.

May 14, 2019
Fully operational lab with a speech by Red Emmerson

Emmerson Lab Success Factors:

- Roofing install parallel with timber install.
- Roof drainage installed with timber.
- Integral parapet wall assemblies

Case Study 2 -

District Office, Portland, OR

Highly repetitive and efficient structural layout and detailing.

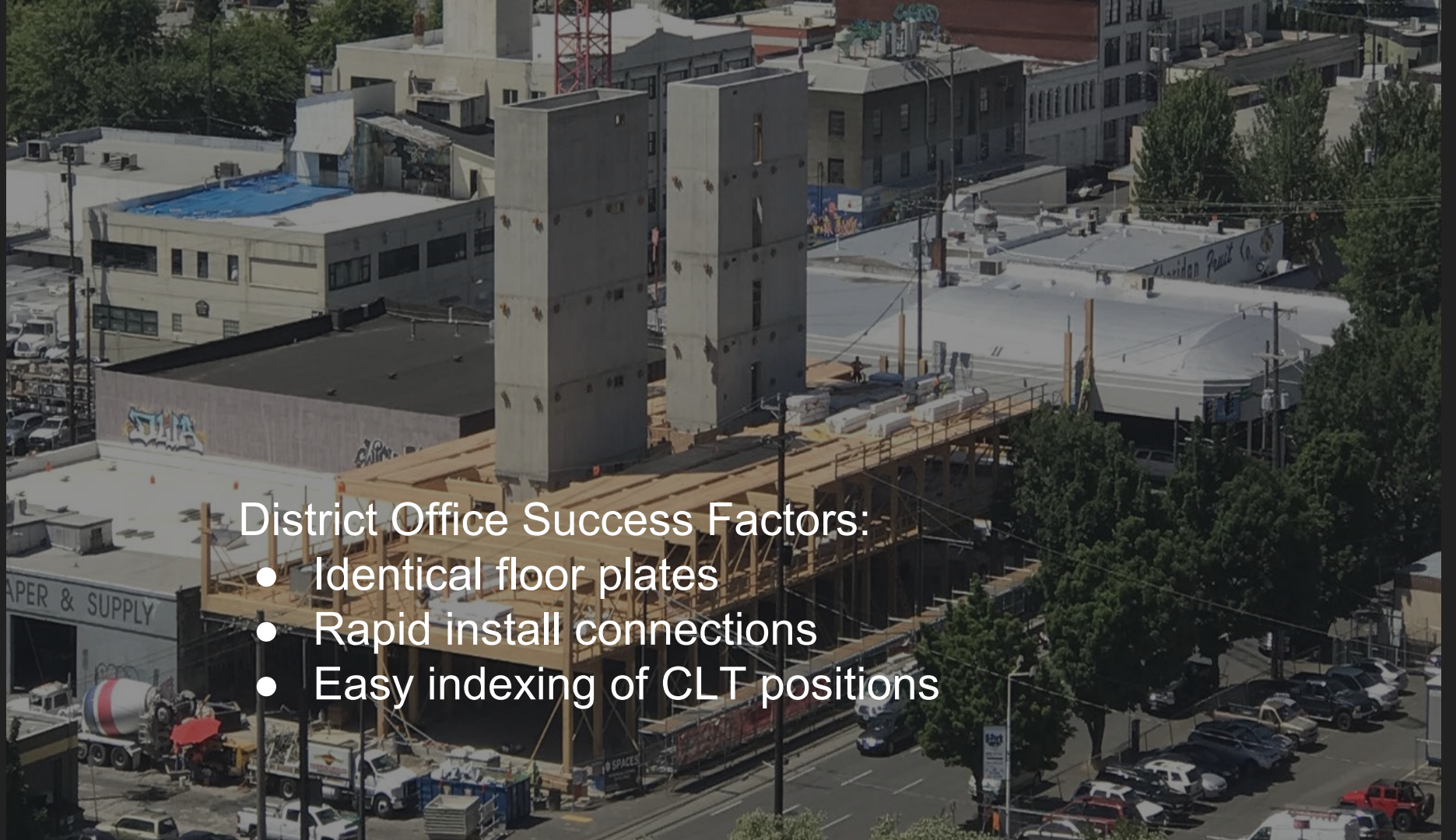
June 4, 2019

And, 6 weeks later…
July 12, 2019



2 minute CLT installation

Identical floor plates and utility pathways.



District Office Success Factors:

- Identical floor plates
- Rapid install connections
- Easy indexing of CLT positions

Case Study 3 - UW Milgard Hall

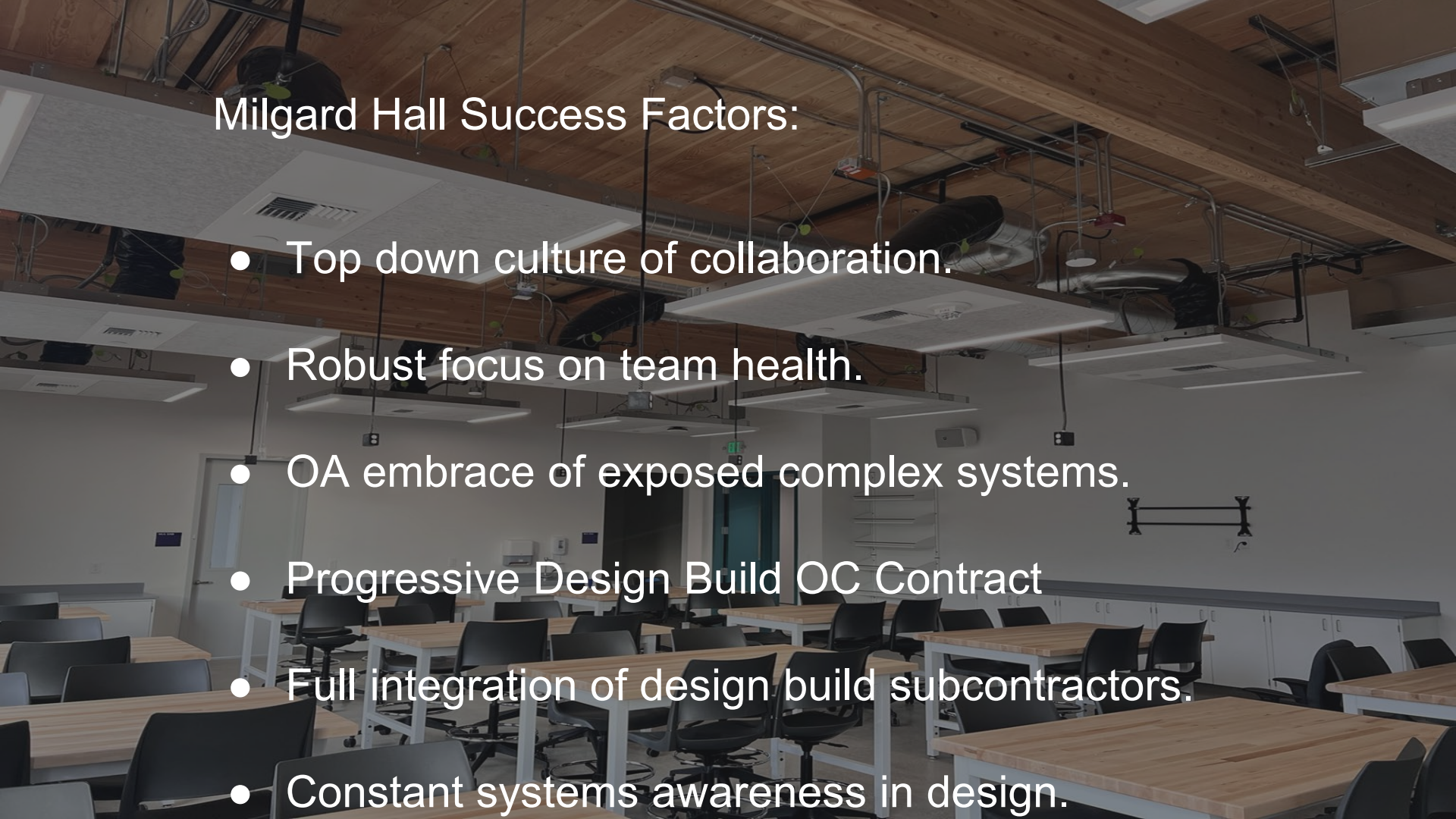
Full integration of MEP systems for rapid installation

January 10, 2022

And…10 months later

November 10, 2022

Grand Opening



Milgard Hall Success Factors:

- Top down culture of collaboration.
- Robust focus on team health.
- OA embrace of exposed complex systems.
- Progressive Design Build OC Contract
- Full integration of design build subcontractors.
- Constant systems awareness in design.

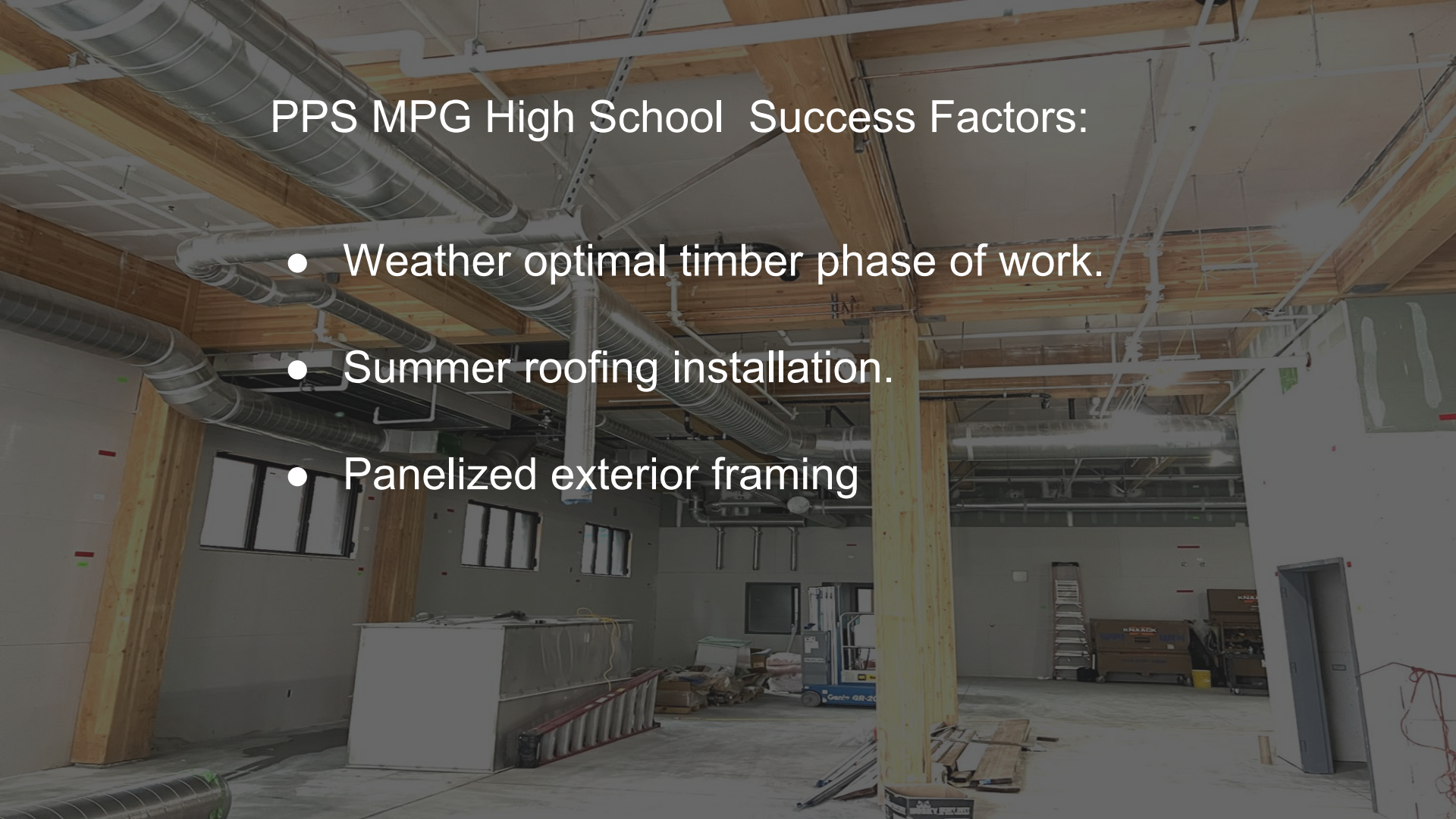
Case Study 4 - PPS Multiple Pathways to Graduation High School

Early Start of MEP Systems

May 24, 2023 (6 weeks after timber start)

November 8, 2023 - Rough in complete, drywall finishing underway

November 8, 2023 (7 Months after timber start.)



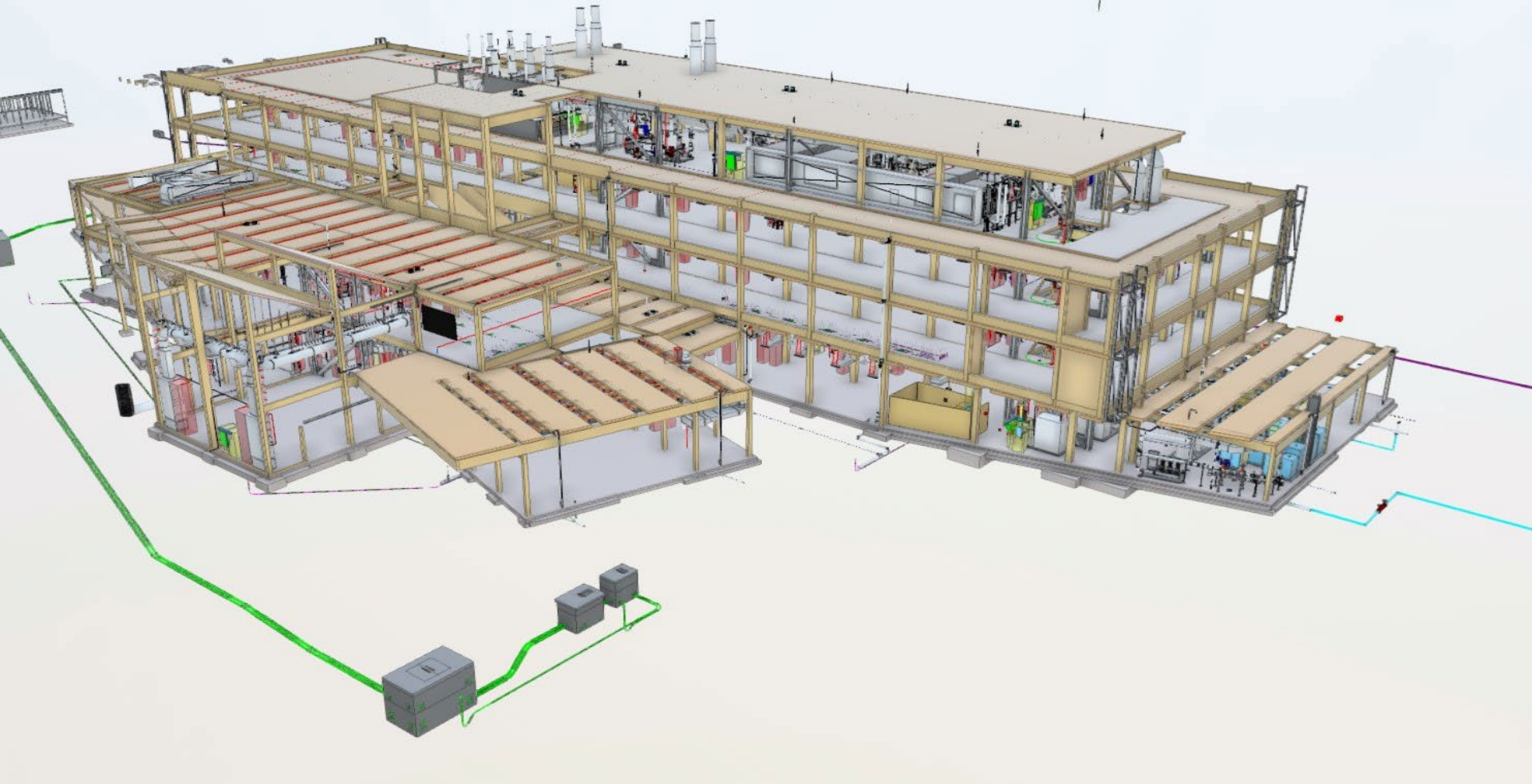
PPS MPG High School Success Factors:

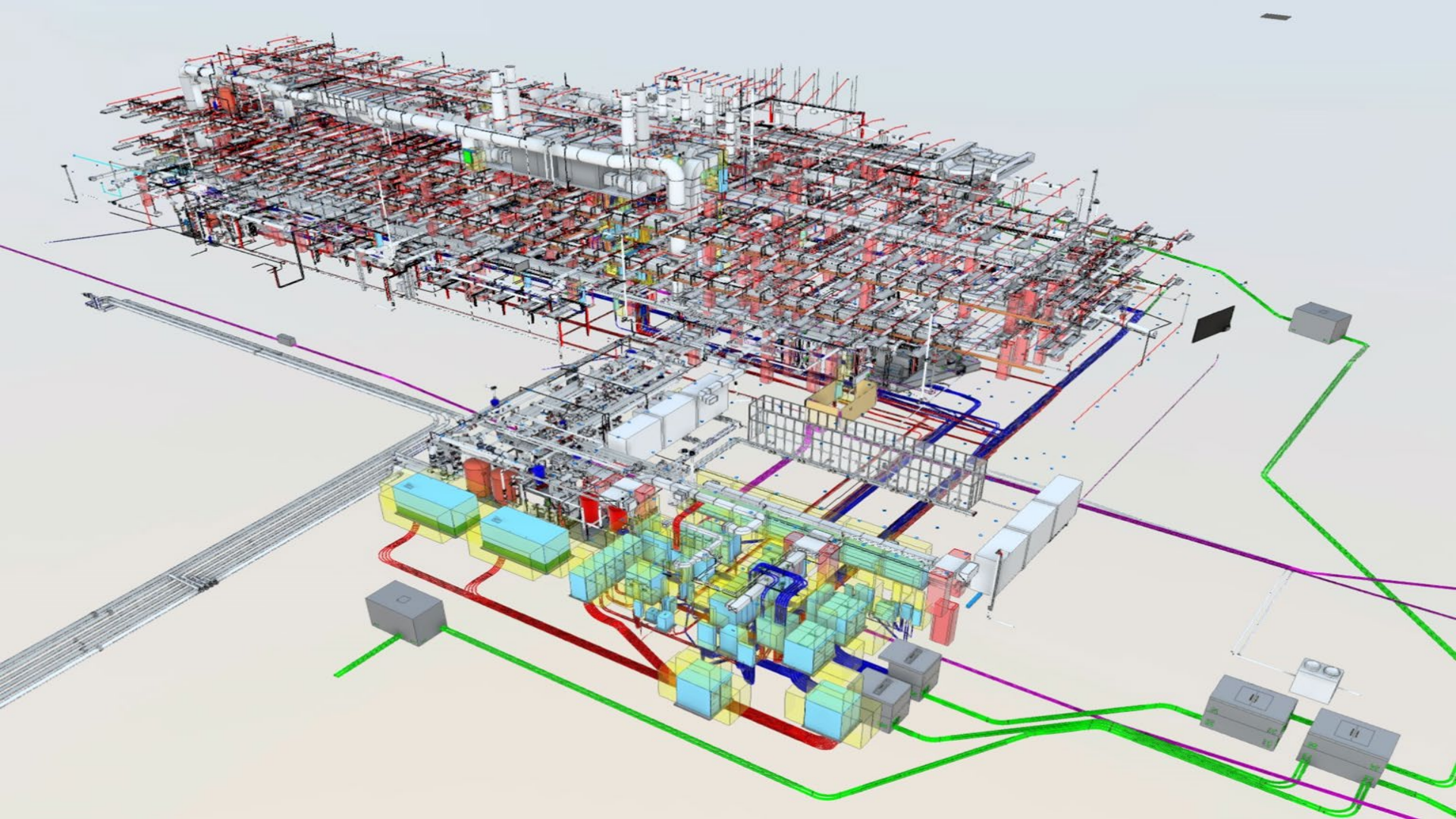
- Weather optimal timber phase of work.
- Summer roofing installation.
- Panelized exterior framing

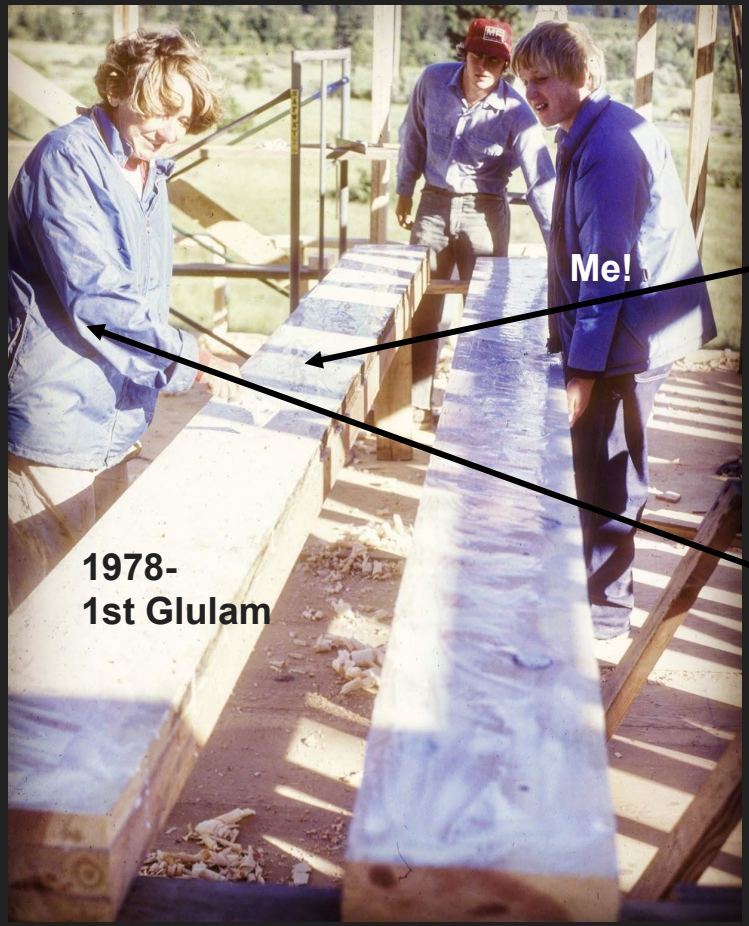
Case Study 5 -
PCC Workforce Training Center

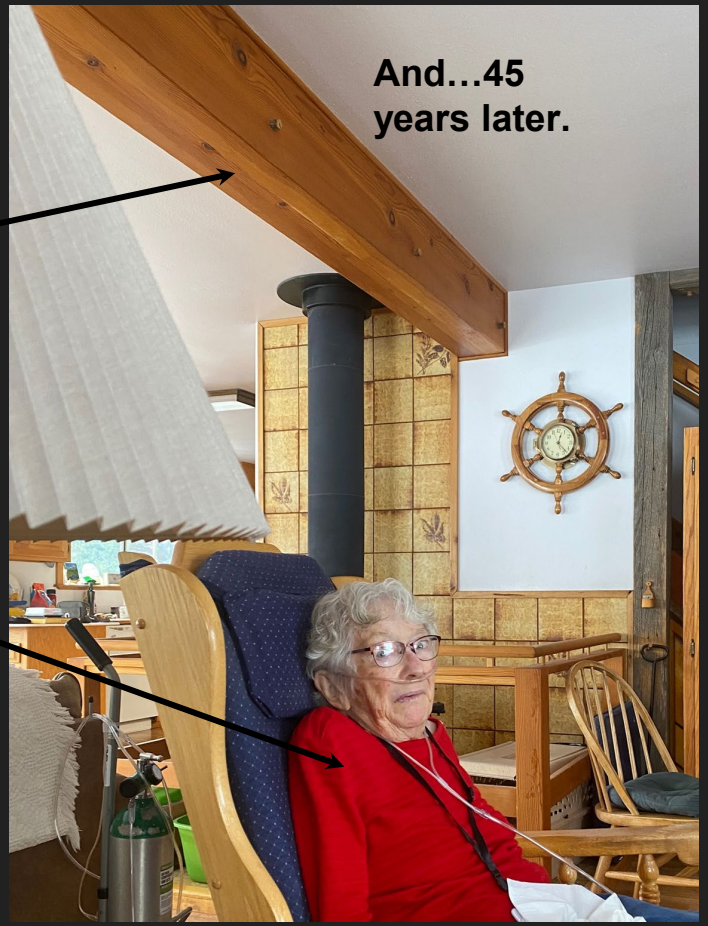
All of the above…

Any questions?









Final feel-good slide. Mt. Shasta, CA