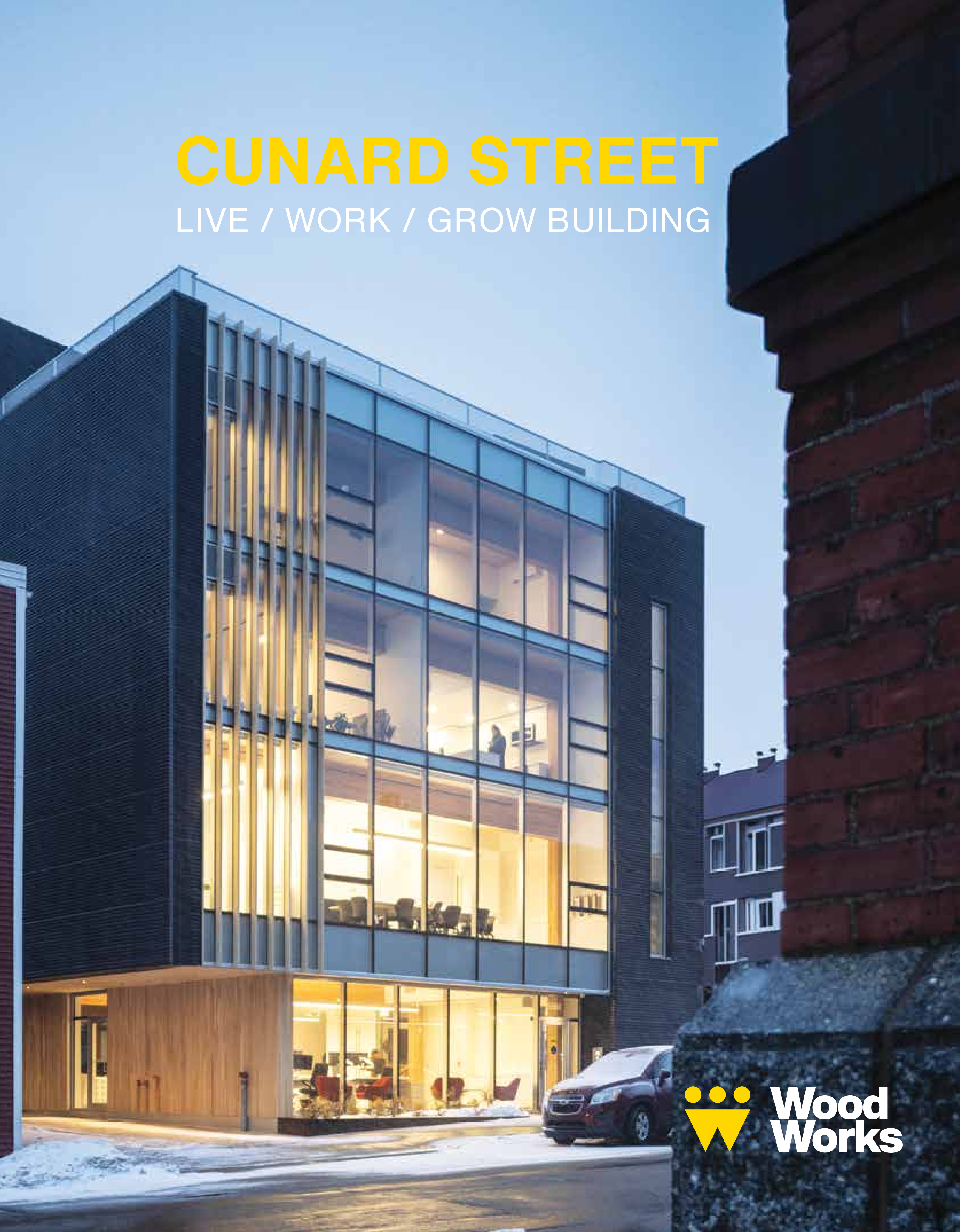
CUNARD STREET

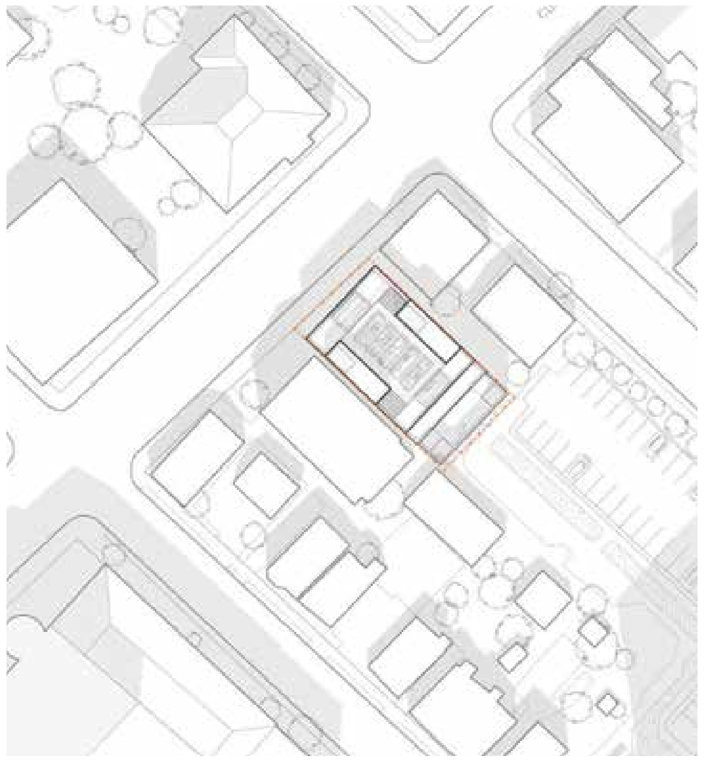
LIVE / WORK / GROW BUILDING



Wood Works

Cunard Street Live Work Grow Building

The new home for FBM is constructed on a 50 ft by 100 ft brown field site in the north end of Halifax; close to the city's Commons. A one-storey transmission shop was previously located on the site, making the soil and bedrock remediation necessary to allow for the current development.

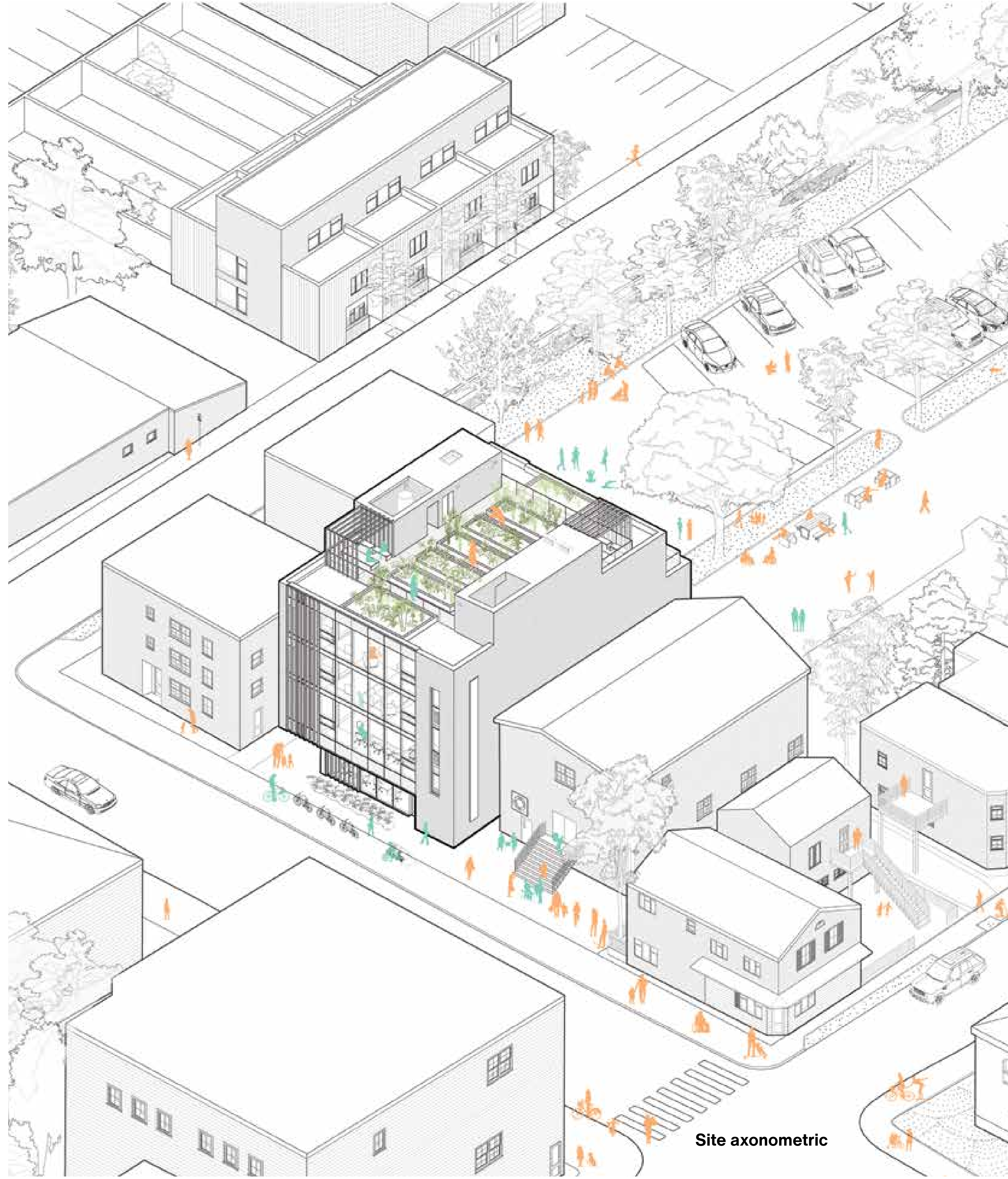


Site plan

The Commons, in the centre of the city, forms a green swath of space for recreation, sports fields, and well-being. Surrounding the site is a mix of occupancies, including social housing for seniors, small scale businesses, day cares, bars and restaurants, military uses at the Halifax Armory for the Princess Louise Fusiliers and Cadet units, Urban agriculture, and several architecture firms that have recently chosen this area for their new offices.

The design of the new Cunard St Live/ Work/ Grow building embodies the values of FBM Architecture - a place for 'people driven design'. This is expressed through the firm's interest in contributing to the community, through the materials, and the work culture that the building supports.

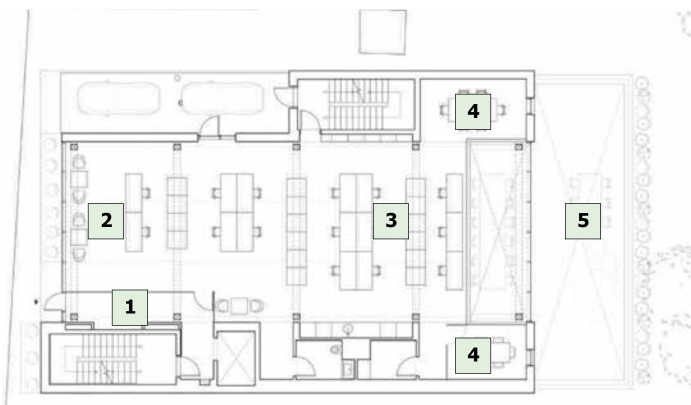
Conversations within the team at FBM were particularly important, especially since the firm has grown rapidly and consists of planners, interior designers, technologists, architects, and support staff. Input from the entire team was imperative to shape their shared future.



Site axonometric

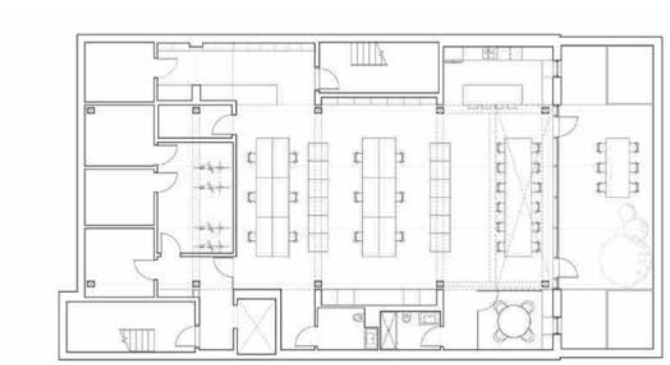
The building has seven residential units that are located above the office space. The inclusion of dwellings in the project was desirable to increase housing within the neighbourhood. The rooftop growing beds create a space to enjoy nature and support food cultivation for both the tenants and the office. Collectively, these spaces enhance people's ability to live, work, and grow with their community.

Social, economic, and ecological sustainability are all important considerations in the work conducted by FBM. With the interest to study mass timber construction, but unable to pursue it with clients, their new office space has served as a research project-exploring glulam within a five-storey wood structure.

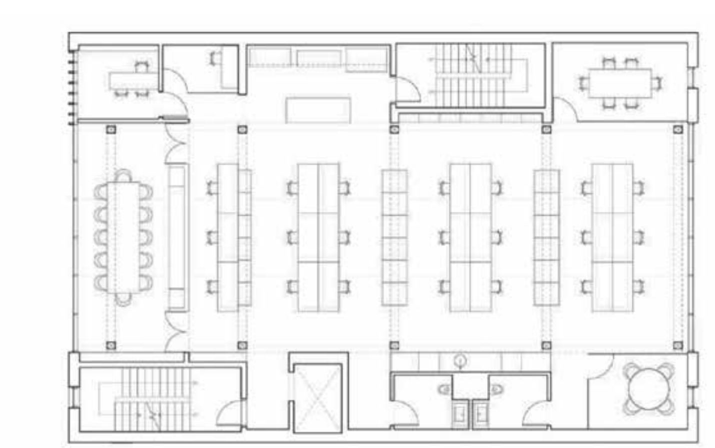


Below

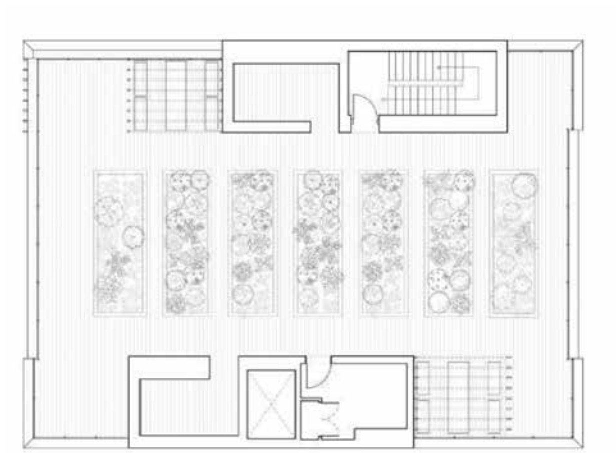
1 Lobby
2 Reception
3 Studio
4 Break Out
5 Courtyard Below



Level 1



Second Floor



Roof

Mass Timber Considerations

Working closely with Timber Systems, Aitchison Fitzgerald Builders, and Campbell Comeau Engineering, FBM investigated many different wood solutions. The floor assemblies were originally designed using nail laminated timber (NLT) from 2x8 dimensional lumber, but it was difficult to source 20-foot lengths that would have been required.

By changing the floor slabs to glulam (GLT) panels, the spans were achieved efficiently. It also reduced the amount of wood in the assembly. The GLT panels allowed for a thinner floor system and were able to vary the thickness throughout the building based on load requirements.

A standard beam width of 305mm was used throughout, with matching columns widths, to ensure a consistency of member faces and a clean aesthetic. In most areas, the GLT panel thickness was 175mm, but in more lightly loaded areas it was possible to use 130mm panel thickness.

The glulam post and beams were fabricated using Douglas Fir, while the floors and roof GLT panels were built from Spruce-Pine. The production was phased to account for the anticipated staging of the jobsite construction progress.

The jobsite itself was tight, with very little room for material storage. The timber was delivered to a local yard for temporary storage, which allowed for just-in-time deliveries to the site according to the construction activity. Wood is a lighter material than steel allowing for a reduction in the overall volume of concrete. The mass timber erection facilitated a shorter construction schedule and reduced construction noise and debris, and the laydown area required on the construction site.

The concrete elevator and stair cores slowed down the construction of the project due to the alternating trades with the erection of each floor, causing the project to not fully benefit from the speed of construction characteristic of wood construction. Having two trades alternating on site was challenging. Formwork had to be stored on the wood floor slabs as there was very little laydown area on the construction site. This required that the structure be reinforced with temporary steel posts. Given the constraints of the construction site, the exteriors walls were required to be of non-combustible construction, by code. An alternative solution, or had this project been built in a different location, could have utilized CLT cores, reducing the different trades required and simplifying the construction process.

The length of time that the wood was exposed to the elements was carefully considered. The wood arrived with a Sansin clearcoat finish and wrapped in a tarp. The contractors installed plywood as soon as the wood floors were installed and used Flexseal liquid rubber paint and 3m tape over the plywood seams to protect the structure from rain at the seams.

In contrast to the all-wood structure, all the other walls and ceilings have gypsum wallboard cladding painted white. The casework is also from white melamine. This clearly expresses the primary structural elements within the building and makes them stand out against all the other elements.

Fire and Acoustic Performance

The tight urban site added additional complications to the project as the exterior walls are very close to property lines of the building. These exterior walls were required to be of non-combustible construction and non-combustible cladding, so steel was selected.

The floors required a one-hour floor-to-floor fire rating. The wood design standard, CSA O86, is only intended to address the structural fire-resistance rating provided by an assembly and does not cover the ability of the assembly to function as a fire separation to delay the passage of flames, hot gases, and the transmission of heat through the assembly: two key aspects that CANULC-S101 and NBC Subsection 3.1.7 look for in a fire separation.

A 48mm (2 in.) concrete topping over the glulam and plywood served this function while forming the finish floor surface.

The metal connections within the building were meant to be left exposed, however they had to be encased in wood or treated with intumescent paint to maintain the integrity of the fire rating of the structure.

This protection takes the form of 38mm (1-½ in.) wood blocks that were added to the underside of the steel brackets and the same thickness of wood plugs to cover all of the countersunk metal bolts that connect the wood and metal brackets.

In addition, as wood assemblies typically transmit more sound than steel buildings, this had to be considered in the floor assembly. A 14mm-thick (9/16-in.) Insonomat acoustic membrane by Soprema for floors, placed beneath the concrete topping slab, fulfilled this function and greatly enhanced the STC of the floor assembly.

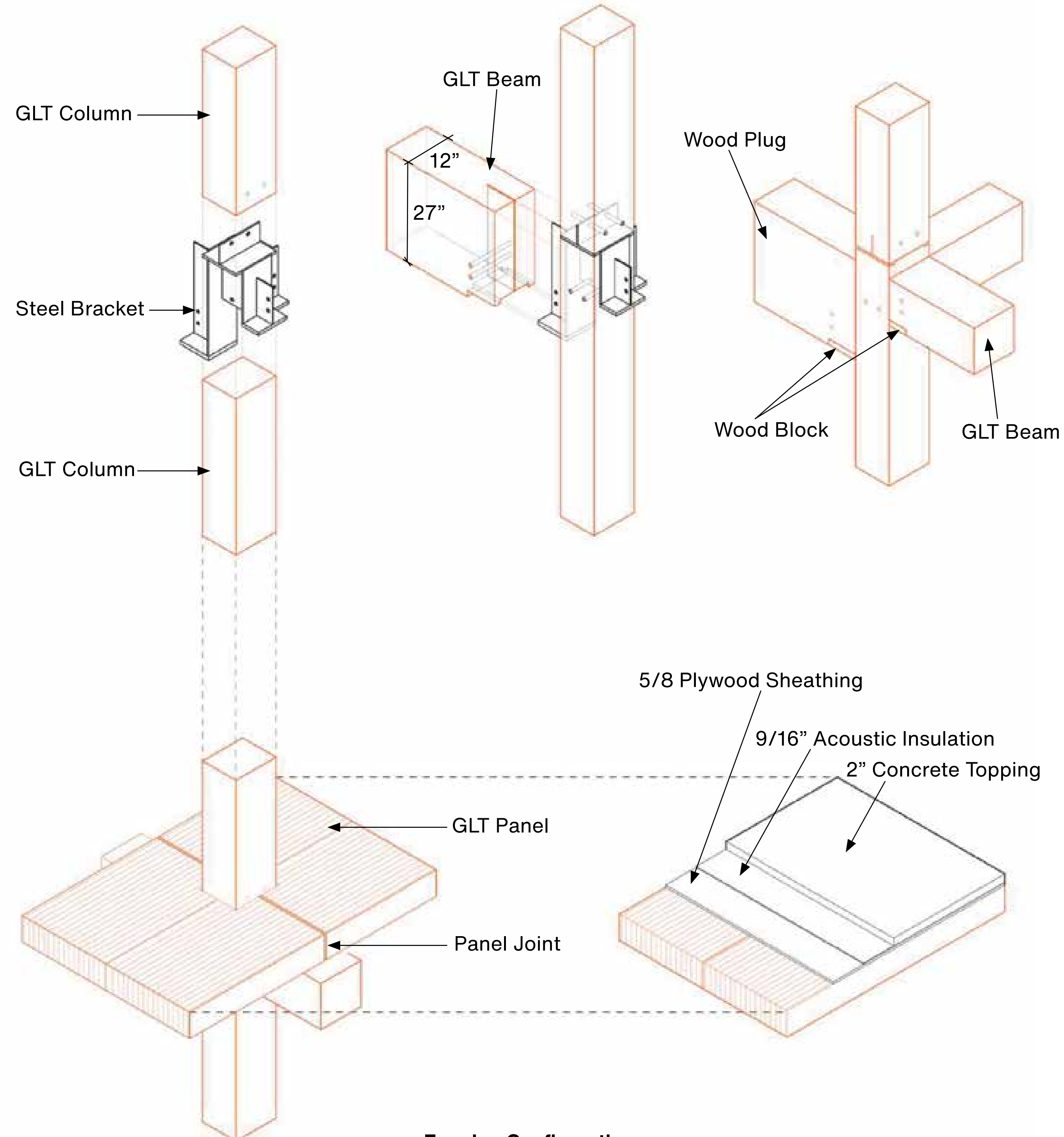
Building axonometric
This shows the relationships between the different activities of live, work, grow.

Structural Considerations

Gilles Comeau of Campbell Comeau Engineering Ltd notes that when designing with mass timber one must consider lateral loads acting on the structure, wood shrinkage, hidden connections for fire resistance, floor vibration, protection of the mass timber elements during construction, and how the structural design can complement the desired architectural aesthetic.

In assessing the lateral bracing system for wind and earthquake loading, Campbell Comeau Engineering considered three types: wood-based shear walls, steel X-bracing, and concrete shear walls. They selected concrete shear walls for their ability to resist overturning forces and familiarity by local labour.

The glulam floor slabs are supported independently of the columns to avoid the cumulative effect of wood shrinkage, which worked well with the concrete shear wall system chosen. Further to what has already been noted, the mass timber was factory coated with sealant and wrapped prior to shipping with the wrapping retained during installation. The glulam floor system was installed on fair weather days, and the plywood seams taped with peel and stick waterproofing product the same day. The trades were regularly reminded to take care of the timber surfaces with touch up sanding and final sealant applied in the field.



Framing Configurations

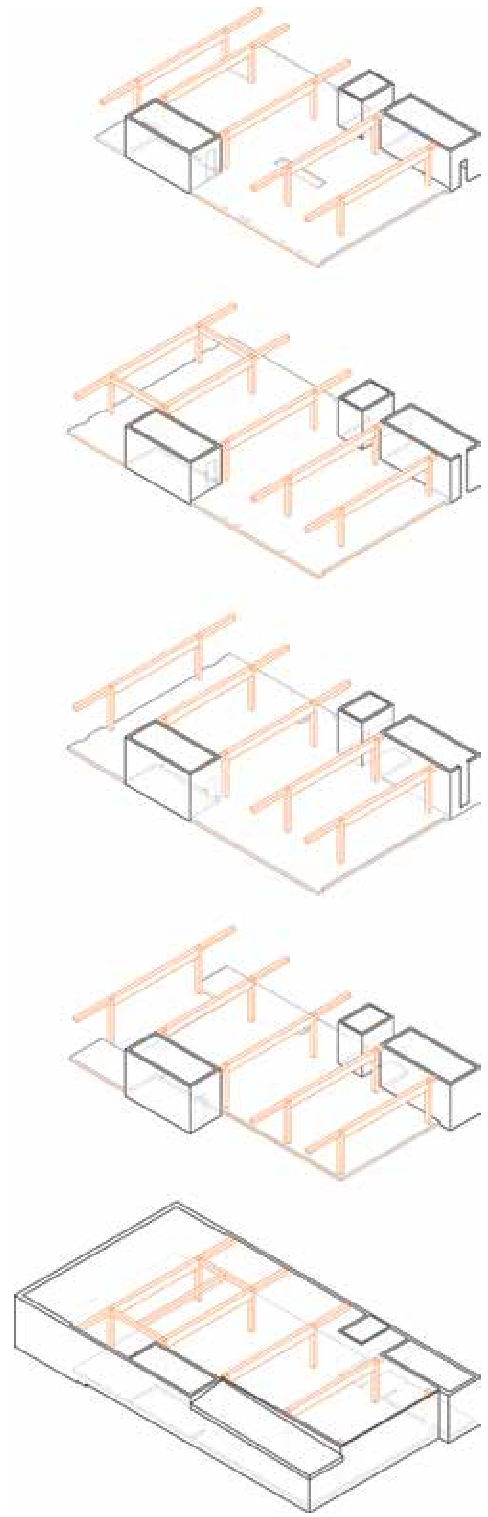
A place for collaboration and nature

Covid radically changed everybody's work culture throughout the world. Many have returned to the studio, some will continue to work from home, but most people desire the flexibility of both worlds. Collaboration, socialization, and serendipity are vital to creativity— something that has been more difficult during the past years with reduced face-to-face encounters.

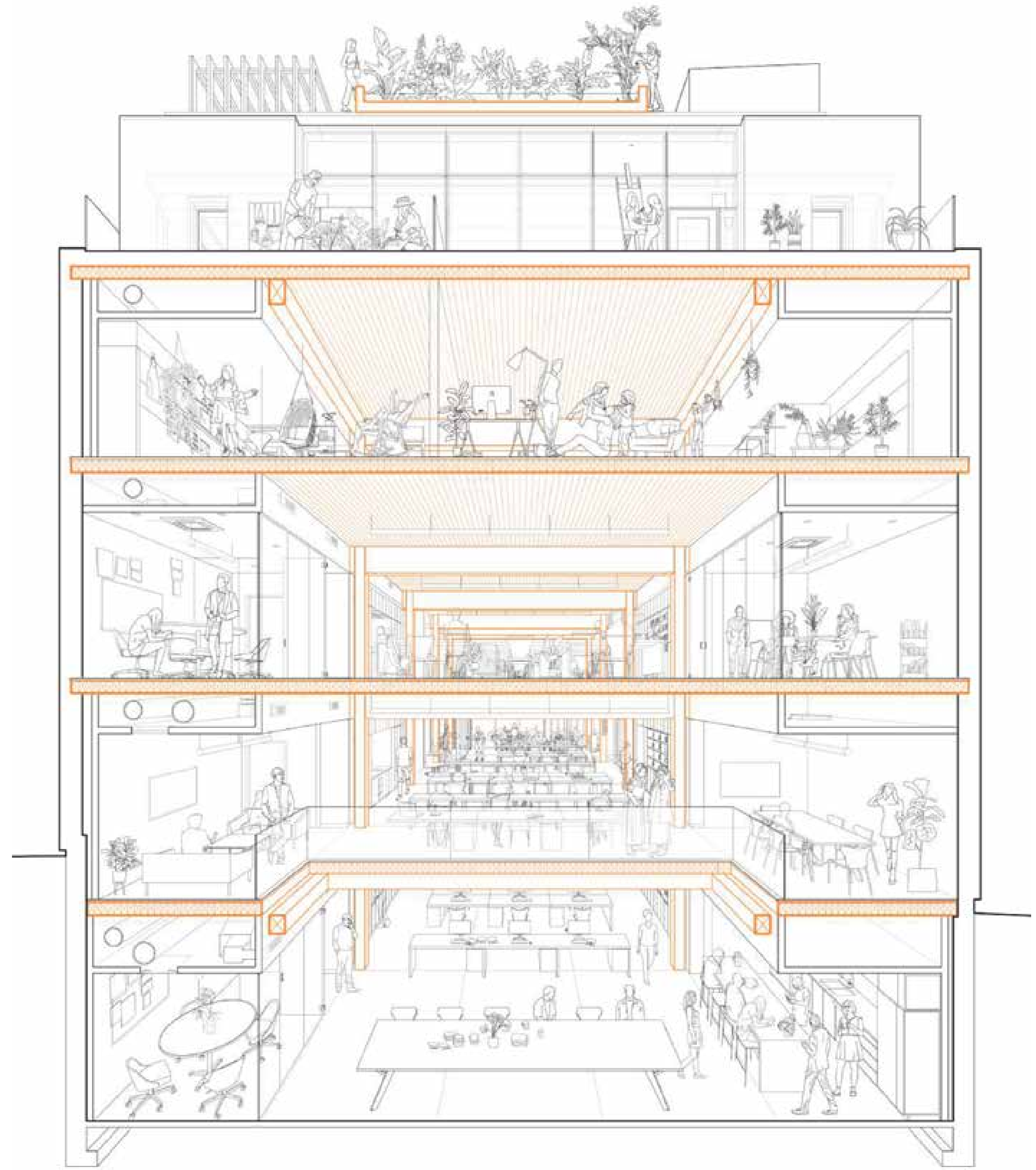
FBM's post-pandemic office needs multiple indoor and outdoor gathering spaces and private rooms for zoom calls. Fresh air, daylight, and access to nature are more important than ever. The building also has a studio on each floor. Daylight enters the space from the north and south elevations with the services of the building all located on the east and west sides, flanking the property lines.

These side portions of the plan house the bathrooms, stairs, elevator, and small break-out spaces. These are also the areas where the mechanical ductwork and electrical systems are run to leave the exposed wood ceilings in the studio free from mechanical services. Coordinating all these systems precisely was very important within the building.

Wood is a natural material that feels warmer and softer to the touch. It creates spaces that have enhanced indoor air quality, and along with the inherent beauty of this natural material, connects people with nature. Most importantly of all, the office serves as an example of the possibilities for future projects and as a way to help de-carbonize the construction industry in Atlantic Canada.



Construction Diagram
Wood Structure + Concrete
Load-bearing Core
Glue-laminated timber (GLT) columns and beams are highlighted



Building Occupation Section

CARBON COMPARISON

Carbon Comparison

The construction industry plays a pivotal role in shaping our environment, and as the world faces the urgent need to combat climate change, reducing the carbon footprint of buildings has become paramount. Buildings are significant contributors to greenhouse gas (GHG) emissions, accounting for a substantial portion of global carbon dioxide emissions. By integrating sustainable building materials in the design of new construction, we can significantly mitigate the environmental impact of the construction sector.

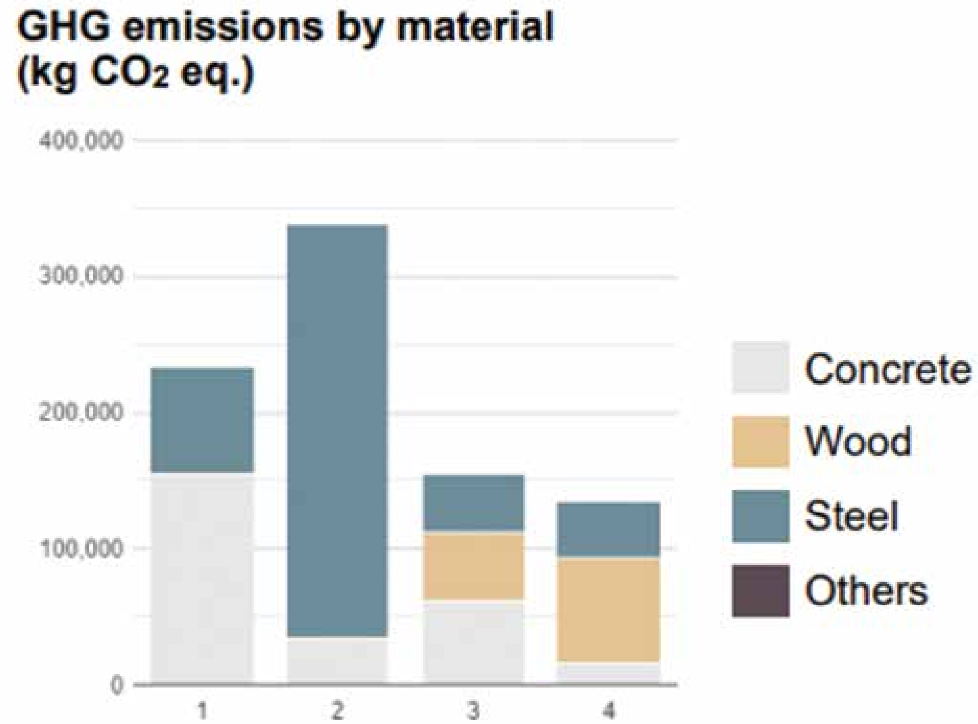
Wood and mass timber have emerged as champions in the quest for sustainable construction. Wood acts as a natural carbon sink, sequestering carbon dioxide from the atmosphere as it grows. When used in construction, the carbon remains stored within the building and helps offsets the emissions associated with other construction processes. By choosing wood and mass timber products, we are reducing the demand for carbon-intensive materials and creating healthier communities.

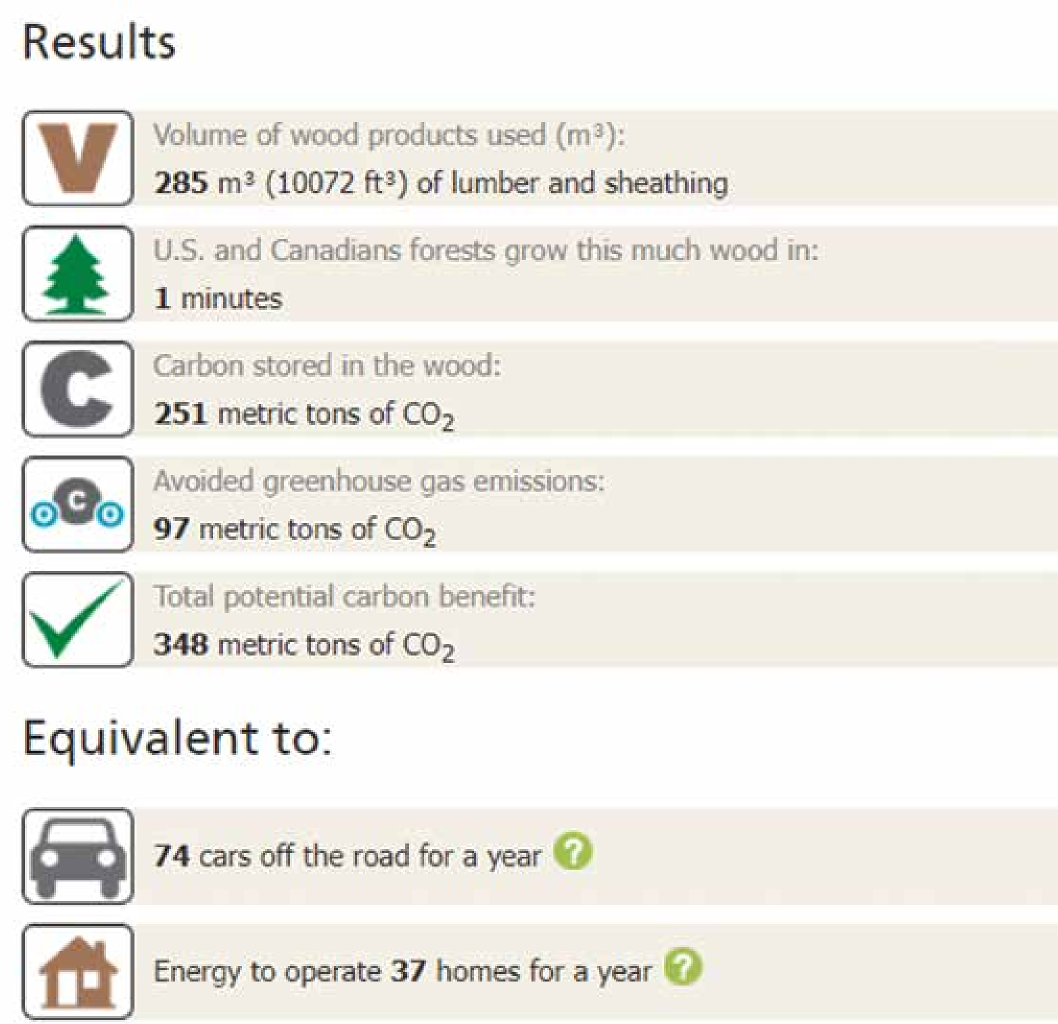
Structural wood products present a powerful strategy in the prefabrication and modular building sector. By incorporating eco-friendly construction practices and using sustainable building materials, we can reduce waste and the energy required to construct buildings and infrastructure.

Special considerations

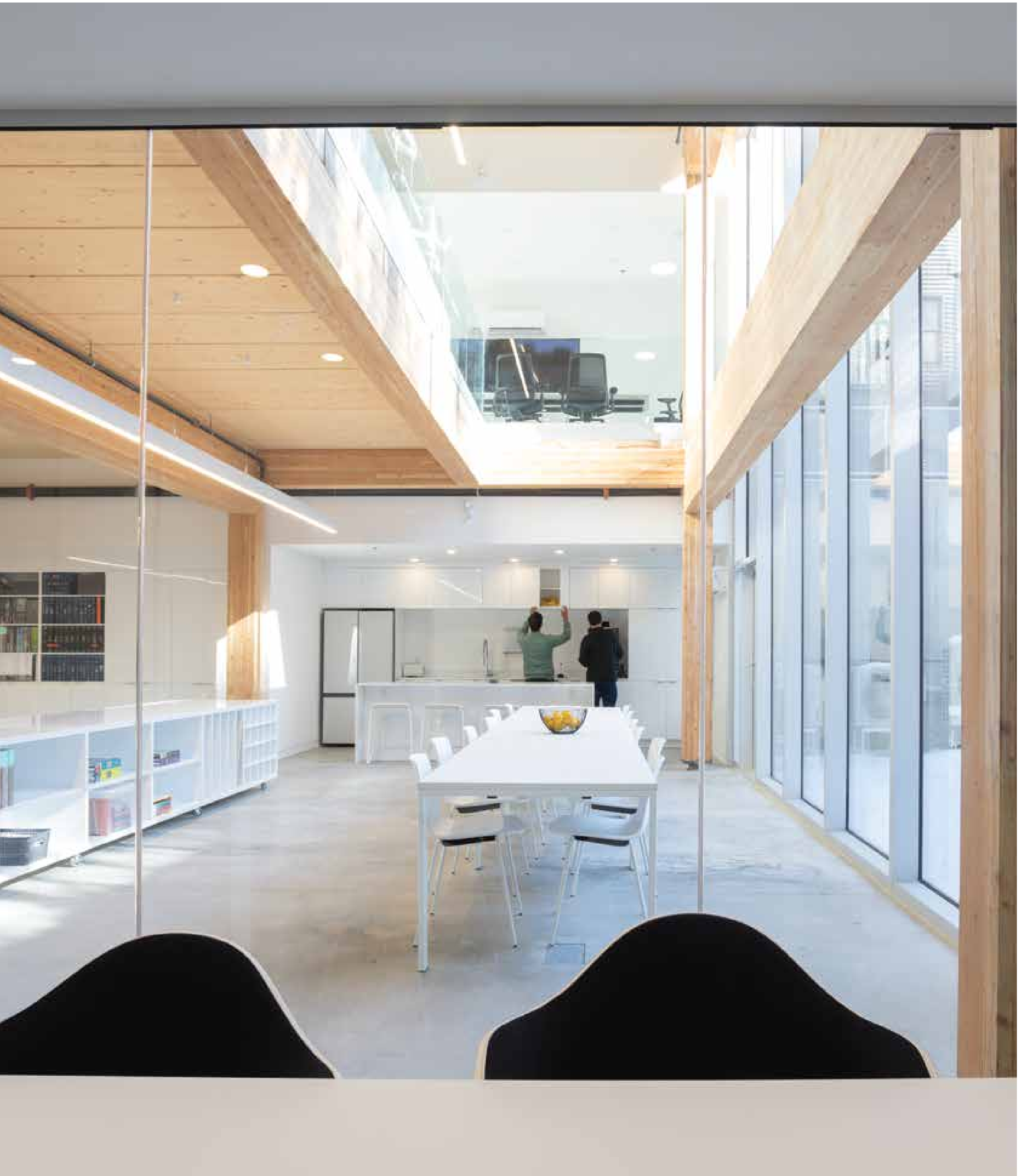
- GHGMAT, a tool used to calculate the carbon impacts of a building, was used to obtain the results. www.ghgmat.ca
- The scenarios were adapted from a ‘typical model output’ to better suite the engineer’s specifications of the various models.
- Structure only.
- Excludes foundation, partitions, finishes.
- Excludes transportation

The bar chart shows a carbon comparison for Cunard St Live/ Work/ Grow, an 18,301 sqft building.
Scenario 1 - Concrete structure (Concrete Shafts) 233,134 kg CO_2
Scenario 2 - Steel structure (Steel Shafts) 338,275 kg CO_2
Scenario 3 - Mass Timber structure (Concrete Shafts) 154,526 kg CO_2
Scenario 4 - Mass Timber structure (CLT Shafts) 135,216 kg CO_2





COST
COMPARISON



The choice of building materials in a project influence not only the environmental impacts, but also the economic feasibility. Light wood frame, Mass timber, Steel, and Concrete serve as principal construction materials, each boasting its own set of advantages and considerations. The primary objective of this cost comparison report is to provide decision-makers with the insights needed to make informed choices that align with both their financial and sustainability goals.

1. Weight and Structural Efficiency: Mass timber is significantly lighter than masonry block construction. This reduced weight simplifies the foundation design and construction process, leading to overall structural efficiency. The lighter weight of mass timber can also result in cost savings during the construction phase.
2. Sustainability: Mass timber is a sustainable and renewable building material. The use of timber in construction contributes to carbon sequestration and aligns with the growing demand for eco-friendly and sustainable building practices.
3. Speed of Construction: Mass timber systems are prefabricated, allowing for faster and more efficient construction compared to other types of construction. This speed can lead to reduced labour costs and quicker project completion, making it an attractive option for time-sensitive projects.
4. Design Flexibility: Mass timber offers greater design flexibility, allowing for innovative and modern architectural designs. It can be easily adapted to various shapes and sizes, providing architects and builders with more creative freedom.
5. Seismic Performance: Mass timber shear walls have demonstrated excellent seismic performance. Timber's inherent flexibility and ability to dissipate energy make it well-suited for seismic-resistant construction. This can be crucial in regions prone to earthquakes, where the performance of shear walls during seismic events is a critical consideration.
6. Thermal Performance: Wood products have thermal insulation properties, providing an effective barrier against temperature fluctuations. This can contribute to improved energy efficiency and occupant comfort and enhancing the overall performance of the building envelope.
7. Reduced Construction Waste: Mass timber construction generates less on-site waste compared to other building products. The prefabricated nature of mass timber components ensures that materials are precisely cut off-site, minimizing waste during the construction process.

8. Aesthetics and Natural Beauty: Mass timber has a warm and natural aesthetic that many find appealing. Exposed timber elements can contribute to a visually pleasing interior, enhancing the overall ambiance of a space. This aesthetic quality is often preferred in modern architecture and interior design.
9. Renewable Resource: Timber is a renewable resource, and responsible forestry practices ensure the long-term sustainability of wood as a building material.

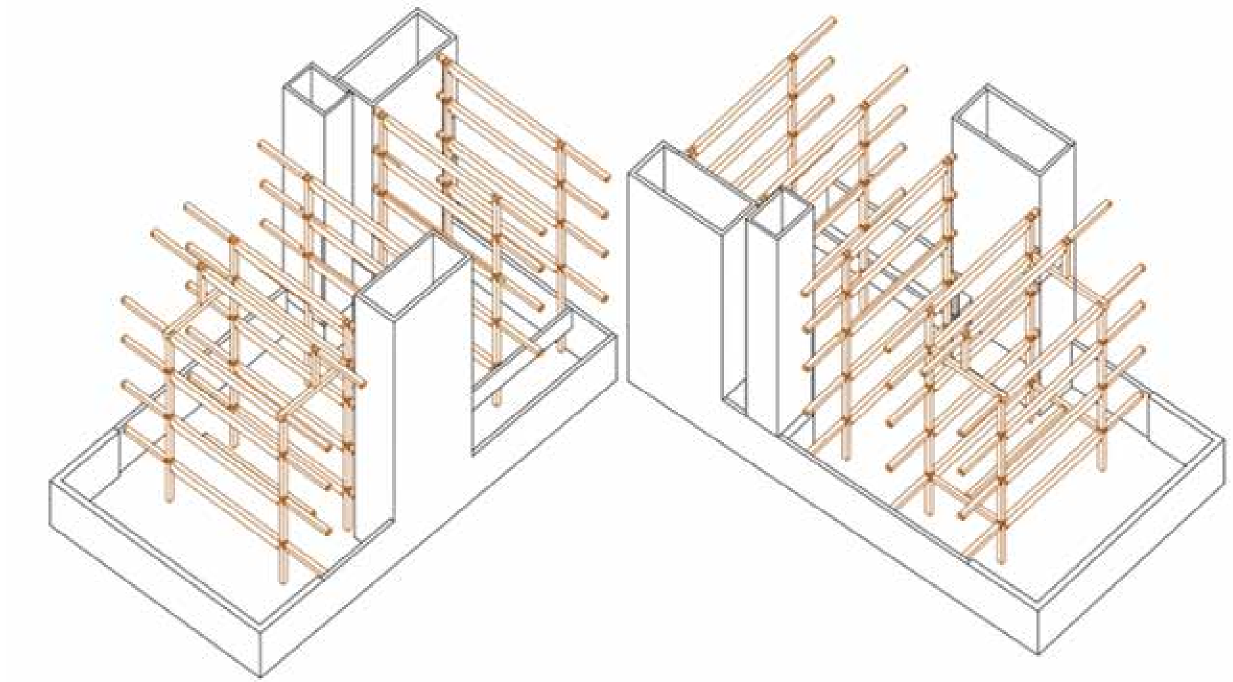
This Class B cost comparison was completed by QS Online Cost Consultants Inc. The following provides a realistic, reconcilable, and preliminary allocation of direct costs for the construction of a midrise mixed-use building, built with either mass timber, structural steel, or concrete, located within the regional municipality of Halifax, Nova Scotia. Soft costs are excluded from this study.

This costing exercise compares a Midrise Mixed-Use Building using four different construction methods:
- Mass Timber with Concrete Core (Base Model)
- Mass Timber with Cross Laminated Timber Core
- Steel Structure with Steel Core
- Concrete Structure with Concrete Core

From the documentation and information provided, quantities for all major elements were assessed or measured where possible and priced at rates considered competitive for a project of this type under a stipulated form of contract in this region of Nova Scotia. The estimate is a determination of fair market value for the construction of this project and is not a prediction of low bid, as pricing assumes competitive bidding for every portion of work.

The class B detailed elemental estimates for all building types can be downloaded from our website: www.atlanticwoodworks.ca

Elemental Cost Breakdown



	Base Model GFA: 18,301 SF	Wood Model GFA: 18,301 SF	Steel Model GFA: 18,301 SF	Concrete Model GFA: 18,301 SF
Structure	98.35	97.78	99.87	80.98
Exterior Enclosure	86.24	84.05	86.31	86.30
Partitions and Doors	45.17	44.03	59.04	47.01
Finishes	26.79	30.93	41.18	35.45
Total Cost/SF	516.46	518.31	573.16	522.02
Total Building Cost	9,451,803	9,485,661	10,489,464	9,553,635
Percent Increase Over Base Model	0%	0.35%	10.97%	1.07%

Executive Summary and Comparison – Mass Timber, Steel, Concrete
Mid-rise mixed use building

	Base Wood Model			Base Model c/w CLT Shear Walls			Structural Steel Model			Concrete Model		
	GFA : 18,301 SF			GFA : 18,301 SF			GFA : 18,301 SF			GFA : 18,301 SF		
	Quantity	Unit Rate	Total	Quantity	Unit Rate	Total	Quantity	Unit Rate	Total	Quantity	Unit Rate	Total
SHELL	18,301 SF	197.06	3,606,415	18,301 SF	195.29	3,574,051	18,301 SF	202.77	3,711,024	18,301 SF	179.89	3,292,274
A1 SUBSTRUCTURE	3,651 SF	62.51	228,232	3,651 SF	67.51	246,474	3,651 SF	83.21	303,816	3,651 SF	63.24	230,899
A2 STRUCTURE	18,301 SF	98.35	1,799,902	18,301 SF	97.78	1,789,439	18,301 SF	99.87	1,827,665	18,301 SF	80.98	1,482,069
A3 EXTERIOR ENCLOSURE	18,301 SF	86.24	1,578,281	18,301 SF	84.05	1,538,138	18,301 SF	86.31	1,579,543	18,301 SF	86.30	1,579,306
B INTERIORS	18,301 SF	96.42	1,764,539	18,301 SF	99.59	1,822,593	18,301 SF	122.56	2,242,941	18,301 SF	106.64	1,951,629
B1 PARTITIONS & DOORS	15,517 SF	45.17	700,917	15,517 SF	44.03	683,157	15,517 SF	59.04	916,050	15,517 SF	47.01	729,490
B2 FINISHES	18,301 SF	26.79	490,304	18,301 SF	30.93	566,118	18,301 SF	41.18	753,572	18,301 SF	35.45	648,822
B3 FITTINGS & EQUIPMENT	18,301 SF	31.33	573,318	18,301 SF	31.33	573,318	18,301 SF	31.33	573,318	18,301 SF	31.33	573,318
C SERVICES	18,301 SF	87.85	1,607,773	18,301 SF	87.85	1,607,773	18,301 SF	99.01	1,812,089	18,301 SF	99.01	1,812,089
C1 MECHANICAL	18,301 SF	54.39	995,347	18,301 SF	54.39	995,347	18,301 SF	64.78	1,185,584	18,301 SF	64.78	1,185,584
C2 ELECTRICAL	18,301 SF	33.46	612,426	18,301 SF	33.46	612,426	18,301 SF	34.23	626,506	18,301 SF	34.23	626,506
NET BUILDING COST - EXCL. SITE	18301.2 SF	381.33	6,978,728	18301 SF	382.73	7,004,417	18301 SF	424.35	7,766,054	18301 SF	385.55	7,055,992
D SITE & ANCILLARY WORK	18,301 SF	10.54	192,834	18,301 SF	10.54	192,834	73 SF	2,641.56	192,834	18,301 SF	10.54	192,834
D1 SITE WORK	1,311 SF	147.09	192,834	1,311 SF	147.09	192,834	1,311 SF	147.09	192,834	1,311 SF	147.09	192,834
D2 ANCILLARY WORK	18,301 SF	0.00	0	18,301 SF	0.00	0	18,301 SF	0.00	0	18,301 SF	0.00	0
NET BUILDING COST - INCL. SITE	18301.2 SF	391.86	7,171,562	18301 SF	393.27	7,197,252	18301 SF	434.88	7,958,888	18301 SF	396.08	7,248,826
Z1 GENERAL REQ'S & FEE	18,301 SF	60.74	1,111,592	18,301 SF	60.96	1,115,574	18,301 SF	67.41	1,233,628	18,301 SF	61.39	1,123,568
Z15 General Requirements	5.00%		358,578	5.00%		359,863	5.00%		397,944	5.00%		362,441
Z16 Contractor Fee	10.00%		753,014	10.00%		755,711	10.00%		835,683	10.00%		761,127
TOTAL-EXCLUDING CONTINGENCY	18301.2 SF	452.60	8,283,154	18301 SF	454.22	8,312,826	18301 SF	502.29	9,192,515	18301 SF	457.48	8,372,395
Z2 ALLOWANCES	18,301 SF	63.86	1,168,649	18,301 SF	64.09	1,172,836	18,301 SF	70.87	1,296,949	18,301 SF	64.54	1,181,240
Z21 Design & Pricing Allowance	5.00%		414,158	5.00%		415,641	5.00%		459,626	5.00%		418,620
Z22 Escalation Allowance	3.50%		304,406	3.50%		305,496	3.50%		337,825	3.50%		307,686
Z23 Construction Allowance	5.00%		450,086	5.00%		451,698	5.00%		499,498	5.00%		454,935
TOTAL ESTIMATE	18301.2 SF	516.46	9,451,803	18301 SF	518.31	9,485,661	18301 SF	573.16	10,489,464	18301 SF	522.02	9,553,635
TAX	0%		0	0%		0	0%		0	0%		0
TOTAL CONSTRUCTION ESTIMATE	18301.2 SF	516.46	9,451,803	18301 SF	518.31	9,485,661	18301 SF	573.16	10,489,464	18301 SF	522.02	9,553,635

Estimate Details Summary and Comparison

	Base Wood Model			Base Model c/w CLT Shear Walls		
	GFA : 18,301 SF			GFA : 18,301 SF		
	Quantity 0	Unit Rate	Total	Quantity 0	Unit Rate	Total
SHELL	18,301 SF	197.06	3,606,415	18,301 SF	195.29	3,574,051
A1 SUBSTRUCTURE	3,651 SF	62.51	228,232	3,651 SF	67.51	246,474
A11 Foundations	3,651 SF	10.94	39,948	3,651 SF	15.94	58,190
A12 Basement Excavation	2,503 CY	75.22	188,284	2,503 CY	75.22	188,284
A13 Special Conditions	0 SF	0.00	0	0 SF	0.00	0
A2 STRUCTURE	18,301 SF	98.35	1,799,902	18,301 SF	97.78	1,789,439
A21 Lowest Floor Construction	3,651 SF	8.03	29,326	3,651 SF	8.00	29,201
A22 Upper Floor Construction	14,650 SF	87.66	1,284,273	14,650 SF	93.73	1,373,156
A23 Roof Construction	3,651 SF	133.20	486,303	3,651 SF	106.02	387,082
A3 EXTERIOR ENCLOSURE	18,301 SF	86.24	1,578,281	18,301 SF	84.05	1,538,138
A31 Walls Below Grade	3,018 SF	66.03	199,264	3,018 SF	66.03	199,264
A32 Walls Above Grade	13,237 SF	91.68	1,213,574	13,237 SF	88.65	1,173,431
A33 Windows & Entrances	168 SF	407.73	68,498	168 SF	407.73	68,498
A34 Roof Covering	3,651 SF	26.55	96,945	3,651 SF	26.55	96,945
A35 Projections	0 SF	0.00	0	0 SF	0.00	0

	Structural Steel Model			Concrete Model		
	GFA : 18,301 SF			GFA : 18,301 SF		
	Quantity 0	Unit Rate	Total	Quantity 0	Unit Rate	Total
SHELL	18,301 SF	202.77	3,711,024	18,301 SF	179.89	3,292,274
A1 SUBSTRUCTURE	3,651 SF	83.21	303,816	3,651 SF	63.24	230,899
A11 Foundations	3,651 SF	30.46	111,195	3,651 SF	11.38	41,532
A12 Basement Excavation	2,577 CY	74.75	192,621	2,577 CY	73.49	189,367
A13 Special Conditions	0 SF	0.00	0	0 SF	0.00	0
A2 STRUCTURE	18,301 SF	99.87	1,827,665	18,301 SF	80.98	1,482,069
A21 Lowest Floor Construction	3,651 SF	8.03	29,326	3,651 SF	8.03	29,326
A22 Upper Floor Construction	14,650 SF	97.88	1,433,892	14,650 SF	73.27	1,073,440
A23 Roof Construction	3,651 SF	99.82	364,448	3,651 SF	103.89	379,303
A3 EXTERIOR ENCLOSURE	18,301 SF	86.31	1,579,543	18,301 SF	86.30	1,579,306
A31 Walls Below Grade	3,018 SF	66.44	200,526	3,018 SF	66.36	200,289
A32 Walls Above Grade	13,237 SF	91.68	1,213,574	13,237 SF	91.68	1,213,574
A33 Windows & Entrances	168 SF	407.73	68,498	168 SF	407.73	68,498
A34 Roof Covering	3,651 SF	26.55	96,945	3,651 SF	26.55	96,945
A35 Projections	0 SF	0.00	0	0 SF	0.00	0

Estimate Details Summary and Comparison - continued

B INTERIORS	18,301 SF	96.42	1,764,539	18,301 SF	99.59	1,822,593	18,301 SF	122.56	2,242,941	18,301 SF	106.64	1,951,629
B1 PARTITIONS & DOORS	15,517 SF	45.17	700,917	15,517 SF	44.03	683,157	15,517 SF	59.04	916,050	15,517 SF	47.01	729,490
B11 Partitions	14,026 SF	29.46	413,242	14,026 SF	28.20	395,482	14,026 SF	44.80	628,375	14,026 SF	31.50	441,815
B12 Doors	71 Leaves	4,051.76	287,675	71 Lvs	4,051.76	287,675	71 Lvs	4,051.76	287,675	71 Lvs	4,051.76	287,675
B2 FINISHES	18,301 SF	26.79	490,304	18,301 SF	30.93	566,118	18,301 SF	41.18	753,572	18,301 SF	35.45	648,822
B21 Floor Finishes	18,301 SF	11.50	210,464	18,301 SF	11.50	210,464	18,301 SF	11.50	210,464	18,301 SF	11.50	210,464
B22 Ceiling Finishes	18,301 SF	6.14	112,459	18,301 SF	6.14	112,459	18,301 SF	20.63	377,617	18,301 SF	14.63	267,711
B23 Wall Finishes	47,457 SF	3.53	167,382	66,501 SF	3.66	243,196	50,607 SF	3.27	165,492	51,920 SF	3.29	170,647
B3 FITTINGS & EQUIPMENT	18,301 SF	31.33	573,318	18,301 SF	31.33	573,318	18,301 SF	31.33	573,318	18,301 SF	31.33	573,318
B31 Fittings & Fixtures	18,301 SF	15.00	274,518	18,301 SF	15.00	274,518	18,301 SF	15.00	274,518	18,301 SF	15.00	274,518
B32 Equipment	18,301 SF	0.00	0	18,301 SF	0.00	0	18,301 SF	0.00	0	18,301 SF	0.00	0
B33 Elevators	6 Stops	49,800.00	298,800	6 Stops	49,800.00	298,800	6 Stops	49,800.00	298,800	6 Stops	49,800.00	298,800
B34 Escalators	0 Stop	0.00	0	0 Stop	0.00	0	0 Stop	0.00	0	0 Stop	0.00	0
C SERVICES	18,301 SF	87.85	1,607,773	18,301 SF	87.85	1,607,773	18,301 SF	99.01	1,812,089	18,301 SF	99.01	1,812,089
C1 MECHANICAL	18,301 SF	54.39	995,347	18,301 SF	54.39	995,347	18,301 SF	64.78	1,185,584	18,301 SF	64.78	1,185,584
C11 Plumbing & Drainage	18,301 SF	15.98	292,484	18,301 SF	15.98	292,484	18,301 SF	15.98	292,484	18,301 SF	15.98	292,484
C12 Fire Protection	18,301 SF	4.23	77,415	18,301 SF	4.23	77,415	18,301 SF	5.48	100,292	18,301 SF	5.48	100,292
C13 HVAC	18,301 SF	30.54	558,898	18,301 SF	30.54	558,898	18,301 SF	38.54	705,308	18,301 SF	38.54	705,308
C14 Controls	18,301 SF	3.64	66,550	18,301 SF	3.64	66,550	18,301 SF	4.78	87,500	18,301 SF	4.78	87,500
C2 ELECTRICAL	18,301 SF	33.46	612,426	18,301 SF	33.46	612,426	18,301 SF	34.23	626,506	18,301 SF	34.23	626,506
C21 Service & Distribution	18,301 SF	8.54	156,251	18,301 SF	8.54	156,251	18,301 SF	8.54	156,251	18,301 SF	8.54	156,251
C22 Lighting, Devices & Heating	18,301 SF	17.84	326,575	18,301 SF	17.84	326,575	18,301 SF	18.37	336,145	18,301 SF	18.37	336,145
C23 Systems & Ancillaries	18,301 SF	7.08	129,601	18,301 SF	7.08	129,601	18,301 SF	7.33	134,110	18,301 SF	7.33	134,110
NET BUILDING COST - EXCL. SITE	18301.2 SF	381.33	6,978,728	18301.2 SF	382.73	7,004,417	18301.2 SF	424.35	7,766,054	18301.2 SF	385.55	7,055,992

Estimate Details Summary and Comparison - continued

D SITE & ANCILLARY WORK	18,301 SF	10.54	192,834	18,301 SF	10.54	192,834	73 SF	2,641.56	192,834	18,301 SF	10.54	192,834
D1 SITE WORK	1,311 SF	147.09	192,834	1,311 SF	147.09	192,834	1,311 SF	147.09	192,834	1,311 SF	147.09	192,834
D11 Site Development	1,311 SF	101.16	132,619	1,311 SF	101.16	132,619	1,311 SF	101.16	132,619	1,311 SF	101.16	132,619
D12 Mechanical Site Services	1,311 SF	24.60	32,250	1,311 SF	24.60	32,250	1,311 SF	24.60	32,250	1,311 SF	24.60	32,250
D13 Electrical Site Services	1,311 SF	21.33	27,965	1,311 SF	21.33	27,965	1,311 SF	21.33	27,965	1,311 SF	21.33	27,965
D2 ANCILLARY WORK	18,301 SF	0.00	0	18,301 SF	0.00	0	18,301 SF	0.00	0	18,301 SF	0.00	0
D21 Demolition	0 SF	0.00	0	0 SF	0.00	0	0 SF	0.00	0	0 SF	0.00	0
D22 Alterations	0 SF	0.00	0	0 SF	0.00	0	0 SF	0.00	0	0 SF	0.00	0
NET BUILDING COST - INCL. SITE	18301 SF	391.86	7,171,562	18301 SF	393.27	7,197,252	18301 SF	434.88	7,958,888	18301 SF	396.08	7,248,826
Z1 GENERAL REQ'S & FEE	18,301 SF	60.74	1,111,592	18,301 SF	60.96	1,115,574	18,301 SF	67.41	1,233,628	18,301 SF	61.39	1,123,568
Z15 General Requirements	5.00%	0.00	358,578	5.00%	0.00	359,863	5.00%	0.00	397,944	5.00%	0.00	362,441
Z16 Contractor Fee	10.00%	0.00	753,014	10.00%	0.00	755,711	10.00%	0.00	835,683	10.00%	0.00	761,127
TOTAL-EXCLUDING CONTINGENCY	18301 SF	452.60	8,283,154	18301 SF	454.22	8,312,826	18301 SF	502.29	9,192,515	18301 SF	457.48	8,372,395
Z2 ALLOWANCES	18,301 SF	63.86	1,168,649	18,301 SF	64.09	1,172,836	18,301 SF	70.87	1,296,949	18,301 SF	64.54	1,181,240
0 Z21 Design & Pricing Allowance	5.00%	0.00	414,158	5.00%	0.00	415,641	5.00%	0.00	459,626	5.00%	0.00	418,620
0 Z22 Escalation Allowance	3.50%	0.00	304,406	3.50%	0.00	305,496	3.50%	0.00	337,825	3.50%	0.00	307,686
Z23 Construction Allowance	5.00%	0.00	450,086	5.00%	0.00	451,698	5.00%	0.00	499,498	5.00%	0.00	454,935
TOTAL ESTIMATE	18301 SF	516.46	9,451,803	18301 SF	518.31	9,485,661	18301 SF	573.16	10,489,464	18301 SF	522.02	9,553,635
TAX	0%	0.00	0	0%	0.00	0	0%	0.00	0	0%	0.00	0
TOTAL CONSTRUCTION ESTIMATE	18301 SF	516.46	9,451,803	18301 SF	518.31	9,485,661	18301 SF	573.16	10,489,464	18301 SF	522.02	9,553,635

CONSTRUCTION
SCHEDULING AND OTHER DETAILS

Construction Scheduling

The construction of mass timber buildings offers significant time savings compared to traditional construction methods. Mass timber, characterized by its engineered wood components such as glued-laminated timber (glulam) and cross-laminated timber (CLT), allows for faster assembly and reduced construction timelines. The prefabricated nature of mass timber components enables precision in manufacturing, minimizing on-site errors and streamlining the construction process.

Mass timber components can be manufactured off-site and delivered to the construction site in a 'just-in-time' delivery method. This reduces the amount of product stored on site and eliminates the need for extensive on-site cutting and fitting, accelerating the overall construction timeline.

Additionally, because of the prefabrication, mass timber buildings often enhance the efficiency and safety of the building process and result in fewer worksite injuries. The reduced weight of these materials allows for faster and more straightforward transportation, lifting, and positioning during construction. This is particularly advantageous in urban environments where logistics and site access can present challenges.

The incorporation of mass timber shear walls can lead to significant schedule savings on site. The prefabricated panels are installed in a matter of days, compared to weeks for other building products. It also minimizes the different trades required to construct the project, which can lead to further efficiencies.

Compressing the Typical Construction Schedule with Mass Timber

Look for these potential schedule savings in comparison to steel and concrete

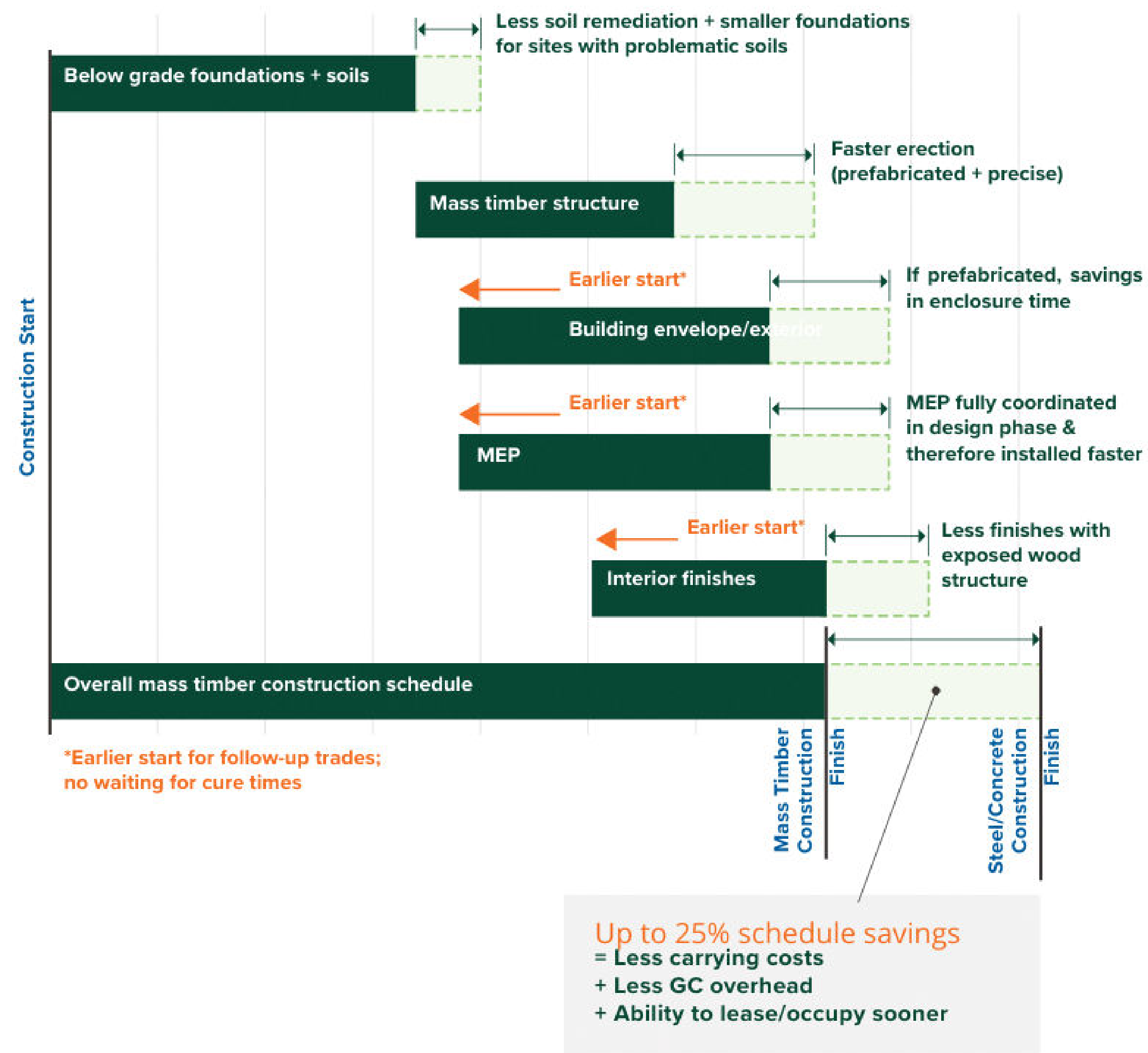
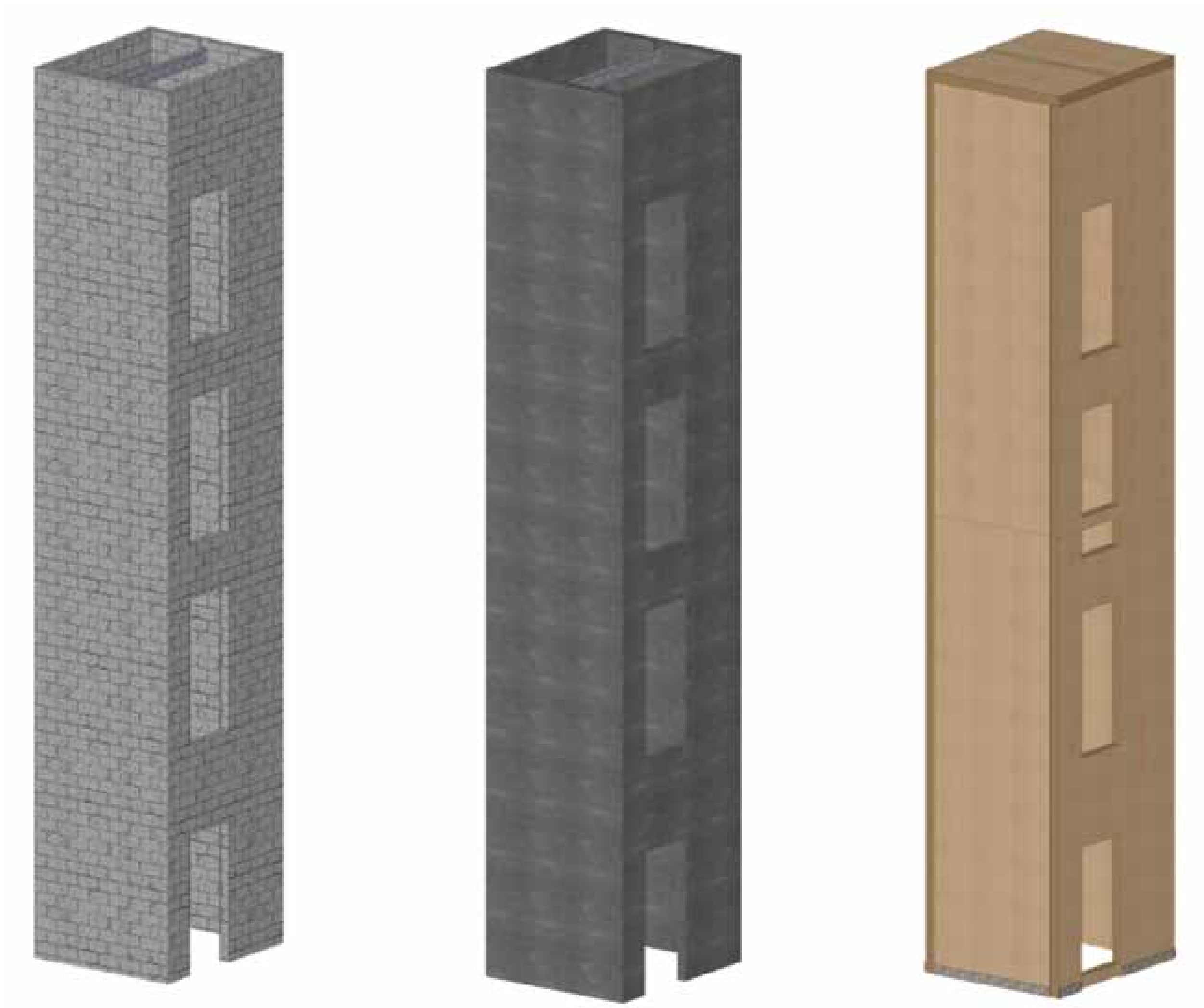


Image Source: https://www.woodworks.org/wp-content/uploads/wood_solution_paper-Mass-Timber-Design-Cost-Optimization-Checklists.pdf

Elevator shaft comparison (7ft x 10ft x 41ft tall)



Masonry CMU
· 3 - 4 week installation
· Multiple building trade
· Multiple inspections
· Weather impact time and cost

Cast-in-place concrete
· 2 - 3 week installation
· Multiple building trade
· Multiple inspections
· Weather impact time and cost

CLT
· 1 - 2 day installation
· 1 building trade (framing subcontractor)
· Limited inspections
· Weather impact minimized

Image source : https://www.smartlam.com/wp-content/uploads/2020/06/SmartLam-2020-Elevator-and-Stair-Shaft-Flyer_June.pdf

Insurance

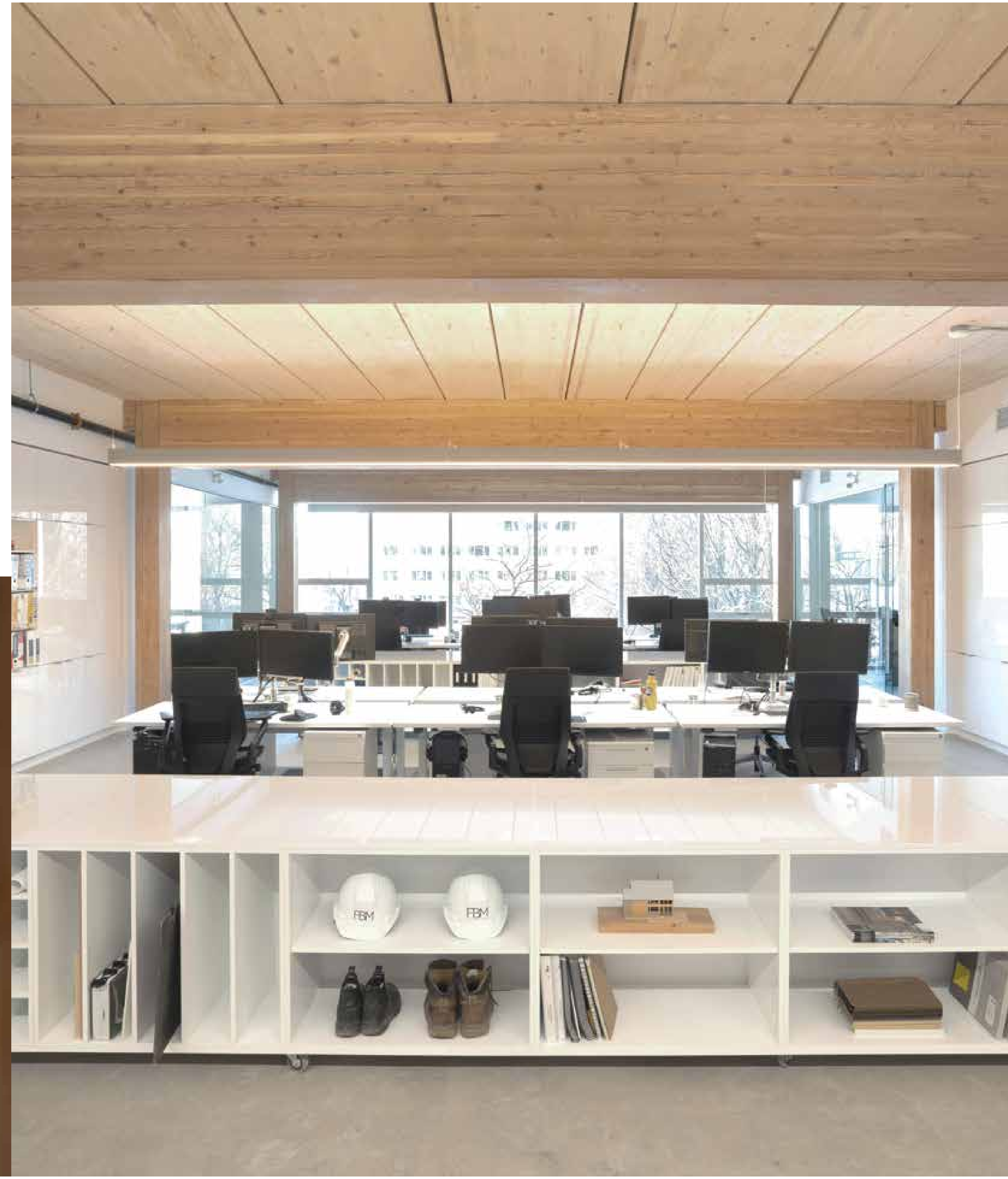
Wood generally tends to have a higher insurance premium compared to non-combustible materials. Combustibility refers to the material's susceptibility to catching fire and sustaining combustion. Insurance providers assess the risk associated with a building material when determining premiums, and combustible materials, like wood, inherently pose a greater risk of fire-related incidents compared to non-combustible alternatives such as steel or concrete.

Insurance premiums are, in essence, a reflection of risk. The higher the perceived risk associated with a building material, the higher the insurance premium. Non-combustible materials generally have a lower risk profile in terms of fire hazards, making them more attractive to insurance providers. However, it's crucial to note that advancements in construction technologies and fire-resistant treatments have significantly improved the fire performance of wood structures, helping to mitigate some of the concerns and contributing to a more comparable scenario by insurers.

Through strategic planning on site and risk management plans, insurance rates for a wood building can drop significantly.

Connections

There are many different types of connections and optimizing this section is important in reducing costs. One option is for the mass timber manufacturer/supplier to design and supply the connections for the project. In this case, the visual aesthetics and strength required are specified and then the supplier will design and supply the appropriate connections. Connections can also be sourced from connection manufacturers. Most connection manufacturers have product lines for mass timber and can help identify appropriate solutions for the project.



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PROJECT TEAM

ARCHITECT: FBM Architecture and Interior Design

STRUCTURAL ENGINEER: Campbell Comeau Engineering Limited

MASS TIMBER SUPPLIER: Timber Systems Limited

CONTRACTOR: Aitchison Fitzgerald Builders

COST STUDY CONSULTANT: QS Online Cost Consultants

PHOTOGRAPHER: Greg Hanlon

WoodWorks Atlantic
(902) 667-3889
Info@atlanticwoodworks.ca
www.atlanticwoodworks.ca