BUILDINGENERGY BOSTON

Local Mass Timber: A Paradox

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Curated by Megan Nedzinski (Vermont Integrated Architecture)

Northeast Sustainable Energy Association (NESEA)
February 28, 2022

CONSIGLI
Est. 1905
HGA

LOCAL MASS TIMBER: A PARADOX

NESEA BuildingEnergy Boston 2022
February 28, 2022

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AGENDA

What is Mass Timber?

Case Study: Bowdoin College
Mills Hall & Center for Arctic Studies

Timber: Sourcing, Benefits & Constraints

Results at Bowdoin

Questions

LEARNING OBJECTIVES

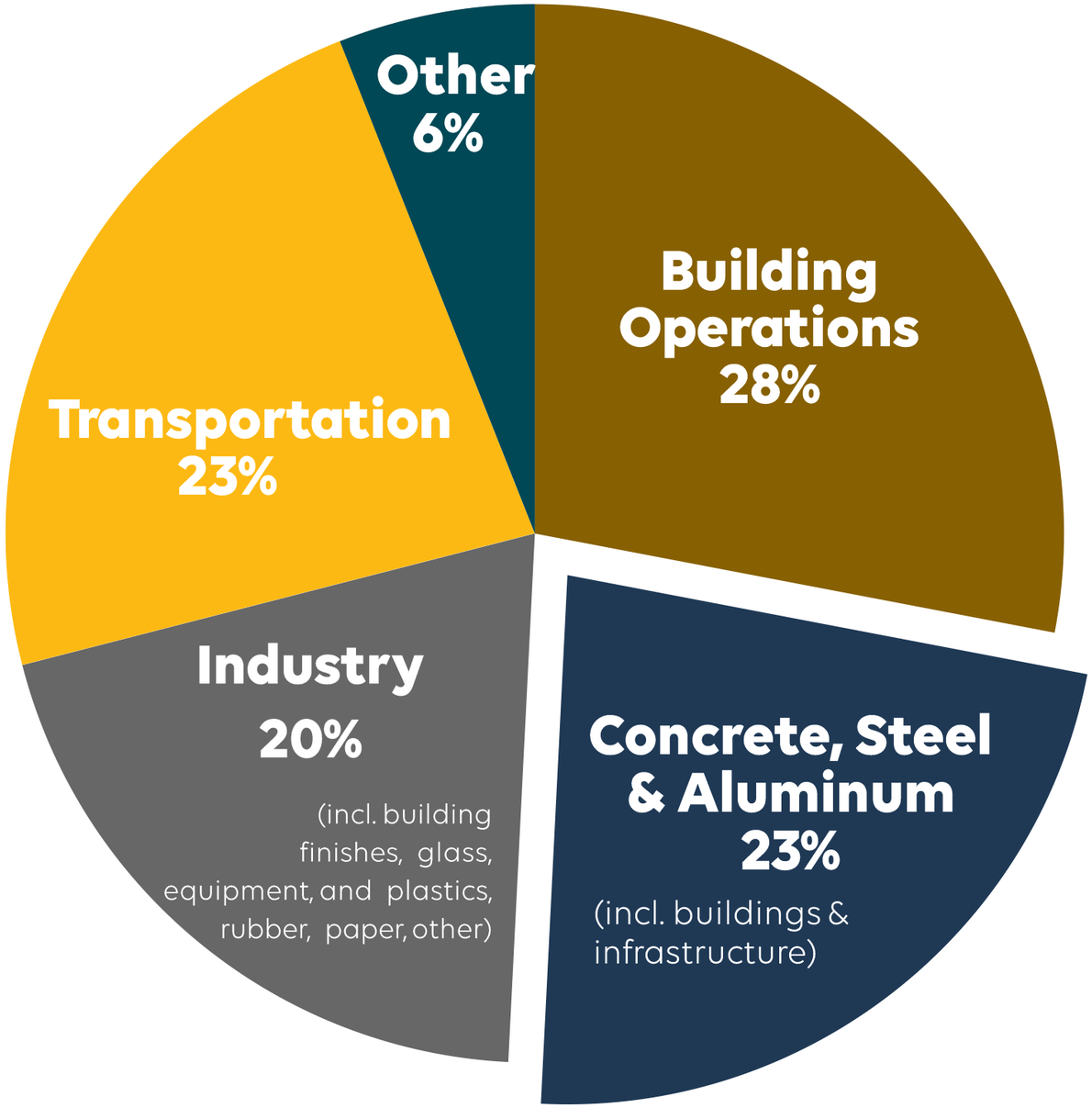
Measure the benefits of mass timber structures in relation to embodied carbon in new building design, compared to other structural systems.

Describe **the alignment of a college's core educational and research mission on climate, environment, and human activities** for specific building projects.

Define the **current constraints to local sourcing and fabrication** of mass timber structural components.

Evaluate **possibilities for establishing future localized industry with renewable forestry resources**.

GLOBAL CO_2 EMISSIONS BY SECTOR



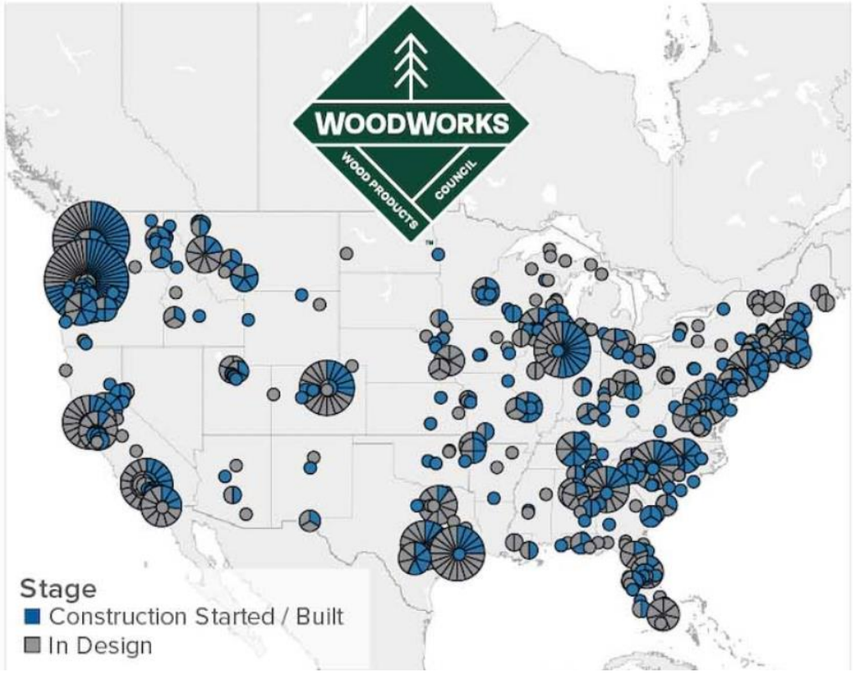
Source:
2018 Global ABC Report; IEA

WHAT IS MASS TIMBER?

Mass timber consists of structural members formed by combining laminations of multiple layers of dimensional lumber into panels, which achieves greater strength than traditional dimensional lumber.

History

- 1985 – 1st CLT patent (France)
- 1993 – 1st CLT projects (Switzerland and Germany)
- 1998 – 1st multi-story project (Austria)
- Early 2000s – widespread use in Europe



BENEFITS

Environmental Impact

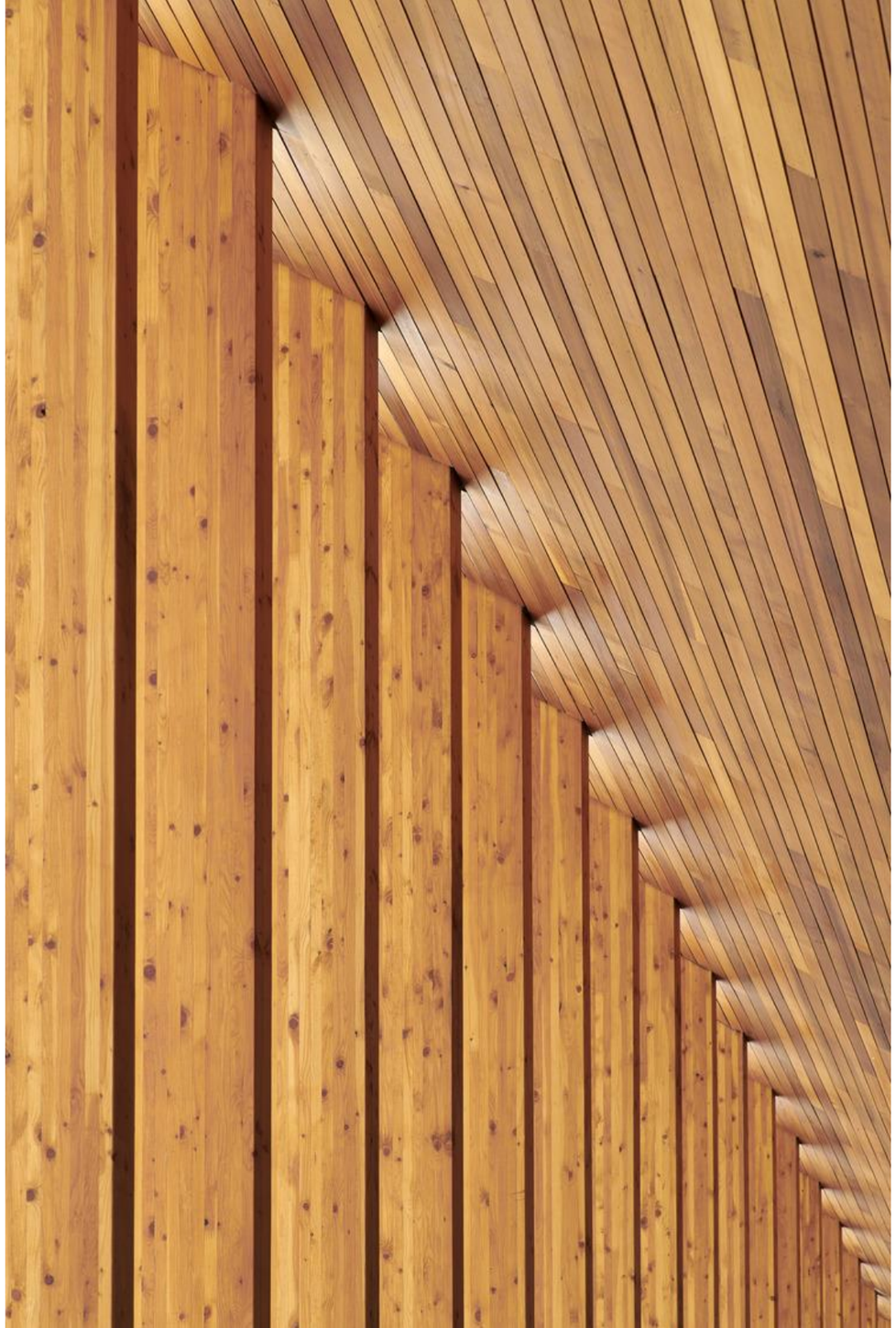
- Reduced embodied energy
- Reduced carbon emissions
- Positive impacts on forest health

Construction Flexibility

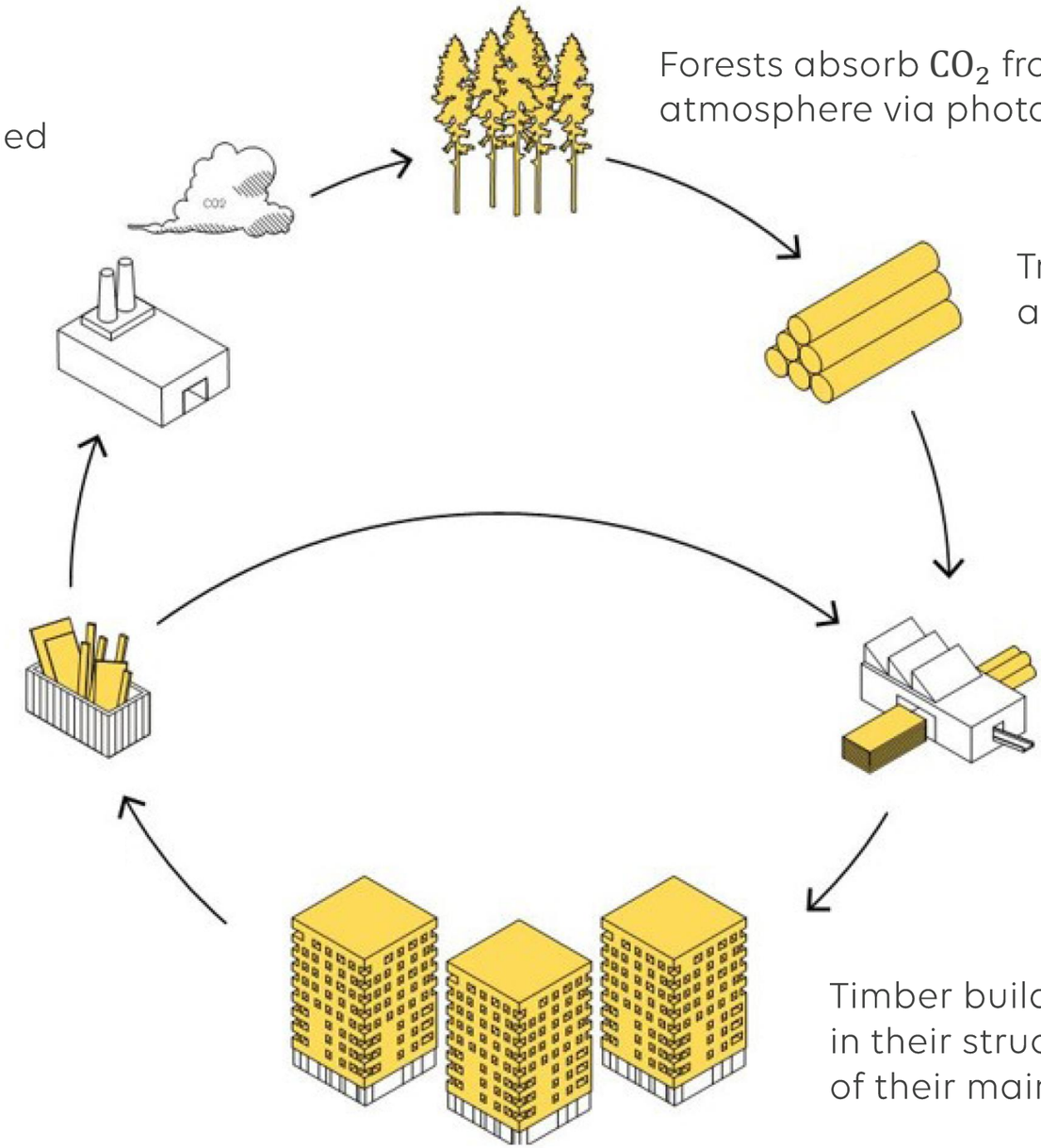
- Reduced construction time
- Reduced building weight
- Proven fire resistance

Occupant Wellbeing

- Improved interior air quality
- Good response to humidity control
- Acoustic properties
- Aesthetics
- Reduced stress levels in building occupants



ENVIRONMENTAL IMPACT | REDUCED CARBON EMISSIONS



CONSTRUCTION FLEXIBILITY | PROVEN FIRE RESISTANCE

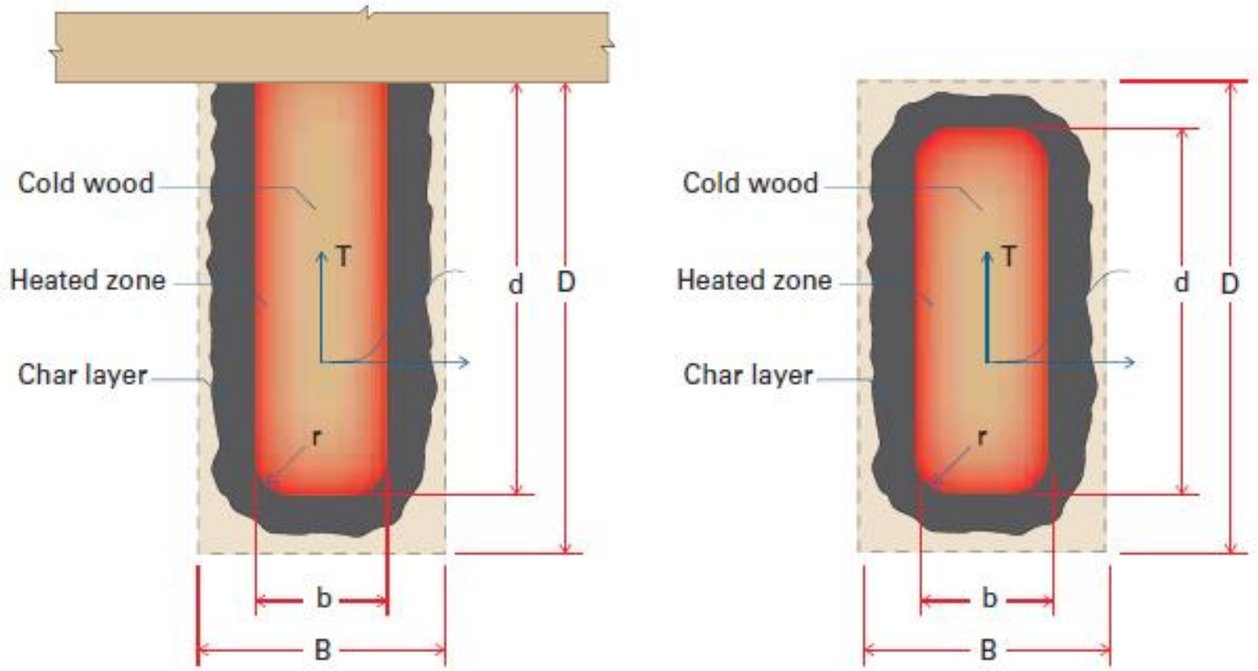


Figure 1-1 Reduction in member breadth and depth over time, t

OCCUPANT WELLBEING | AESTHETICS+

BOWDOIN COLLEGE

- **Project Name:** Barry Mills Hall | John & Lile Gibbons Center for Arctic Studies
- **Location:** Brunswick, ME
- **Size:** 2 Buildings | 50,000 SF
- **Program:** Museum, Event Space, Classroom, Offices
- **Construction Type:** V-A

CARBON NEUTRAL BY 2018

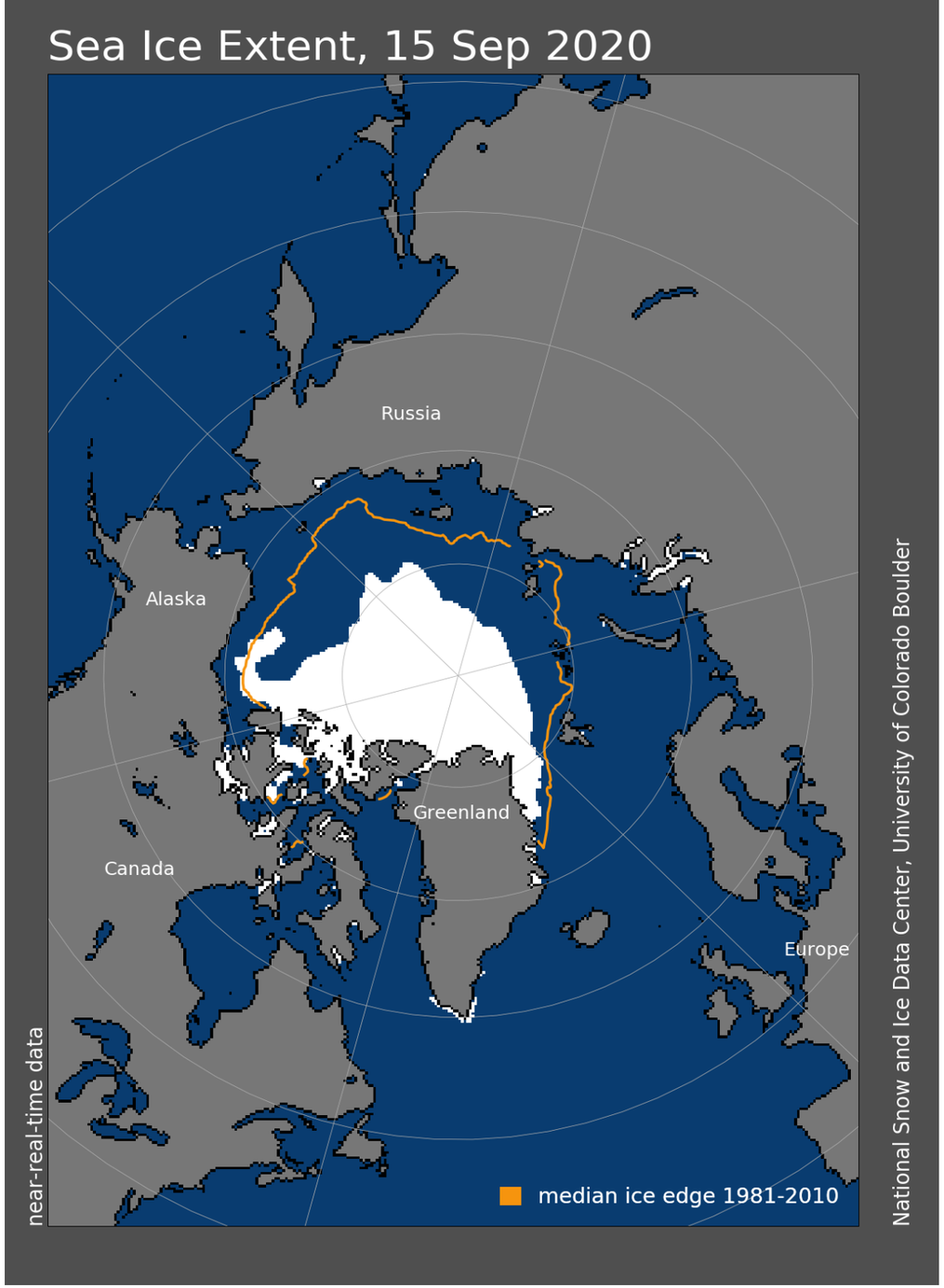
In June 2007, Bowdoin joined 270 colleges and universities in signing the American College and University Presidents' Climate Commitment, pledging to achieve carbon neutrality by 2020.

In April of 2018, carbon neutrality was achieved **two years ahead of schedule**, making Bowdoin only the third college in the country to have fulfilled its commitment.

PROGRAM

Arctic Studies

- 4 million people, living in 8 nations
- Sensitive marine and terrestrial ecosystems
- Rich in natural resources
- Feeling the effects of global warming, pollution, colonization, and globalization



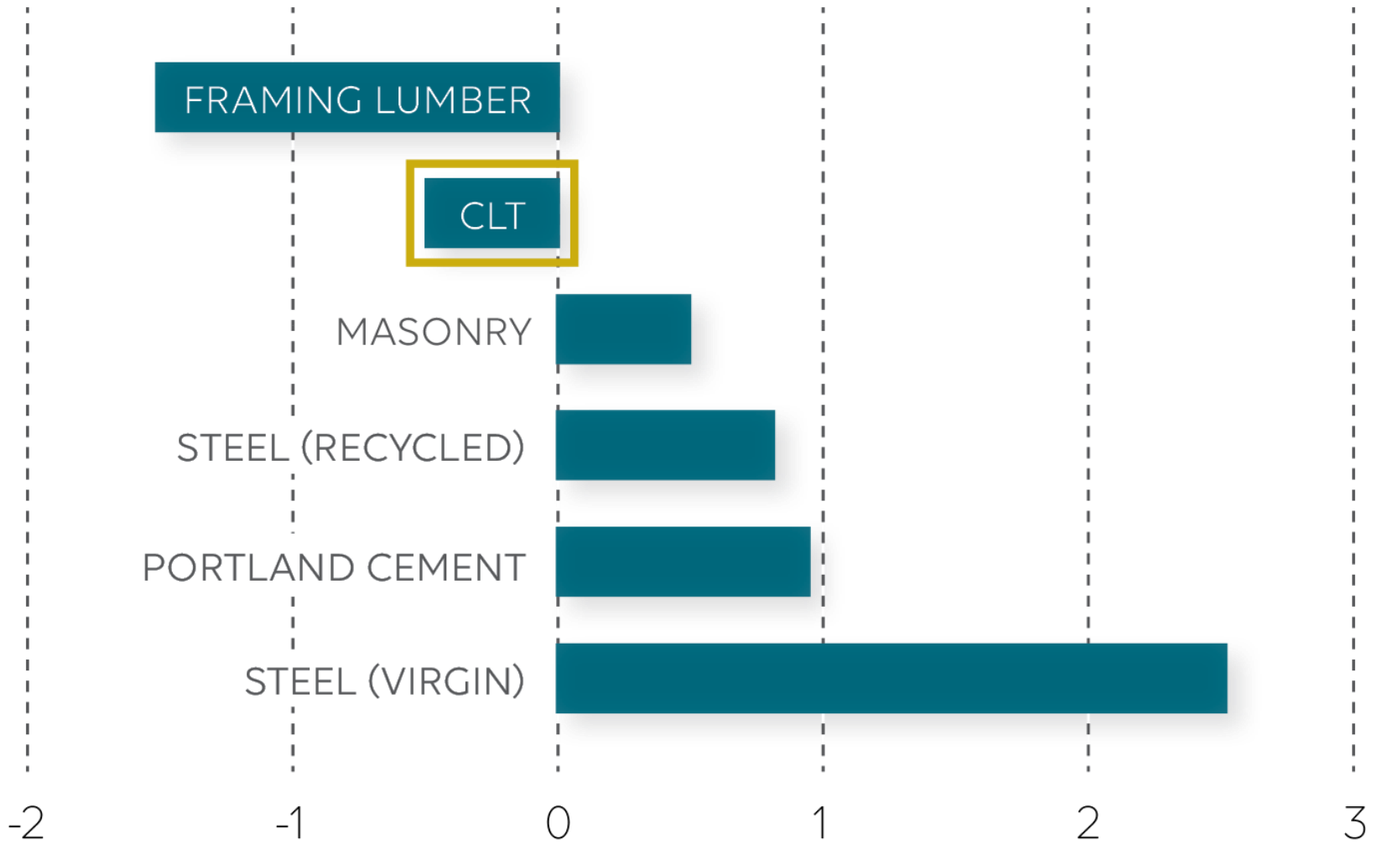
INSPIRED BY THE ARCTIC

‘THE ROOSEVELT’

HUBBARD SLEDGE

NET CARBON EMISSIONS

PROCESS EMISSIONS LESS CARBON STORED

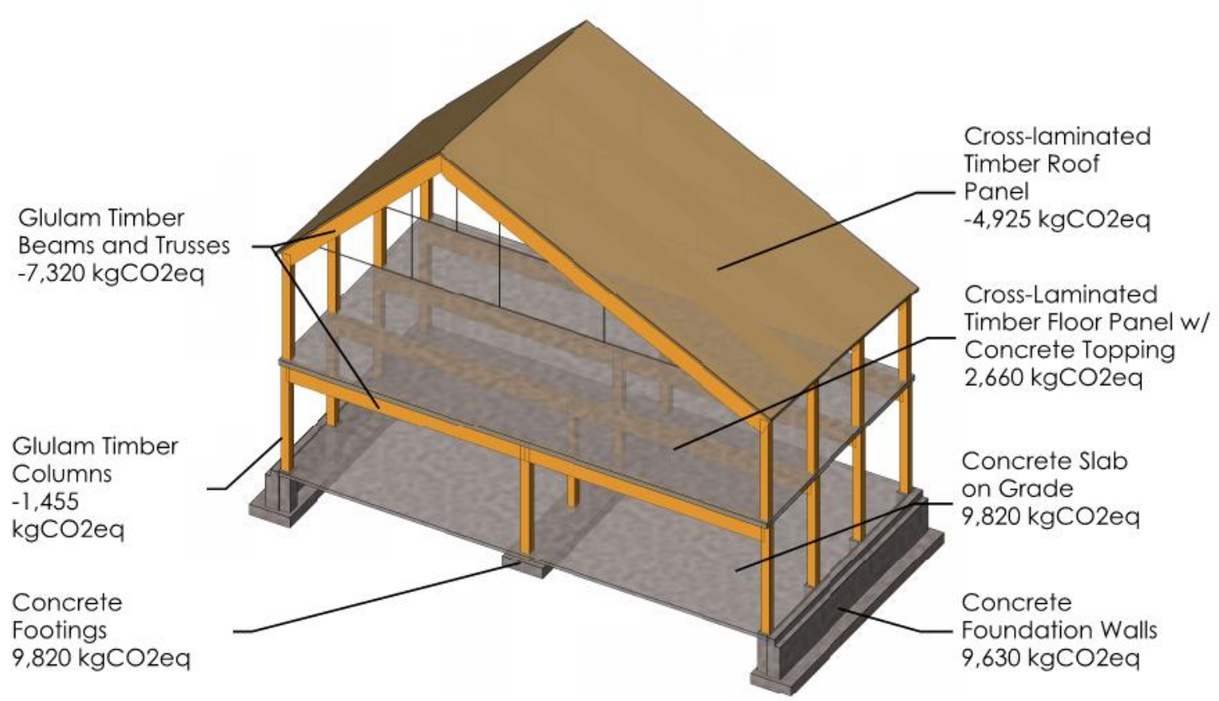


LIFE CYCLE ANALYSIS | THE CARBON CYCLE

Steel

Comprehensive Structure: 92,455 kgCO2eq
Superstructure: 63,185 kgCO2eq

Mass Timber



Comprehensive Structure: 18,230 kgCO2eq
Superstructure: -11,040 kgCO2eq

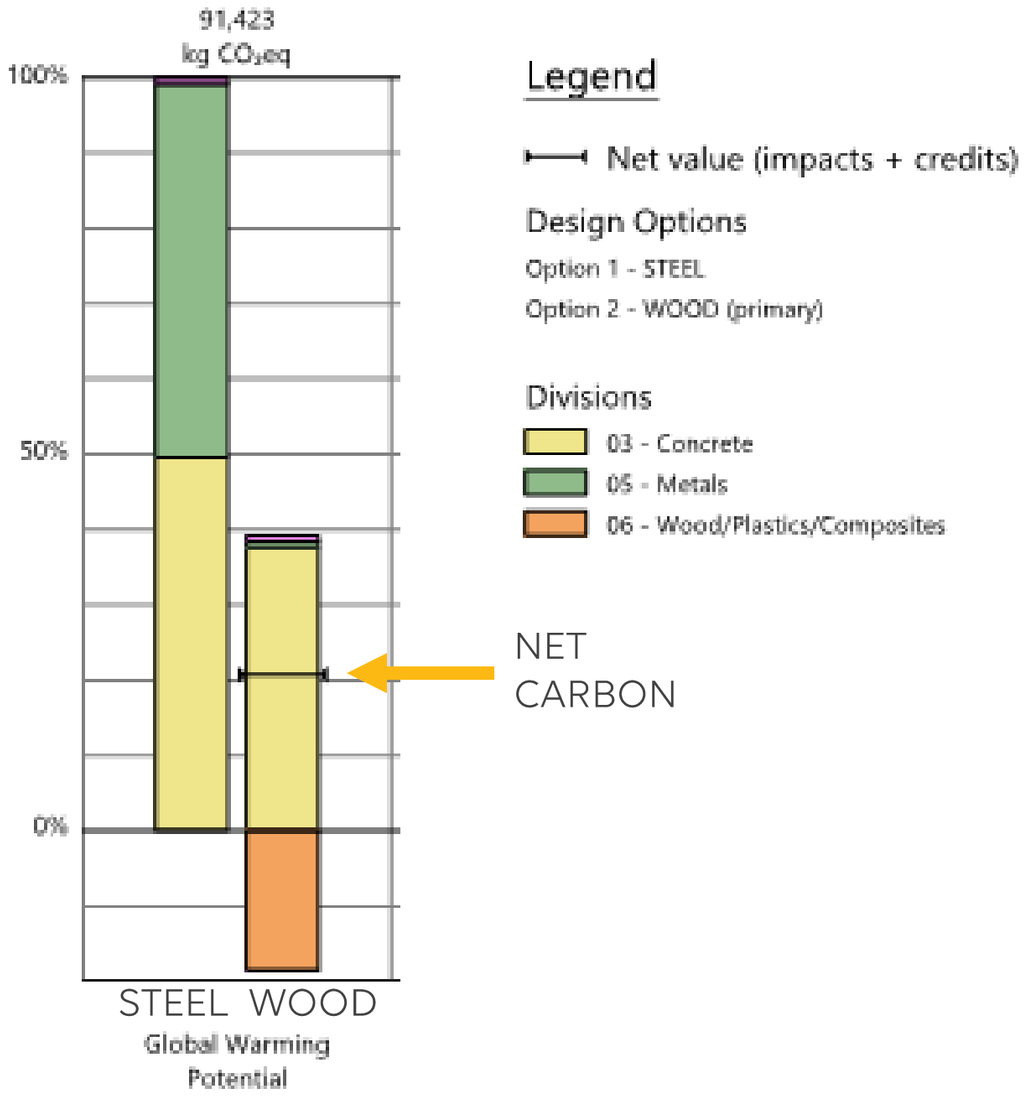
NET CARBON EMISSIONS

Steel: 92,455 kg CO_2eq

Wood: 18,230 kg CO_2eq

Steel: 5 X CO_2eq

Wood: 1 X CO_2eq



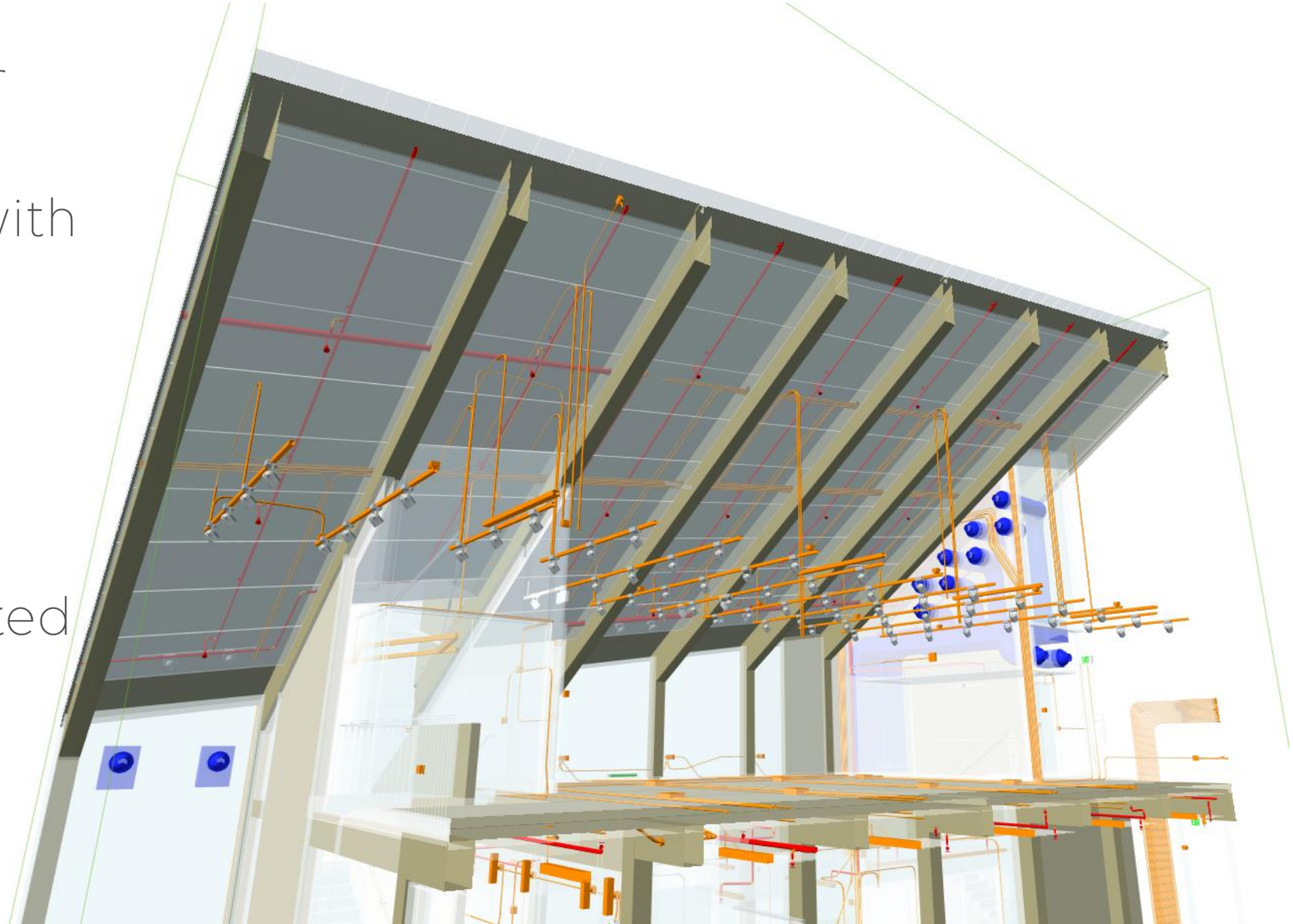
Tally LCA App for Revit

“Cambridge in England has its willows, Oxford its osiers and we have our pines.”

-Bowdoin College Peucinian Society

KEYS TO SUCCESS

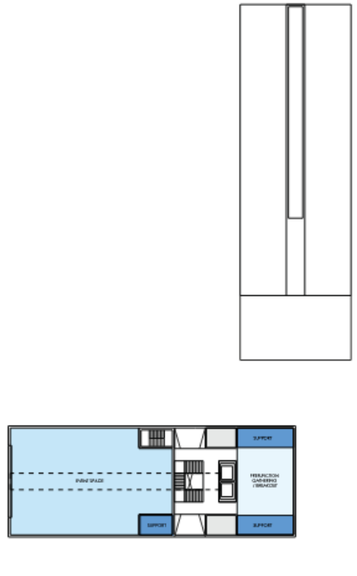
- Early Goal Setting Involving Owner/Designer/Contractor
- Structural System Aligned with Project Goals
- Early Procurement – Timber Vendor selection
- Early Coordination Completed prior to CDs



EARLY CM INVOLVEMENT

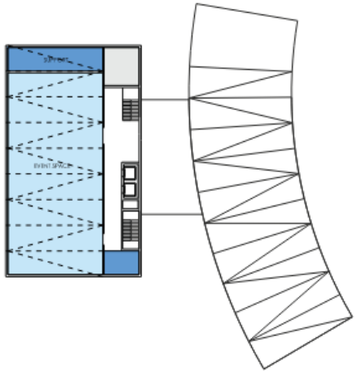
- Construction Manager engaged simultaneously with Designer

- Designer & CM Involved in Project Goal Setting



'L' SCHEME

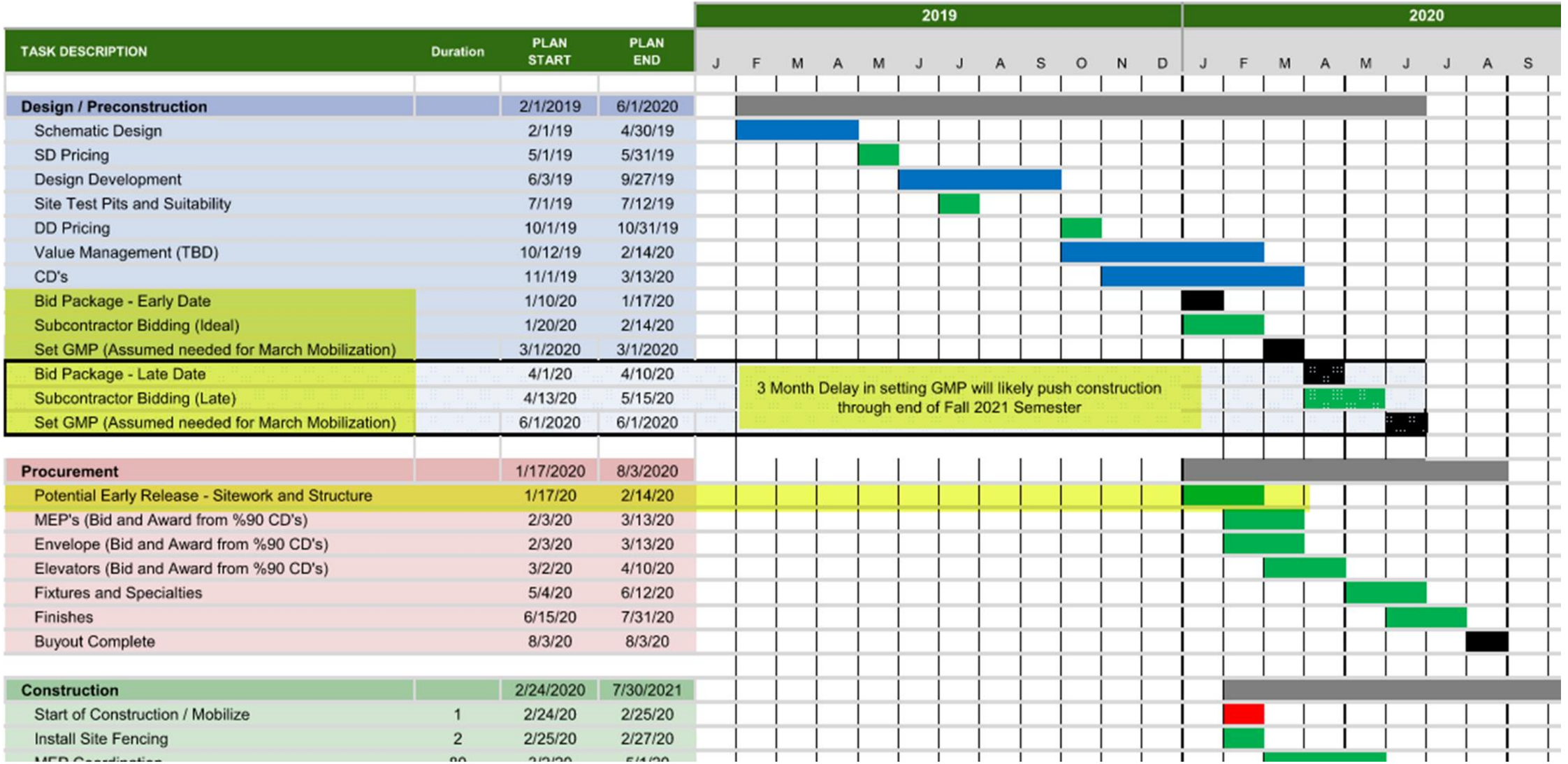
L03 - 7,200 sf



CANTILEVER SCHEME

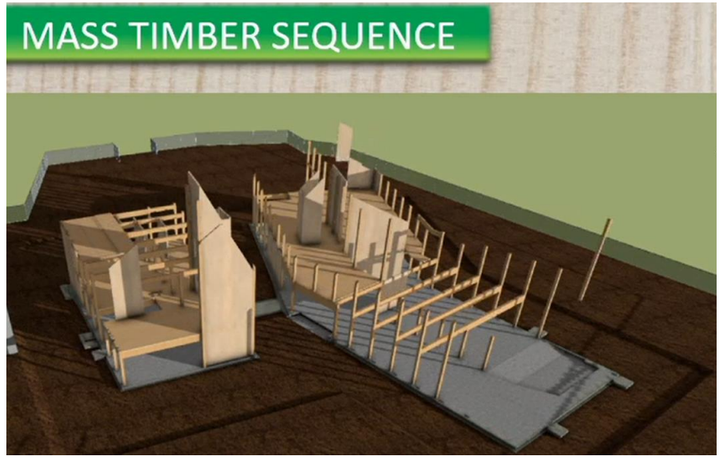
L03 - 7,400 sf

KEYS TO SUCCESS



TASK DESCRIPTION	Duration	PLAN START	PLAN END
Design / Preconstruction		2/1/2019	6/1/2020
Schematic Design		2/1/19	4/30/19
SD Pricing		5/1/19	5/31/19
Design Development		6/3/19	9/27/19
Site Test Pits and Suitability		7/1/19	7/12/19
DD Pricing		10/1/19	10/31/19
Value Management (TBD)		10/12/19	2/14/20
CD's		11/1/19	3/13/20
Bid Package - Early Date		1/10/20	1/17/20
Subcontractor Bidding (Ideal)		1/20/20	2/14/20
Set GMP (Assumed needed for March Mobilization)		3/1/2020	3/1/2020
Bid Package - Late Date		4/1/20	4/10/20
Subcontractor Bidding (Late)		4/13/20	5/15/20
Set GMP (Assumed needed for March Mobilization)		6/1/2020	6/1/2020
Procurement		1/17/2020	8/3/2020
Potential Early Release - Sitework and Structure		1/17/20	2/14/20
MEP's (Bid and Award from %90 CD's)		2/3/20	3/13/20
Envelope (Bid and Award from %90 CD's)		2/3/20	3/13/20
Elevators (Bid and Award from %90 CD's)		3/2/20	4/10/20
Fixtures and Specialties		5/4/20	6/12/20
Finishes		6/15/20	7/31/20
Buyout Complete		8/3/20	8/3/20
Construction		2/24/2020	7/30/2021
Start of Construction / Mobilize	1	2/24/20	2/25/20
Install Site Fencing	2	2/25/20	2/27/20

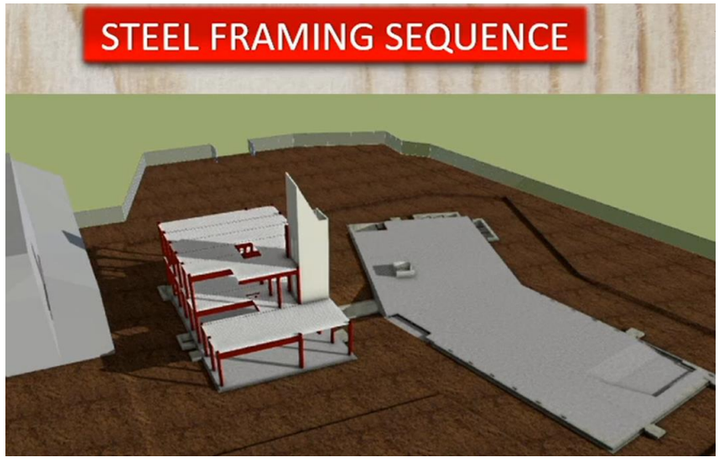
EVALUATION OF SCHEDULE & SYSTEMS



Mass Timber

- Exposed Timber
- CLT Shear Walls
- CLT Walls – Finished surfaces
- Single Trade Sequencing

VIMEO Link

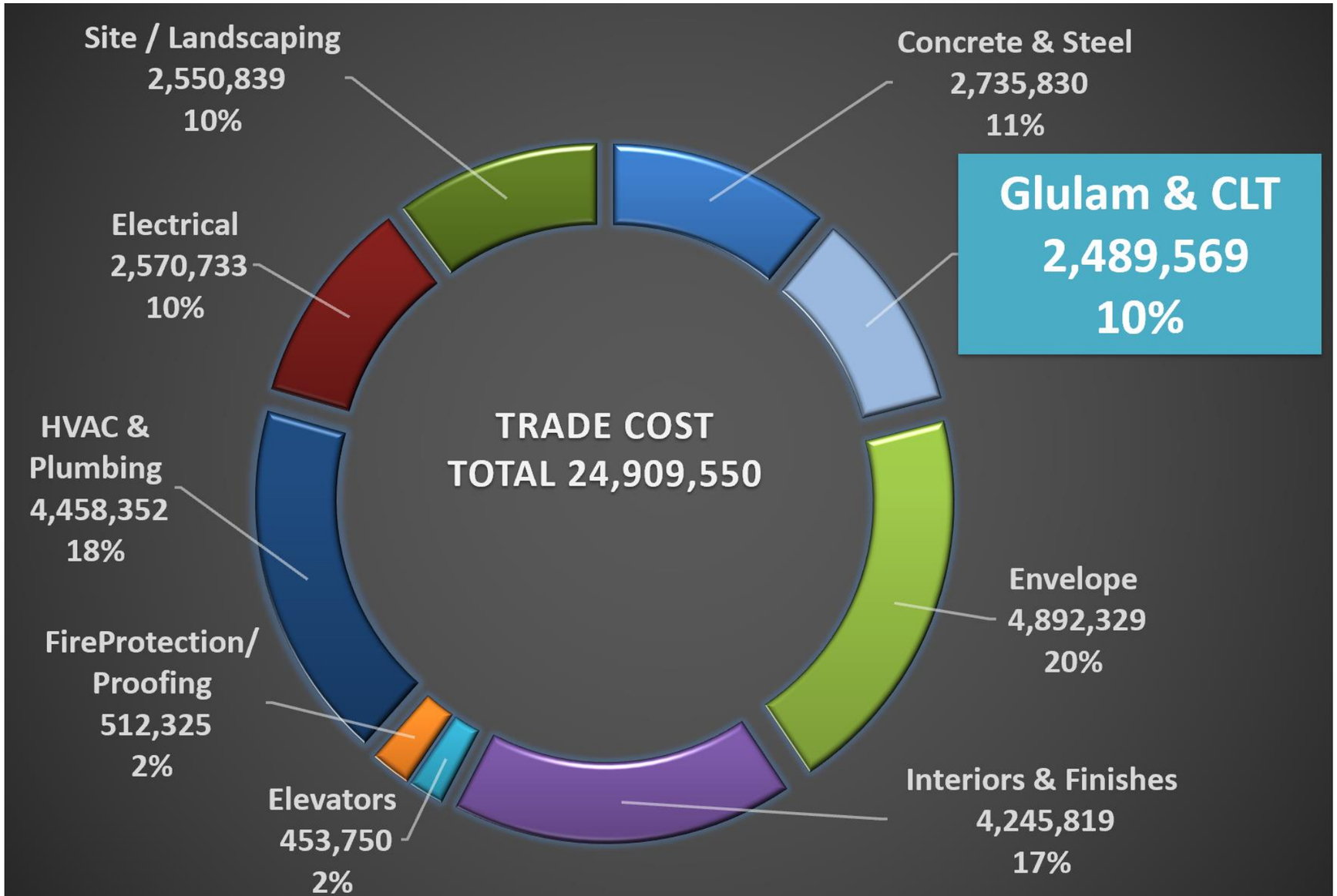


Structural Steel

- AESS Steel or Column Wraps
- CMU Shear Walls
- Millwork Wall Panels
- Six Trades in Sequence

Local Link

LARGER COST FACTORS IN DESIGN



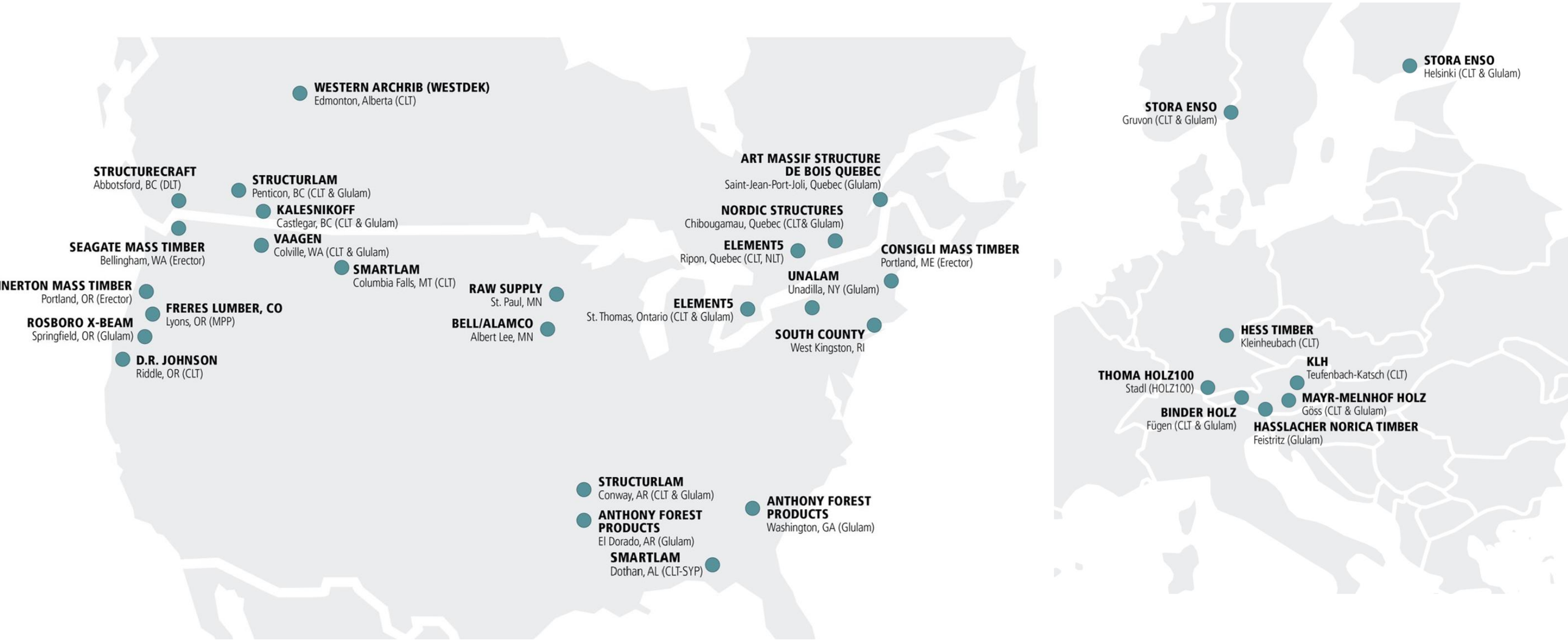
LOCAL SOURCING CONSTRAINTS

- Closest Manufacturer of CLT: Nordic – Chibougamau, Quebec (560 miles)
- Closest Manufacturer of Glulam: Unalam – (388 miles)
- Closest Fabricator of Glulam: South County Post & Beam (230 miles)
  Limitations: Less than 4′ wide fabrication

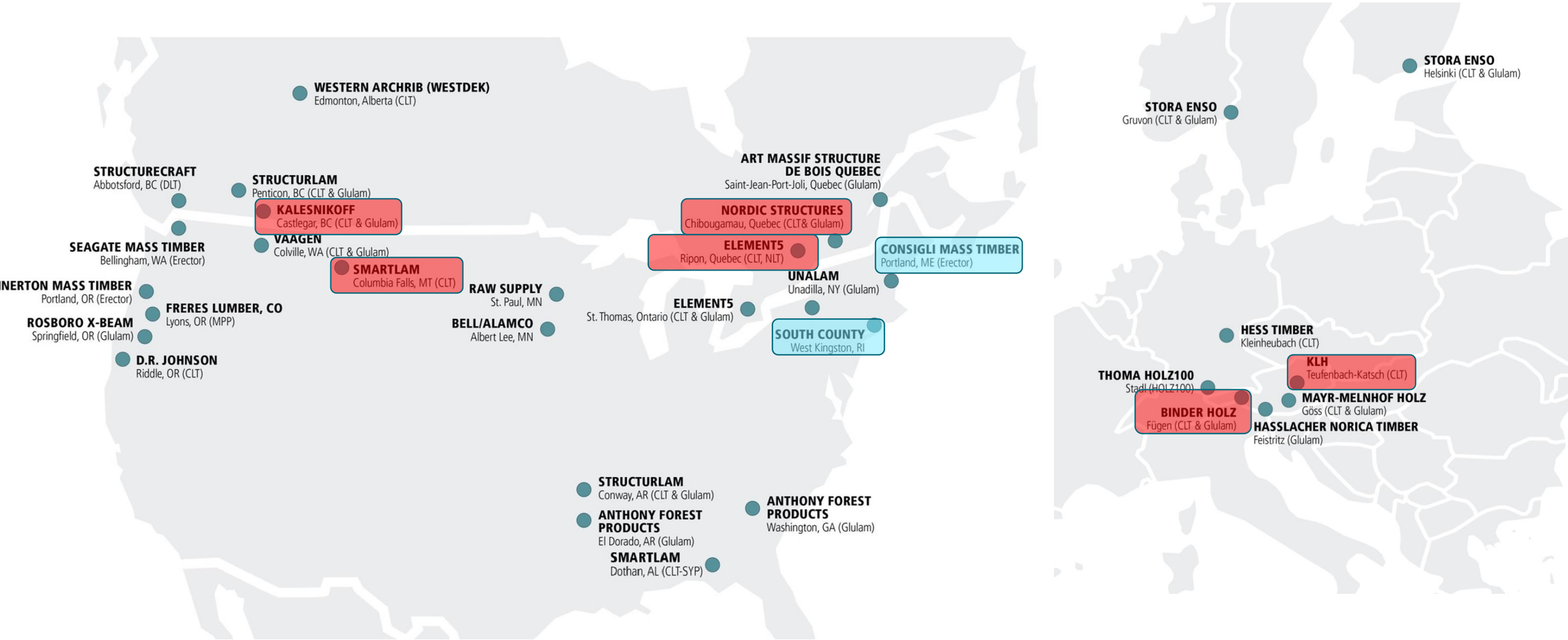
RFP for Design Assist to (5) manufacturers
(2) independent Fabricators / Integrators

$ 00,982	$ 82,462	$ 14,749	$ 41,407	$ 88,812	$ 59,799	$ 10,215	$ 81,035
Kalesnikoff	Structure Fusion (subsidary of Canam)	KLH US Holding Corp	Binderholz (Holzpak)	South County Post & Beam	SmartLam	RedBuilt	ElementFive Co.
(250) 399-4211	(844) 907-9713	(971) 804-3794		(401) 783-4415	(406) 892-2241	(866) 859-6757	(647) 668-8457
tonys@kalesnikoff.com	ichael.kissane@canamgroupinc.co	sebastian.popp@klhuk.com	antonio@holzpak.com	josh@scpb.com	sales@smartlam.com	kliebich@redbuilt.com	lee@elementfive.co
Tony Saad	Michael Kissane	Sebastian Popp	Antonio Guariento	Joshua Bouvier	Sales	Kurt Liebich	Lee Scott

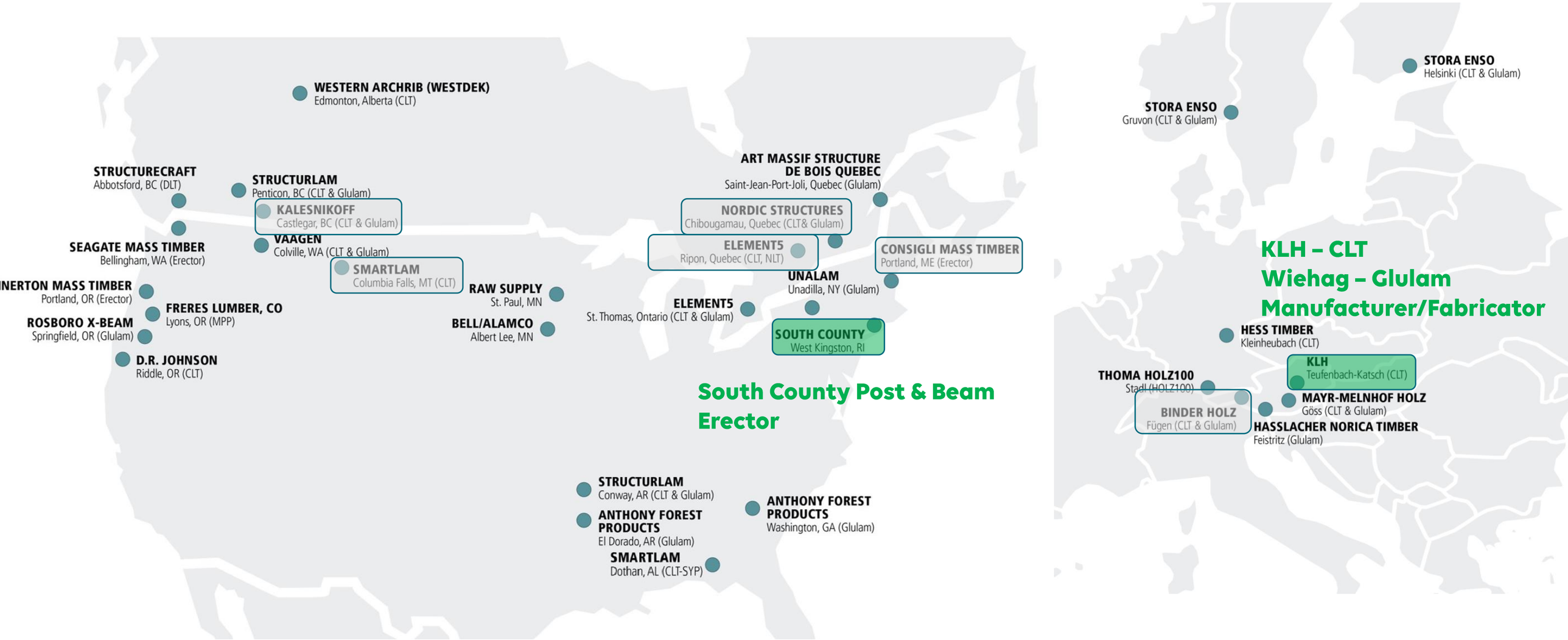
GLOBAL AND LOCAL SUPPLIERS



GLOBAL AND LOCAL SUPPLIERS



GLOBAL AND LOCAL SUPPLIERS



INTERNATIONAL PROCUREMENT

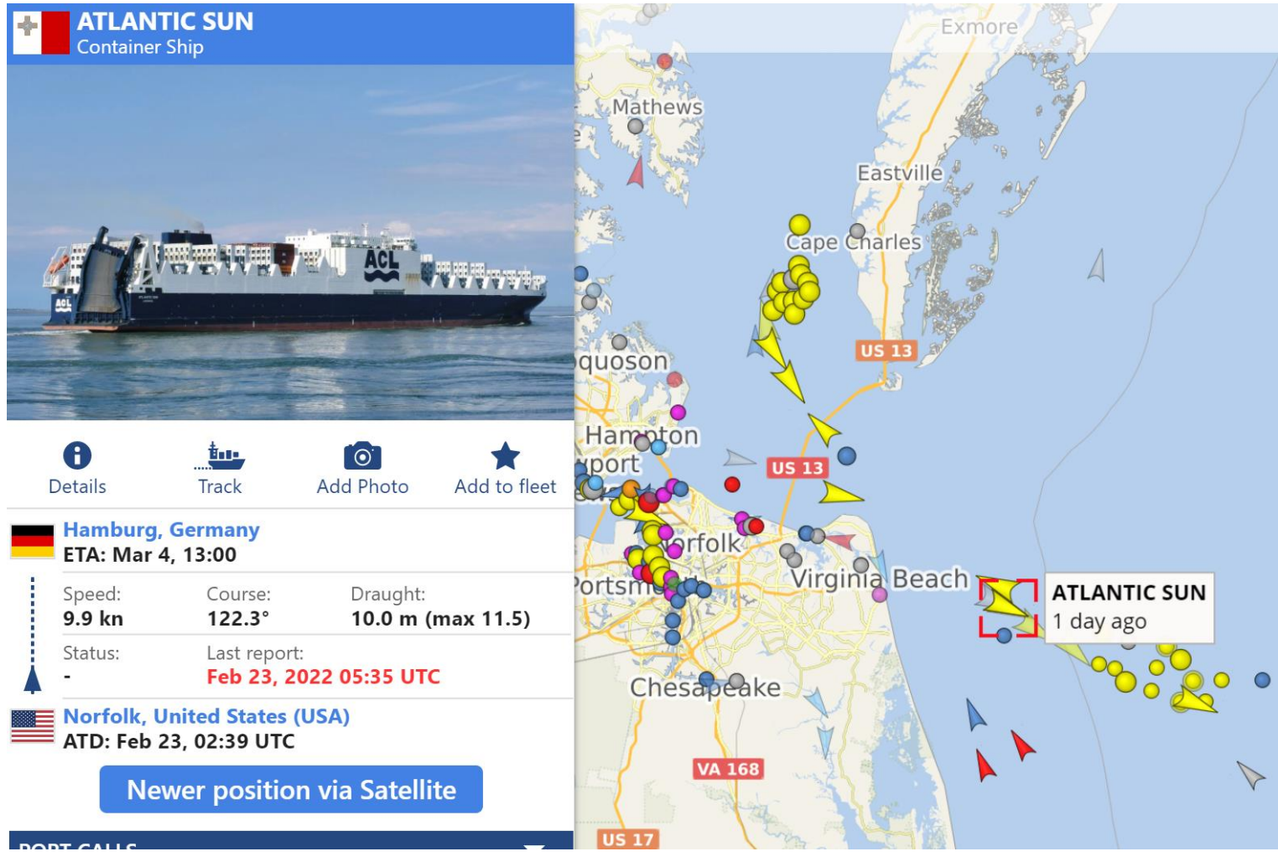
- European Glulam – Conversion
  - Engineering Responsibility
- Connection Hardware Clarifications / Ownership
- Escalation Risk Management
- Supply Chain Understanding – Who is doing what
  - Manufacturing / Fabrication / Logistics Planning

New Lessons Learned: Containers/Port Selection

GLOBAL SHIPPING CONTAINER SHORTAGE

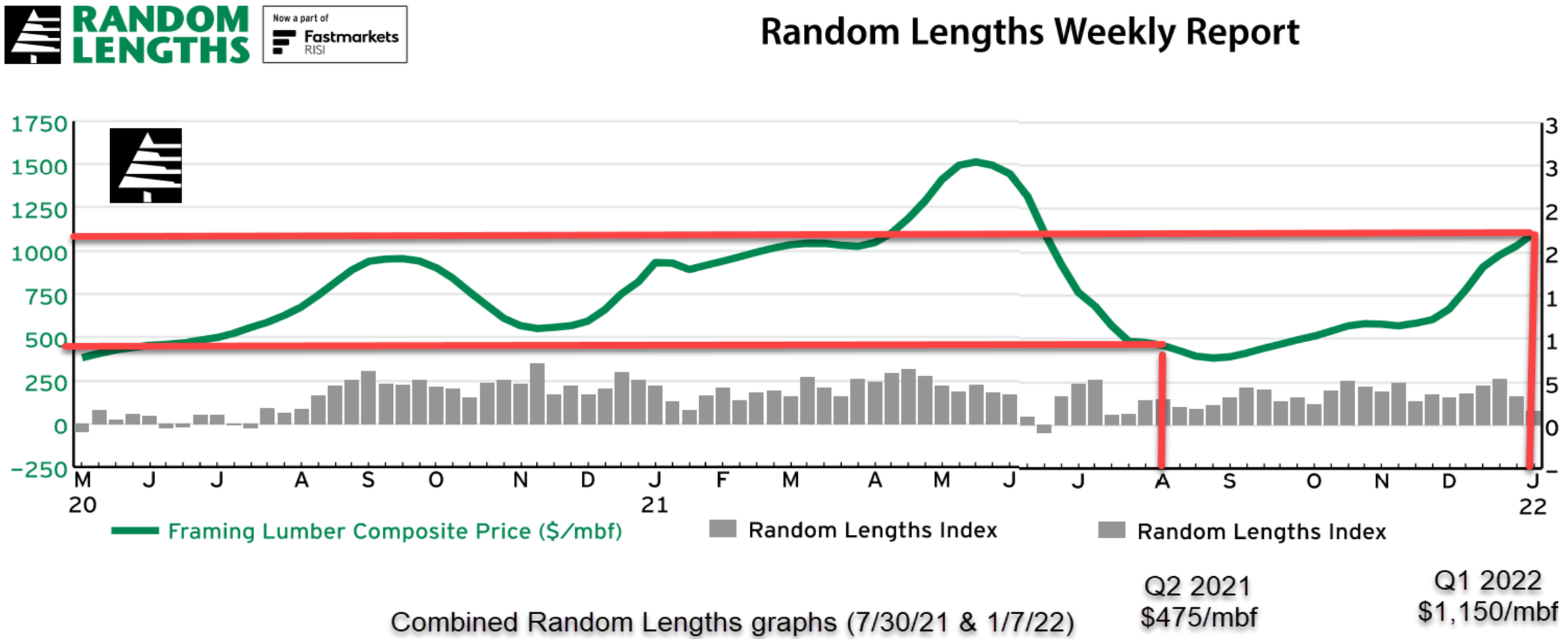
CONTAINERS - "RORO" / BREAK BULK

SCPB Load Reference	SCPB Delivery Sequence	Current Location	DBS P	Vessel:	Sailing	Arrival
CAS CLT 1	3	On Site	KLUOE	Atlantic Sail	7/15/2021	7/30/2021
CAS CLT 2	2	On Site	KLUO	Atlantic Sail	7/15/2021	7/30/2021
CAS CLT 3	1	On Site	KLUOE	Atlantic Sail	7/15/2021	7/30/2021
GLULAM 1	5	In Port	KLUOE	Atlantic Star	7/23/2021	8/8/2021
GLULAM 2	4	On site	KLUOE	Atlantic Star	7/23/2021	8/8/2021
GLULAM 3	6	In Port	KLUOE	Atlantic Star	7/23/2021	8/8/2021
GLULAM 4	12	At Re-load in New Jersey	KLUO	Atlantic Star	7/23/2021	8/8/2021
CAS CLT 4	7	In Port	KLUO	Atlantic Star	7/23/2021	8/8/2021
CAS CLT 5	9	In Port	KLUOE	Atlantic Star	7/23/2021	8/8/2021
CAS CLT 6	8	In Port	KLUOE	Atlantic Star	7/23/2021	8/8/2021
GLULAM 5	13	In Port	KLUOE	Atlantic Sun	7/29/2021	8/13/2021
GLULAM 6	14	In Port	KLUO	Atlantic Sun	7/29/2021	8/13/2021
GLULAM 7	15	In Port	KLUO	Atlantic Sun	7/29/2021	8/13/2021
GLULAM 8	18	In Port	KLUOE	Atlantic Sun	7/29/2021	8/13/2021
Mill CLT 1	10	At Sea	KLUO	ATLANTIC SEA V. ATE7321	8/5/2021	8/26/2021
Mill CLT 2	11	At Sea	KLUOE	ATLANTIC SEA V. ATE7321	8/5/2021	8/26/2021
Mill CLT 3	14	At Sea	KLUOE	ATLANTIC SEA V. ATE7321	8/5/2021	8/26/2021
Mill CLT 4	16	At Sea	KLUOE	ATLANTIC SEA V. ATE7321	8/5/2021	8/26/2021
Mill CLT 5	17	At Sea	KLUO	ATLANTIC SEA V. ATE7321	8/5/2021	8/26/2021
Mill CLT 6	19	At Sea	KLUOE	ATLANTIC SEA V. ATE7321	8/5/2021	8/26/2021
Mill CLT 7	20	At Sea	KLUO	ATLANTIC SAIL V. ATS6921	8/18/2021	9/2/2021
Mill CLT 8	21	At Sea	KLUOE	ATLANTIC SAIL V. ATS6921	8/18/2021	9/2/2021
Mill CLT 9	22	At Sea	KLUO	ATLANTIC SAIL V. ATS6921	8/18/2021	9/2/2021
Mill CLT 10	23	At Sea	KLUO	ATLANTIC SAIL V. ATS6921	8/18/2021	9/2/2021
Mill CLT 11	24	At Sea	KLUOE	ATLANTIC SAIL V. ATS6921	8/18/2021	9/2/2021



ESCALATION MANAGEMENT

RANDOM LENGTHS Now a part of Fastmarkets RISI

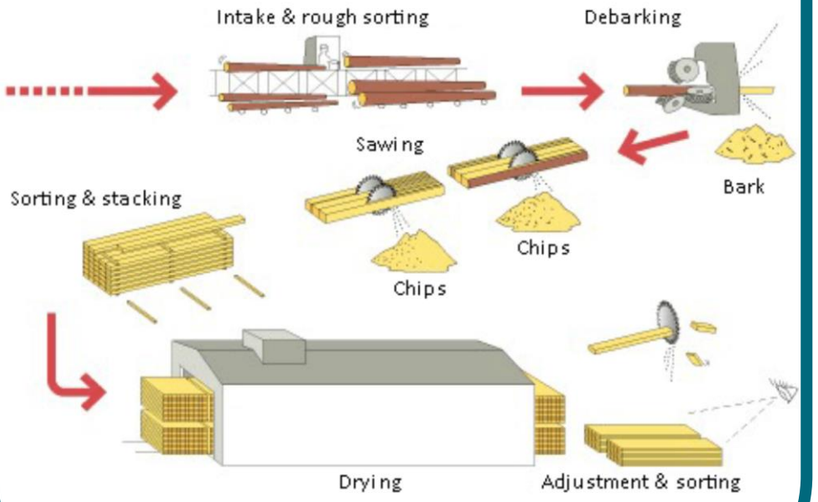


Combined Random Lengths graphs (7/30/21 & 1/7/22)

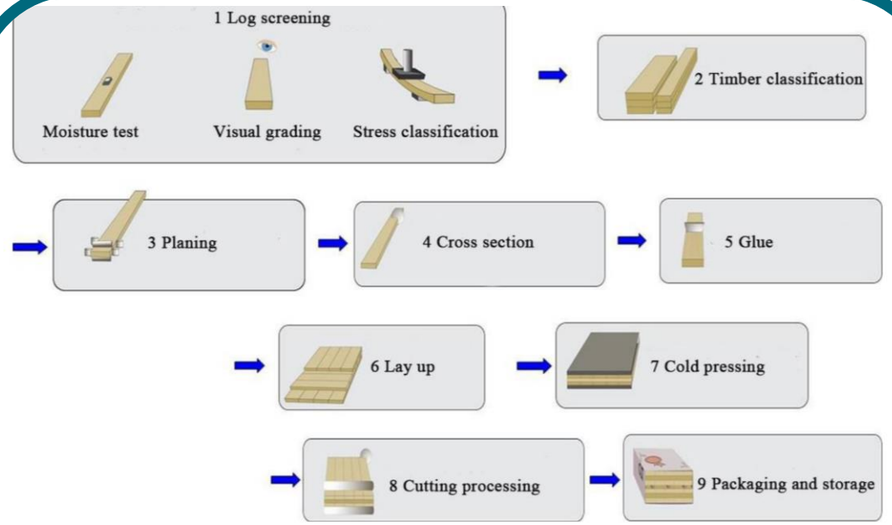
Q2 2021
$475/mbf

Q1 2022
$1,150/mbf

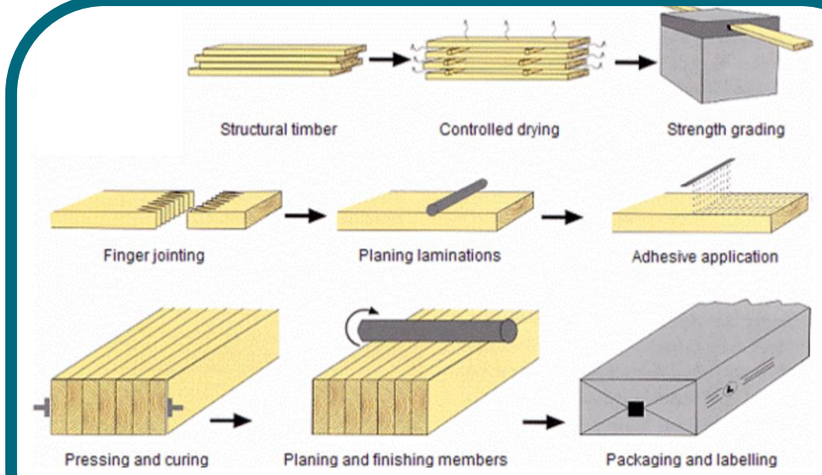
WEEK OF 2/22/2022: $1,325 / THOUSAND BF



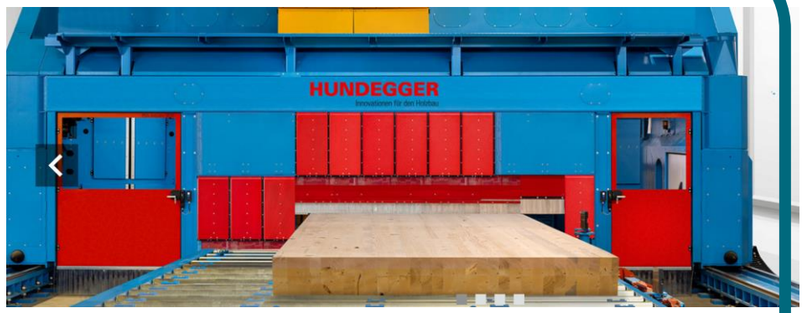
LUMBER MILL



CLT MANUFACTURING



GLULAM MANUFACTURING

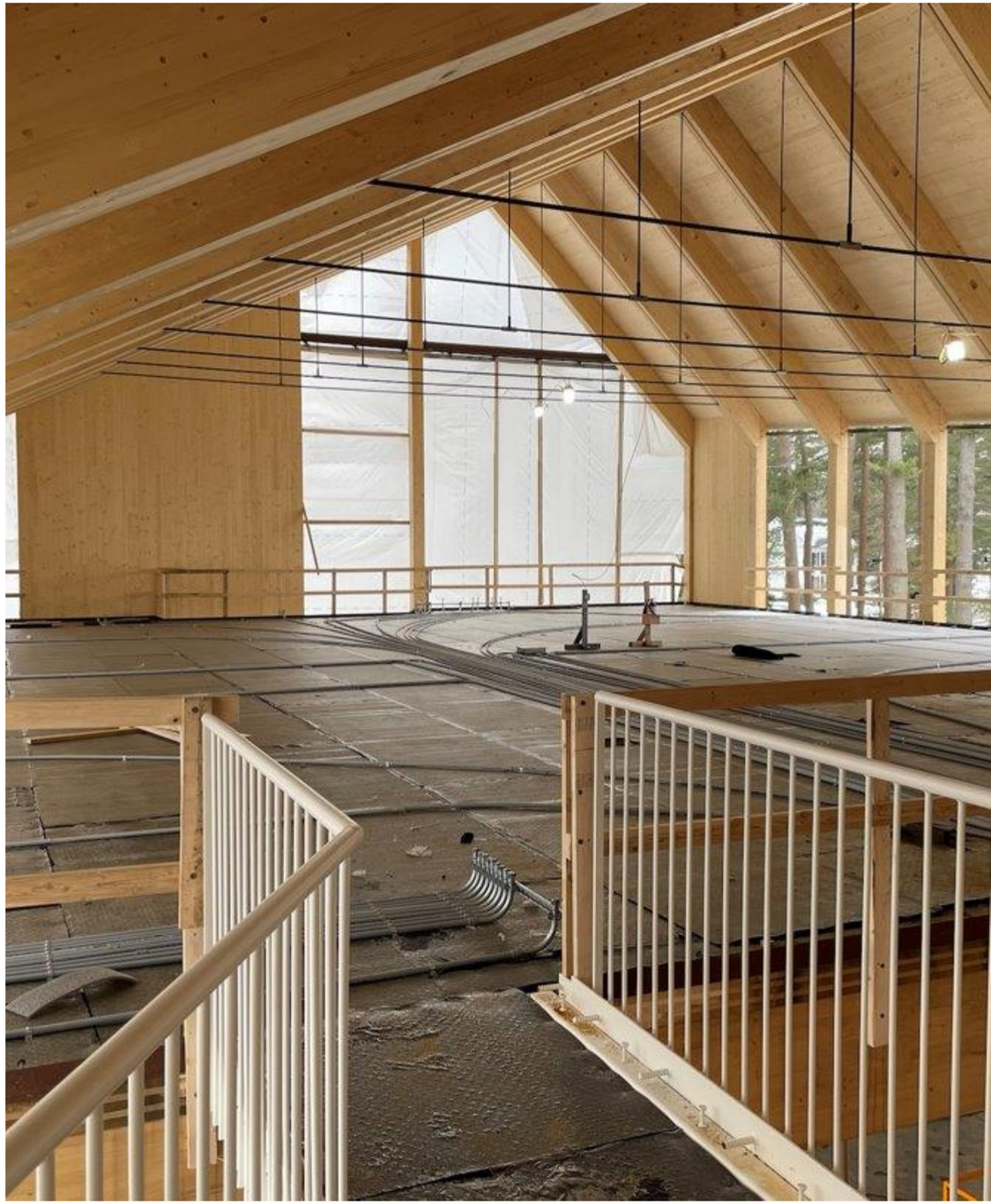


FINAL FABRICATION

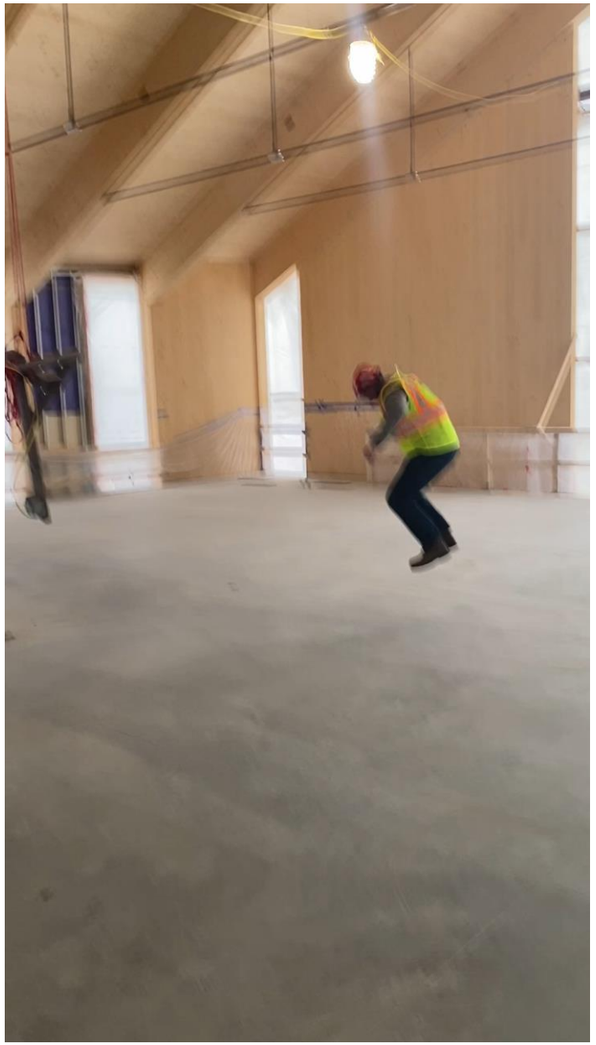
RESULTS AT BOWDOIN

- How did it go? Expectations / Reality
- No, really, how did it go? Side by side

Local Side by side



RESULTS



HOW TO TRULY LOCALIZE

HOW TO TRULY LOCALIZE

- Less Costly Capital Cost Equipment
- Stabilization of Lumber Cost
- Supply Chain Maturity
- Market – Sufficient Demand
  - Additional Manufacturing Choices
  - Additional Fabricator Options
  - More Experienced CMs