Hamilton and Oyster River Fire Halls

RICHMOND AND COMOX, BC

Canadian Wood Council | Conseil canadien du bois

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Wood in Fire Halls

Protective services buildings have a critical role to play in our communities, both on a day to day basis and in post-disaster situations. They are typically designed for a 100 year service life, and to the most exacting standards of structural performance, as they must serve not only as operations centres in the event of natural disasters, but also as a place of refuge for the surrounding community.

Fire and Life Safety

The use of wood for the construction of fire halls has always been a viable option within the BC Building Code and is further supported by the fact that wood is a regionally based material.

The critical code requirement for buildings of this type is that they must be designed to post disaster standards, but need not be of non-combustible construction. In the two examples of fire halls showcased here, the extensive shear wall systems that are an essential component of post-disaster construction have been simply and economically constructed using built up wood members, tie downs and plywood sheathing.

The challenges come with the coordination of each discipline: architectural, structural, mechanical and electrical to position wood shear walls and structural components so that they become attributes to the design and so that services can run uninterrupted without compromising the post disaster standards. The use of wood in these conditions has always served as well or better than other materials as wood is readily available and most trades are familiar with its installation and inherent properties.

Fire Chief Niels Holbek of Oyster River Fire Rescue noted that, “Wood provided a cost effective option for the construction of the hall to post disaster standard. (With) metal cladding on the exterior and the roof, drywall on the interior and a monitored alarm system concerns about fire and life safety are minimal. Whether subject to fire, earthquake or other natural forces, wood structures tend not to fail in the dramatic way that some other types of structures can.”

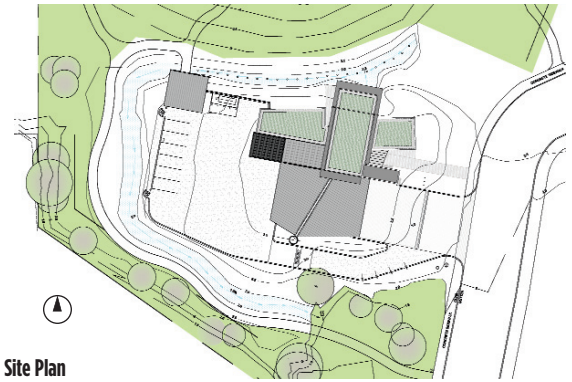
Hamilton Fire Hall

Richmond, BC

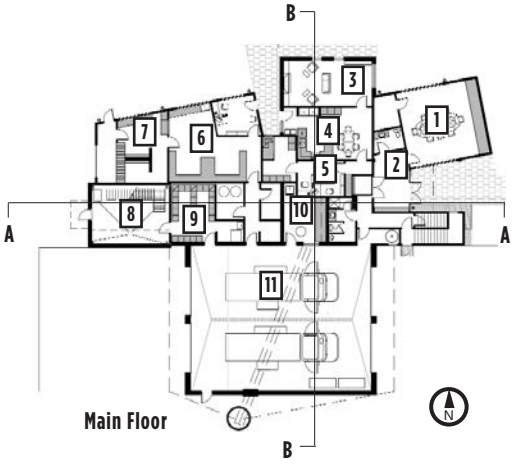
Building Design

Expanding the idea of protective services to embrace the protection of the environment, the Hamilton Fire hall in Richmond BC combines concepts of sustainable architecture with the specific programmatic needs of the Richmond Fire Department. A career fire hall (staffed by full time fire fighters) it is located in a rapidly growing neighbourhood adjacent to McLean Park on the city's eastern edge.

With a total area of 8200 s.f. the building program consists of two large apparatus bays, a SCBA facility which repairs and maintains breathing apparatus for the entire Richmond Fire Department, a workshop, gear storage room, training rooms, a 65 foot hose drying tower, crew quarters including separate facilities for male and female fire fighters and a large meeting room which can be accessed by the public. In addition, there is a stand alone public washroom which serves the surrounding park and a large fire fighter training yard at the rear of the site.



Site Plan



1 Meeting Room
2 Entrance Foyer
3 Day Room
4 Kitchen / Dining
5 Captain's Office
6 SCBA Room
7 Filling Chambers
8 Hose Tower
9 Gear Storage
10 Workshop
11 Apparatus Bays
12 Dormitories
13 Fitness Room
14. Training Surface
15 Green Roof

Fire halls are built to post-disaster standards, in order to ensure that they can continue to function during natural emergencies such as forest fires and floods, providing both service and a place of refuge for the community. It is increasingly important that these buildings are not reliant on municipal infrastructure. Accordingly, the approach to site development and building design incorporate many strategies to reduce the consumption of electricity and water from the traditional centralized sources of supply. These measures are described under Sustainable Design Features.

The simple, strong building form with its vertical hose tower as counterpoint, maintains the formal tradition of fire hall design. The material palette is understated, with muted natural colours, and subtle variations in visual texture. Wood and brick add visual warmth that complement the painted profiled metal cladding and white painted structural steel frame.

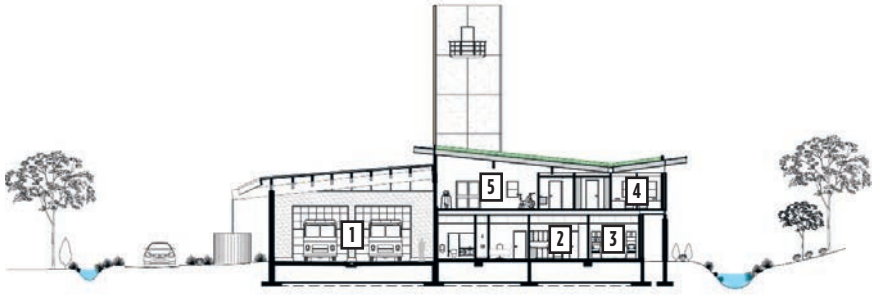
Structure

The City of Richmond is situated on low-lying land at the delta of the Fraser River. Consequently, the foundation design for the Hamilton Fire Hall is dictated by the soft soils and the high water table. This, together with the post disaster design requirement for the building necessitated a lightweight structure, both to minimize overall loading, and to reduce the amount of seismic forces that the building would attract during major earthquake events. To address the difficult soil conditions a grid of interconnected foundation walls were employed to form a void space and to support a continuous concrete floor slab. This resulted in a stiff but lightweight foundation solution.

To respond to these parameters, the fire hall is of hybrid construction, with the exterior walls of the apparatus bays being constructed of load bearing concrete masonry, and those of the two storey living quarters being constructed of 2x6 and 2x8 traditional wood frame. Where

Section A-A

1 Entrance foyer
2 Mechanical room
3 Hose tower
4 Fitness room



Section B-B

1 Apparatus bays
2 Kitchen
3 Training room
4 Dormitories
5 Fitness room

loads dictate, (as under the dormitory) the wood frame construction is supplemented by a number of HSS columns.

In the apparatus bays, the roof structure is lifted clear of the masonry walls on a series of HSS posts, creating space for continuous clerestory windows that admit light to the apparatus bays. The posts are connected laterally by steel cross bracing.

The roof itself has a reverse slope, with its low point in the centre to facilitate the collection of rainwater. A 30" diameter steel pipe supports the valley, running at an angle across the building in both plan and section. Through a series of welded steel cleats, the pipe picks up the glulam roof beams that form the primary roof structure. Diagonal steel braces connect the mid point of these beams back to the perimeter HSS posts, forming a succession of composite trusses. This system creates a rigid roof diaphragm capable of resisting the lateral wind and seismic loads on the building.

In the administration and living areas, the roofs are supported on a more conventional system of primary glulam beams and secondary glulam purlins. Together, these two layers of glulams form an exposed lattice of structural members that complements the white painted galvanized steel roof deck. All the glulams used in the building are Douglas Fir and vary in dimensions from 3 1/8" x 12" in the administration area, to 5 1/8" x 22-1/2" for the 42' span across the apparatus bays. The suspended floor is supported on 18" TJIs.

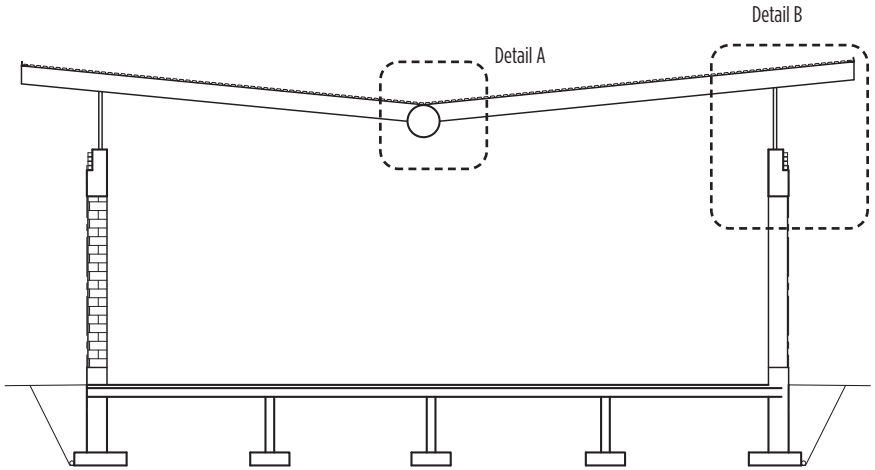
The exterior walls are sheathed in plywood, and finished either with profiled galvanized metal, or brick masonry. The hose tower is entirely of steel frame construction and clad in a combination of profiled galvanized metal and Solar Wall.

Sustainable Design Features

The sustainable features of the project begin with the approach to site development. And continue right through to the specification of wood and other non toxic materials for the structure and interior finishes.

Buildings and their adjacent hard surfaces traditionally interrupt the natural flow of water back into the ground, piping run off to municipal storm sewers, and compromising or damaging the natural ecosystems of the site. Hamilton Fire Hall eliminates this problem by reducing run off volumes through the use of green roofs and carefully designed site grading and drainage. These strategies have eliminated the need for piped drainage throughout the site.

The shape of the building has been designed to limit the width of each of the program areas which are most frequently occupied, so as to give all personnel working in the building access to fresh air, natural light and views.



Buiding section

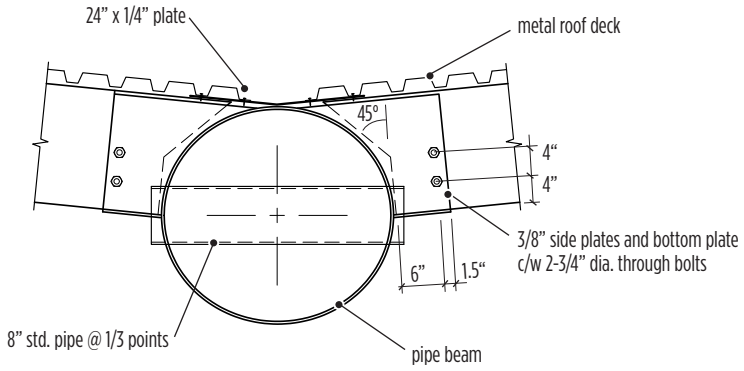
The 65' hose tower, a traditional symbol of fire departments everywhere, is not only used to dry the fire hose but incorporates balcony elements that can be used for training purposes. Hose drying is achieved with the help of a proprietary Solar Wall system that heats external air and directs it into the tower.

In several areas, the glulam structure supports sloping green roofs that help to insulate the building as well as reducing the amount of rain water run off. The remainder of the roofs have a light coloured, reflective finish that prevents heat build up in the structure.

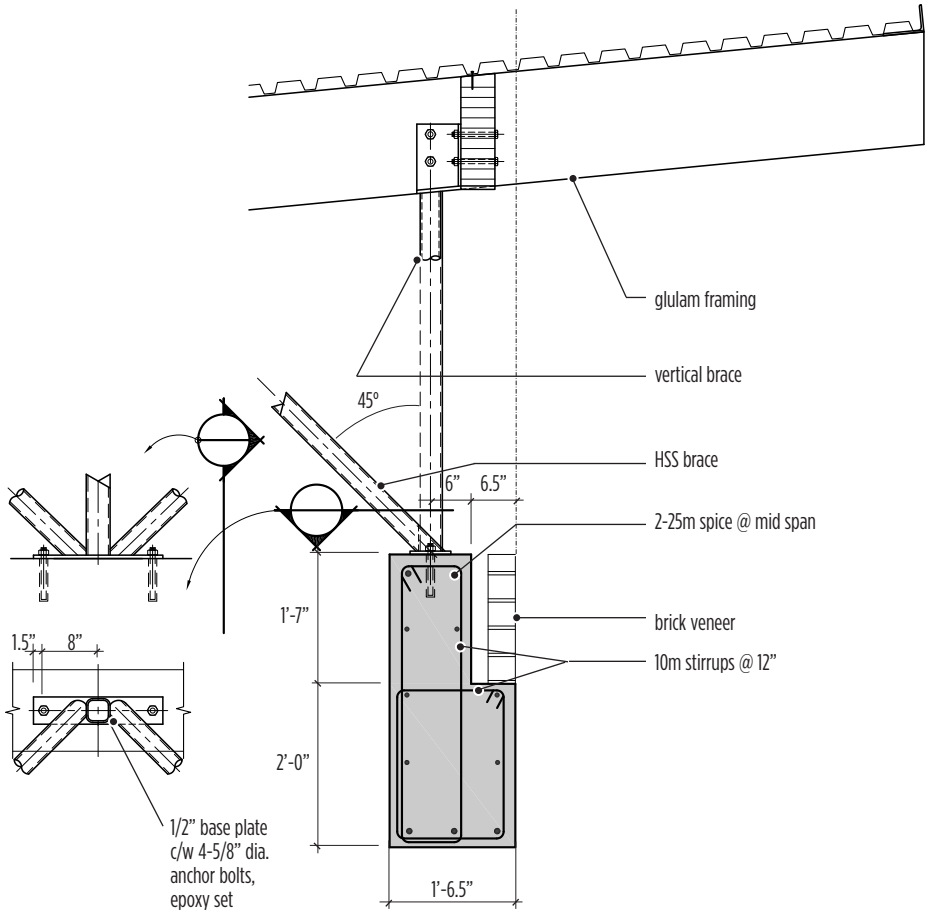
A radiant floor system, combined with displacement ventilation, is used to heat the apparatus bays in preference to the standard overhead infra-red heaters, making this space more comfortable to work within and more energy efficient. A Direct Digital Control System is used to give occupants more control over their environment.

The building also incorporates low flow fixtures and waterless urinals which help to reduce the demand for potable water from the municipal supply. Water for cleaning equipment and flushing toilets is collected from the sloping roofs. There is also a solar panel water heating system mounted on the roof that reduces the demand for centrally supplied energy to meet the building's hot water needs.

The materials used throughout the project were chosen especially for durability and for environmental sensitivity.



Detail A



Detail B

The glulam and other wood products are from sustainably managed forests located within an 800km radius of the site. This ensures that they have the least possible environmental impact and lowest embodied energy. Interior millwork and doors incorporate wood veneers over wheat board cores.

For the City of Richmond, Hamilton Fire hall is the latest addition to a growing portfolio of environmentally responsible public projects.

As of Spring 2008, the project is registered with the Canadian Green Building Council and is striving to achieve LEED gold certification. The use of wood contributes to LEED points for interior environmental quality, and for regionally sourced materials.

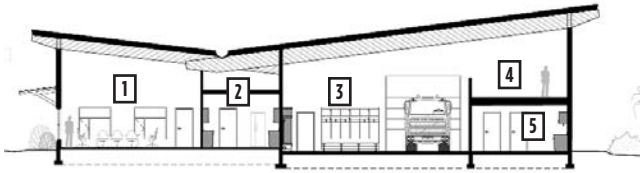
Oyster River Fire Hall

Comox, BC

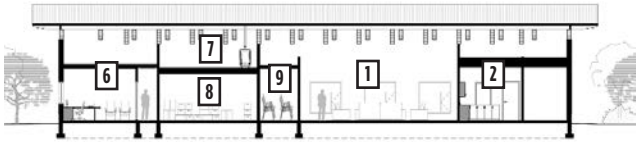
Building Design

This 8,100 s.f. rural fire hall was designed to accommodate a volunteer fire rescue department in a growing community north of Nanaimo on Vancouver Island. The program for the single storey building includes 2-1/2 apparatus bays as well as a large workshop, training room and department offices.

The fire hall features exposed glue-laminated roof beams and purlins over both the apparatus bays and support areas. The roof features substantial cantilevers at the eaves. With beams and roof sheathing exposed on the soffits the visual warmth of the wood contrasts with the other exterior materials, such as the brightly coloured metal cladding. The bright colours and strong form announce the fire hall to the street while maintaining a relationship with the regional character.



Section A-A



Section B-B

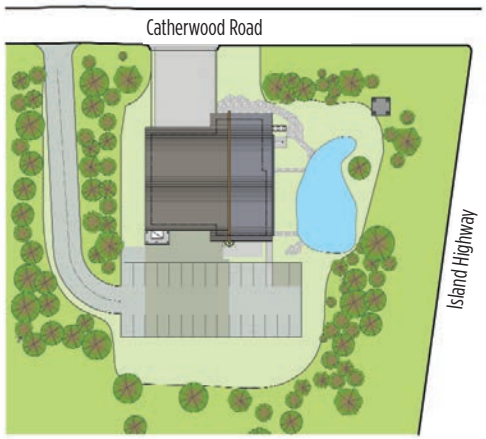
1 Training room
2 Kitchen
3 Apparatus bays
4 Mezzanine
5 Workshop
6 Office
7 Mechanical
8 Storage
9 Chair Storage

Structure

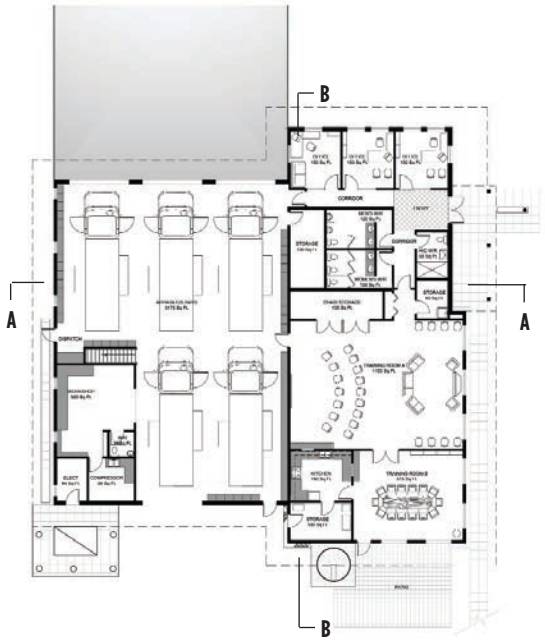
The Oyster River Fire hall is a single storey structure, built entirely of wood. The lightweight construction meant that only simple strip footings were required. Both the interior and exterior walls of the administration area are of conventional 2x6 construction, with 5/8" plywood sheathing used where shear resistance is required. The roofs in this area employ a system of 8x24 Douglas Fir glulam beams which in turn support 2x8 rafters and plywood roof decking. Glulam, rafters and deck are all exposed.

Larger glulam beams, also Douglas Fir, are used to span the 54' across the apparatus bays. At either end these beams bear on posts built up from 2x8 material set within a 2x8 frame wall. At the rear of the apparatus bays, the necessary lateral resistance is provided by ply 5/8" plywood sheathing fastened to the exterior wall. At the front of the building, however, the three apparatus doors are separated only by slender posts and do not leave a large enough area of wall to develop the required shear resistance. Instead, the lateral resistance is provided by an additional over-length glulam beam set slightly back from the exterior wall that serves as a 'drag strut'.

This beam sits on top of a shear wall in the administration area, and is secured from below by lag screws driven through the top plates of the wall. The beam spans the full width of the apparatus bay, and its other end sits on a post built up from 2x8 material. This post is made wider than the beam, and the two outside 2x8 members extend up the sides of the beam and are lag screwed to it, so as to form a positive connection capable of transferring lateral loads.



Site Plan

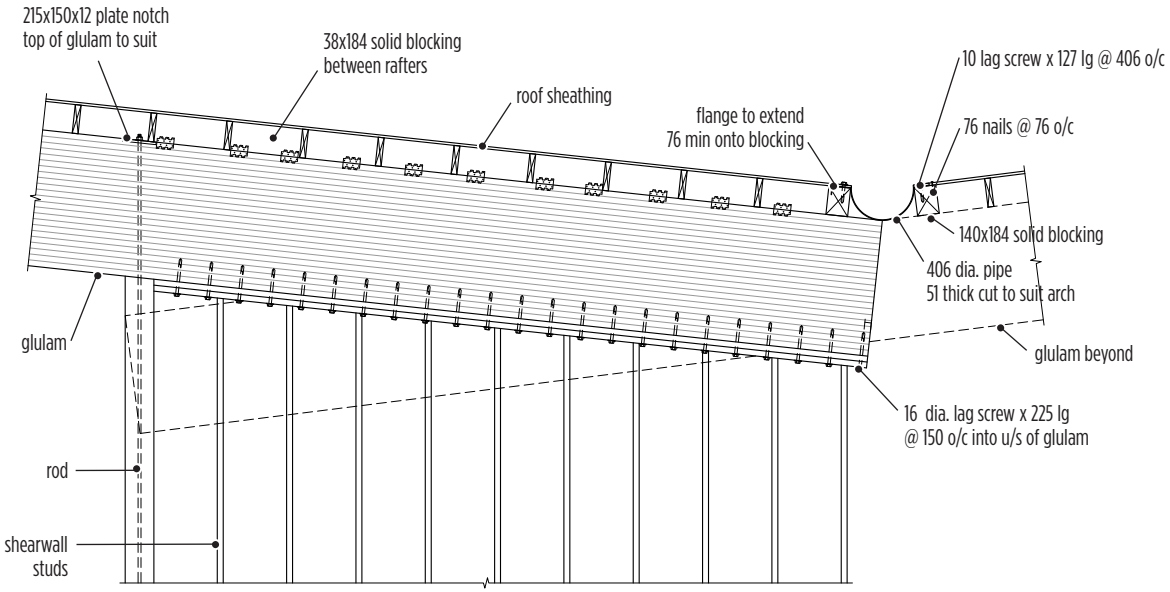


Sustainable Design Features

The development of the site addresses a number of issues including storm water management, retention of trees and the desire to create a striking presence on the street while minimizing the visual impact of on-site parking.

The giant bird's wing form of the roof is designed to collect water and control discharge to the site. A bio-swale to the east of the building controls run off, enabling the majority of the water to be returned to the site. A large above ground storage tank on the south side of the building intercepts and retains water for reuse in washing fire trucks and irrigating the landscape as required.

The building itself is designed for natural light and ventilation, for reduced energy and water consumption relative to current standards, and for a high indoor environmental quality. Wood contributes to the sustainable design approach in several ways: as a local material with low embodied energy, it is self finished and non-toxic.



Administration area: glulam beam "drag strut" on stud shearwall
(dimensions in mm)

Conclusion

In these projects, wood was selected for its ability to perform in a number of different roles, with safety and durability being of paramount concern in buildings designed for a 100 year service life. In addition, wood contributes to the success of the buildings in many other ways: as part of a lightweight and flexible structure suited to the soil conditions and the post-disaster designation of the buildings; as a contributor of visual warmth in contrast to the other structural and finish materials that were used; and as a component in the building's sustainable design strategy. In the case of Hamilton Fire Hall, the use of wood contributes to a LEED point for local materials, and to another LEED point for indoor environmental quality.

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