Edmonton Transit System
LRT Stations

Canadian Wood Council
Conseil canadien du bois

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Program of the Canadian Wood Council

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Introduction

Edmonton, the capital of Alberta, is a fast-growing city with a population of 1,200,000 people in the overall metropolitan area. It boasts comprehensive bus and light-rail transit (LRT) transportation provided by the Edmonton Transit System (ETS).

The North LRT line is a 3.3 km extension of the light rail transit system from the Churchill LRT Station in downtown Edmonton to the Northern Alberta Institute of Technology (NAIT) (**Figure 1**). It's the first segment of a planned LRT expansion to the northwest Edmonton city limits. Light rail service on this line will commence in July 2014 and bring two new LRT stations and one bus transfer station into service.

The NAIT LRT Station will have modular, temporary shelters until land use planning for the City Centre Airport lands has been completed. The North LRT line to NAIT is expected to serve 13,200 weekday passengers, with many more expected as the new line is eventually extended to the city limit near St. Albert.

Wood was used for both structural and architectural elements for the MacEwan and Kingsway/Royal Alex LRT Stations, and for the Kingsway/Royal Alex Bus Transit Station. Glulam decking and beams were used for the platform and building roofs. In addition, the MacEwan LRT Station has a decorative wood ceiling in the main heated waiting area. The roof structures for both LRT stations are cantilevered from pairs of columns located at the centre of the platforms so that the edges of the platforms are not obstructed.

Rationale for Selecting Wood

During public consultation, the City of Edmonton received positive feedback from the community about using wood in the new stations to create bright, welcoming spaces. An added perceived benefit was using wood and landscaping to blend the stations into the existing neighbourhoods, given their proximity to existing and planned buildings. The roofs of the stations were required to be free of mechanical equipment to provide clean appearances when viewed from above.

The architect appreciated the ability of the timber to create inviting places while respecting city construction budgets. Wood was selected for the LRT station roofs because it offered better value compared to steel structure, especially for the undulating roof of the MacEwan LRT Station roof. It is expected that future stations on the North LRT line will also use wood to create a unified appearance.

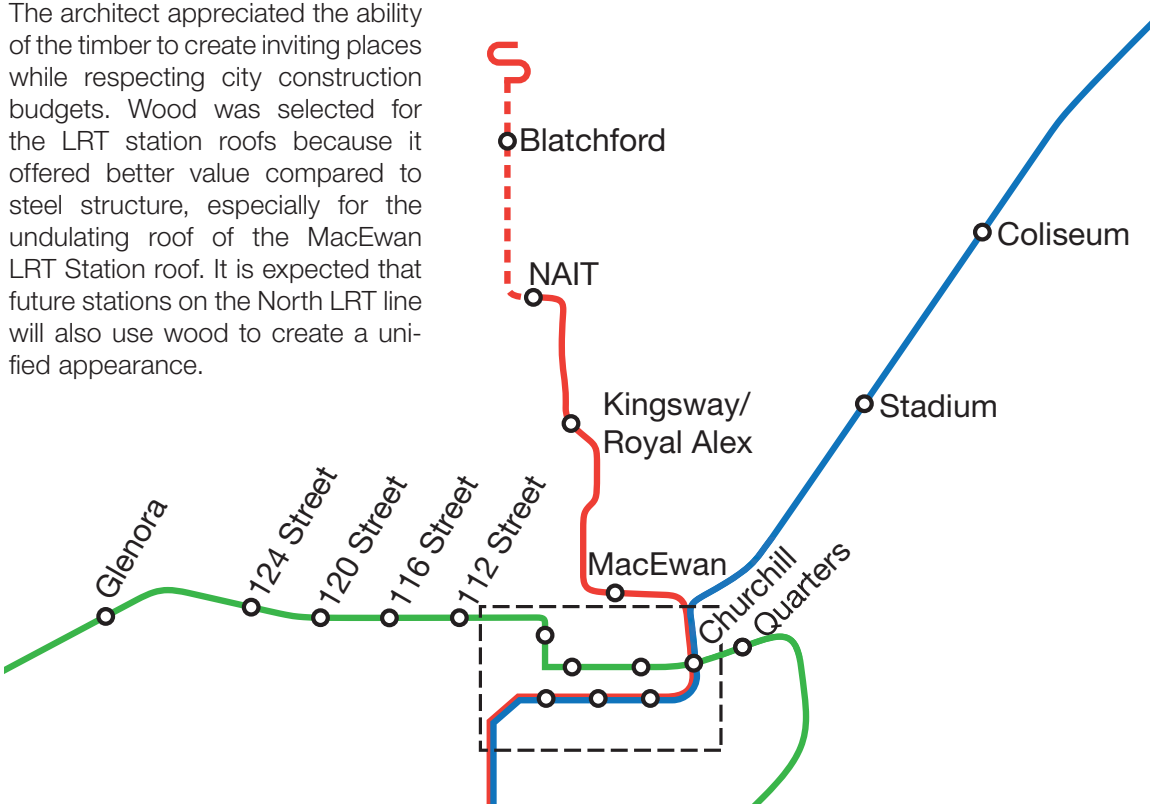


FIGURE 1 The new North LRT line

FIGURE 2 MacEwan LRT Station

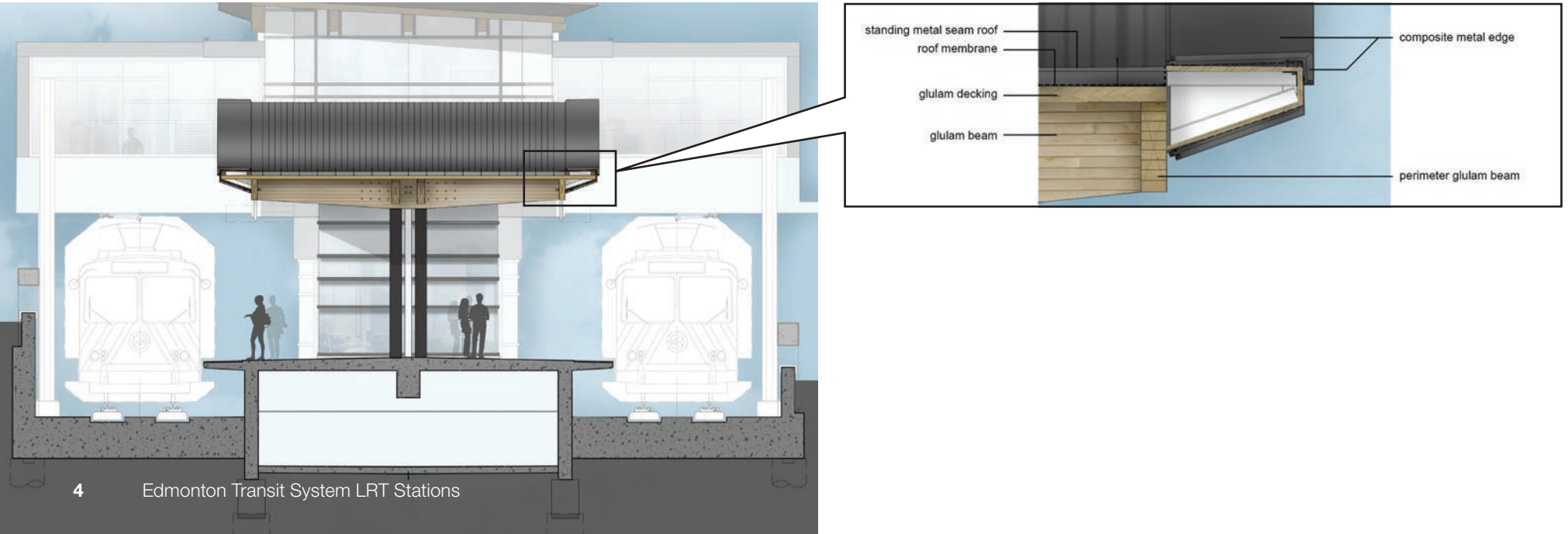
Photo: Stantec Architecture and ISL Engineering

MacEwan LRT Station

The MacEwan LRT Station is surrounded by an outdoor plaza, landscaped green space and intersecting pedestrian walkways. In addition to serving local residential neighbourhoods, the station will serve MacEwan University and the 20,000 seat Rogers Centre Arena, which will be the new home of the Edmonton Oilers when it is completed in 2016. The building and associated platform is covered by undulating timber roofs (**Figure 2**).

The MacEwan LRT Station is designed to handle passengers on both north and southbound tracks (**Figure 3**). In addition to its platform canopy, the station has two heated waiting areas.

FIGURE 3 MacEwan LRT Station cross-section



The indoor waiting areas have ceilings clad with 19x89 mm (nominal 1x4 in.). Douglas fir, V-groove, tongue-and-groove cladding (**Figure 4**) mounted on gypsum board.

The platform roof consists of undulating glulam beams (**Figure 5**) and 89x600 mm (3/12x24 in.), splined, V-groove glulam decking. The decking is covered with plywood sheathing, a roof liner air barrier, Z-girts and standing-seam metal roofing. The roofs of the heated areas are similar except that a water-proof membrane and 90 mm (3-1/2 in.) of polyisocyanate insulation was also installed. The sizes of the glulam beams range from 130 to 175 mm (5 to 6-3/4 in.) in width and 532 to 648 mm (21 to 25-1/2 in.) in depth.

In all cases, the steel-to-glulam and glulam-to-glulam connections are unobtrusive (**Figure 6**).

FIGURE 5 Platform roof

Photo: Owen Murray©2014/ommphoto.ca

FIGURE 4 Wood ceiling in the MacEwan LRT Station waiting room

Photo: Owen Murray©2014/ommphoto.ca

FIGURE 6 Concealed connections

Photo: Owen Murray©2014/ommphoto.ca

FIGURE 7 Kingsway/Royal Alex LRT Station (upper right) and Bus Transit Station (centre left)

Photo: Stantec Architecture and ISL Engineering

Kingsway/Royal Alex LRT and Bus Transit Stations

Kingsway/Royal Alex is a major transportation hub that links the LRT system to the bus routes in northwest Edmonton and provides convenient access to the Royal Alexandra Hospital and the Kingsway Mall. There are two structures at the Kingsway/Royal Alex hub. One is the LRT station and the other is the bus transit station (**Figure 7**).

The LRT station is 123 m long. It is comprised of the platform roof, and a building area that contains an operator washroom, mechanical, electrical and communications rooms, and two heated waiting areas (**Figure 8**).

The perimeter beams and the glulam decking act as diaphragms. The beams that run perpendicular to the platform taper, giving the roof a tapered profile (**Figure 9**).

FIGURE 8 Rendering of Kingsway/Royal Alex LRT Station

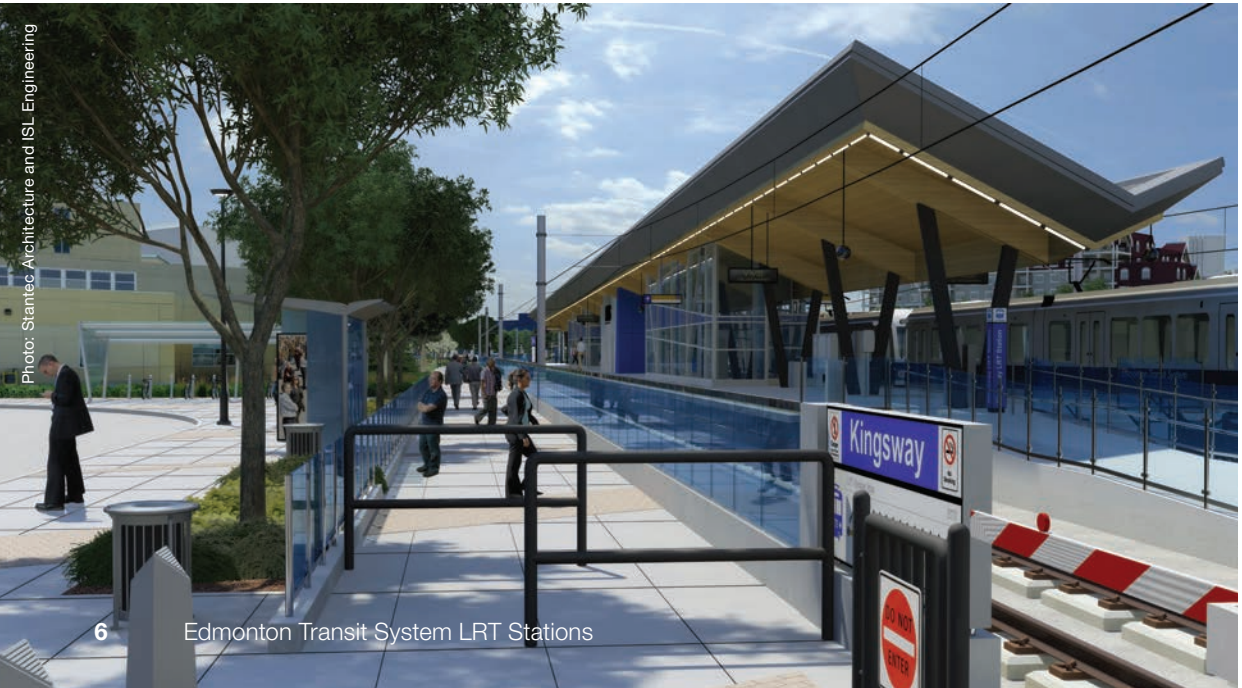


Photo: Stantec Architecture and ISL Engineering

FIGURE 9 View of the platform and one of the waiting areas (rear)

Photo: Owen Murray/©2014/ommphoto.ca

The platform roof consists of 89x600 mm (3/12x24 in), splined, V-groove glulam decking, plywood sheathing, roof liner air barrier, Z-girts and standing-seam metal roofing (**Figure 10**). The sizes of the glulam beams range from 130 to 175 mm (5 to 6-3/4 in.) in width and 532 to 760 mm (21 to 30 in.) in depth.

Heat is provided to the waiting area from a furnace located in the crawl space below the station (**Figure 11**).

The metal-and-glass exterior walls are carefully integrated with the glulam ceiling (**Figure 12**).

FIGURE 10 Kingsway/Royal Alex LRT Station platform roof

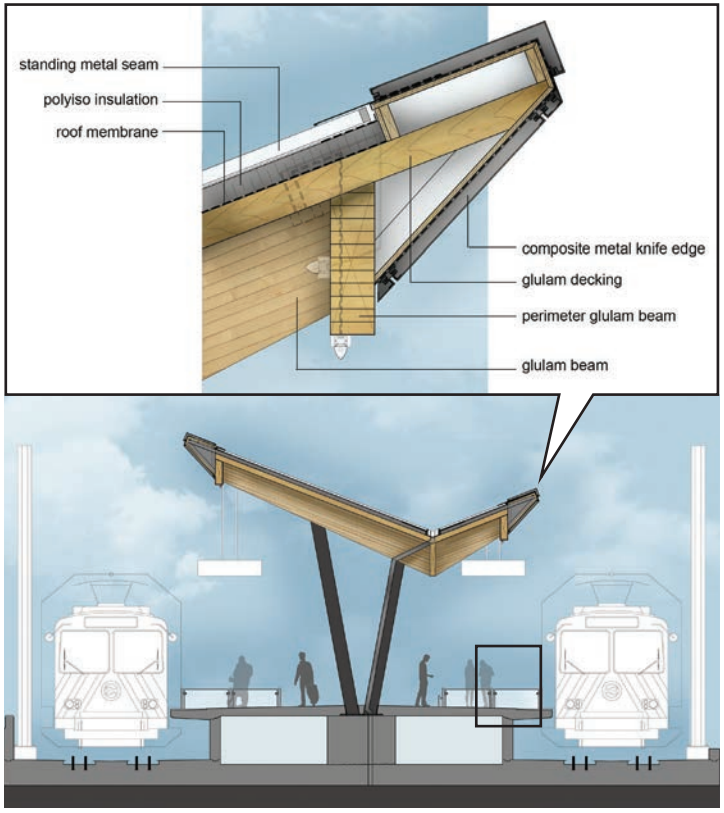


FIGURE 11 Heated waiting area

Photo: Stantec Architecture

FIGURE 12 Separation of the waiting area from the platform

Photo: Owen Murray©2014/ommphoto.ca

Photo: Owen Murray©2014/ommphoto.ca

FIGURE 13 Kingsway/Royal Alex Bus Transit Station

FIGURE 14 Bus Transit Station waiting room ceiling

Photo: Owen Murray©2014/ommphoto.ca

The Bus Transit Station (**Figure 13**) has a heated waiting area with standing room for 70 people, a food concession kiosk, two washrooms for ETS operators, one male and one female handicap-accessible public washroom, a mechanical/janitor room and a communication room/electrical room. The one-person handicap-accessible washrooms are accessible only from inside the transit station. Only the ETS can grant access remotely once a call button is pushed. ETS has cameras in place to ensure the facility is safe and the person seeking washroom access is not a threat. The entrance canopy provides an additional, unheated waiting area.

The waiting areas feature natural daylighting that accentuates the glulam roof decking (**Figure 14**). The glulam beams are 175 mm (6-3/4 in.) wide and range up to 570 mm (22-1/2 in.) in depth.

Wood Finishing

The glulam members were factory finished with two coats of clear tone base and one coat of clear UV protection. All the exposed, non-structural wood in the buildings was finished on site with the same finish. Non-exposed faces had three coats of clear finish.

All wood elements are located at least 3 m (10 ft.) above floors and furniture to protect them from vandalism. For all exterior applications, wood members are protected by overhangs or are kept back from drip lines to provide end-grain protection from potential moisture damage.

Meeting Building Code Requirements

It was necessary for both LRT stations to have a length of 123 m (650 ft.) to accommodate trains up to five cars long.

MacEwan LRT Station

The MacEwan LRT Station has: a platform area of 1,107 m^2 (11,910 $ft.^2$); an enclosed building area of 216.4 m^2 (2,330 $ft.^2$); a mezzanine (east and west, excluding stairs and escalators) area of 86.4 m^2 (930 $ft.^2$); and an enclosed glass building area of 66.17 m^2 (712 $ft.^2$). It was designed according to the Alberta Building Code requirements for a Group A, Division 2, assembly occupancy. The building is two storeys, and is permitted to be of combustible construction.

A variance was required due to the length of the structure and the distance between exits. The variance was granted based on compensating measures that provide an equal or greater level of safety to the public. These include: the provision of sprinklers, two stairways, two escalators and a passenger elevator; high visibility provided by the open mezzanine; wide exit doors; the openness of the platform canopy to allow smoke to dissipate; and a platform egress capacity that easily meets the NFPA 130 *Standard for Fixed Guideway Transit and Passenger Rail Systems* requirement of 4 minutes or less. One stair/escalator area is shown in **Figure 15**.

FIGURE 15 MacEwan LRT Station stairwell

Photo: Stantec Architecture

Kingsway/Royal Alex LRT Station and Bus Transit Station

The Kingsway/Royal Alex LRT Station was designed according to the Alberta Building Code requirements for a Group A, Division 2, assembly occupancy. The building is 1 storey, combustible construction, and is not sprinklered. The platform area is 1,107 m^2 (11,910 $ft.^2$). No variance was required for Kingsway/Royal Alex Station.

The Bus Transit Station was also designed to Group A, Division 2, assembly occupancy. The building is one storey, has an enclosed area of 162 m^2 (1,720 $ft.^2$) and is not sprinklered.

Space Heating

The buildings are heated with high-efficiency gas furnaces. All the heating ducts run under the platforms in the crawl spaces or basements. All the heated areas have insulated walls and double-glazed windows to minimize heat loss. Supplementary heating is provided at main doors by electric force-flow heaters and there are air curtains to reduce heat loss.

Solid Wood and Climate Change

Using sustainably harvested wood products that store carbon, instead of non-renewable, energy-intensive building materials that require large amounts of fossil fuels to manufacture, can help slow climate change. Trees provide the only major building material grown by energy from the sun.

Carbon Summary

Results

Volume of wood products used:
364 cubic meters (12854 cubic ft) of glulam

U.S. and Canadian forests grow this much wood in:
1 minute

Carbon stored in the wood:
298 metric tons of carbon dioxide

Avoided greenhouse gas emissions:
633 metric tons of carbon dioxide

Total potential carbon benefit:
931 metric tons of carbon dioxide

Project Name: Edmonton LRT Stations
Date: March 6, 2014

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.

Equivalent to:

178 cars off the road for a year

Energy to operate a home for 79 years

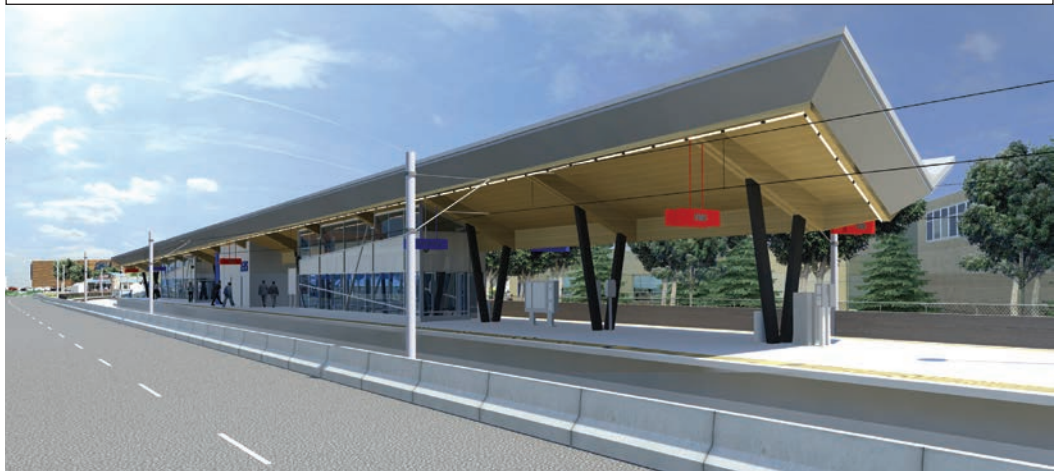


Photo: Stantec Architecture and ISL Engineering

Though processing the wood into building products does require energy, albeit less than competing materials, the needs of the mills are often supplied by using the biomass waste generated by the manufacturing process. At the end of their service lives, forest products can be reclaimed for reuse, recycled or used as a carbon-neutral source of energy. The glulam volumes, not including finishing products, used in the LRT buildings and platforms were:

MacEwan LRT Station	154 m^3
Kingsway/Royal Alex LRT Station	168 m^3
Kingsway/Royal Alex Bus Transit Station	42 m^3

The on-line Carbon Calculator tool (www.cwc.ca/index.php/en/resources/electronic-tools) calculates the amount of carbon that is not released to the environment when wood construction is used instead of other major building materials. The carbon calculation for the new Edmonton Transit System stations is shown on the left. The carbon benefit of the wood structure is equivalent to taking 178 cars off the road for one year or, expressed differently, the energy to operate a home for 79 years.

For more information about the benefits of using Canadian forest products visit: www.feel-good.ca

Conclusion

Wood was selected for the first new LRT stations to be added to the Edmonton Transit System in several years. The wood structures and finishes met all code requirements and were cost-effective compared to using other materials. The structural and decorative wood provides a bright, welcoming environment that was mentioned during the public consultation process.

Photo: Owen Murray©2014/ommphoto.ca

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