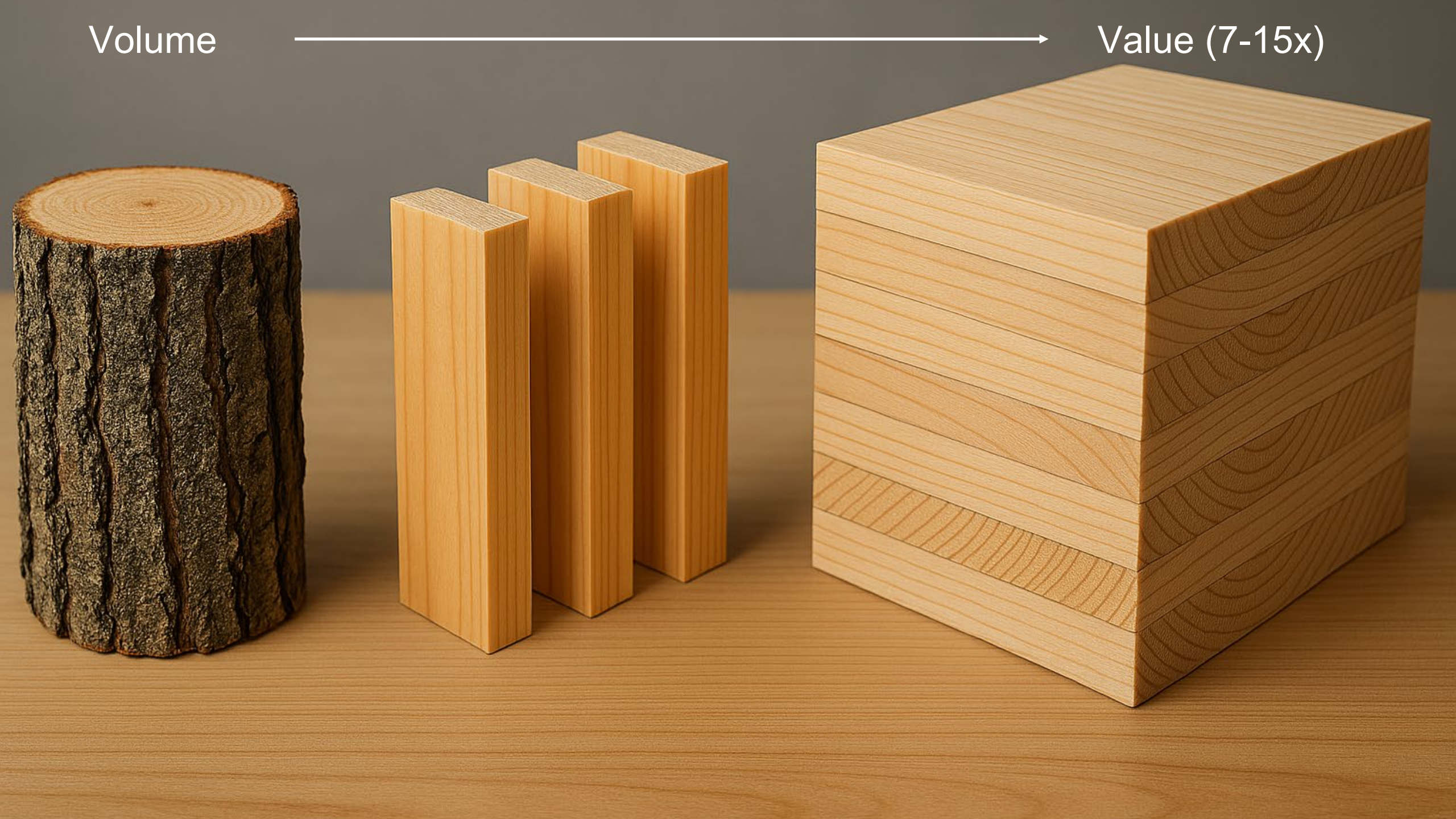
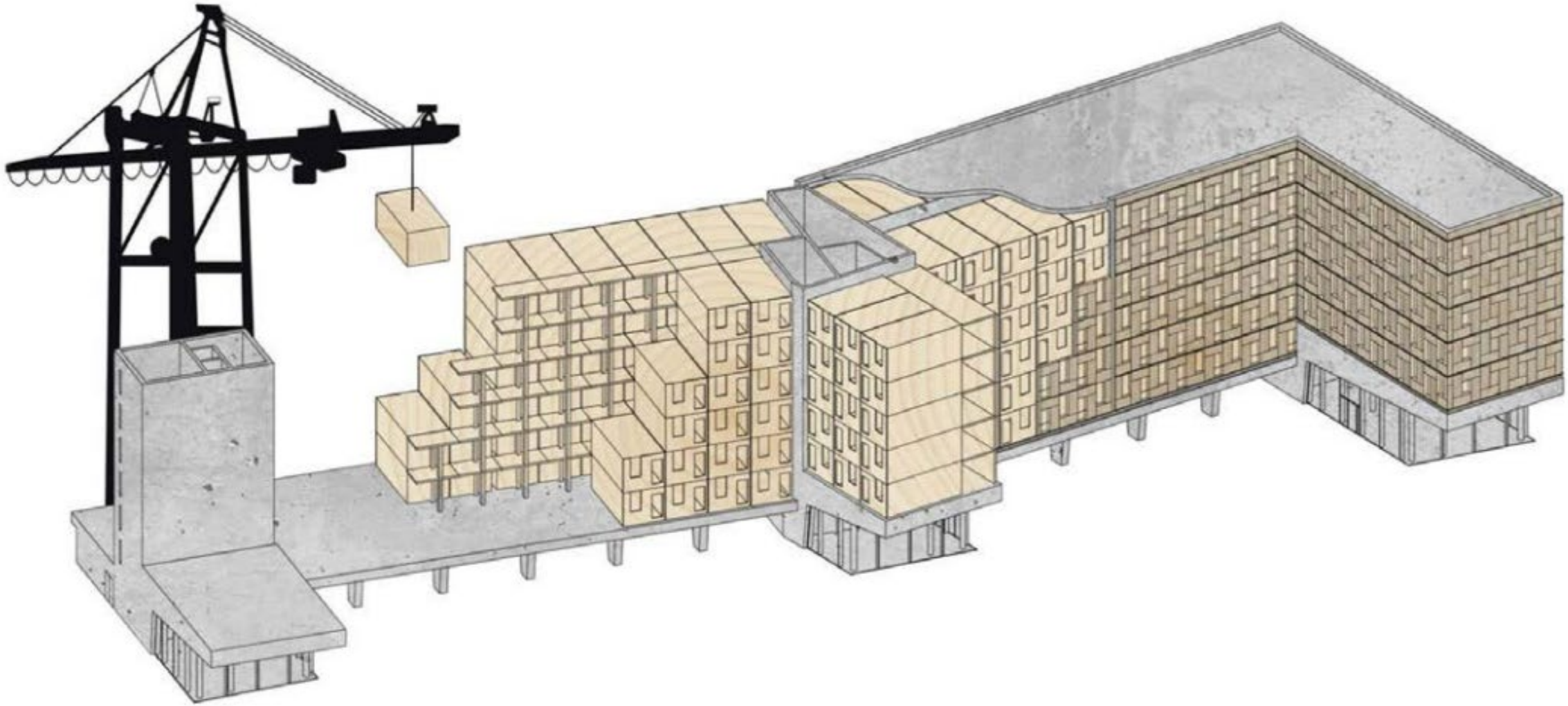
Mass Timber

Volume to Value


Volume
Value (7-15x)




LIGNA
SYSTEMS


RICHMOND
OLYMPIC OVAL
CANADA

Mass Timber Market Dynamics

Demand / Supply Gap in Mass Timber

- Demand growth in eastern markets is expected to rapidly outpace mass timber material supply capacity

Design Inefficiency in North American Mass Timber Production

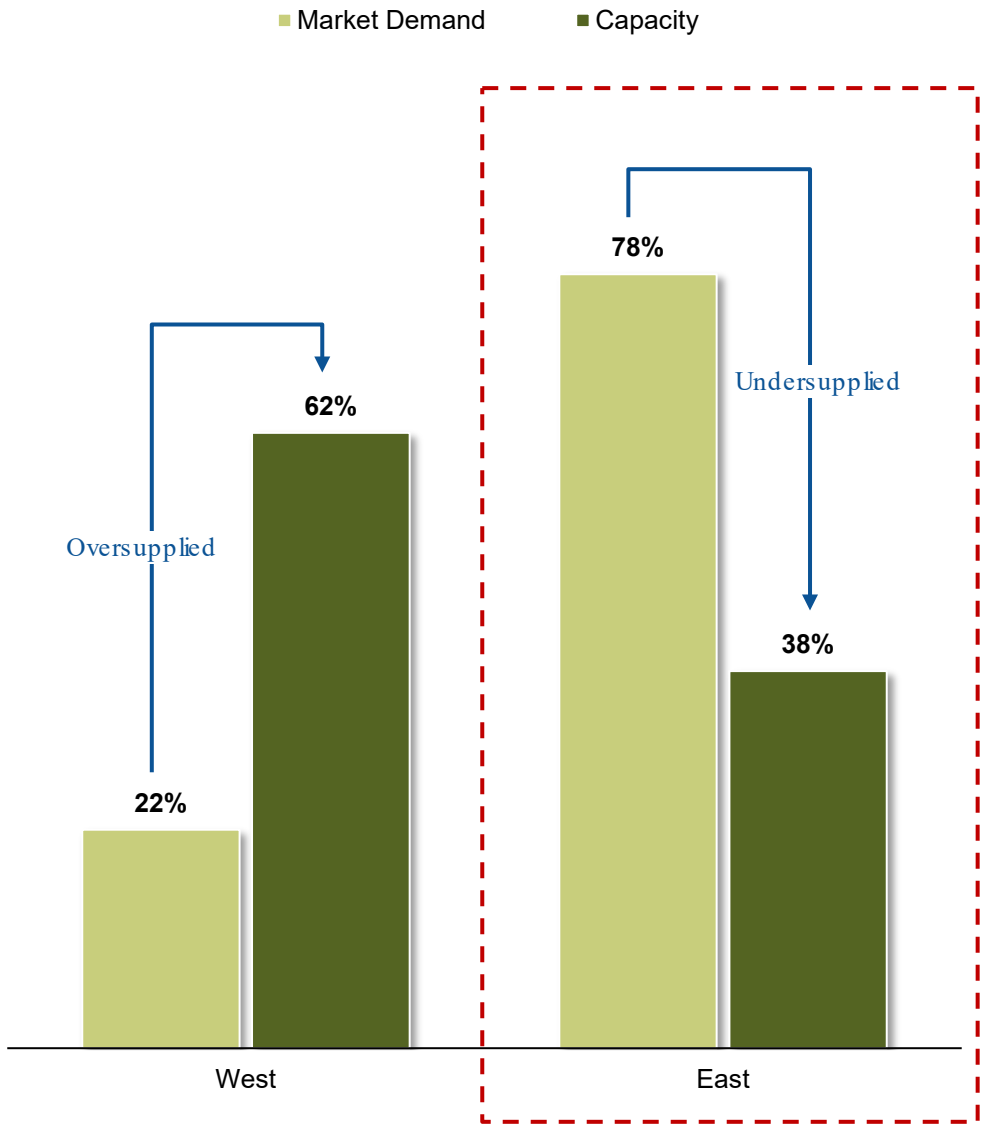
- Existing mass timber manufacturers in North America are not designed to efficiently supply components for large buildings (i.e., large glulam columns and beams)

Long Production Lead Times

- Mass timber projects have discouraging lead times +12 months
- MTC's goal is to fill this market demand and reduce lead times

Partnership for massive growth

- Many Canadian projects are currently supplied from European mass timber companies
- MTC can competitively service 90 million people within a 1,500 km radius (>50% within urban centres), reducing freight costs

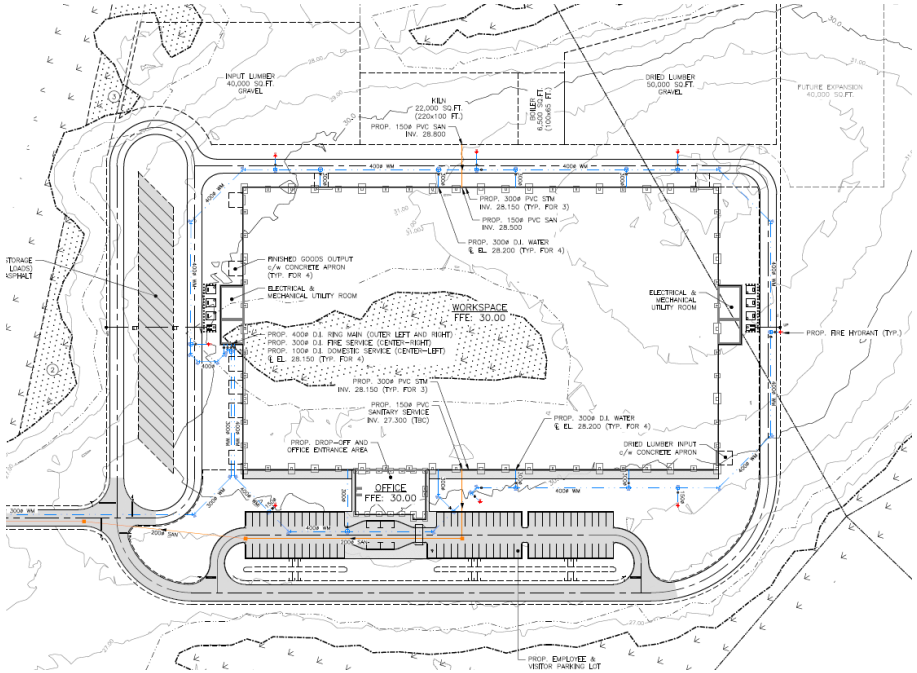


ary of Average Specific Gravity and Moisture Content by Mill and Nominal Cross Section

Nominal Size	Average Specific Gravity	Specific Gravity COV (%)	Average Moisture Content (%)	Moisture Content COV(%)
2x4	0.46	14%	14%	52%
2x6	0.43	10%	9%	50%
2x8	0.40	8%	10%	45%
2x4	0.42	15%	18%	40%
2x6	0.43	23%	13%	48%
2x8	0.45	15%	10%	52%
2x4	0.43	12%	12%	41%
2x6	0.45	10%	9%	37%
2x8	0.42	8%	12%	36%
All Sizes	0.43	14%	12%	52%

Known Specific Gravity of Selected Spruce Species		
Common Name	Scientific Name	Specific Gravity
Black Spruce	Picea mariana	0.38
Red Spruce	Picea Rubens	0.38
White Spruce	Picea Glauca	0.37

Mass Timber Company– Benefit to Nova Scotia



Infrastructure perspective:

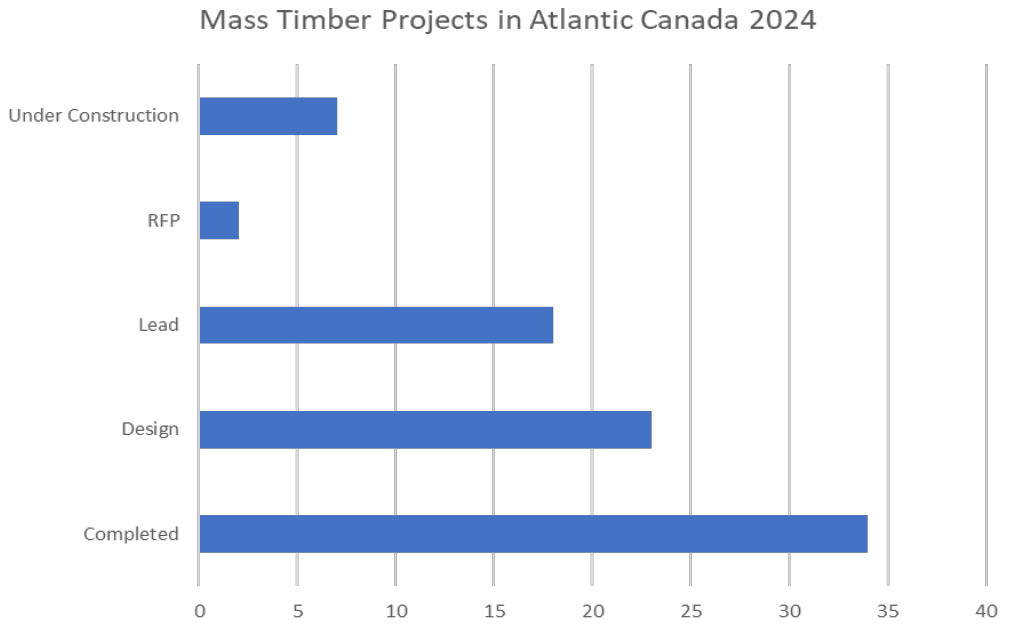
- Provides 2.5M ft^2 of construction annually (all markets)
- Increases infrastructure capacity ~ 4,000 - 5,000 units /year | 8,200 is target
- Expedited construction due to prefabrication – heads in beds faster (25-30% schedule efficiency)
- 40% less carbon than concrete & code approved for 12 storey's multi residential as well as school and healthcare.
- Projected that first 3 years of production will supply ONLY Atlantic Canadian demand.

Economic Perspective $215M investment:

- 120+ employees = $16.5M in Salaries
- EBIDTA $54M / year – 80% will be return to local economy
- Nova Scotia would be a world leader in value added wood product manufacturing and mass timber construction.
- Post secondary relationships are mature and will unlock new education streams and education differentiation

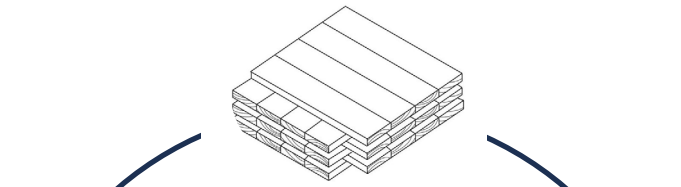
Project Pipeline

- **Scale of construction:** Nova Scotia Market – Has capacity for 5,200 housing units / year | province needs 8,200 / year to meet 2035 growth targets.
- **Housing:** HRM has the 5th most tower cranes in Canada next to Toronto, Vancouver, Calgary and Montreal.
- **Workforce Demand:** The construction industry requires 10,600 new workers by 2033 to meet housing needs.
- **Retirement Impact:** 16% of current construction workers are projected to retire by 2027, further straining workforce capacity.



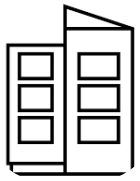
Mass Timber Company– Benefit to Nova Scotia

Mass Timber Provides a True Circular Economic Opportunity



Mass Timber Manufacturing

Design and Construction Services



Low Carbon Housing and;

Community Infrastructure

Maximize value of NS forest resources

Incentivize volume to value

Insulation from USA

- True circular economic solution to provide infrastructure capacity, keeping money, jobs, knowledge and innovation within the province
- Stabilizing the Nova Scotia sawmilling industry – add value and supply new markets, stabilizing commodity pricing and market diversification
- Finished wood products are less likely to attract tariffs
- 75% of softwood lumber exported to USA from Atlantic Canada

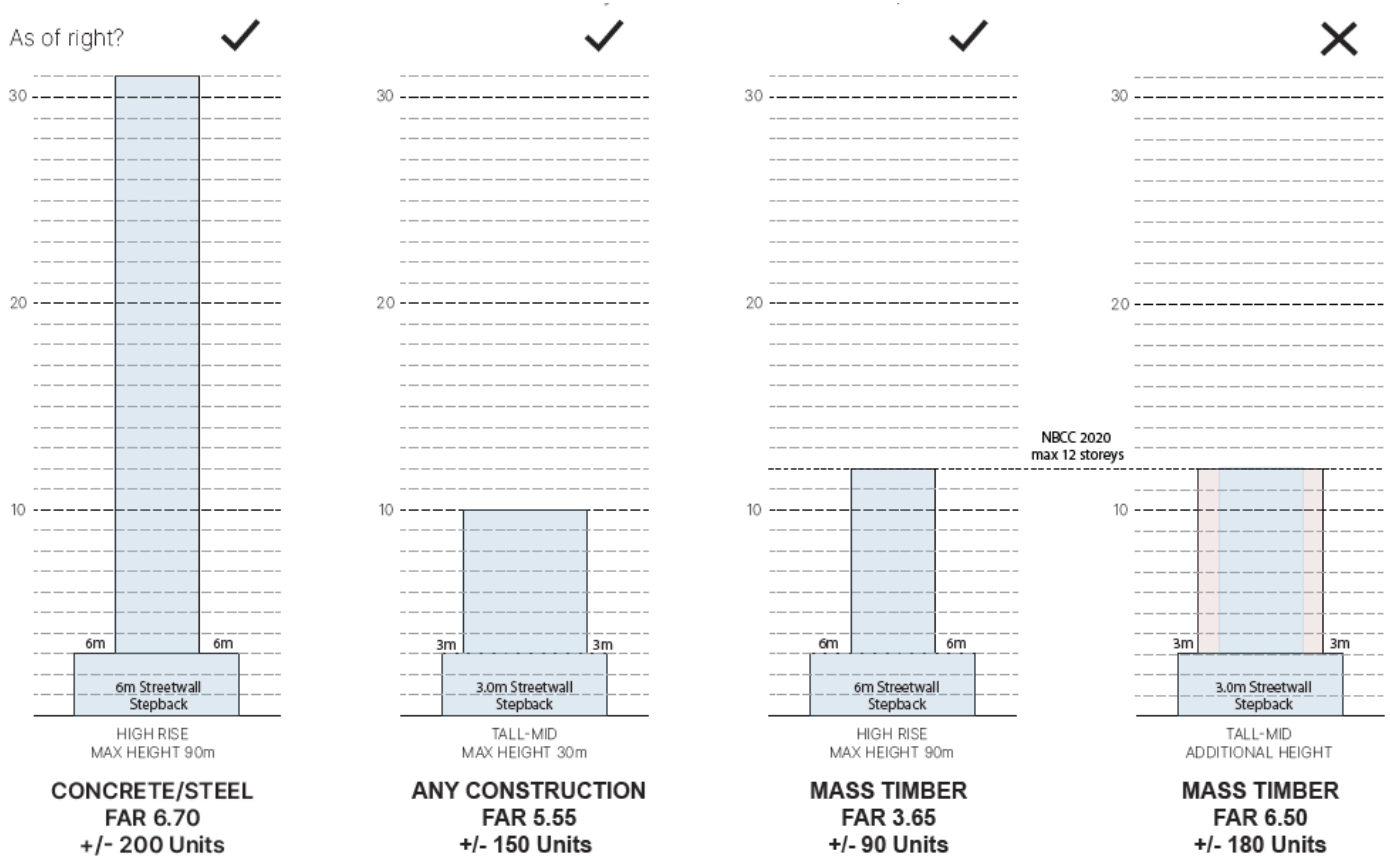
First nations

- Unlock wood supply, empowering new economic development in communities
- Community housing and infrastructure projects can be supplied, manufactured and installed by MTC - majority first nation owned business.

HRM Housing Initiative

Mass Timber Proposed Land Use Bylaw Changes

- **Mass Timber Bonus Density Initiative** proposed for Halifax Centre Plan
- **12-storey mass timber buildings now permitted** under the **provincial building code** (effective April 1st)
- **Bonus density incentive** encourages developers to choose mass timber over traditional materials
- **Modeled after Vancouver & Toronto**, aiming to cut carbon footprint & speed up construction
- **Actively championed** by the Mayor of Halifax, architects, and developers
- **Focused on sustainability** and strengthening the local economy



**This amendment will initiate a 12 storey mass timber project in Dartmouth, NS*

SIDEWALK Fathom bird

BUSINESS CASE FOR TALL WOOD

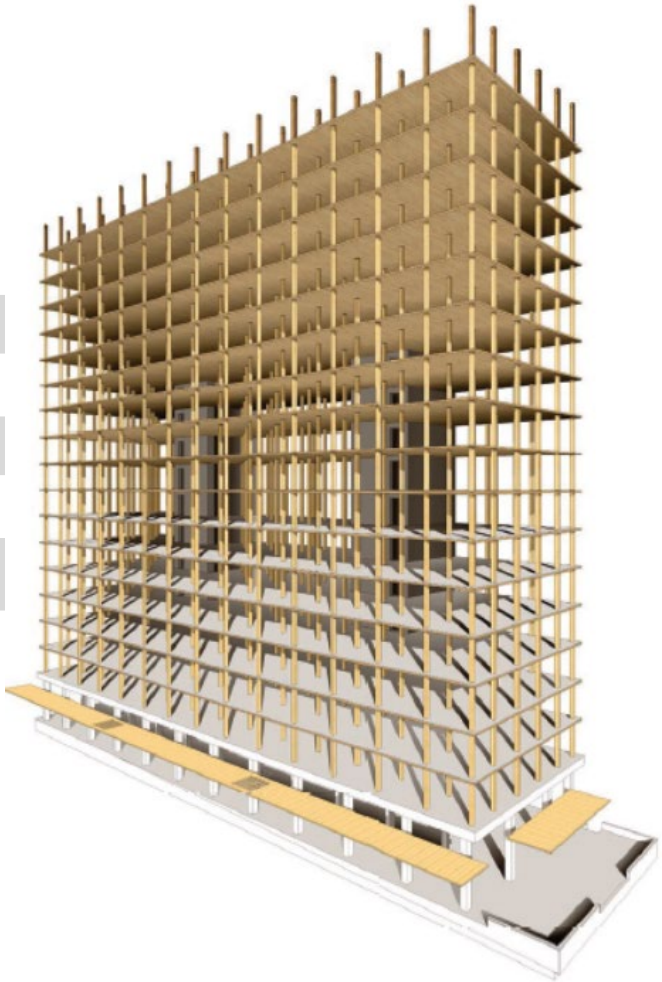
PROPOSED TALL WOOD RESIDENTAL TOWER

- The Reveal -

Cost Results

Premium for Mass Timber	**175,000 ft2**	**$5.30 / ft2**	**$927,500**
Schedule Savings	**-45 weeks**	**$55,000/week**	**$2,475,000**
		Total:	**- $1,547,500**

- Formwork based on **$18/sf**
- Rebar costs also increasing



MASS TIMBER FUNDAMENTALS

CONVENTIONAL SCHEDULE

MASS TIMBER SCHEDULE

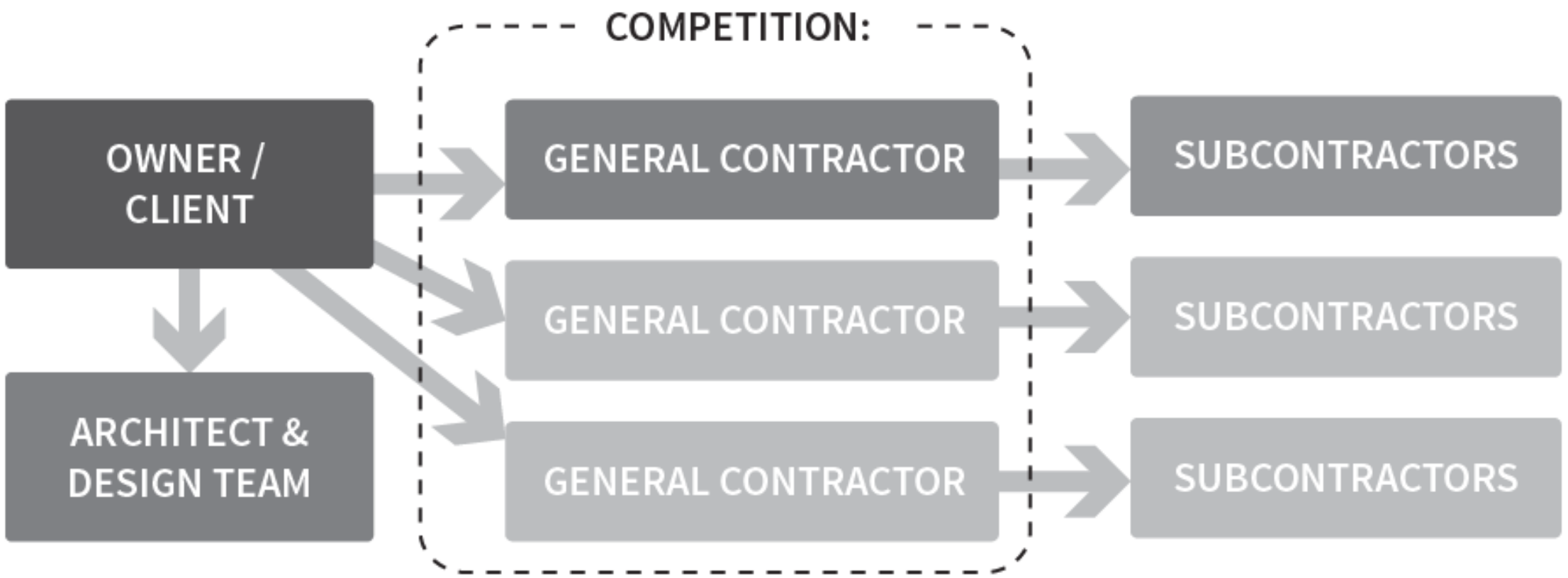
*Cost and time efficiency's are further realized when a team is awarded based on experience and partnership dynamics. If the team is repeated for bundled projects, further efficiencies are inevitable.

The new Affordability is Cost and Schedule Certainty

Contract Delivery Models

Construction Management vs. Hard Bid

Hard Bid


COMPETITION:
OWNER / CLIENT
ARCHITECT & DESIGN TEAM
GENERAL CONTRACTOR
GENERAL CONTRACTOR
GENERAL CONTRACTOR
SUBCONTRACTORS
SUBCONTRACTORS
SUBCONTRACTORS

Hard Bid Reality

Market

Designers

Contractors

Hard Bid & Mass Timber

CONVENTIONAL BUILDINGS (ie. Steel and Concrete):

- Optimize functionality/programming first – client driven & often not aware of constructability constraints
- Recycling previous designs (ie. 30'x30' not conducive to mass timber)
- Design objectives are not focused on exposing the structure
- M&E systems are covered via. drop ceilings and less effort is required (ie. 30-40% of total build cost)
- Contingencies are blindly thrown at project innovations (Mass timber bids, M&E systems) because of unknowns and lack of **mass timber supplier engagement** and GC experience

PROJECT DELIVERY (ie. LUMP SUM) & CONVENTIONAL DESIGN & ESTIMATING METHODS FEED PERCEPTION OF MASS TIMBER COST PREMIUMS

bird


I don't have any historic cost data for this structural system.
Who makes this stuff? How do you procure it?
Photo: Swinerton

Why Collaboration is Critical During Design for Mass Timber

- Mass timber is a prefabricated system not a commodity construction solution
  - \+ Design Effort
  - \- Construction schedule
  - \- Margin for error on site
- Pre-construction Resource heavy – maximizing creativity of the team
- Glulam and CLT product options differ based on region and mass timber manufacturing capability.
- Mass timber structural grid needs to be evaluated parallel to early programming exercises.
- Engage AHJ!

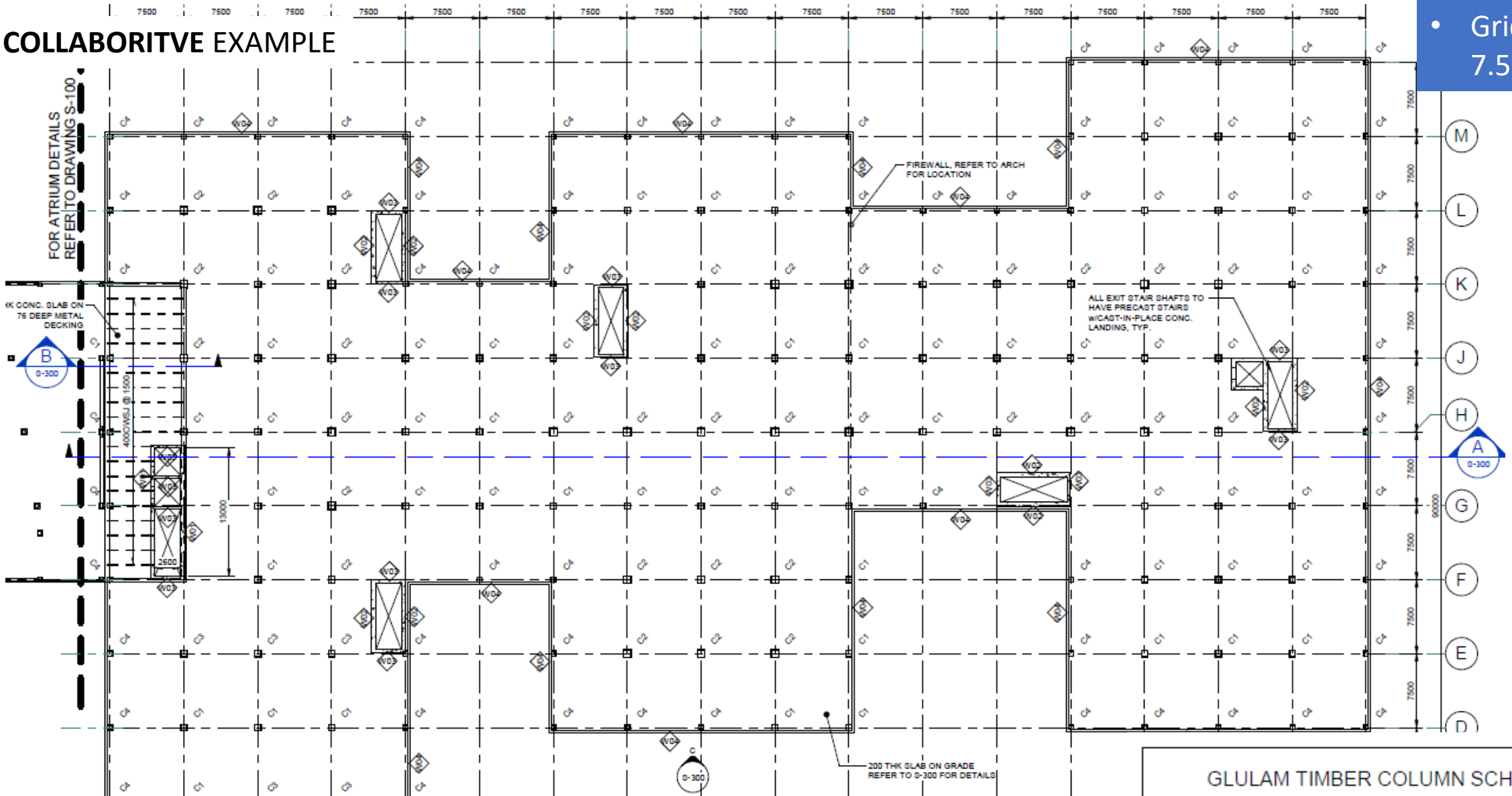
Design for Manufacturing and Assembly (DfMA approach)

Design according to manufacturing and supply chain constraints

North American Mass Timber Manufacturing Capabilites									Maximum CLT			Maximum Glulam		
Company	MT Panel Start Date	CLT	GLT	Panel Capacity (m3)	Glulam Capacity (m3)	PRG 320 Certification	Species Used	CoC Certification	Width (ft)	Length (ft)	Thickness (inches)	Width (inches)	Depth (inches)	Length (ft)2
Mercer***	2020	Y	N	185,000	0	PFS TECO	SPF, DF	SFI, FSC, PEFC	12	60	12	N/A	N/A	N/A
SmartLam NA, MT	2012	Y	N	75000	0	APA	SPF-S, HF	SFI, FSC	10	53	12	N/A	N/A	N/A
Structurlam, AR	2021	Y	Y	75000	31,000	APA	SYP	FSC	12	60	12	20	43.3	65
MTC, NS	2025	Y	Y	70,000	30,000	WRD, APA	SPF	FSC SFI CSA	11.5	60	12	23	80	60
Sterling****	2022	Y	X	59,500	0	PFS TECO	SYP	Unknown	8	18	9.6	N/A	N/A	N/A
Sterling****	2022	Y	X	59,500	0	PFS TECO	SYP	Unknown	8	18	9.6	N/A	N/A	N/A
Nordic	2011	Y	Y	50,000	31,000	APA	SPF	FSC, CEAF	8.8	64	12	23.75	96	80
SmartLam NA, AL	2018	Y	Y	50,000	19,000	APA	SYP	SFI, FSC	8	52	12.4	12	36	60
Element5, ON	2020	Y	Y	45,000	5,000	APA	SPF	FSC	11.5	52.5	15	TBD	TBD	TBD
Structurlam, BC	2011	Y	Y	45000	19,000	APA	SPF, DF	FSC	10	40	12	20	96	110
StructureCraft	2018	X	N	30,000	0	APA	SPF, DF, HF, SS,	FSC, PEFC	12	60	12	N/A	N/A	N/A
Freres	2017	X	X	30,000	0	APA	DF	Unknown	11.8	48	12	N/A	N/A	N/A
Kalesnikoff	2020	Y	Y	30,000	13,000	APA	DF, HF, SPF	FSC, PEFC	11.5	60	15.2	36	96	60
DR Johnson	2015	Y	Y	30000	20,000	APA	DF	FSC	10	41.5	9.6	20	108	145
Vaagen	2020	Y	Y	30,000	6,000	APA	DF, SPF	SFI, PEFC	4	60	9.7	12	48	60
Element5 QC**	2015	Y	Y	10000	0	APA	SPF	FSC	9.5	35.5	16	N/A	N/A	N/A
Western Archrib	N/A	X	Y	0	10,000	APA	DF, HF, SPF	FSC	N/A	N/A	N/A	25	0.25	7
Western Archrib		X	Y	0	10,000	APA	DF, HF, SPF	FSC	N/A	N/A	N/A	25	0.25	7

COLLABORITVE EXAMPLE

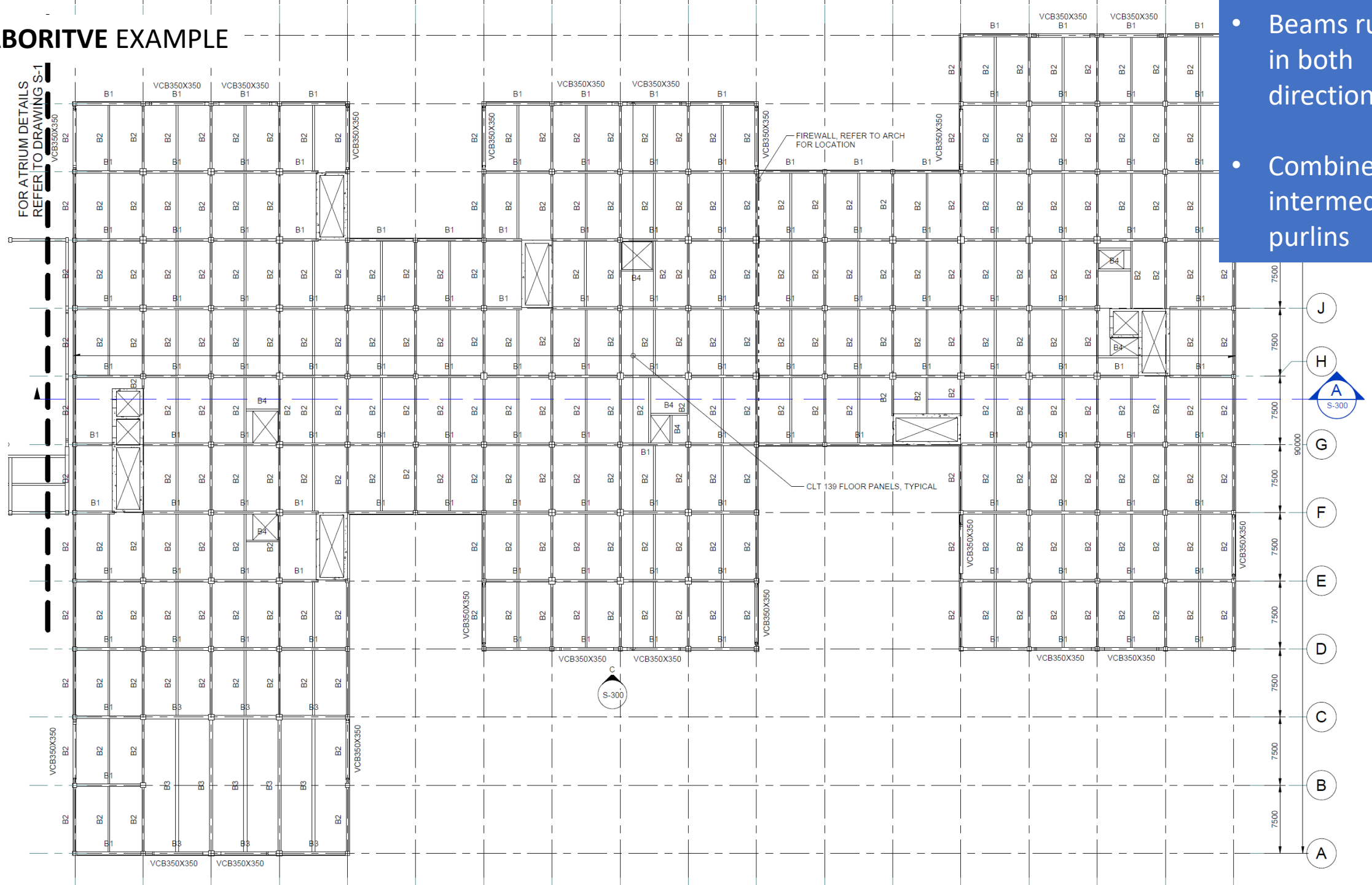
- Grid Spacing 7.5m x 7.5m



GLULAM TIMBER COLUMN SCHEDULE			
MARK	SIZE	BOTTOM LEVEL	TOP LEVEL
C1	550x550	GROUND FLR	ROOF
C2	700x700	GROUND FLR	ROOF
C3	600x600	GROUND FLR	ROOF
C4	450x450	GROUND FLR	ROOF

Veronica Madonna & Patrick Crabbe

COLLABORITVE EXAMPLE

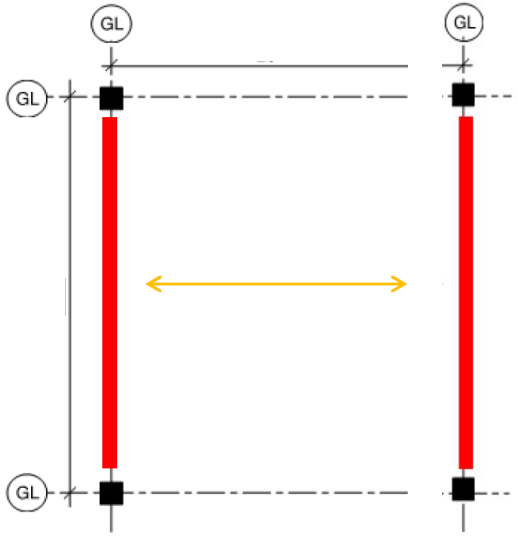


- Beams running in both directions
- Combined with intermediary purlins

‹ Crabbe

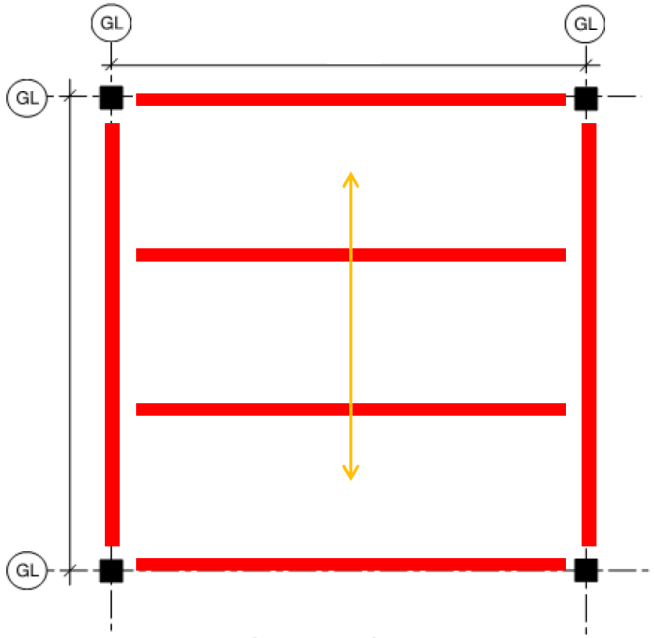
COLLABORITVE EXAMPLE

Commercial Office Grids



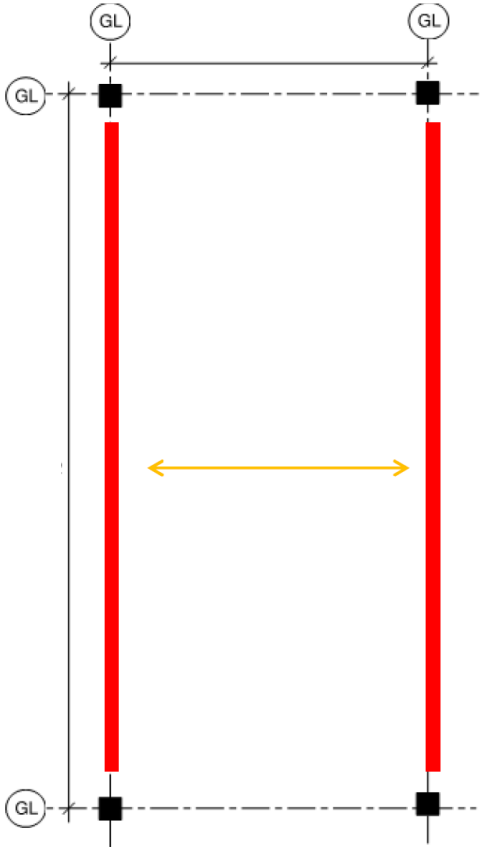
6m x 6m

+ Clear Span Deck
+ GL Girders



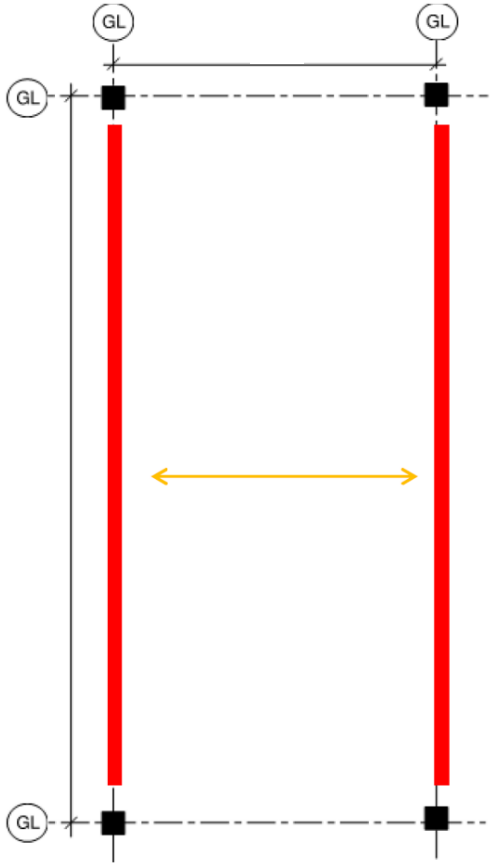
9m x 9m

+ Thin Deck
+ GL Girders & Purlins



6m x 12m

+ Clear Span Deck
+ GL Girders & Purlins

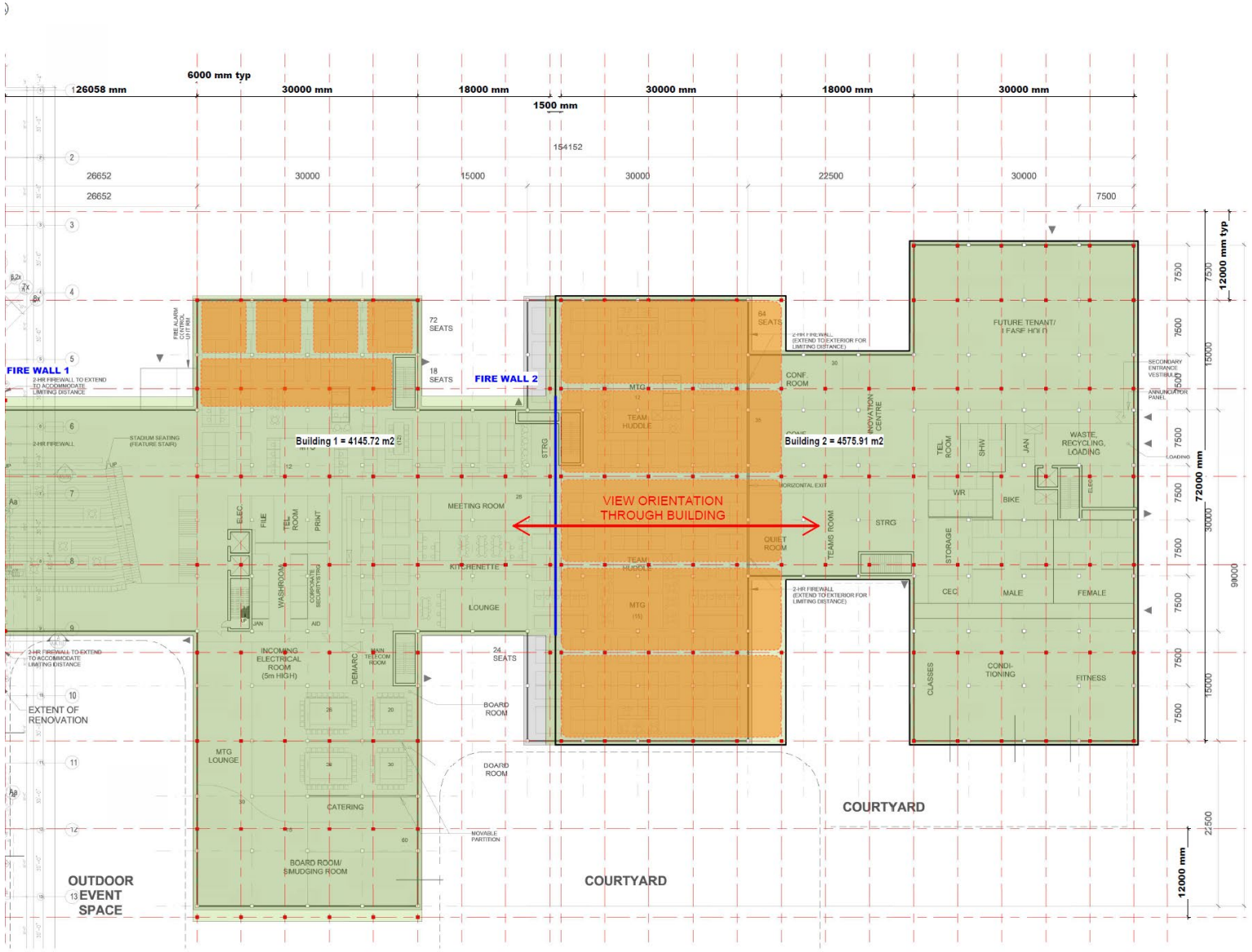


6.1m x 13.7m

+ Clear Span Deck
+ Hybrid Girders

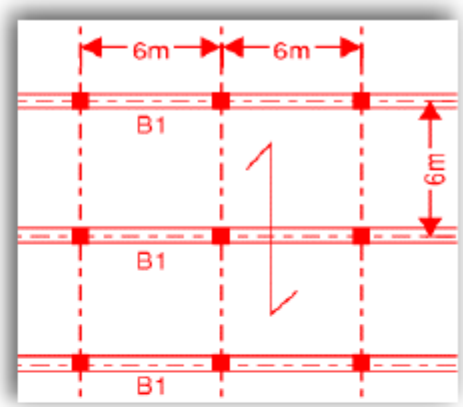
COLLABORITVE EXAMPLE

6m x 12m Programming Check



Footing Sizing Analysis

Beam Designation	Trib Width [m]	L [m]	Beam section b [mm]	Beam section d [mm]	wf [kN/m]	fb [MPa]	Kzbg	Mf [kN.m]	Mr1 [kN.m]	URb Mf/Mr	fv [MPa]	Vf [kN]	Vr [kN]	URs Vf/Vr
B1	6	6.0	265	608	68.55	28.2	0.971	308	402	0.77	2.50	209	242	0.86



CLT=5-ply, 175mm

RCD Column Schedule: C2 - 700 x 700

Proposed Glulam Column	Level	b (mm)	d (mm)	Pry (kN)	Pf (kN)	UR (Pf/Pr)
H/8 (interior, under penthouse)	3	457	489	2682	1134	0.42
	2	457	489	2796	1546	0.55
	Ground Floor	457	489	2778	1957	0.70

qr=200 kPa (SLS)

Footing	Footing b1 (mm)	Footing b2 (mm)	t (mm)	qs (kPa)	UR qs/qr
H/8	3000	3000	800	161	0.81

RCD Column Schedule: C1 - 550 x 550

Proposed Glulam Column	Level	b (mm)	d (mm)	Pry (kN)	Pf (kN)	UR (Pf/Pr)
G/16 (interior, under roof)	3	365	380	1600	260	0.16
	2	365	380	1710	672	0.39
	Ground Floor	365	380	1692	1083	0.64

qr=200 kPa (SLS)

Footing	Footing b1 (mm)	Footing b2 (mm)	t (mm)	qs (kPa)	UR qs/qr
G/16	2500	2500	550	127	0.64

RCD Column Schedule: C4 - 450 x 450

Proposed Glulam Column	Level	b (mm)	d (mm)	Pry (kN)	Pf (kN)	UR (Pf/Pr)
M/1 (corner)	3	315	342	1154	65	0.06
	2	315	342	1263	212	0.17
	Ground Floor	315	342	1245	355	0.28

qr=200 kPa (SLS)

Footing	Footing b1 (mm)	Footing b2 (mm)	t (mm)	qs (kPa)	UR qs/qr
M/1	1500	1500	450	120	0.60

RCD Column Schedule: C4 - 450 x 450

Proposed Glulam Column	Level	b (mm)	d (mm)	Pry (kN)	Pf (kN)	UR (Pf/Pr)
M/3 (perimeter)	3	315	342	1154	130	0.11
	2	315	342	1263	378	0.30
	Ground Floor	315	342	1245	622	0.50

qr=200 kPa (SLS)

Footing	Footing b1 (mm)	Footing b2 (mm)	t (mm)	qs (kPa)	UR qs/qr
M/3	2000	2000	450	116	0.58

COLLABORITVE EXAMPLE

Glulam Beam Volume Comparison

6m x 12m					
Beam	#	B (mm)	D (mm)	L (m)	V (m3)
GB1	181	265	608	990.2	159.5
GB2	44	265	532	252.3	35.6
GB3	10	265	760	71.8	14.5
Total	235				209.6

6m x 12m	209.6
Original	414.5
Savings	49%

Original 7.5m x 7.5m					
Beam	#	B (mm)	D (mm)	L (m)	V (m3)
B1	138	315	608	935.3	179.1
B2	262	215	494	1847.3	196.2
B3	11	365	874	114.7	36.6
B4	8	215	418	29.3	2.6
Total	419				414.5

Competitively
Early on Board Mass Timber Supplier

Early on Board - key reasons

- Design optimization, fabrication and connection efficiency
- Can be achieved with minimal design information
- Design Assist Provides an opportunity for an **offramp**
- Focus on value and collaboration (unlocking the creativity of the team) for better outcomes
- Facilitates better design integration with MEP Trades
- Increases schedule and cost certainty
- Overall strong risk mitigation – specifically on large projects

Early on Board – RFP Requirements

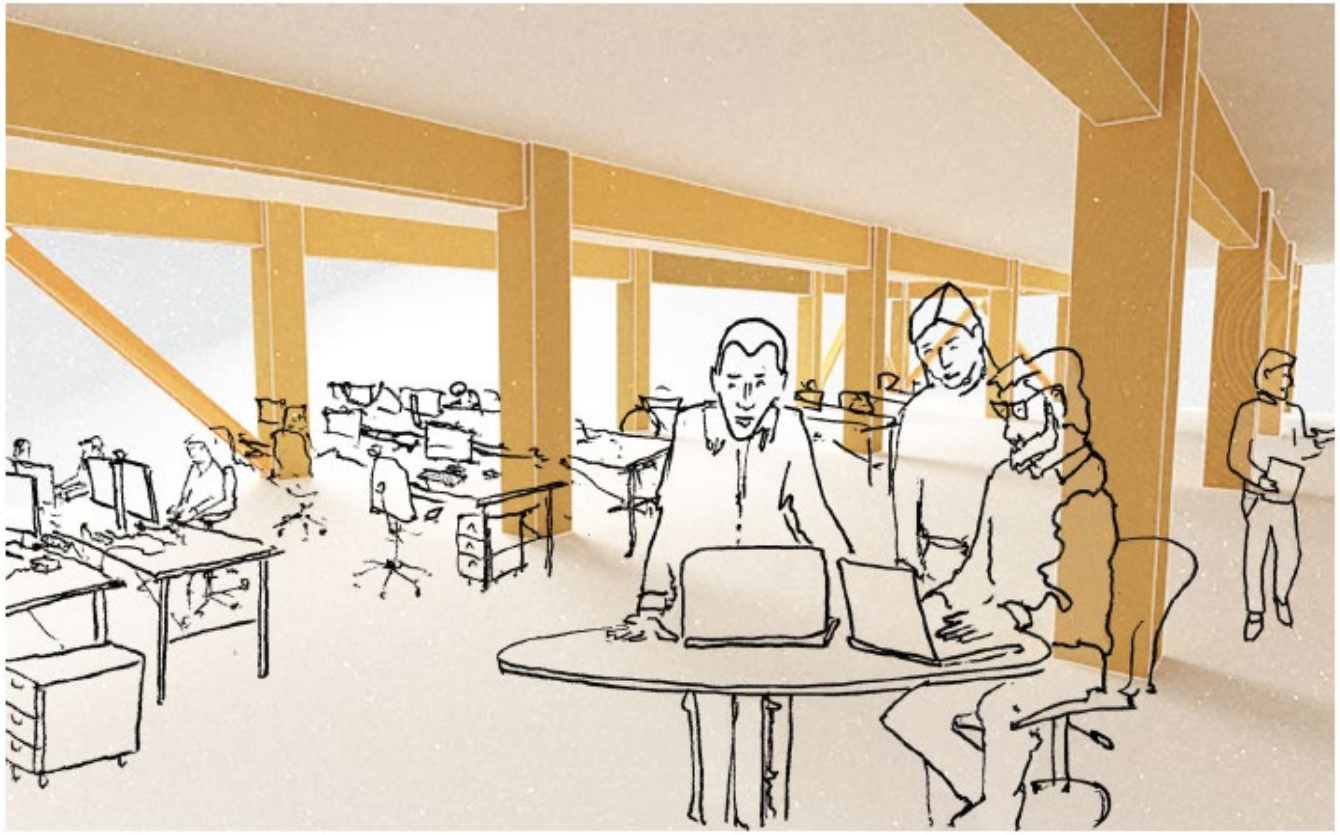
- Architecture
  - Preliminary layout and elevations (spans)
  - Intended Fire Rating
  - Exposure objectives including Intended coatings / finishes
- Structural
  - Rough sizing of mass timber components and volumes.
  - No connection details necessary – very limited.
- Schedule
  - Projected design assist period and award date
  - Mass timber delivery date

RFP Evaluation Matrix

Evaluation Matrix	
Scoring Criteria	**Top Score**
Design Assist Cost	**10**
Budget Price (inc. adders and subtractors)	**35**
Value Engineering	**35**
Description of suggestions	7
Supporting information to validate suggestions:	7
Estimated cost savings	7
Estimated schedule savings	7
Milestone Schedule	**7.5**
Project Team	**7.5**
Procurement Preference	**5**
Total	**100**

Carbon Benefit

Sustainability – Decarbonization



Cost and Carbon for Commercial Construction in Canada

For: The Mass Timber Institute, Daniels Faculty of Architecture, Landscape and Design, at the University of Toronto
By: Ha/f Climate Design in collaboration with Entuitive and Bird Construction

/ Project Team

MASS TIMBER INSTITUTE

ha/f

ENTUITIVE

bird

This report is supported by the Mass Timber Institute and Entuitive. The following project team was assembled by the Mass Timber Institute to undertake the study:

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Shan Shukla, Research Coordinator

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Karimat Okunlola, Structural Designer

Bird Construction Inc:
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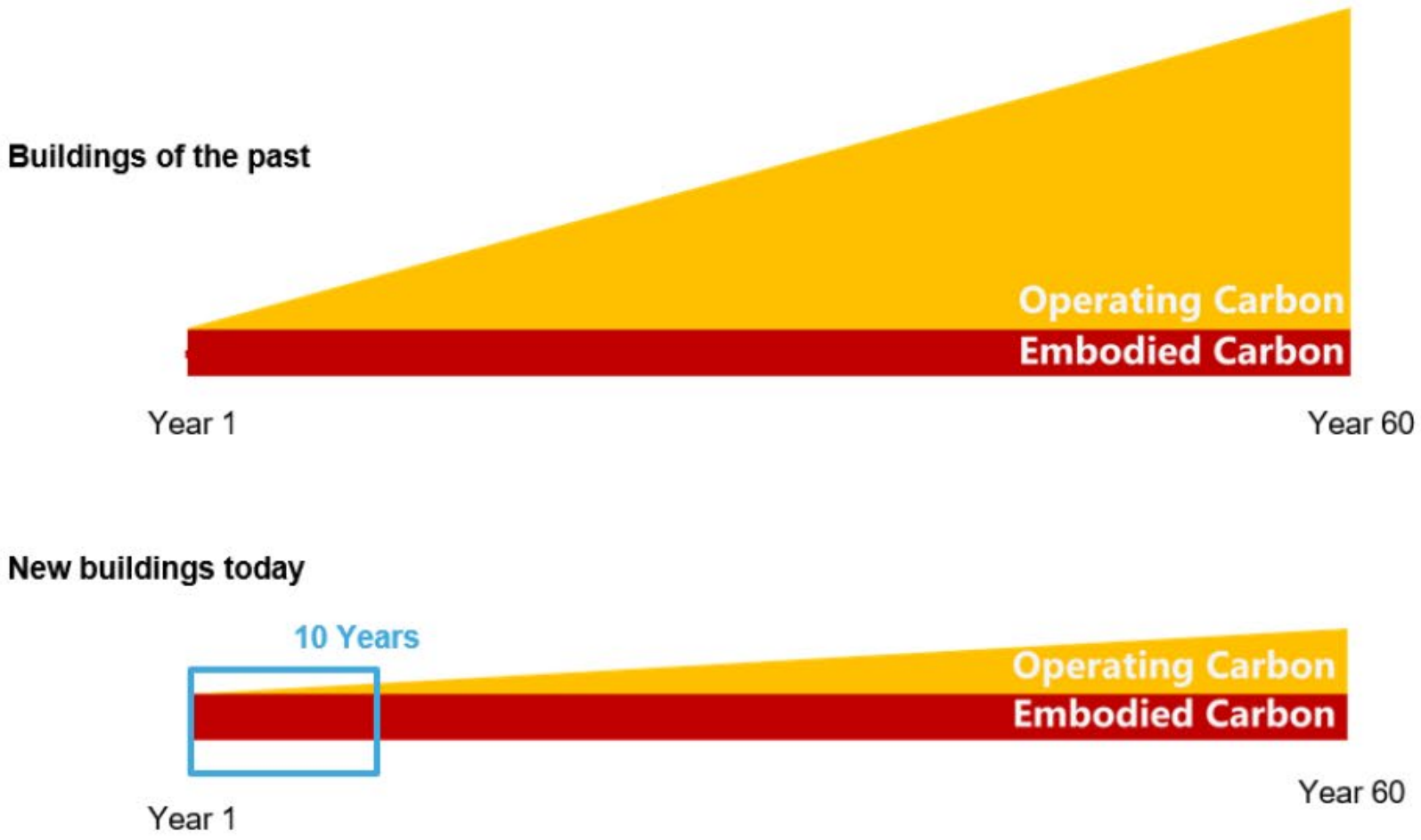
Eddie Baek, Estimating Manager

Publication Date:
June 03, 2024

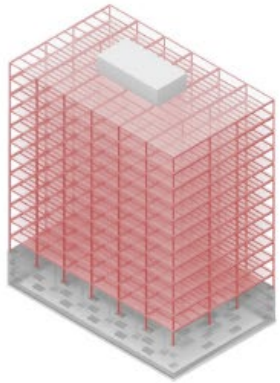
Sustainability – Decarbonization



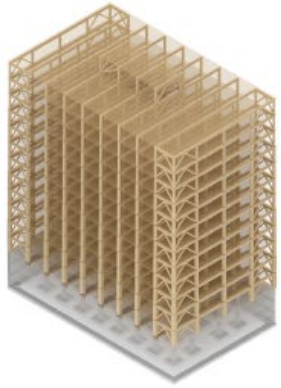
New buildings are increasingly energy efficient, and energy is increasingly lower-carbon

Sustainability – Decarbonization

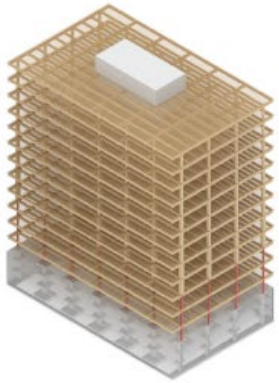
D1 - Concrete Design



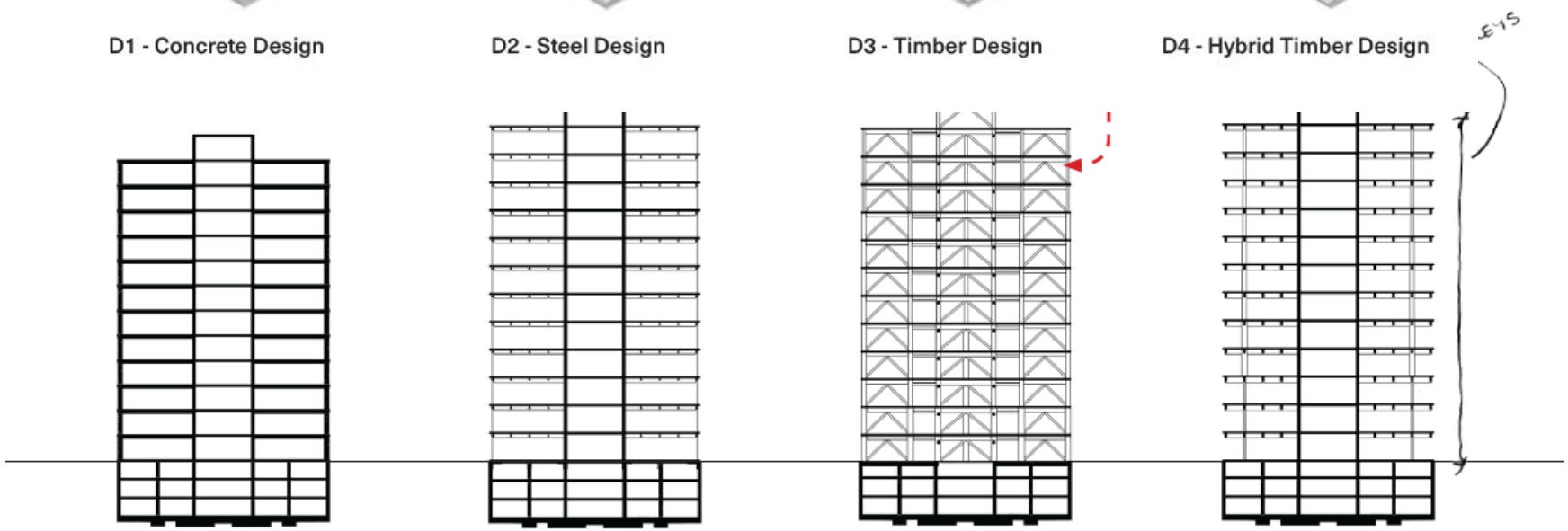
D2 - Steel Design



D3 - Timber Design



D4 - Hybrid Timber Design



Design 1
D1-Reinforced Concrete

The reinforced concrete design employs a 12m x 9m typical column spacing with floor framing consisting of 250mm concrete slabs with 300mm drops. The floor to floor height is 4m.

Design 2
D2-Steel

The structural steel design also has a 12m x 9m typical column spacing with floor framing consisting of 114mm concrete on a 76mm metal deck.

Design 3
D3-Mass Timber

The all-timber design employs a 7.5m x 9m column spacing with a typical floor framing consisting of 7-ply CLT spanning between glulam girders.

Design 4
D4-Hybrid Timber

The hybrid timber design has a larger column spacing at 9m x 9m with a floor framing consisting of 5-ply CLT between glulam purlins which are picked up by beams in both directions

Sustainability – Decarbonization

The steel cost estimate was the lowest at 9% less than concrete, 8% less than all-timber, and 30% lower than hybrid timber

	Calgary (77%)	Vancouver (94%)	Toronto (100%)
Concrete	$ 18,862,624	$ 23,027,099	$ 24,496,914
Steel	$ 17,230,132	$ 21,034,188	$ 22,376,795
All-Timber	$ 18,661,502	N/A	$ 24,235,716
Hybrid Timber	$ 22,876,673	$ 27,927,367	$ 29,709,965

Fig 11. Total costing results including location factors for three cities. Price is based on market pricing as

What are the embodied carbon and construction costs of a generic 12-storey office building built out of a) reinforced concrete, b) steel, c) mass timber, and d) hybrid timber structural systems?

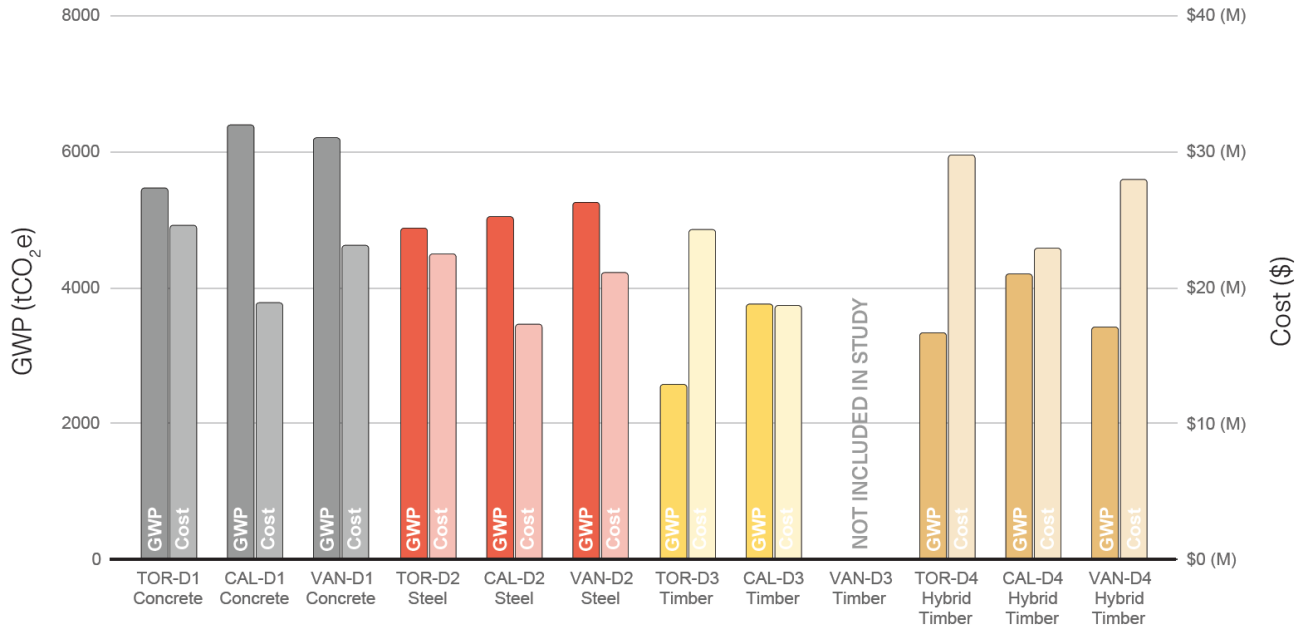
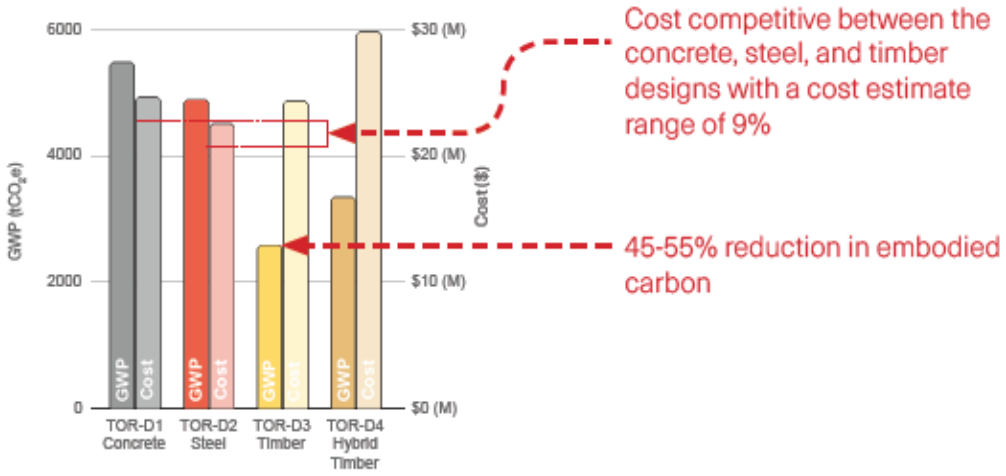


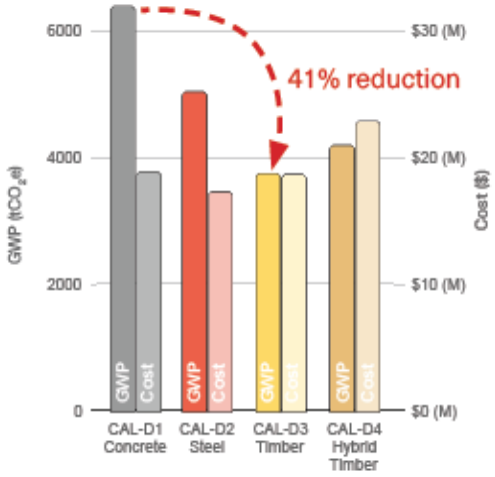
Fig 17. A-C Embodied carbon (GWP) and upfront cost of all designs

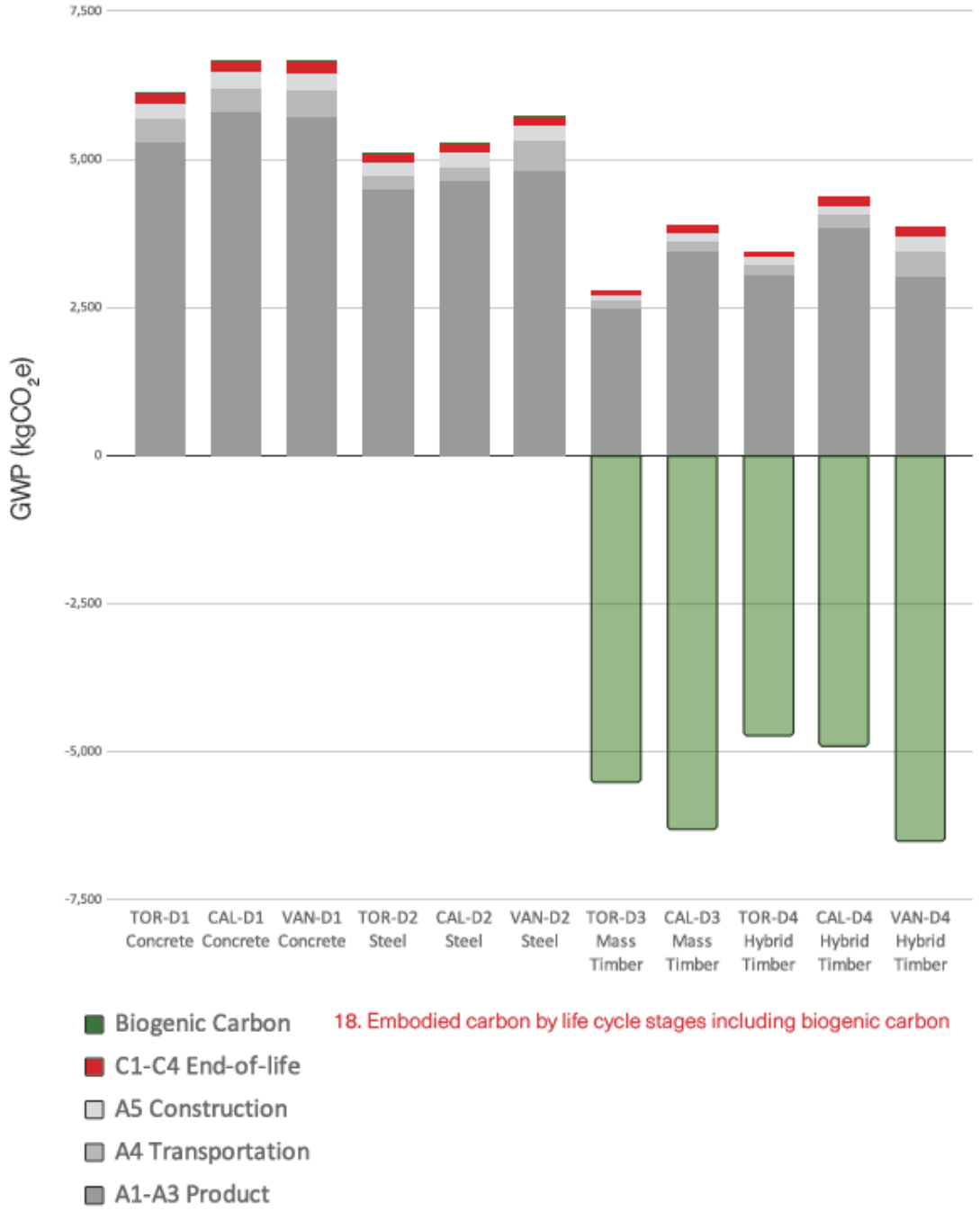
Sustainability – Decarbonization

Toronto



Calgary





18. Embodied carbon by life cycle stages including biogenic carbon

bird

Mass Timber

Bird is a North American leader in wood construction with unmatched expertise, experience, and supply chain knowledge.

May 2025

$1.3B

30 Completed Projects

$932M

15 Projects Awarded / Under Construction in Canada

$3B

Targeted Mass Timber Pursuits

Mass Timber Centre of Excellence

- PROCURMENT, DESIGN AND PRE-CONSTRUCTION EXPERTISE
- SUPPLY CHAIN AND MASS TIMBER PRODUCT SPECILIST
- INDUSTRY LEADING CoC INSURANCE
- PROPRIETARY QA/QC & EXECUTION STRATEGIES
- EMBODIED CARBON & CARBON LITERECY
- MASS TIMBER INSTALLATION TRAINING PROGRAM