# Mountain Equipment Co-op
## Head Office

VANCOUVER, BC

A CASE STUDY


wood WORKS!
Program of the Canadian Wood Council

Canadian Wood Council
Conseil canadien du bois

Detail of window
*Photo: Ed White Photographics*

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South elevation facing Great Northern Way
*Photo: KK Law, Courtesy naturally:wood*

Cover Photo:
*Ed White Photographics*



"We believe healthy, fun and inspiring workplaces create the conditions for people to do their best work. We provide our employees with the space, tools and equipment they need to do their jobs safely and efficiently, and we aim to embody our culture and values in our workspaces."

*Excerpt from MEC Statement of Corporate Philosophy*

# Background

Mountain Equipment Co-op (MEC) is one of Canada's most progressive retailers, having embraced a philosophy of corporate, social and environmental responsibility since its creation in 1971.

Not simply a retailer, MEC engages in its own research and product development to ensure that it remains on the leading edge of sustainable practice. As early as 1994, MEC began manufacturing clothing using polyester fleece made from recycled pop bottles.

In the same year, anticipating a period of rapid expansion, MEC began to look seriously at the environmental impacts of its building program. Its board of directors endorsed a policy requiring environmental consultation for the construction and renovation of new and existing facilities. From modest beginnings, the outdoor retail co-operative now has over four million members and annual sales of more than $300 million.

With each new building project, MEC has endeavoured to advance its own sustainability agenda, and in this respect wood has played an important role. In 2002, the MEC Ottawa store was constructed largely from heavy timber salvaged from an existing building on the site; in 2008, the Burlington store was designed with a completely demountable heavy timber structure that earned it a Leadership in Energy and Environmental Design (LEED) credit for innovation; and in 2013, the North Vancouver store, another building in which wood features prominently, received a Canadian Green Building Award for its comprehensive approach to sustainability.


Top: MEC, North Vancouver, BC
Exterior of this award-winning store
*Courtesy: Bob Matheson Photography*

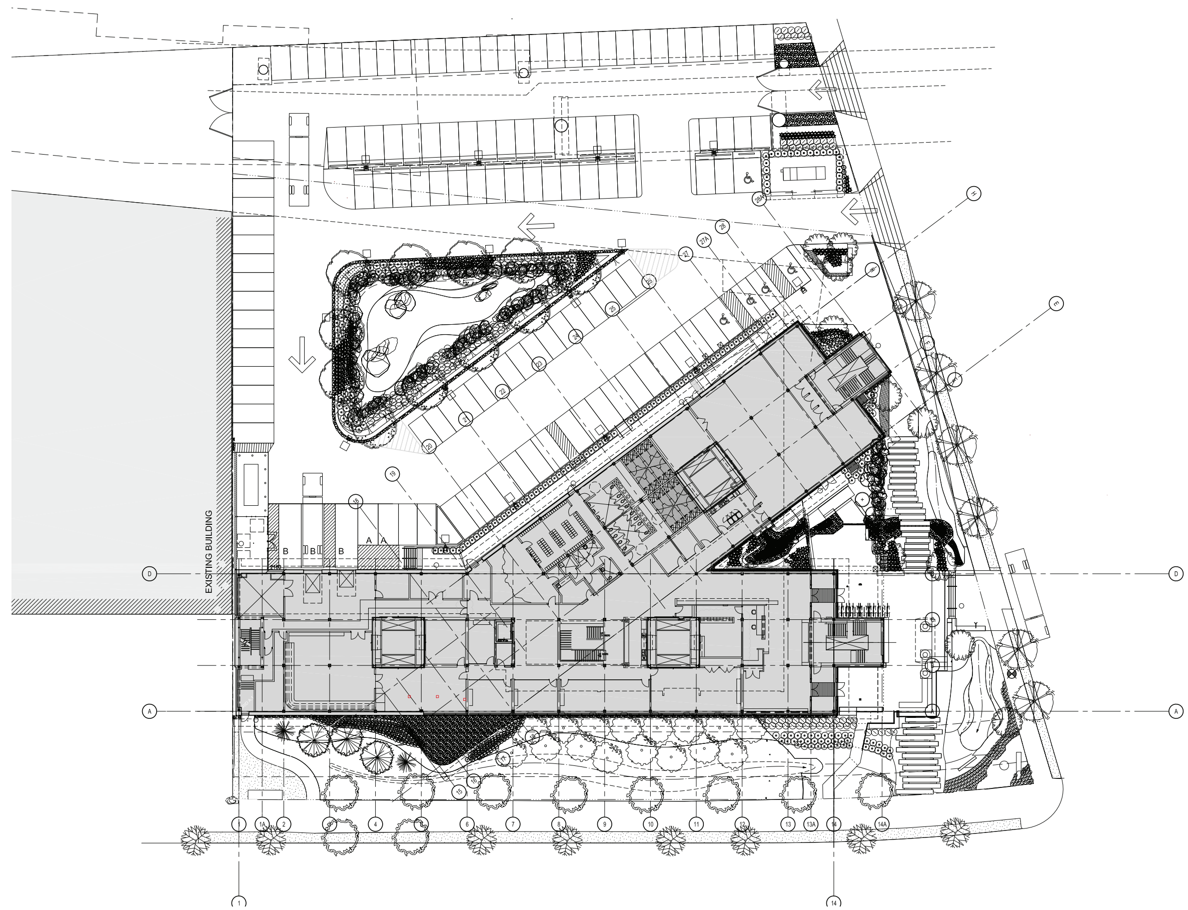
Bottom: MEC, Ottawa, ON
Heavy timber salvaged from an existing building on the site was used in construction
*Courtesy: MEC*

Above: MEC, Burlington, ON
This store was designed with a completely demountable heavy timber structure
*Courtesy: MEC*

# Overview of the Head Office

Prior to the completion of this project, MEC's head office was located in a converted building formerly used as an auto parts warehouse.

Planning for a new head office began in 2008 when it became clear that the company was outgrowing its existing premises. In January 2012, the City of Vancouver approved a rezoning proposal for the construction of a new 10,400m² (112,000 sq ft) LEED®-certified head office facility in the False Creek Flats area southeast of the city centre.




Site Plan 1019a200
*Courtesy: Proscenium Architecture*

View of MEC Head Office from China Creek Park
*Photo: KK Law, Courtesy: naturally:wood*

# Overview of the Head Office

The exposed wood structure is a feature of all the work areas in the building
*Ed White Photographics*

The project continues MEC's commitment to a broad approach to sustainability, incorporating a number of environmentally-responsible, resource-conserving and socially-enlightened strategies. These include:

- ENERGY EFFICIENCY: Overall energy efficiency is projected to be 70 per cent better than an equivalent building of conventional design.
- WATER EFFICIENCY: A cistern on the site will collect rainwater, providing 65 per cent of the water needed to flush toilets. Rain gardens on the grounds will reduce the amount of storm water, soil and debris that go into storm sewers.
- NATURAL LIGHT: Expansive windows flood the interior with daylight. The narrow floor plan ensures that the majority of the occupied areas receive abundant daylight.
- NATURAL MATERIALS: Laminated timber beams and columns, joined and braced with steel fittings, make up the building structure. Floor assemblies are made of modular prefabricated nail-laminated timber (NLT) panels.
- FRESH AIR: Perimeter windows that open and a system for drawing in and distributing outside air provide fresh air throughout the building.
- EXTENSIVE LANDSCAPING: Drought and water-tolerant native plants, situated in and around a series of rain gardens, evoke the site's ecological history. Logs, boulders and boardwalks give the grounds character.
- AMENITIES FOR EMPLOYEES: Amenities include a storage room for 149 bikes, shower and change facilities, multipurpose room (with a dedicated fitness equipment zone) that will also be available for public events, an indoor climbing 'cave', as well as areas to socialize and relax.

The new facility will ultimately be home to all MEC's head office functions – from product design and information technology departments, to human resources and finance, as well as the company's service centre staff – a total of 375 employees altogether.

View of the central atrium
*Ed White Photographics*

# Architecture
## *Design Objectives*

Proscenium Architecture + Interiors had been the architects for MEC's previous head office, and were retained again to investigate the possibility of an addition to the premises on the existing site. While MEC recognized that conserving the embodied energy in the existing structure would have the lowest environmental impact, this option was less than ideal in other respects. MEC did not own the building, and thus would not have full control over its future, nor could they expect the same return on their investment. When a suitable site became available on Great Northern Way, MEC chose to purchase it and proceed instead with the design of a new building.

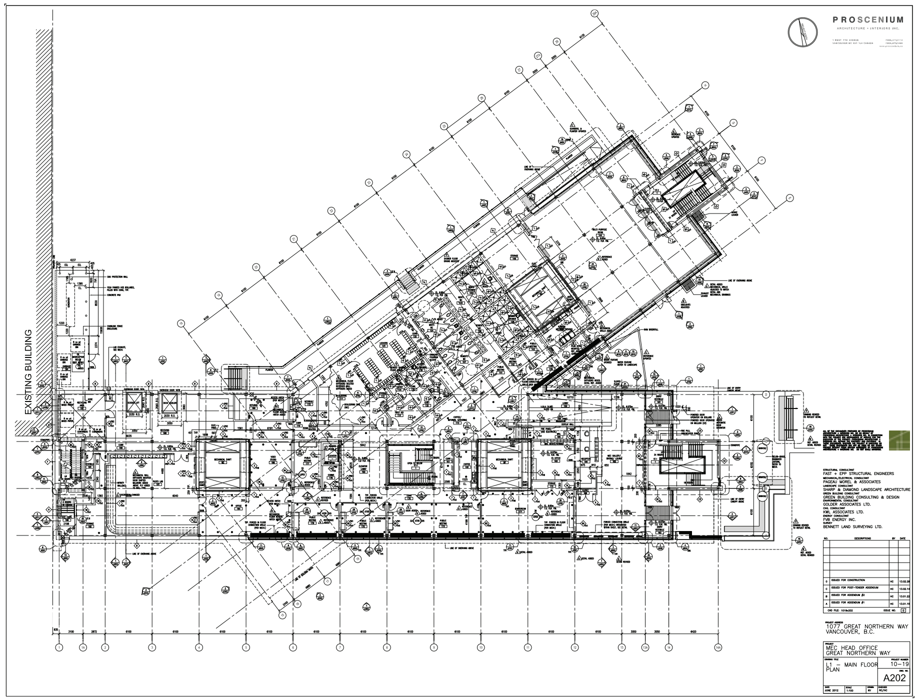
Proscenium developed a program for the new building and a design concept for the site. The objectives were to respect the street edge of Great Northern Way, to optimize orientation for both sun angles and wind direction, and thus maximize the potential for daylight and natural ventilation. This resulted in a building with a cross-plan formed by two narrow, intersecting wings, one of four storeys; the other of three storeys in height.

The intersecting wings of the building
are clearly seen from the east
*Photo: KK Law, Courtesy: naturally:wood*

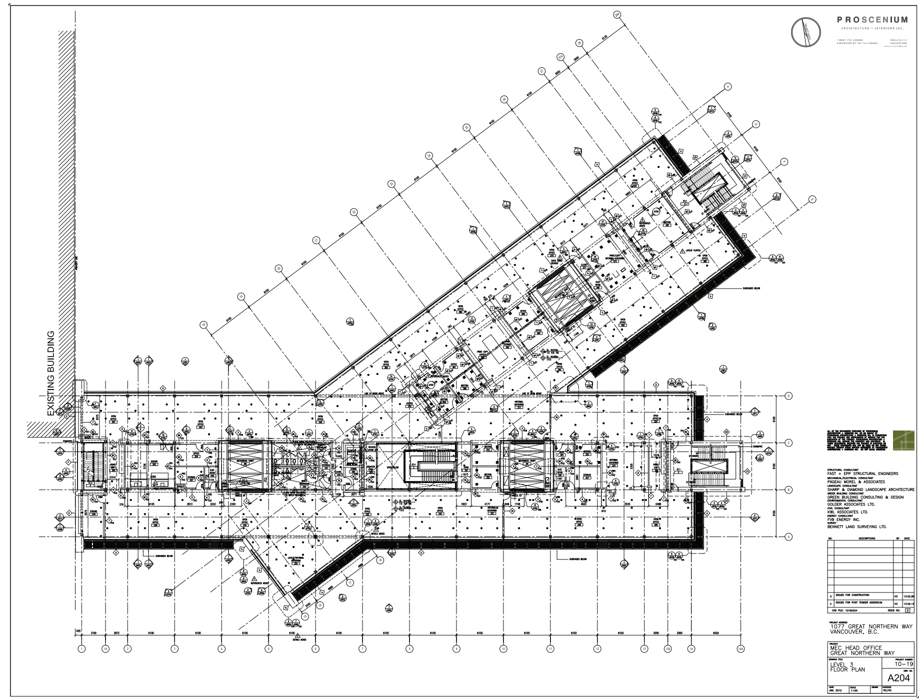
South elevation at dusk
*Ed White Photographics*

# Architecture

## *Organization*




*Courtesy: Proscenium Architecture*




*Courtesy: Proscenium Architecture*

The plan is organized so that enclosed offices and service rooms are in the centre while open plan offices are close to exterior walls and windows. The arms of the plan intersect at the atrium, the social focus of the building where employees can meet, and the activities on one floor can be seen and heard from another.

The use of natural ventilation to cool the building also dictated that the floor plates be as open as possible, the ceilings be high enough to promote stratification and that there be wind towers to facilitate air movement vertically through the building. The wind towers, or ventilation shafts, are a passive/hybrid system that both supply air to the building and exhaust air. All three are centrally located within the floor plan and help set up the office configurations for each floor plate.

The ventilation towers act as both fresh air intakes and exhaust chimneys for stale air. Air is drawn into the towers and down to the basement mechanical room, where it is conditioned using heat drawn from a geothermal field. From the mechanical room, the fresh air is circulated through the floor plenums at each level. Stale air collects at ceiling level and is drawn back into a different chamber of the ventilation shafts where it is exhausted at a high level through heat recovery ventilators.

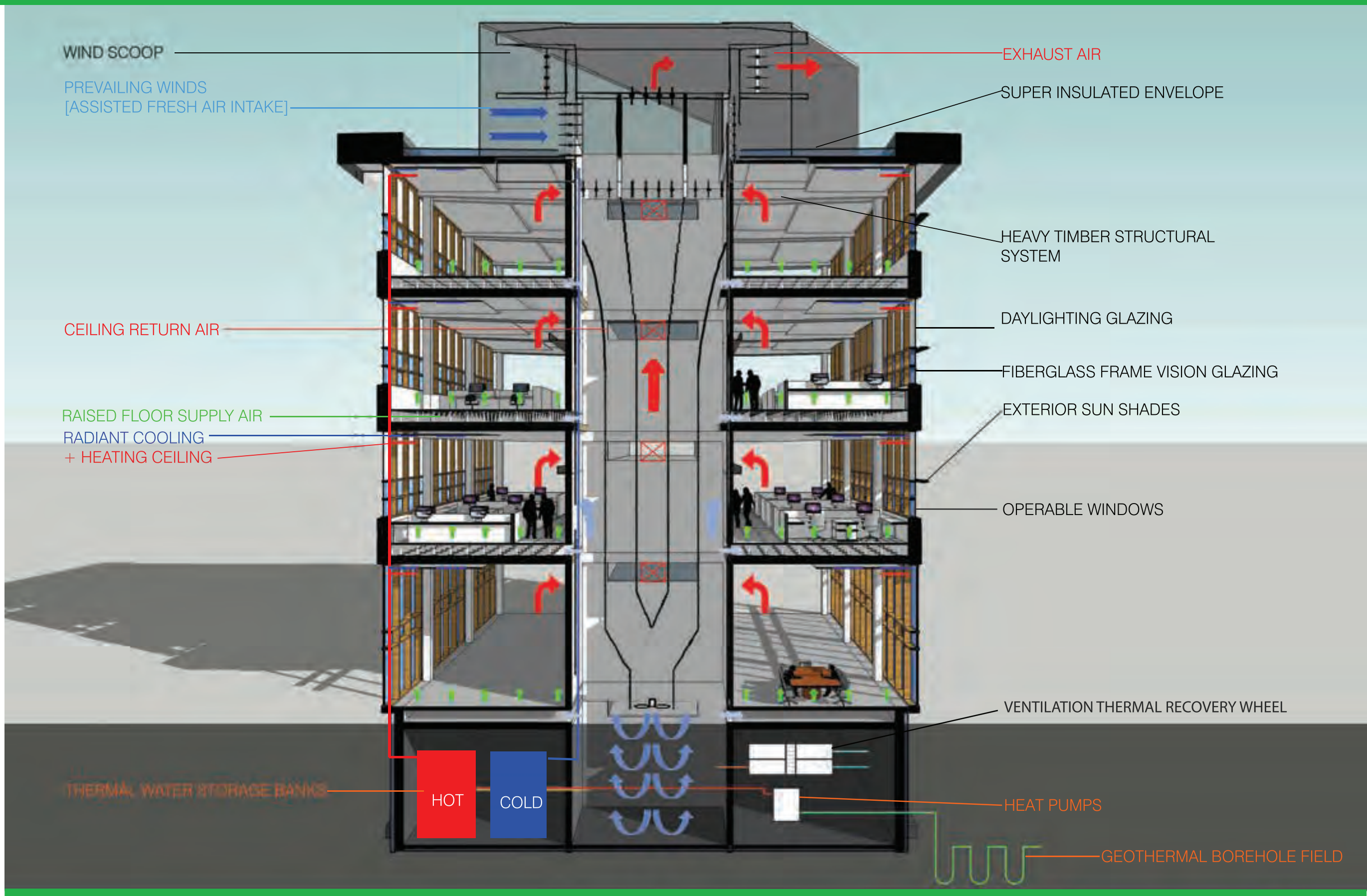
# Architecture

*Organization*

Erection of the post and beam structure
*Photo: Proscenium Architecture*

In order for cooling by natural ventilation to be effective, it was necessary to control unwanted heat gains through the specification of a high-performance building envelope and solar control devices. Accordingly, the exterior walls on the upper floors are made up of 300mm- (12 inch) thick structural insulated panels (SIPs) and triple-glazed windows in fiberglass frames. The SIPs are faced with 13mm- (1/2 inch) thick oriented strand board (OSB) on both sides, filled with foam insulation and framed with 2x12-inch lumber. The glazing is fitted with operable blinds that close automatically to eliminate glare and control heat gain.

Internally, the interconnected atrium volume presented a challenge in terms of smoke containment, with the architects wanting to find an aesthetically appropriate alternative to the standard glass draft stops that typically surround an atrium space at ceiling level. This was resolved by dropping the perimeter beams so that the structure itself is acting as a smoke curtain.




Natural Hybrid Ventilation / Thermal Recovery Systems and Environmental Features
*Courtesy: Proscenium Architecture*

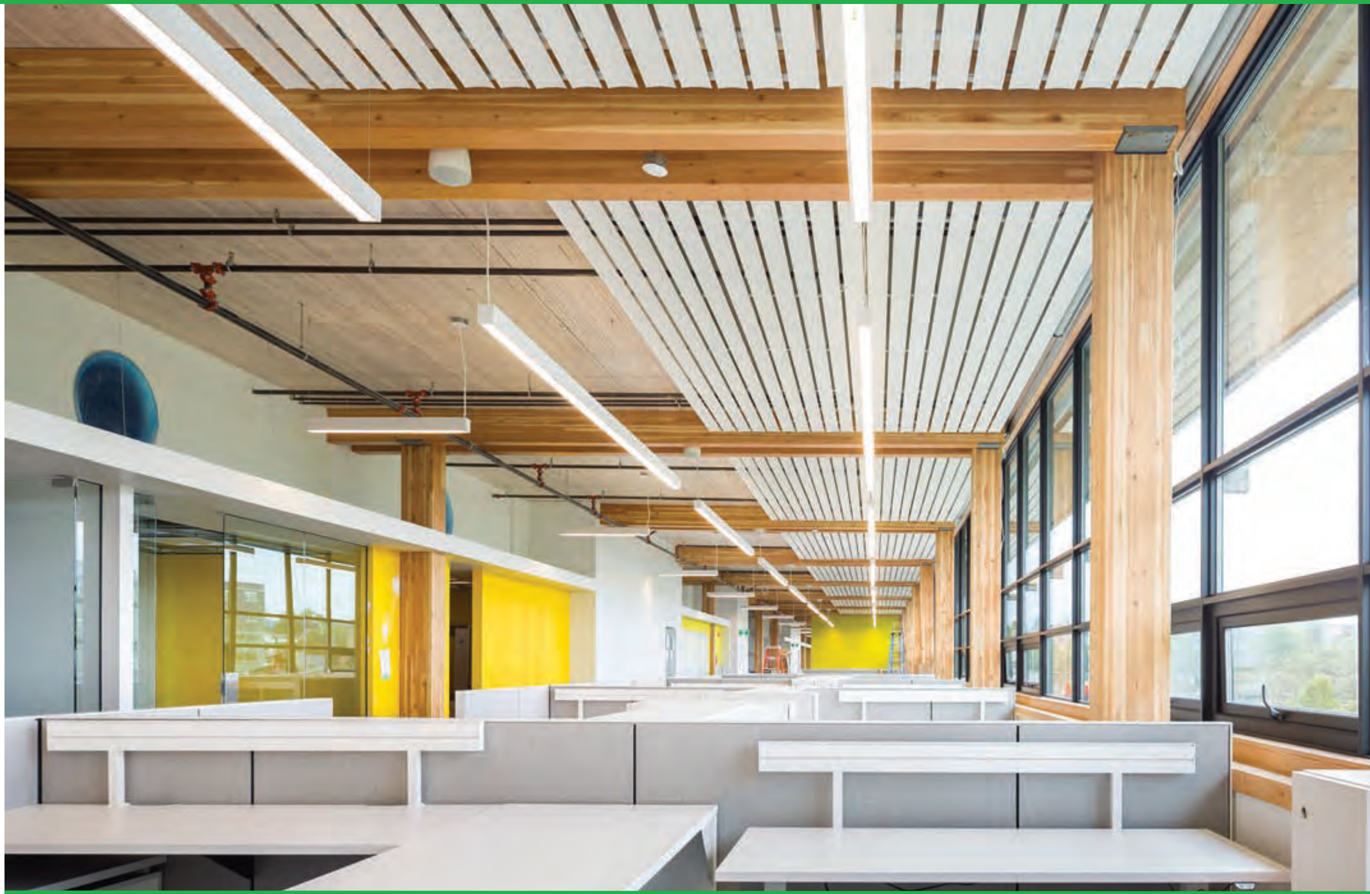
# Architecture

## *Material Choices*

With cast-in-place concrete construction being the default choice in Vancouver for a commercial building of this scale, that became the baseline against which the design team evaluated other options. A quantity surveyor was engaged early in the design process and identified a small cost premium relative to concrete for a heavy timber structure.

However, given the client's expressed desire to create a healthy, fun and inspiring workplace for its employees, and its commitment to sustainability, it quickly became clear that wood was the right choice.

> "We realized that wood could give the space the atmosphere the client wanted; at the same time being the most environmentally responsible choice."
>
> *Hugh Cochlin, Principal - Proscenium Architecture + Interiors Inc.*



Radiant ceiling panels are positioned alongside the windows to provide additional heating or cooling as required
*Ed White Photographics*

# Architecture
## *Material Choices*


Top: Accent colours complement the warmth of wood in the work areas
Lower: The top floor cafeteria has a roof terrace and views of the North Shore mountains
*Ed White Photographics*

Wood-panelled wall in the ground floor corridor at the east end of the building
*Photo: KK Law, Courtesy: naturally:wood*

Interior millwork screen
*Ed White Photographics*

# Structure

As noted above, at the outset of the project, a number of different structural systems were considered by the structural engineers. Fast + Epp compared the traditional approaches of cast-in-place concrete, steel frame with concrete slabs on metal deck, and a wood system with a glulam frame and cross-laminated timber (CLT) floors and roof.

Each of these systems would have resulted in a building of a different character, due in part to the inherent properties of each material with regard to strength, rigidity, fire resistance and other physical properties. Wood was chosen because it best supported the client's commitment to sustainability and a healthy and inspiring work environment.

With the desire for simplicity, economy and flexibility, a glulam post and beam system was chosen for the primary structure, with the floors being constructed using mass timber panels. While the initial preferred option was to use CLT panels for the floors, the building was designed in such a way that permitted nail-laminated timber (NLT) panels to be carried forward as an alternate at the time of tender.

Although this technology closely resembles that used for warehouses and other structures a century or more ago, there was a perceived risk in re-introducing heavy timber as a structural system in a building of this scale.[1] To its credit, Mountain Equipment Co-op was willing to trust the management of this perceived risk to its design team.

The Leckie Building (R) and Vancouver Building (inset). These impressive massive wood structures were built before the turn of the century in Gastown, Vancouver. The glulam beams in the Leckie Building (R) are supported off the glulam columns using a steel saddle detail.
*Photo: Courtesy, Wood WORKS! BC*

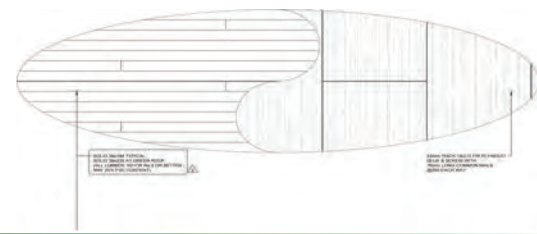
[1] With approximately 1.35 million board feet equivalent (including 1" plywood) of lumber, this is the largest contemporary wood building in Vancouver.

# Structure

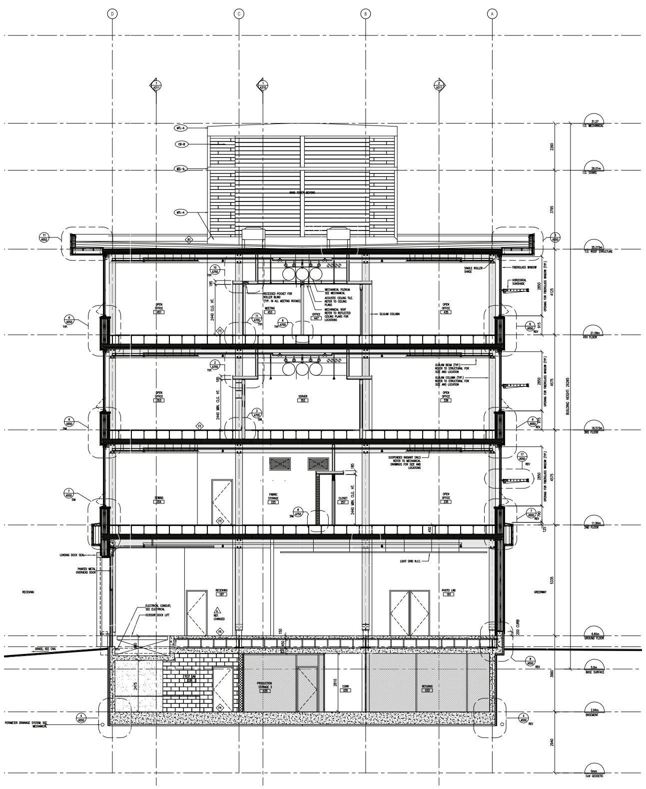
CLT and NLT have similar structural characteristics and require a similar depth when used as a panelized floor system. There are, however, differences in physical properties (discussed below) that affect the detailing of the resulting floor system to meet the fire resistance requirements of the building code. When the project was tendered, NLT proved to be the more economical choice.

Each main bay of the building is 18m (60 feet) wide and is divided into three equal sub-bays of 6m (20 feet). Thus, there are four lines of glulam columns connected by three sets of paired glulam beams in each main bay. The NLT panels are 1200mm (4 feet) wide and 12m (40 feet) long, so that they span two sub-bays of the building. To facilitate diaphragm action, the panels are laid in an overlapping pattern to minimize continuous joints. Plywood sheathing is similarly laid across two adjacent panels in a staggered configuration, again to facilitate diaphragm action.

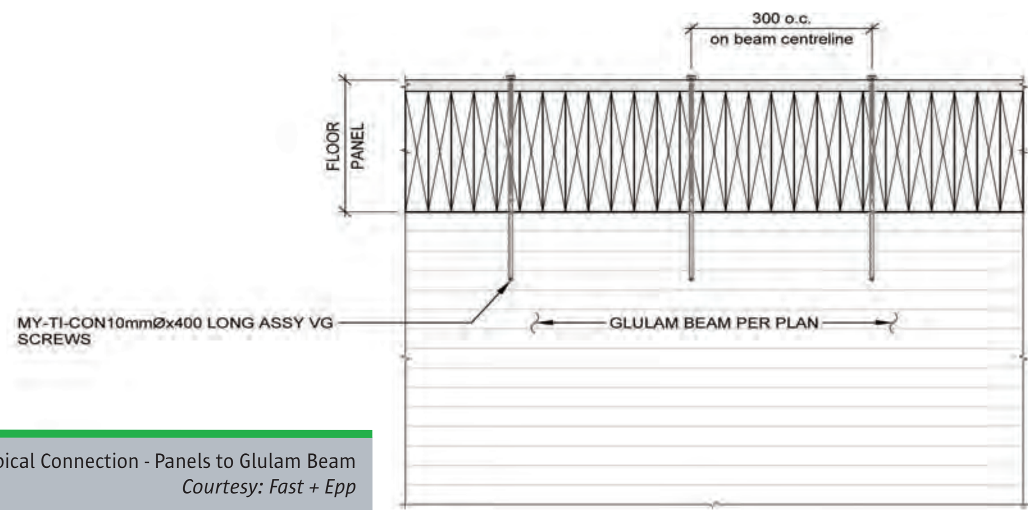
The supporting structure comprises glulam beams and columns calculated to provide a minimum one-hour fire-resistance rating. The NLT panels are made up of 2x8-inch material to provide a sacrificial charring layer while maintaining the required structural integrity and resistance to vibration.



Solid Sawn Lumber Floor - Floor Assembly
*Courtesy: Fast + Epp*



CLT Enclosure Band Option - Section at loading bay looking east
*Courtesy: Fast + Epp*




Solid Sawn Lumber Floor - Typical Connection - Panels to Glulam Beam
*Courtesy: Fast + Epp*

# Structure

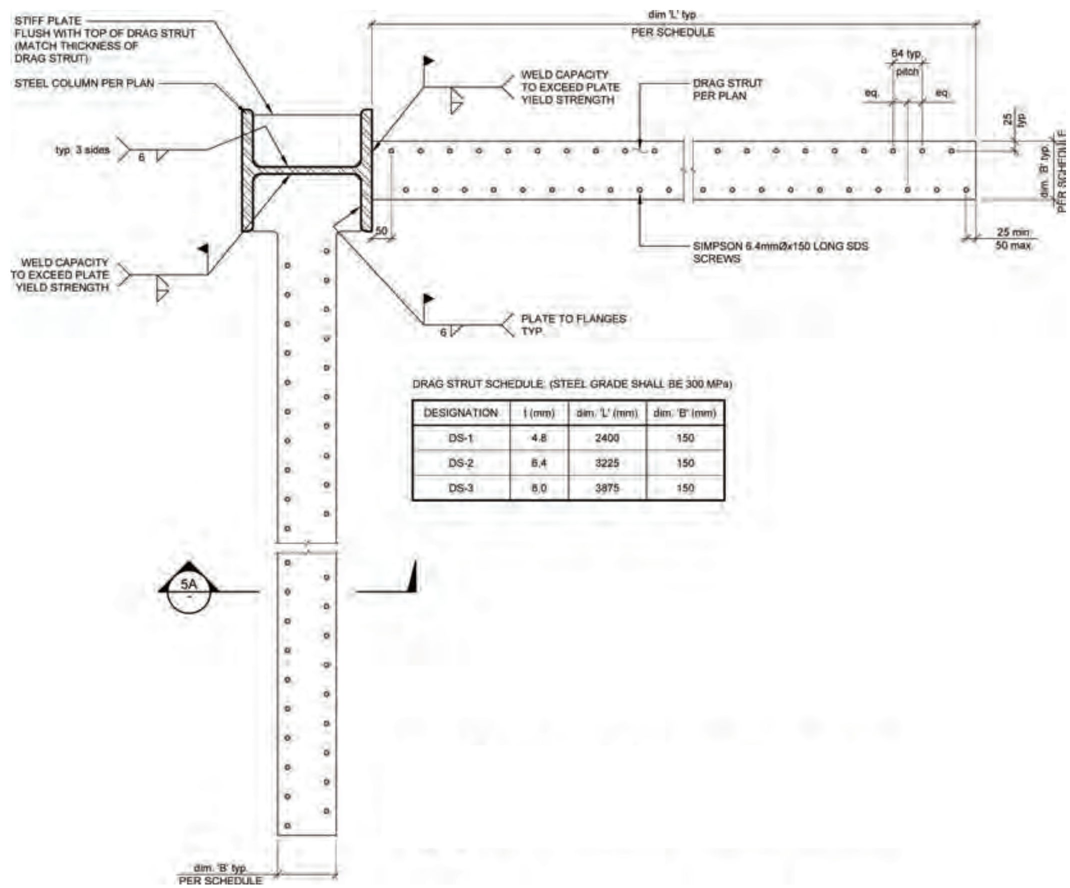

The nail-laminated floors are tied into braced steel frames that provide lateral resistance to the structure
*Courtesy: Fast + Epp*

# Structure

Among the initial challenges faced by the structural engineers was the need to maintain open floor plans for natural ventilation and a continuous underfloor plenum for air distribution.

The open plan immediately limited the options for the placement of shear walls, and the underfloor plenum prevented them from tying in to the structural floor. This meant that there were too few locations available for solid shear walls, and it became necessary to use a hybrid system involving cross-bracing.

> "The cost of wood was close enough to concrete to make it the better choice. Using concrete would have led to a very different building. There would have been concrete shear walls, as well as implications for the extent of exterior glazing. These decisions should always be made in the context of a full building comparison, even if some of the criteria applied lie outside of straight economics."
>
> *Tanya Luthi, Senior Project Engineer - Fast + Epp*




DRAG STRUT SCHEDULE: (STEEL GRADE SHALL BE 300 MPa)

| DESIGNATION | t (mm) | dim. 'L' (mm) | dim. 'B' (mm) |
|---|---|---|---|
| DS-1 | 4.8 | 2400 | 150 |
| DS-2 | 6.4 | 3225 | 150 |
| DS-3 | 8.0 | 3875 | 150 |

Typical Drag Strut Plan View
*Courtesy: Fast + Epp*

# Structure

## *Connections*

Steel strap tying wood floor to steel frame for lateral bracing
*Courtesy: Fast + Epp*

The stairwells and ventilation shafts at either end of the building became the primary elements in the lateral system, with the solid wood floors being tied in by drag straps to structural steel frames stiffened by buckling-restrained steel braces. These core elements of the lateral system behave in a ductile manner, absorbing and dissipating seismic forces in both tension and compression, permitting the remainder of the structure to behave elastically.

To limit the cross-grain shrinkage that can be challenging to deal with in a building of this height, the structure has been designed with storey-height glulam posts, superimposed one on top of the other with end-grain-to-end-grain bearing. A combination plate and saddle connection secures the base of one post to the top of another and provides bearing plates for the beams that run either side. The plates are secured to the top of each column with wood screws. Rebar dowels above the plate are epoxy-grouted into holes drilled into the bottom of each post.

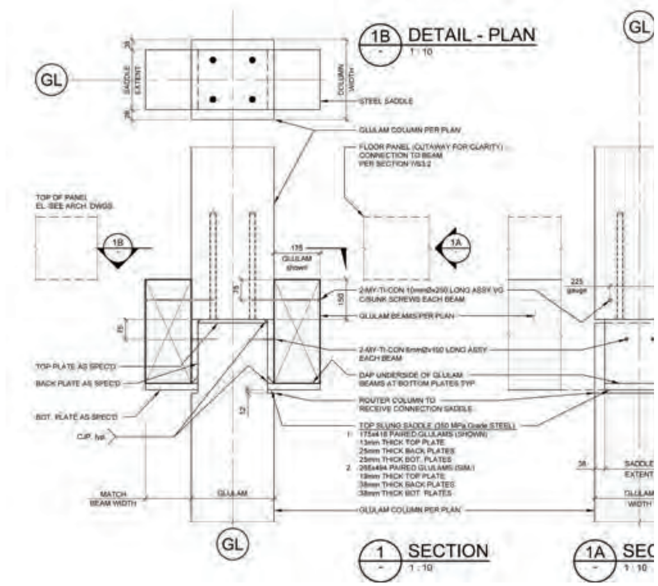
The column-to-column connector with saddles to carry glulam beams
*Courtesy: Fast + Epp*

The columns have end-to-end bearing to minimize shrinkage over the height of the structure. Rebar rods on the saddle connector fit into holes drilled in the base of the column above.
*Courtesy: Fast + Epp*

The double-beam configuration was chosen both for aesthetic reasons (as the beams are exposed), and because it provides increased stiffness to help reduce deflections and floor vibrations. The detail allows the beams to remain continuous at the supports, stiffening the beams; it also shortens the unsupported span for the NLT, stiffening the floor panels.

# Structure

## *Connections*




S5.6 Sections and Details
*Courtesy: Fast + Epp*

At the edge of the building, the floor plate extends beyond the perimeter column line. However, the prefabricated panels terminate at the column line, leaving an edge detail between the columns that was field-framed. This detail had to be completed before the final sheets of plywood sheathing were installed.

*(Note: Had the building proceeded with a CLT floor system, it would have been necessary to devise an overlap or splice detail to achieve this diaphragm action.)*

Connection between paired beams and column viewed from below
*Photo: KK Law, Courtesy: naturally:wood*

The floor structure is tied in to the steel cross-braces using steel strapping sitting on top of plywood. These drag straps (the longest being approximately 2m) were field-welded to the steel frames.

For the exterior walls, the lateral loads are resisted by the floor system and by a series of horizontal glulam beams that run the length of the building, separating the glazing from the SIP spandrel panels.

A section of the perimeter beam that resists the horizontal forces on the external wall of the building
*Photo: KK Law, Courtesy: naturally:wood*

Detail of cladding installation
*Courtesy: Jim Taggart*

# Building Code Considerations

As a result of the decision to use a combustible construction type, the MEC Head Office was constructed in accordance with the prescriptive requirements of the Vancouver Building Bylaw as follows:

- The building is classified as a Group D major occupancy, containing offices as the principal use;
- The building area is limited to not more than 3600 $m^2$;
- The building height is limited to four storeys;
- The building is sprinklered throughout;
- Floor assemblies are required to be constructed as fire separations. They and their supporting structures are designed to provide a minimum one-hour fire-resistance rating; and,
- Since the building contains a four-level interconnected floor space, the building is required to be constructed with heavy timber construction if noncombustible construction is not used.

As mentioned above, the Vancouver Building Bylaw requires the floor assemblies of this type of building be constructed of fire separations with a minimum one-hour fire-resistance rating. However, the heavy timber construction defined under the bylaw, which includes minimum member size requirements, is permitted to be used when combustible construction with not more than a 45-minute fire-resistance rating is required. As a result, LMDG Building Code Consultants Ltd. worked with the architect and structural engineer to develop a solution incorporating heavy timber elements and NLT floor assemblies that satisfied the bylaw fire-resistance requirements.

Access flooring. For a building of this size and type, the concealed space must be non-combustible.
*Photo: KK Law, Courtesy: naturally:wood*

The dropped beams around the perimeter of the atrium are designed to contain smoke in the case of a fire
*Photo: KK Law, Courtesy: naturally:wood*

# Construction Considerations

According to Lloyd Froome, Superintendent - Ventana Construction, constructing buildings of this size in wood presents particular challenges, some related to the properties of the material itself and others to the aesthetic aspirations of the client and design team.

There are logistical considerations that must be addressed when building in the rainy months of the year. Weather protection is required during transportation, while components are stored on site prior to installation, and then from the time they are installed until the building is closed in.


Prefabricated floor panels are delivered to site for installation
*Courtesy: Fast + Epp*

Factory prefabrication of nail-laminated floor panels
*Courtesy: Proscenium Architecture*

Floor panels were lifted into place by crane
*Courtesy: Proscenium Architecture*

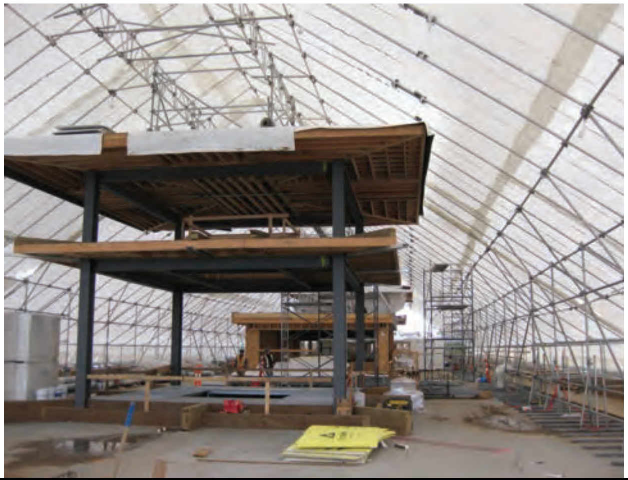
Once in place, the floor panels were lag screwed into the glulam beams
*Courtesy: Proscenium Architecture*

In the case of MEC, the original construction schedule would have seen the building closed in by October, but unforeseen site conditions delayed the project, making it necessary to erect the structure during the winter. Panels were delivered from the factory by flatbed truck in batches of eight or 10 at a time. This was intended to be a ‘just in time’ delivery system, but in some cases panels had to sit on site for several days prior to installation.

# Construction Considerations

Engineered wood products such as glulam, which are manufactured from kiln-dried material and glued together under pressure, are less susceptible to water damage than those assembled mechanically from solid sawn material. Glulam typically is plastic wrapped in the factory, with the wrap remaining in place until the building is closed in.

Having carried both options through the design phase, NLT was preferred in the end over CLT because of price and availability. The lower cost of NLT panels is to some degree offset by other considerations. NLT construction requires larger tolerances compared with CLT. As a consequence, it is more difficult to achieve the required fire rating. It was necessary to maintain minimum tolerances to conform to code. So long as the gap between panels conforms to the code, installing a layer of plywood over top will meet fire resistance requirements.



A tent was erected to protect the wood structure
from inclement weather during erection and prior to closing in
*Courtesy: Proscenium Architecture*

# Construction Considerations

NLT panels are more susceptible to water damage and, in the case of MEC, the staggered arrangement of floor panels required to create diaphragm action made protection of the exposed edges a challenge for the contractor. Similarly, the plywood sheathing that would have provided an increased degree of weather protection also needed to be overlapped, leaving portions of the NLT panels exposed.

Small gaps were filled with mineral wool insulation and sealed with fire-rated caulking to meet fire separation requirements. Oversize gaps also had wood filler strips nailed in place from below.
*Courtesy: Ventana Construction*

Another moisture protection challenge occurred at the perimeter of the building, where the portion of the floor structure between the grid line and the outer face of the column had to be assembled on site. The panels were installed quickly in order to complete the assembly and reduce moisture exposure to panel edges.

The NLT panels were constructed using No. 2 and Better Douglas fir lumber dried to a moisture content of 19 per cent, but even this material has considerable variability. The gaps between laminations are large enough to permit water infiltration, making preventive measures a priority.

Moisture metering of all the wood components was carried out on a regular basis to ensure that they were at the required moisture content before being covered. This is particularly critical with the roof, as the membrane, once installed, prevents the evaporation of entrapped moisture from the substrate.

The 1200mm- (4 foot) wide panels, each comprising 30 laminations, are subject to considerable cross-grain shrinkage that can add to the gaps between panels already required for construction tolerance. Because the floors are also fire separations, it was necessary to keep the accumulated gaps to a minimum, but to devise a detail that could ensure the integrity of the fire separation if the gaps exceeded the maximum width permitted by the design. Where gaps between nail- laminated panels exceed the maximum permitted by code, they were sealed with fireproof caulking to achieve the required fire-resistance rating.

Because the structural elements of wood buildings are generally designed to be exposed, they must be treated with the same care that would be used when handling any finish material. The scale of the structural wood components adds to the challenge, and inevitably there will be scuff marks and other surface blemishes that can be sanded off.

The weather protection methodology was included in the structural specifications, but this did not include tenting of the structure. The decision to erect the tent came during construction, after the owner, design team and the contractor evaluated various options for keeping the structure dry. However, due to a combination of circumstances, the tent, which ideally should have been in place by the end of October, was not completed until February.

Given that any project can be subject to unforeseen delays, and that adverse weather can occur at any time of year, both the structural engineer and contractor now believe that weather protection should be the primary design driver for large wood structures in wet climates. The implications of such a strategy might involve little more than redesigning the lateral load resistance system, using (for example) drag struts rather than staggered panels and plywood sheathing – but could extend to the complete tenting of the building, as is common practice in Scandinavia.

# Wood and Sustainability

MEC recognizes the many sustainable attributes of wood including its ability to contribute both to low carbon construction and to the creation of healthy and stimulating workplaces.

Growing trees sequester carbon from the atmosphere, which remains locked within wood products throughout their service life in a building. BC has more than 50 million hectares of certified forest – more than half the province's land base (96.4 million ha). Reforestation maintains the natural diversity of tree species, maximizing the habitat values and resilience of the forest. Reforestation also optimizes carbon sequestration by ensuring there are always a substantial number of trees in the most vigorous stage of their growth cycle.

As an interior structural or finished product, wood is durable and requires little maintenance. In addition, the visible presence of wood has been shown to reduce stress and promote health and well-being in workplaces and public spaces. Natural light, fresh air and exposed wood provide a warm ambience to enable people to do their best work.

## Carbon Summary

### Results

Volume of wood products used:
2,394 cubic meters (84,543 cubic ft) of lumber and sheathing

Carbon stored in the wood*:
1,726 metric tons of carbon dioxide

Avoided greenhouse gas emissions:
3,668 metric tons of carbon dioxide

Total potential carbon benefit:
5,393 metric tons of carbon dioxide

### Equivalent to:

1,030 cars off the road for a year

Energy to operate a home for 458 years

Results from this tool are estimates of average wood volumes only. Detailed life cycle assessments (LCA) are required to accurately determine a building's carbon footprint. Please refer to the References and Notes for assumptions and other information related to the calculations.

cwc.ca/resources/online-tools

What is old is new again: Nail-laminated timber panels featured in the modern MEC Head Office (above and L) were also used in structures built in Vancouver in the 1880s.
*Photos: Photography West*

MEC's commitment to innovative green building includes choosing wood as a primary building material for its new headquarters. The avoided and sequestered greenhouse gases from the wood used in the building is equivalent to removing 1,030 cars off the road for a year and approximates the energy used to operate a home for 458 years. The total carbon dioxide equivalent avoided by using wood products* over other materials in the building is more than 5,393 metric tonnes.

*cwc.ca/resources/online-tools

# Benchmarking Study

The Mountain Equipment Co-op (MEC) project is a hybrid mass timber/steel office building approved for construction through the 'Alternative Solutions' provision in the Vancouver Building By-Law, which is comparable to the provision found in the British Columbia Building Code and the National Building Code.

In order to understand potential cost differences using alternative and conventional materials, the MEC project team evaluated the building design and cost parameters and then re-worked a number of project variables to create four similar hypothetical building designs. A comparative analysis of these four hypothetical buildings was subsequently initiated:

- A mass timber system – incorporating glulam post and beam structural elements, nail-laminated timber panels using commodity dimensional lumber sheeted with plywood, and steel buckling-restrained braces for shafts and cores;
- A structural steel frame system – incorporating open-web steel joists supporting metal decking with concrete topping, and steel buckling-restrained braces for shafts and cores;
- A structural steel system – incorporating precast concrete hollow core panels and buckling-restrained braces for shafts and cores;
- A reinforced concrete system – incorporating two-way flat plates and concrete shear walls.

The four designs and specifications created were further reviewed as to the cost of secondary impacts to various elements of the building that would occur by changing the structural framing systems. The quantity of building materials applicable to each hypothetical design was then estimated and compared to a Class "C" construction cost level.*

The study results showed the cost competitiveness of mass timber building systems compared to reinforced concrete and structural steel options under current Vancouver market conditions using the contractor's internal statistics and figures. Approximately 15 equivalent board feet of glulam, lumber and plywood per gross square foot of construction (15fbm/sq ft) was incorporated within the hypothetical wood building estimation. The total cost for all building systems considered was within 2.5 per cent of each other, and the timber building cost was the second lowest.

For the hypothetical wood building, the cost of the foundation was the lowest and the cost of superstructure the highest compared to the hypothetical concrete option. However, the secondary impacts helped offset the additional net cost for mass timber building solutions.

The two most influential secondary impacts included the speed of construction for the mass timber building and the cost of finishing treatments for the ceilings and drywall, which was far less for the mass timber building. By understanding the relation between a structural framing system and these secondary impacts, building designers can make an informed decision when considering the overall budget of a given project.

Weather protection during construction can be a significant part of the cost of a mass timber building structure and this consideration becomes increasingly important as timber buildings get taller and larger. A well-planned strategy for weather protection can significantly reduce the related expenses and further enhance the speed and quality of construction – especially if the structural framing is going to be left exposed in the finished building in order to save cost on finishes (i.e. exposed structural surfaces).

Early input from general contractors/construction managers, suppliers, timber installers and other sub-trades is also important to further increase the cost competitiveness of mass timber building systems. This approach will achieve a material- and system-compatible design that fully respects the manufacturing, assembly, logistics and installation sequencing, thereby reducing the total cost. Although this is generally true for any material, it is especially relevant when using prefabricated elements typically found in mass timber systems.

Also, the greatest cost efficiencies can be achieved by using simple and repetitive construction systems and details. It is understood that buildings with a strong architectural expression will, in most cases, create unique situations within the building structure. It is recommended the designers involved find effective and efficient solutions by using repetitive and simple construction systems and details as much as possible.

*Guide to Cost Predictability in Construction. Prepared by the Joint Federal Government / Industry Cost Predictability Taskforce. November 2012.

# In Conclusion

The MEC Head Office building offers us a glimpse into the past and the future simultaneously. In the 19th and early 20th centuries, a significant proportion of Canada's commercial buildings were constructed using a heavy timber post-and-beam structure, with floors of solid nail-laminated dimension lumber and a non-loadbearing exterior skin – most often of masonry. At the time, this system was chosen for its economy, strength and durability. With these attributes, it is perhaps not surprising that many such structures are still to be found in Canadian cities. Some of them (like The Landing in Vancouver) are as tall as nine storeys.

Today, wood structures continue to deliver on the promises of the past, but now our understanding of wood has broadened to include its benefits to environmental sustainability and human health. These contemporary concerns are central to the corporate philosophy of Mountain Equipment Co-op, which has demonstrated its commitment to environmental stewardship for more than 40 years, and whose concern for employee well-being is recognized across Canada.

Given this outlook, MEC was prepared to consider the option of an all-wood building from the outset, and to be an early adopter in re-inventing this historic construction technique within the context of today's codes and standards. The result, as shown in the pages of this case study, have exceeded expectations in terms of the warm, welcoming and healthful working environment.

The floor construction resembles that of late 19th and early 20th century commercial buildings across Canada. This technique is being revived and updated to reduce the environmental impact of new buildings.
*Courtesy: Fast + Epp*

The success of this project has demonstrated that solid wood systems for commercial buildings are a viable and desirable alternative to other forms of construction. The structural system used for MEC is highly replicable, as it does not require high-tech mass timber panel products, but can be successfully undertaken in any well-organized prefabrication shop. As such, the MEC Head Office offers compelling evidence of how heavy timber construction may once again become the system of choice for commercial buildings across the country and around the world.

MEC has a highly replicable structural system
*Photo: Ed White Photographics*

"It's simple, really. Running a $300-million retail co-operative that serves more than four million members is a huge undertaking. And if our employees love where they work, then they happily support our members to live active outdoor lifestyles."

*Excerpt from MEC Statement of Corporate Philosophy*

# Mountain Equipment Co-op - Head Office

## Project Credits

Owner: MOUNTAIN EQUIPMENT CO-OP

Architect: PROSCENIUM ARCHITECTURE + INTERIORS

Structural Engineer: FAST + EPP STRUCTURAL ENGINEERS

Mechanical and Electrical Engineer:
PAGEAU MOREL & ASSOCIATES

Landscape Architect:
SHARP & DIAMOND LANDSCAPE ARCHITECTURE INC.

Surveyor: BENNETT LAND SURVEYING LTD.

Civil Engineer: KERR WOOD LEIDAL (KWL) ASSOC. LTD.

Geotechnical Engineer: GEOPACIFIC CONSULTANTS LTD.

Environmental Consultant: GOLDER ASSOCIATES LTD.

District Energy Review Report: FVB ENERGY INC.

Cost Consultant: JIM BUSH & ASSOCIATES

Transportation Planners and Engineers:
BUNT AND ASSOCIATES LTD.

Code Consultant: LMDG CODE CONSULTANTS LTD.

Commissioning: STANTEC CONSULTING

Public Art Consultant: ID A PUBLIC ART CONSULTING

General Contractor/Construction Manager:
VENTANA CONSTRUCTION CORPORATION

Glulam Supplier: STRUCTURLAM

Nail-Laminated Timber panel fabricator:
BRENTA GROUP IN ASSOCIATION WITH SEAGATE STRUCTURES, BUILT BY ALLIANCE TRUSS


*Ed White Photographics*


NATIONAL FUNDERS

Natural Resources Canada / Ressources naturelles Canada

BSLC

PROVINCIAL FUNDER

Forestry Innovation Investment

NATIONAL PARTNERS

StructureCraft · STRUCTURLAM Innovative Wood Specialists · western archrib structural wood systems · Weyerhaeuser

PROVINCIAL PARTNERS

COFI Council of Forest Industries · ILMA Interior Lumber Manufacturers' Association · Coast Forest Products Association · CMSA · Boise Cascade Engineered Wood Products