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CASE STUDIES OF

Outstanding Wood Buildings

wood WORKS!

engineered for strength and style...*naturally!*

Natural Resources Canada

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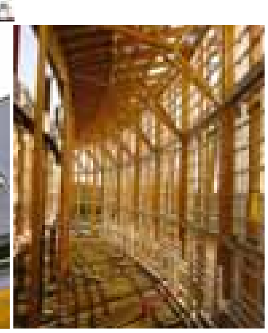



Introduction

Proud, confident and imaginative. This series of Case Studies demonstrates how Canadian building designers are finding exciting uses for Canada's oldest, yet newest building material – world-renowned quality wood products that can meet all the challenges of modern building science. The Wood *WORKS*! Program was conceived to show the world how to create amazing living and working environments with building materials that are renewable and have a low environmental price tag.

Supported by industry and government, Wood *WORKS*!, a Canadian Wood Council initiative, is more than a resource for wood construction, engineered wood products and building systems. It is an affirmation of Canada's world leadership in the management of forest resources, the manufacture of quality products, and the design and construction of buildings with these materials. Wood *WORKS*! is dedicated to your success in building with wood, developing your expertise and celebrating your pride.

Since its launch, the Wood *WORKS*! Team has helped several high profile projects meet or exceed building code and owners' requirements, while offering the best value compared to other building systems. The following projects showcase wood's potential in construction:

Wood *WORKS*! is managed and supported by the Canadian wood industry through the Canadian Wood Council, its member associations, several companies and various levels of government (federal and provincial) including Natural Resources Canada.

1. West Vancouver Aquatic Centre
New Life for an Old Building

The West Vancouver Aquatic Centre has provided aquatic recreation opportunities for the past 25 years. After years of heavy use, the facility was in need of a major overhaul to bring it up to current aquatic standards, and to add new features. This project combines the refurbishment of an original 25-year-old aquatic facility with the addition of a new leisure pool, accessible hot pool, 20 m (65 ft) water slide, family change rooms, multi-purpose room, fitness areas, and public viewing areas (*Figure 1*).

Although the shell of the original aquatic centre was retained, the renovation was very extensive and the new facility covers almost two times the area of the original. Completed in January 2004, in the two-storey, 3,050 m^2 (33,000 ft^2), $7.5 million, a major attracting feature of the West Vancouver Aquatic Centre is the extensive use of wood.

Architectural Considerations

The original aquatic centre was constructed in 1974 and consisted of concrete and masonry walls supporting a glulam arch roof. The facility had very little natural light and no natural ventilation.

The design team reconfigured the existing flank of change rooms for better use and added a fitness area. The expressive volume of the new pools springs from a re-interpretation of the existing building geometry, structural systems, and site constraints. In contrast to the existing pool volume, the new shell volume presents an open expression to the adjacent civic spaces, as well as to the pedestrian and vehicular energy of Marine Drive (*Figure 2*). Generous mountain views exist to the north of the site while panoramic views of Burrard Inlet grace the upper levels.

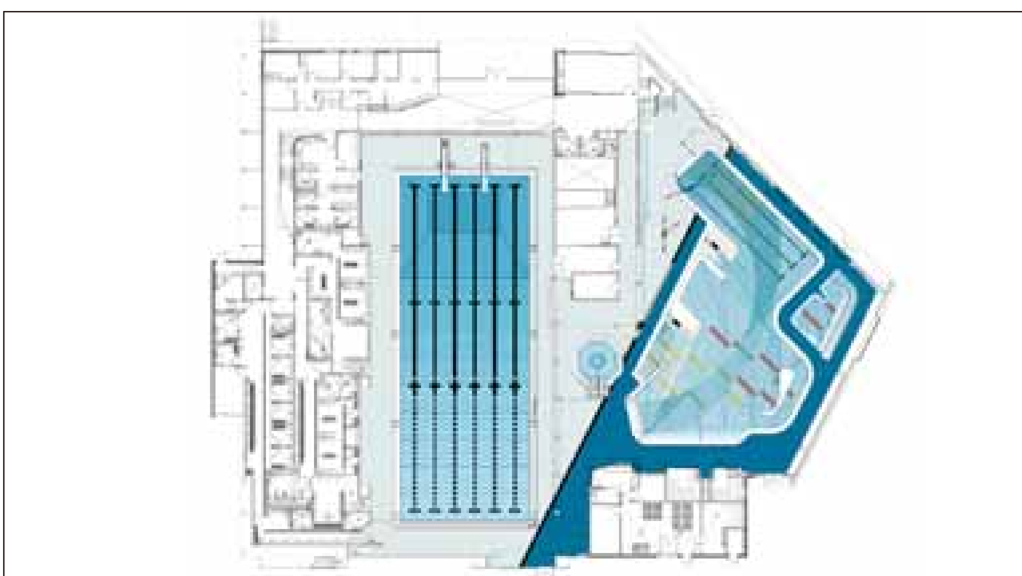


Figure 1
Plan view of refurbished pool and facilities (left) and new leisure pool and related amenities (right)

Figure 2
Rendering of façade for
the new leisure pool

Structural Wood System

Using as its starting point the structural grid and system of the original building, the design utilizes a palate of durable materials including reinforced concrete, concrete masonry, glass (curtain wall), and wood. The structure of the new pool space is primarily glulam beams and purlins.

Roof Design – The structure features glue-laminated arches and columns in the pool spaces supporting a metal roof on a metal deck. The glulam beams provide versatility and up to 30 m (100 ft) clear span. The "wish-bone" supporting columns (*Figure 3*) contrast typical aqua colours and create a strong first impression when people enter the facility.

Wall Design – Retaining the shell of the original building, the walls are a combination of load bearing masonry, glass curtain wall, and metal cladding set on a cast-in place concrete floor system. In the addition, glulam columns support an innovative curtain wall system in the exterior façade (*Figure 4*). The innovative structure of the eastern wall of the new pool space uses a glulam glazing system that accommodates glazed over-head doors and a series of electrically-operable solar shading devices.

Figure 3
Curved glulam columns in
the new leisure pool

Environmental Features

Site Conservation – The original building has been recycled into the expanded facility extending its lifespan and making it relevant to the recreation needs of today's community. The additions to the facility have been designed to have minimal impact on the mature existing trees on the north and west sides of the facility.

Energy Conservation – In addition to energy and water efficient systems, the design makes extensive use of natural light and natural ventilation. The pool water is heated using a combination of recovered heat from the de-humidifiers and geothermal heat sources below the civic lawn. Waste heat from the adjacent ice arena refrigeration plant is also utilized. The east wall of the new pool spaces utilizes a series of electrically-operated solar shades within a deep "egg-crate" glulam structure to provide an effective balance between solar control and natural light.

Indoor Air Quality – Through the use of electrically-operable glazed overhead doors and mechanically operable vents, the facility can be naturally ventilated. Raising the doors also provides access to a public outdoor space overlooking the civic lawn. The natural ventilation significantly improves the indoor air quality, providing the ambiance of an outdoor pool.

Materials – Materials selected are suitable for the demanding atmosphere of an aquatic centre. In a pool or arena where humidity is a factor, wood helps to mitigate the problem. Steel tends to corrode and water drops are created. Wood is able to tolerate the high humidity levels. Acoustically, wood absorbs sound so the building is not as noisy as a complete steel or concrete structure.

Fire Safety Requirements

The West Vancouver Aquatic Centre is sprinkler-protected. A building of this size is required to be of noncombustible construction. However, with the building sprinklered, the roof assembly and its supports are permitted to be heavy timber construction. As such, the glulam beams and supporting columns were left exposed, and no additional fire protection was required.

Figure 4
Night view into the new pool

Conclusion

This project has added many more years of enjoyment for the users of the West Vancouver Aquatic Centre. Upgrading of the original pool area and the addition of new facilities makes it suitable to a wider range of ages, abilities and interests. Wood construction plays a major role in the modernization and humanization of the new facility, and reflects the forestry heritage for which British Columbia is world-renowned.

Project Credits

ARCHITECTS:
Hughes Condon Marler: Architects

STRUCTURAL ENGINEERS:
Fast + Epp Structural Engineers

GLULAM FABRICATOR:
Western Archrib

GENERAL CONTRACTORS:
DGS Construction Company Ltd.

PHOTO CREDITS:
Martin Tessler, and Hughes Condon Marler: Architects

2. Hinton Government Centre
Sustainable by Design

When it's town hall burned down in 1998, the Town of Hinton sought a building design that would demonstrate environmental consciousness and be a functional landmark attraction. The resulting Hinton Government Centre, a 3,000 m^2 (32,000 ft^2), three-storey office building was completed in 2000, providing facilities for the municipal government and office space leased to the Province of Alberta.

Situated west of Edmonton on the eastern edge of Jasper National Park, the Town of Hinton is home to a population of almost 10,000. The forest industry, a pulp mill and a sawmill, is the foundation of the Hinton economy. The result of community involvement that has fostered increased pride and responsibility in the project, the new Government Centre is a proud display of some of the products made in Hinton and distributed around the world.

Figure 5
Artist's rendering of north elevation

Figure 6
Site plan

About the building...

Located on the corner of Switzer Drive and Robb Road, the site is an irregularly shaped 6.5 ha (16 acres) parcel of land on the main road connecting the two historical centres of Hinton, known to residents as the Hill and the Valley. The building, designed according to the sloping landscape (*Figures 5* and *6*), is accessed by means of an elevated wooden walkway (*Figure 7*). Visitors enter into a two-storey lobby space featuring peeled log columns and a full height window wall looking towards the distant Canadian Rockies and the slopes of the Athabasca River Valley.

At the south end of the site, the building is two stories in height, with Municipal Government on the main floor and Alberta Government offices on the upper floor. The north end of the building is three stories high and there is direct grade level access to the lowest level, as well as bridge access to the Municipal Government, Council Chamber, and offices located off the public atrium space on the second level.

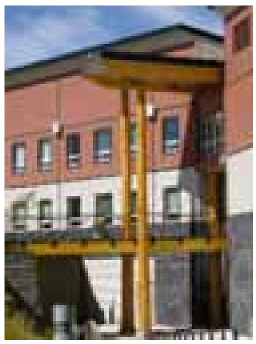


Figure 7
Main entry bridge

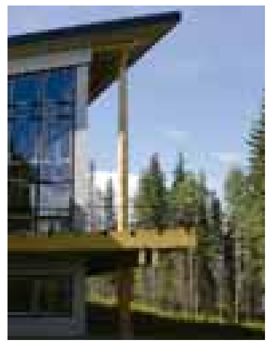


Figure 8
Exterior, north side

Architectural Considerations

The selection of materials took into consideration resource conservation, the reduction of embodied energy, and the use of renewable resources with maximum benefit to the local timber economy. As well, the warmth and character that wood provides was essential to the desired building character.

The building utilizes materials that are durable, easy to maintain, and sustainable. The exterior and structure are made primarily of wood with stone, glass, masonry, and pre-finished metal, using simple and readily available materials, systems, and construction methods. The interior finishes utilize wood for certain key elements to create a sense of warmth and to reflect Hinton's character.

Structural Wood System

Wood construction was chosen for three reasons.

1. It was the most economical building solution.
2. It provided the greatest flexibility for change during construction.
3. It allowed the contractor to utilize local labor and materials.

Structural Frame – The exposed structure of the Hinton Government Centre is comprised of steel columns and peeled-log columns supporting glulam beams. Loadbearing wood stud walls are used at the building perimeter and for interior fixed partition walls. In addition to supporting the roof and floor loads, these walls are also structurally important in resisting lateral loads and act as shearwalls.

The floors are comprised of two layers of OSB / plywood sheathing installed over wood I-joists or open-web wood joists. Office spaces are designed using raised floors to provide easy routing of cables and ventilation.

Exterior – Pre-finished wood siding systems were used extensively as an exterior finish for the project. The exterior siding's acrylic latex paint has an extended wear guarantee that contributes to the need for a low maintenance exterior. The exposed wood structure (*Figure 8*), the interpretive shelter, the exterior wood deck, and the entrance bridge are coated with a water repellent stain.

Interior – Most of the interior walls have a painted gypsum board finish. The ceilings are a combination of t-bar grid ceilings and tight-knot pine in the atrium and Council Chamber. Wherever possible, wood surfaces and structure were stained and left exposed (*Figure 9*). Architectural millwork includes wood and wood veneers, and all interior doors are solid wood core (birch veneer with a clear finish). The Council Chamber makes extensive use of wood as a finish material, including exposed arched glulam beams (*Figure 10*) and a feature wood wall consisting of birch plywood in a metal framing system.

Figure 10
Town of Hinton Council Chamber

Figure 9
Main lobby atrium

Fire Safety Requirements

The Hinton Government Centre is a Group D office occupancy. This occupancy is permitted to be wood-frame construction and/or heavy timber construction for the planned building area and height. The floor assemblies and loadbearing walls are required to have a fire resistance rating not less than 45 minutes. In compliance with the Alberta Building Code, all floor areas are sprinklered. Exterior sprinklers were required and included in the design of the entry canopy, and other areas with large overhangs, because of the use of a combustible structure for the deck, the entrance bridge, and overhangs greater than 2.4 m (4 ft).

Thermal Performance

A wall system with an effective R-value of R-20 and roof system with an R-value of R-30 offsets the demand for winter heating. The wood-frame construction used throughout the building was easily and cost-efficiently insulated to provide the needed effective R-value within the building envelope. The high thermal performance of the building envelope means that perimeter make-up heating is not required.

To optimize thermal performance, the walls and roof are sealed with a continuous torched on air/vapour barrier. The insulation is on the cold side of the membrane to prevent condensation within the wall space. Low-e window glazing was chosen to maximize natural lighting while reducing summer heat gain and reducing winter night-time radiation loss. Operable windows provide localized ventilation, improve staff comfort and reduce cooling energy expenditures during the spring, summer, and fall.

The building orientation was adjusted to face the north and northwest. A daylight analysis was used to optimize the amount of comfortable daylight on the west and north faces of the building to avoid solar heating and the glare impact of the low summer sun exposure from the west. The design is elongated to maximize daylighting, yet compact (with a length to width ratio of 2.85 to 1) to maximize envelope heat transfer performance.

Sustainable Design

With sustainability and environmental issues in mind, the building and site have been designed to meet or surpass the Commercial Building

Incentive Program (CBIP) and CANMET C-2000 requirements. Throughout the design process, the use of energy modelling and building simulation allowed performance to be checked on all aspects of the building: lighting and daylighting, shape and orientation, heating, ventilation and air conditioning, as well as the building envelope. The final design is an integration of sustainable technologies that are specific to the program, site, and needs of the client.

The Hinton Government Centre combines a variety of passive and active approaches to sustainable design, for example, low-impact site strategy, material selection, and sophisticated electronic environmental controls. As a result, the building reduces greenhouse gas emissions by more than 50% compared to a conventional building through the reduction of operational energy and the use of low embodied energy materials. Its energy consumption level is more than 50% less than what is required by the *Model National Energy Code for Buildings* (MNECB). These energy savings are projected to be in excess of $30,000 per year in operating costs, which offsets the cost of capital project funding.

Conclusion

The Hinton Government Centre is an energy efficient and sustainable building that acts as a bridge between hill and valley, industry and environment, past and future. The construction of a wood building provides the desired qualities of warm appearance, economy of means, reduced environmental impacts, and maximum benefit to the local forest product-based economy. The sustainable design strategies used in this project represent the strong environmental stewardship practiced by the Town of Hinton. Most importantly, the building and site is a place serving and belonging to the residents of Hinton.

Project Credits

ARCHITECTS:
Manasc Isaac Architects Ltd.

STRUCTURAL ENGINEERS:
Duthie, Newby, Weber & Associates Inc.

GENERAL CONTRACTORS:
Graham Construction & Engineering Ltd.

PHOTO CREDITS:
Jim Dow

Commercial Building Incentive Program

Natural Resources Canada's Commercial Building Incentive Program *(CBIP) offers a financial incentive for the incorporation of energy efficiency features in new commercial/institutional building designs. The objective of the program is to encourage energy-efficient design practices and to bring about lasting changes in the Canadian building design and construction industry. A financial incentive of up to $60,000 is available to building owners whose designs meet CBIP requirements. The program requirements are based on two documents: the* Model National Energy Code for Buildings *and* CBIP Technical Guide*. An eligible building design must demonstrate a reduction in energy use by at least 25% when compared to the requirements of the MNECB. The program began in 1998 and ends March 31, 2007. For more information on CBIP, visit* **http://oee.nrcan.gc.ca/newbuildings/cbip.cfm**.

Source: CBIP, Natural Resources Canada

3. Charles W. Stockey Centre for the Performing Arts / Bobby Orr Hall of Fame

Sound Performance Takes Center Stage

It's picturesque Georgian Bay frontage, it's outstanding international summer music festival – the Festival of the Sound – and it's native hockey legend – Bobby Orr – are three distinguishing features of Parry Sound. A partnership representing these three features commissioned construction of the Charles W. Stockey Centre for the Performing Arts and the Bobby Orr Hall of Fame (*Figure 11*) in the heart of Parry Sound's waterfront district.

With strong community support and the tireless efforts of numerous Parry Sound and area citizens, the Festival of the Sound now has a breathtaking new edifice in the Charles W. Stockey Centre. More than 40 partners were drawn together for this project, including all area municipalities, the provincial and federal governments, and the private sector.

Figure 11
Main entrance

About the building...

The world-class Charles W. Stockey Centre for the Performing Arts sits on a 1.5 ha (3.5 acres) site. Construction began in the spring of 2002 and the official opening took place in July 2003. The \$12.4 million, 2,500 m^2 (27,000 ft^2) Stockey Centre houses a 480-seat acoustically sound Performance Hall to serve as the new home of the world-renowned chamber music festival, an interactive sports hall of fame, and a hockey museum celebrating many Northern Ontario sports heroes.

Part of the Centre is the hockey museum, featuring Bobby Orr, a native of Parry Sound. The Orrs have handed over a large assortment of memorabilia for display in the new facility. The Bobby Orr Hall of Fame also celebrates the achievements of these athletes using the latest, interactive technologies.

Architectural Considerations

A common lobby is shared between the Centre for Performing Arts and the Bobby Orr Hall of Fame entertainment centre. The complex also incorporates two reception rooms, and a waterside outdoor performance deck. The main theatre, whose prime function is the performance of chamber music, can be configured for raked seating or flat floor for receptions and conferences. A large Bay-side deck further extends the building's connection with the water allowing boaters to view performances.

To reflect the unique natural beauty of the area, the building was designed to have the appearance and atmosphere of a Georgian Bay cottage. The use of the area's natural stone and indigenous

Figure 12
Stage and
ground floor seating

Figure 13
Auditorium
roof structure

Figure 14
Raised and suspended
auditorium seating

trees, pine beams and granite from the local quarry add a special intimacy to the interior of the concert hall (*Figure 12*).

Structural Wood System

The building features heavy timber framing. Heavy timber trusses and wood decking are an essential acoustical requirement – they provide both the slightly textured surfaces for good sound reflection, and a visually warm appearance much favoured by musicians and audiences. For the same reasons, special acoustical reflectors and suspended ceilings were also made of wood.

The Auditorium

In addition to the aesthetic and acoustical advantages of using wood in this project, the wood decking was also the most economical choice of material for the auditorium roof in terms of structural functionality (*Figure 13*). The glulam trusses form the structural skeleton of the 50 degree sloped pitch roof. An 89 mm (3-1/2 in) tongue and groove timber deck was the most suitable choice for spanning the 3 m (10 ft) between the glulam scissor trusses. The heavy timber decking also acts as a diaphragm, providing additional stiffness to the roof framing system.

The exposed trusses spanning between the auditorium side walls provide a 19 m (62 ft) high ceiling for the auditorium. The timber trusses not only provide support for the auditorium roof, but also for the two levels of balconies (*Figure 14*) and the catwalks, which are suspended from two points along the roof trusses using glulam timber hangers.

The auditorium floor is made of maple strip flooring supported by a plywood / joist subfloor, on rubber pads, similar to a regular gymnasium floor.

The Lobby

The wood theme carries from the auditorium into the lobby where wood columns and beams create a unique example of combining and integrating architecture and structure. The lobby structure consists of two glulam towers that act as three-dimensional space frames to stabilize the lobby and the front gallery. Each tower consists of four built-up glulam columns linked by four 950 mm (38 in) deep glulam beams supporting the roof, the lobby floors below, and the walkways giving access to the upper levels of the auditorium (*Figure 15*).

Figure 15
Lobby and glulam-supported walkways

The wood framing and decking also extends into the reception rooms, parts of the Hall of Fame and outside the building enclosure to form overhangs and entrance canopies to create a warm inviting presence for the building in its waterside setting.

Fire Safety Requirements

The Stockey Centre is fully sprinklered, a requirement regardless of construction type for an assembly building of this size (NBCC / OBC Group A-2). All combustible floor assemblies and the loadbearing walls, columns, and beams supporting them are designed to provide a minimum fire resistance rating of 45 minutes. The wood was sized to conform to the 'heavy timber construction' section of the Ontario Building Code, which meant that it could be left exposed with no additional fire protection. Since the building is fully sprinklered and the sprinkler system is electrically supervised, no minimum fire ratings were required for the roof system.

Acoustic Design

Priority at every stage of the design process was given to the special acoustical needs of the Festival of the Sound. The acoustics in the Stockey Centre were enhanced by the use of wood decking in the ceilings, soffits, and reflector devices. The wood was treated with a subtly striated finish. In combination with the rough stone walls, the wood diffuses and directs reflected sounds to the audience seating areas. The heavy timber truss members also diffuse sound in the upper part of the room before reflecting it down to the audience.

Conclusion

Structural wood systems give the Charles W. Stockey Centre unique aesthetic appeal and acoustical performance at a cost comparable to the other building systems investigated. This wood building brings both music enthusiasts and hockey fans under the same roof in Parry Sound on the shores of Georgian Bay.

Project Credits

ARCHITECTS:
Keith Loffler Architect + ZAS
(Zawadzki Armin Stevens) Architects

STRUCTURAL ENGINEERS:
Carruthers & Wallace Ltd.

ACOUSTICAL ENGINEERS:
Artec Consultants Inc.

CONSTRUCTION MANAGERS:
EllisDon Limited

PHOTO CREDITS:
Andre Beneteau

4. Rutland Elementary School
A Sustainable Approach to School Design

Figure 16
Main entrance and classroom wings of the school

The building configuration and the selection of materials for the Rutland Elementary School in the Central Okanagan (*Figure 16*) area of British Columbia was determined by an extensive design and value analysis process focused on economy, efficiency, durability, and sustainability. The 3,000m^2 (32,500 ft^2) school (*Figure 17*) employs several design innovations to address evolving needs and priorities in both the teaching environment and long-term maintenance. Building systems were selected for each individual element based on appearance, durability, cost and sustainability. The building responds well to the provincial sustainability guidelines.

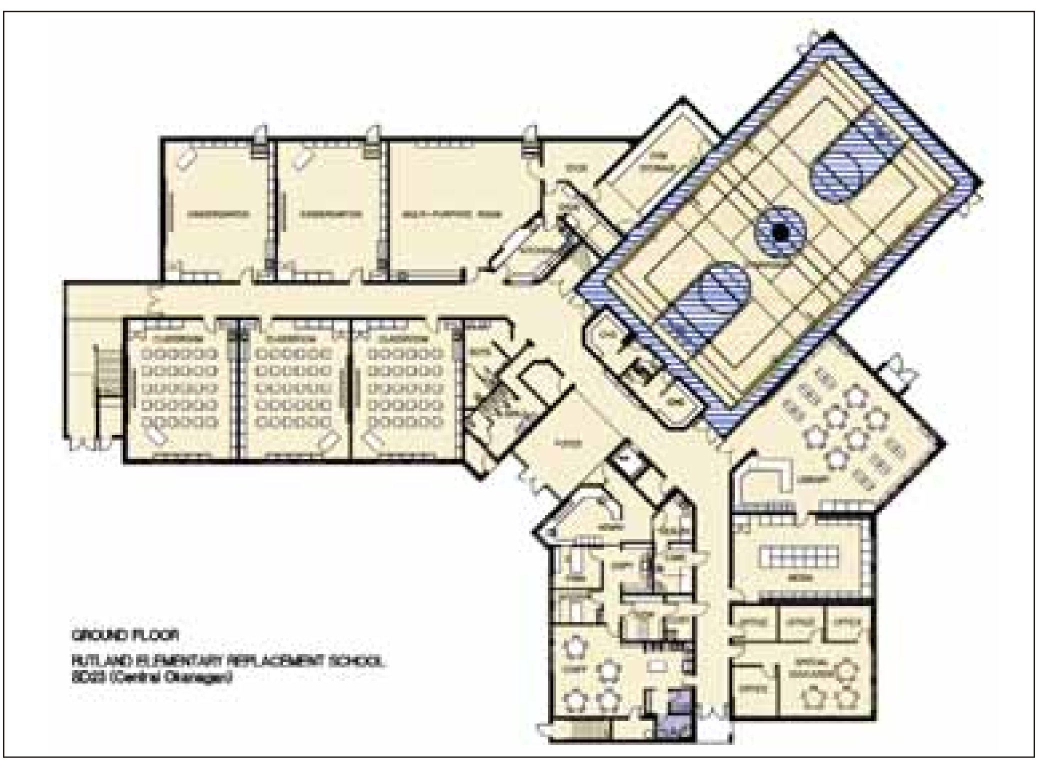


Figure 17
Ground floor plan

Figure 18
Typical classroom (before furnishing) showing roof structure and views to the exterior

Figure 19
The small gym combines block walls and a wood roof

About the building...

Completed in time for the 2003-2004 school year, the 350-student school has 16 classrooms (*Figure 18*), a multi-purpose room, a media technology centre, and a gymnasium (*Figure 19*). Natural day lighting and visual inter-connection of spaces encourages a sense of lightness and community. The building plan anticipates future growth by providing for addition of up to twelve classrooms without significant additional infrastructure.

Structural Wood System

Like most parts of British Columbia, the Okanagan area is a manufacturer of quality wood products and familiar with the economic, aesthetic, and life-cycle advantages of wood construction. The Rutland school makes extensive use of wood, both as a structural material and for cabinetry and finishing details throughout.

The ground floor walls are urethane-insulated masonry bearing walls, while the upper floor walls are primarily wood frame. The roof structure uses long-span structural insulated panels (SIPs) supported by wood beams and trusses (*Figure 20*). The use of sloped roof forms provides larger interior volumes within upper floor classrooms and results in a reduced two-storey mass to compliment the adjacent residential neighbourhood.

The SIPs consist of 150 mm (6 in) EPS insulation reinforced and glued to OSB sheets top and bottom. In many places, the SIP panels receive roof shingles directly, and act as the interior finish material.

Fire Safety Requirements

The building is sprinklered, a basic requirement regardless of construction type for a school of this size. Based on the occupancy requirements and the size of the building, the construction type and fire rating of the structural assemblies is governed as a Group A, Division 2 building. However, given that the school is fully sprinklered and the sprinkler system is electrically supervised, no minimum fire ratings were required for the roof system. When the roof assembly does not require a rating, the supports for the roof are also exempt. This results in greater design flexibility for combustible wood construction.

Sustainable Design

Rutland Elementary is the result of a conscious effort to reduce the environmental footprint of the building. A partial list of the measures used includes:

- Compact two-storey plan minimizes site impact (on a small site) and conserves energy;
- Ground source heating and cooling uses over 50% less energy than conventional systems. Rutland is the first school in the region to use a ground source heat pump for heating and cooling;
- Concrete containing fly ash lowers CO_2 emissions;
- Locally produced masonry block used for the ground floor walls minimizes transportation energy;
- Local wood products and engineered wood structures are used on the second floor, in cabinetry and in finishing details throughout;
- Use of structural insulated panels on upper level walls and roof minimizes the use of materials and maximizes the insulation value;
- Low e and tinted glazing control HVAC loads and reduce required equipment size;
- Roof and storm runoff is recharged to the ground water;
- Landscape materials appropriate to the local climate minimize water and maintenance;
- Materials and finishes are selected for low VOC content; and
- HVAC and lighting systems are computer controlled for maximum efficiency.

Conclusion

The Rutland Elementary School employs many innovations designed to provide a quality educational environment while minimizing the environmental effects of the building's construction, operation, and maintenance.

Figure 20
View of the glulam-tied roof, lighting and ventilation

Project Credits

ARCHITECTS:
Maltby & Hill Architects Inc.

STRUCTURAL ENGINEERS:
MSS Engineering Ltd.

QUANTITY SURVEYORS:
Spiegel Skillen & Associates Ltd.

MECHANICAL ENGINEERS:
Stantec Consulting Ltd.

ELECTRICAL ENGINEERS:
Falcon Engineering Ltd.

GENERAL CONTRACTORS:
Sawchuk Developments Ltd.

PHOTO CREDITS:
C. Michael Hill MAIBC, Pacific Edge Architecture Inc.

5. St-Prime Golf Clubhouse
Reaching the Green with the Woods

Nestled on a tract of land in the small municipality of St-Prime on the shores of majestic Lac St-Jean, the St-Prime golf course boasts a challenging 18-hole golf course for both local and visiting golf enthusiasts. The project designers wished to use products that reflected the regional economy reliance on forest product and aluminum manufacturing. Built to provide expanded services, the new clubhouse (*Figure 21*) is a true showcase for wood construction, both inside and out.

Construction began in September, at the end of the 2002 golf season. Ready access to dimensional lumber, structural wood panels, and engineered wood products ensured the project was completed within a tight schedule to allow for timely occupancy that took place in May 2003, as the new season began.

About the building…

Easily accessible, the first storey houses various services offered to the players (change rooms for men and women, the pro shop, administration offices, etc.). An 18.5 x 17.5 m (61 x 57 ft) reception hall with a capacity for 160 people occupies the majority of the second storey. Seated within the hall or from the exterior deck (*Figure 22*), visitors can admire the beauty of Lac St-Jean and the golf course. The second storey also houses reception-related services such as the bar, commercial kitchen, washrooms, and storage. There is also a small office space for tournament management.

Right Elevation

Rear Elevation

Left Elevation

Front Elevation

Figure 21
Elevation views of the Clubhouse

Figure 22
Wide overhang
shelters the verandah

Figure 23
Structural frame
during construction

Architectural Considerations

Wood is showcased throughout the two storey, 435 m^2 (4,700 ft^2) building, both structurally and architecturally. The exposed structural roof frame, combined with wood panelling and trim, wooden staircase and doors, adds warmth and beauty to the interior. Outside, the 38 x 184 mm (nom. 2 x 8 in) bevel profile treated wood siding with its natural texture, color and grain, adds beauty and insulating value to the building. Aluminum roofing, doors, windows, and handrails highlight the use of wood.

Structural Wood System

The main structural support is provided by an exposed glulam timber frame (*Figure 23*). The timber frame supplies the required strength while providing the essential character and design aesthetics for the building interior.

Walls – The post and beam frame provides the structural support for roof load. The infill walls are conventional light frame wood stud wall assemblies. The use of wood-frame construction offers functionality and versatility. The sheathing materials used to provide rigidity also serve as the building envelope to which exterior finishes are attached. The space between the framing is used for insulation, and the framing is used for affixing vapour barrier and interior finish.

Floors – The floor system combines the use of glulam beams and open web joists. The large open spaces provided by this assembly permitted rapid installation of electrical and mechanical services beneath the floor. The use of engineered wood trusses eliminated on-site cutting and reduced construction time. The high strength-to-weight ratio of floor trusses permits long spans offering flexibility in floor layouts by reducing the need for interior loadbearing walls.

Roof – The exposed glulam roof structure in the reception hall, designed as an inverted pyramid, provides a clear span in the hall. The wooden roof structure extends over an exterior deck where it is supported by concrete columns. The use of 38 x 140 mm (2 x 6 in) tongue and groove timber decking provides a warm and bright ceiling finish.

Innovative Products

The St. Prime Golf Clubhouse utilizes two innovative products that are new to the marketplace:

Perdure treated wood is a product of European origin that dries wood at high temperature, between 180 and 230°C (360 - 450°F), compared to temperatures of approximately 100°C for normal wood kiln drying. The Perdure product was used for the wood siding exterior finish. The process results in wood with a rich color that can be used as a finished product and provides a better resistance to insects and decay microorganisms. The process is claimed to be more environmentally friendly than chemically treated wood.

Tectal roofing is an anodized aluminum roofing system. The tiles and moldings are available in a range of bronze and rainbow colors and is claimed to be impervious to deterioration by sunlight.

Fire Safety Requirements

The building is classified as an A-2 assembly and the NBCC / QCC does not require sprinkler protection for a building of this size and occupancy. However, the floors and roof must have a 45-minute fire-resistance rating (FRR) for combustible construction. These ratings were easily achieved using gypsum board on the assemblies. The glulam trusses and beams meet the minimum size requirements for Heavy Timber, and can therefore be left exposed with no additional fire protection required in areas where the 45-minute FRR is required.

Thermal Performance

As a typical Canadian clubhouse, the building was designed for seasonal use. The building is only heated to keep it above the freezing point during the winter. The thermal performance of the building system was taken into consideration at the design stage so that air conditioning would not be required. Generous overhangs, good ventilation, and adequate insulation levels easily attained with wood-frame construction were the features used to keep the building comfortable during the summer.

Conclusion

Combining post and beam and wood-frame construction provides members and guests of the St-Prime Golf Club with an attractive meeting place overlooking the spectacular Lac St-Jean. The use of wood products manufactured in the area offered value, availability, speed of construction, appearance, wood construction, and another opportunity to show the flexibility and possibility for Canadian wood products.

Project Credits

ARCHITECTS:
Boudreault Levasseur, architectes

STRUCTURAL ENGINEERS:
CIMA + Société d'ingénierie

GLULAM FABRICATOR:
Lamellé Québec

GENERAL CONTRACTORS:
Consortium 2H 2000 (Construction P.A.R. Tanguay et Construction Tanguay Bonneau)

PHOTO CREDITS:
Boudreault Levasseur, architectes

6. Intuit Canada Headquarters
Fast-Tracked High-Tech Wood Construction

Figure 24
Artist's rendering of Intuit Canada Headquarters

In keeping with its fast-paced high-tech work environment, the Intuit Canada Headquarters and Call Centre was designed and constructed in just eight months during the summer of 2000. Located in southeast Edmonton, Alberta, this two and a half storey, 8,600 m^2 (95,000 ft^2), state-of-the-art office building (*Figures 24 and 25*) houses 500 employees. In addition to offices, there are numerous employee amenities including a workout and fitness area, gymnasium, staff lounge and commercial kitchen, informal meeting rooms with big-screen televisions, pool tables, and three sleep rooms for naps between day and night shifts.

Wood construction, based on its availability and ease of modification during construction, was selected at the initial design stages in order to meet the tight design and construction schedule (*Figure 26*).

Intuit is a company that develops software for personal and business applications. As a result of its commitment to an outstanding work environment, Intuit has been rated one of the top ten places to work in Canada for the past three years.

Architectural Considerations

Constructed on 3.5 ha (9 acres) along a section of Edmonton's Mill Creek Ravine, the building design blends input from client-employee workshops with the natural features of the site. Driven by economy and speed, yet shooting for quality, designers constantly juggled materials and methods to make the Intuit equation work.

Far from being a standard building, Intuit's new workspace fits its unconventional staff. Unusual angles, curved walls, and architectural elements (*Figure 27*) add to the playful appeal of the building. The Intuit exterior also reflects the firm's dynamic personality. A walkout basement capitalizes on the natural slope toward Edmonton's Mill Creek Ravine. Five balconies and two patios, featuring gas barbecues and radiant heating, put all Intuit staff within a stroll of the outdoors. The landscaping and the west-facing patio create microclimate of sheltered and sunny exterior spaces.

The Intuit building relies on large, operable, energy-efficient windows to maximize daylight, minimize energy and increase comfort, and shading devices control glare from natural light. The tall windows allow daylight to bounce off ceilings and decrease the need for electric illumination of interiors.

Structural Wood System

The entire project was framed in wood. In addition to containing less embodied energy than steel, the wood beams and joists injected speed and flexibility into the construction process. "With wood, you can move that window around. If we had done this as a steel building, those design changes would have cost us," says designer Wes Sims, of Manasc Isaac Architects.

Floors – The elevated floor structures are comprised of glulam beams supporting dimensional lumber or wood I-joists and a 19 mm (3/4 in) tongue and groove OSB / plywood subfloor (*Figure 28*). The typical joist span is 6 m (20 ft), but the span in the Call Centre is 11 m (36 ft) The subfloor is glued and screwed to the supporting joists and the floors are topped with 40 mm (1-1/2 in) of lightweight concrete. In areas where the structure is exposed from below, open web joists and plank decking were specified.

In certain areas the floor is raised 450 mm (18 in) on a grid that allows easy access to a cavity below. Underfloor mechanical and electrical systems provide optimal energy efficiency and user comfort, facilitate air movement by acting as a plenum, and facilitate adjustment to alleviate the change-out of user specific equipment and systems.

Roof – The roof framing mirrors the floor framing and alternate framing is used around the feature stairs and support heavy roof mounted mechanical equipment.

Columns – Interior stand-alone columns are 152 x 152 mm (6 x 6 in) hollow steel sections. Lightly loaded columns within loadbearing wood wall segments are constructed of built-up light timber sections.

Walls/Lateral Stability – The 38 x 140 mm (nom. 2 x 6 in) exterior walls are wind-bearing, and provide lateral stability and support for the exterior membranes, insulation and masonry veneer or cladding. The floor and roof elements are designed to act as diaphragms to transfer the lateral loads to the exterior (or shear) walls. The elevator shaft is comprised of reinforced concrete to support the rails and openings. The elevator shaft also carries a share of the lateral building loads from wind and seismic forces.

Figure 25
Modern entry
and façade

Figure 26
Wood structure
during construction

Figure 27
Concrete-topped floors
and irregular room shapes
provide rigidity and interest

Deflection for wood-frame walls acting as a back up to full height masonry is restricted to 1/720 of the unsupported height. The height of masonry veneer is limited to 5 m (16 ft) from the foundation to avoid the need for intermediate level masonry ledgers.

Sustainable Design

Designed and modelled using DOE-2, the Intuit building will consume 28% less energy than required by the Model National Energy Code for Buildings, resulting in savings of $65,000 per year in operating costs and a significant reduction in greenhouse gas emissions. Sustainable, well-constructed buildings result in lower operating and maintenance and can result in worker productivity gains. The calculated payback for energy saving systems for the Intuit building is two years.

Figure 28
The cafeteria exhibits the upscale feel of this wood building

Fire Safety Requirements

The Intuit building is considered quite large to be of combustible construction and designers did push the maximum allowable building area under the Alberta Building Code. Given its size and occupancy (Group D), a fire separation was provided between the Call Centre and the offices. In addition, all floors are 1-hour rated. Ratings were achieved with gypsum board attached to the underside of the joists. Sprinklers were surface-mounted on the gypsum board surfaces.

Conclusion

Innovative products and project management techniques produced a quality building that was conceived and delivered in an eight-month time frame. Wood-frame construction played an important role in the speed of construction and the moderation of construction costs. The Intuit building is proof that a wood building can be attractive, technologically advanced, energy efficient, cost effective, comfortable, and safe.

Project Credits

ARCHITECTS:
Manasc Isaac Architects Ltd.

STRUCTURAL ENGINEERS:
Reid Crowther & Partners

MECHANICAL & ELECTRICAL ENGINEERS:
Keen Engineering

CIVIL ENGINEERS:
GPEC Engineering

GENERAL CONTRACTORS:
Clark Builders

PHOTO CREDITS:
Jim Dow

7. Vancouver Island Regional Library, Courtenay Branch

Capturing the Threads of History With Wood

This new library is the first new community building to be constructed in downtown Courtenay in many years. The 1,200 m^2 (12,900 ft^2) single-storey building is strategically located at the southern edge of the downtown retail district and serves to visually invigorate the downtown streetscape. The building features expanded book stacks, reading and study areas, a coffee lounge with fireplace, a children's area, a multi-purpose room, and washrooms. The Courtenay Branch was a joint project of the City of Courtenay and the Vancouver Island Regional Library – the City owns the building and leases it to the library.

Building with wood was especially appropriate for downtown Courtenay because forestry is one of the most important economic sectors of the community. Wood both satisfied building code requirements for structural integrity, and offered economic and aesthetic advantages. The new library serves as an example and inspiration of how to combine the many traditional wood buildings with a modern design.

Figure 29
Front elevation showing varied roof lines

Architectural Considerations

To capture the threads of history in the look of the new building, library planners borrowed ideas from, and were inspired by, old photos of the wood-built creamery and school that once neighboured the site. The architect replicated some of the features from earlier times such as roof shapes, materials, and extensive use of wood to fit with the heritage of Courtenay (*Figure 29*).

The new library is two and a half times larger than the previous building, and has room on the property to expand to 1,600 m^2 (17,000 ft^2). The cost of the building was $1.85 million, and the overall project cost, including sitework and parking, was $2.5 million.

The simple building form provides a unique focal point in the downtown area and a central gathering space representative of the community it serves.

Structural Wood System

Wood is used throughout the library to create a heritage ambiance. The new building features exposed heavy timbers and trusses, wood-framed windows, and a wood-shingled exterior. Walking though the doors, the double storey entrance features heavy timber open trusses arched overhead, allowing light to spill in through the skylights (*Figure 30*).

Walls – Wherever possible, exterior 38 x 140 mm (2 x 6 in) light-frame wall construction was used rather than hierarchal beam and column construction. Light-frame construction is a building technique that works well for residential construction and can be adapted to provide economical rigid construction for commercial projects when properly engineered. With this

Figure 30
Bright, open roof structure
in the main entry

Figure 31
Dusk view of the front
of the library

technique, the same building elements are used to enclose, as well as to provide structural support for gravity loads and lateral loads.

Roof – The building has two peaked roofs flanking flat roofs (*Figure 31*). This forms a collection of smaller shapes that mirror the neighbouring streetscape, creating a vintage ambiance. The use of an engineered roof truss system for the peaked roofs provides a more open look with fewer columns.

The flat roof is comprised of a flat roof truss system that employs glulam beams and steel tension rods. Gypsum board ceiling is used in these areas so that electrical, mechanical and HVAC system running through these open-web trusses do not detract from the visual appeal of the building's interior.

Fire Safety Requirement

The library building is sprinkler-protected. Although not a requirement relative to its size and occupancy (Group A-2), adding sprinklers to the design allowed added flexibility in the structural and architectural use of various materials within the building. As such, the entire building was permitted to be of wood-frame construction or any other building system without special fire performance characteristics.

Acoustic Design

Acoustic separation is of utmost importance for a library where reading rooms, private offices and multi-purpose rooms are in close proximity. Although basic acoustic requirements were incorporated in the design, increased sound control was achieved by sheathing the walls with gypsum board and adding batt insulation for noise attenuation.

Conclusion

The new Courtenay Branch Library echoes the city's past, and the use of wood reinforces the future for Courtenay. This excellent example of modern wood construction compliments the historic fabric of the city and provides a large, welcoming library facility.

Project Credits

ARCHITECTS:
Merrick Architecture

STRUCTURAL ENGINEERS:
Peterson Galloway Ltd.

GENERAL CONTRACTORS:
Perma Construction Ltd.

PHOTO CREDITS:
Danny Signer

8. Thunder Bay Regional Health Sciences Centre

Harvesting the Benefits of Wood Use in Health Care

Figure 32
Artist's rendering of the new hospital

Replacing two existing hospitals in Thunder Bay Ontario, the new Thunder Bay Regional Health Sciences Centre represents a significant advance in the provision of quality health care.

Completed in January 2004 after 3 1/2 years of construction, the 60,000 m^2 (640,000 ft^2), 375-bed acute care facility (*Figure 32*) is the first hospital in Canada to use wood extensively throughout the structure of the main public areas. In doing so, it provides a bright and optimistic atmosphere for patients, staff, and the community it serves.

Architectural Considerations

Located on a 25 ha (60 acres) site opposite Lakehead University, this main health centre serving northwestern Ontario includes acute care services, a regional cancer centre, maternal childcare services, and a forensic mental health centre. The three-storey hospital complex is built in a flexible T-style grid consisting of the curved corridor which links two parallel side-by-side main hospital blocks with a much smaller north-facing third block.

The 18,600 m^2 (200,000 ft^2) main public corridor, built entirely with heavy timber frames, celebrates the vernacular of the region by drawing on its historic and continuing ties to the forest industry. The gently curving wooden arcade (*Figure 33*) follows the path of the sun to provide natural light penetration throughout the day for patients, staff and visitors, and access to the outside healing garden.

Figure 33
Glulam structure provides a bright, roomy atmosphere for the main public corridor

Structural Wood System

Wood was used as the main structural element of the public areas for its warmth and non-institutional character, but also as a structural feature. Glulam was used extensively in various structural applications, including the main public corridor structure, the emergency entrance, the entrance and drop-off canopies, and in the Cancer Treatment Centre.

Main Public Corridor – The 7.5 m (25 ft) wide by 140 m (460 ft) long public corridor is made of Douglas fir glue-laminated members (*Figure 34*). The 300 mm (12 in) diameter interior columns are spaced at 9 m (30 ft) and support inverted wood trusses. All members are connected (*Figure 35*) using either wood blocking or concealed galvanized connector plates.

Entrance, Emergency and Drop-off Canopies – The canopies around the main building are a combination of wood, steel, and masonry structure (*Figure 36*). Glulam members span the roadway to provide shade and accent the entrances.

Cancer Treatment Centre – The roof of the cancer treatment area corridor is supported by three glulam support clusters (*Figure 37*) spaced 9 m (30 ft) apart. All connections employ concealed galvanized steel plates.

Figure 34
Detail of the glulam roof trusses and struts

Figure 35
Timber connectors and tie rods

Fire Safety Requirements

The Thunder Bay Regional Health Sciences Centre is the first hospital in Canada to gain approval for the use of wood as a primary structural element. Under the guidance of code consultants, the design team incorporated safeguards that demonstrated to the Ontario Fire Marshal's office and municipal building officials, the ability of the wood structure to meet code requirements for performance. For example, the wood-intensive pedestrian corridor is separated from the rest of the hospital by a two-hour-fire-rated masonry separation and fire doors. The design also includes compartmentalization, creating isolated clusters of rooms, thus minimizing any potential fire spread. Other safeguards included the placement of two sprinkler heads at each wooden member that span the corridor, as well as two sprinklers at each column. In addition, special fire-retardant coatings are used on the wood columns in the main public corridor to reduce the flame-spread rating of the wooden structural elements.

Figure 36
Glulam entrance canopy

Figure 37
Glulam support structures
in the cancer treatment centre

Design and Construction Process

The Thunder Bay Regional Health Sciences Centre is not only the first Canadian hospital to use wood extensively in construction, but also the first hospital complex in Ontario to be delivered using the construction management process, completing the project in 3 1/2 years versus 8 years, as is typically the case for this building type. Using this method, efficiencies of design and construction could be implemented. For example, the building was designed so that the steel frame areas of the hospital could be erected first, with the wood structure added later over a period of three months. The program was fast-tracked under a unique "partnership" between the owner, architects, and builders. This form of project delivery has enabled the Thunder Bay Regional Health Sciences Centre to build a health centre in record time while still maximizing user input and involvement in creating the design solution.

Cost Considerations

Initially there was some reluctance to the proposed use of wood as the main structural element in the public corridor. However, preliminary pricing by the construction managers showed that the wood structure, including fire suppression, would be slightly less expensive than a steel solution, and in addition, offered far more qualitative value.

Conclusion

From the outset, the architects were challenged by the owners to design a facility that responded to the indigenous cultural and natural features synonymous with Thunder Bay. As a result, wood was selected as the material of choice for the structure of the main public areas of the hospital and Cancer Centre. Intended to evoke optimism and cheerfulness, the wood structure successfully greets and warms these public areas.

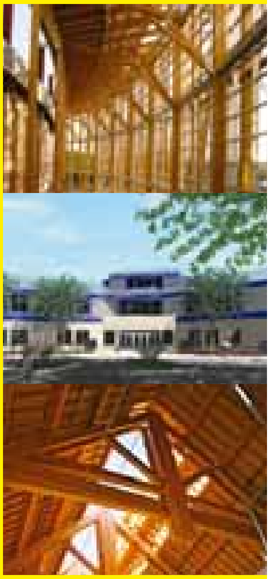
Project Credits

ARCHITECTS:
Salter Farrow Pilon Architects Inc.

STRUCTURAL ENGINEERS:
Mikelson Cook Engineering

CONSTRUCTION MANAGERS:
EllisDon Limited / Tom Jones Corporation

PHOTO CREDITS:
Farrow Partnership Architects Inc.



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