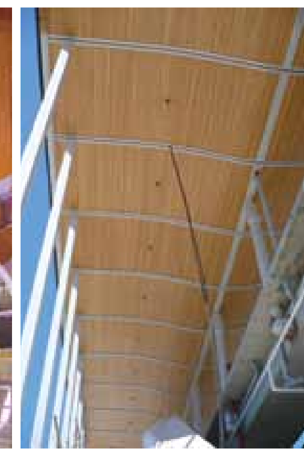
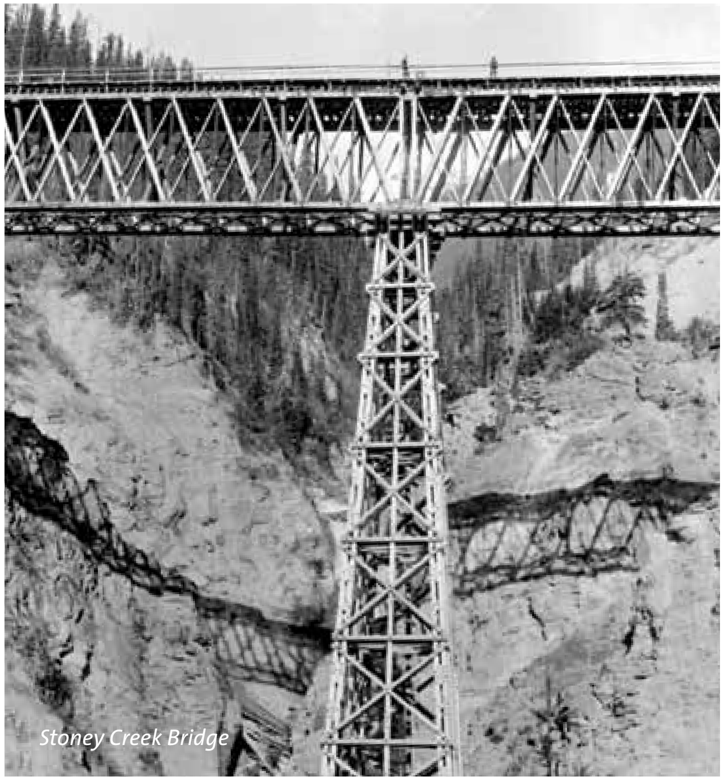
PAST, PRESENT AND FUTURE; THE NATURAL CHOICE
CONNECTING CANADA AND THE WORLD

WOOD IN TRANSPORTATION



Wood in Transportation

Trestle Bridge


Stoney Creek Bridge

Cranbrook Railway Station

CONTENTS

BRITISH COLUMBIA'S WOOD-BUILDING TRADITION

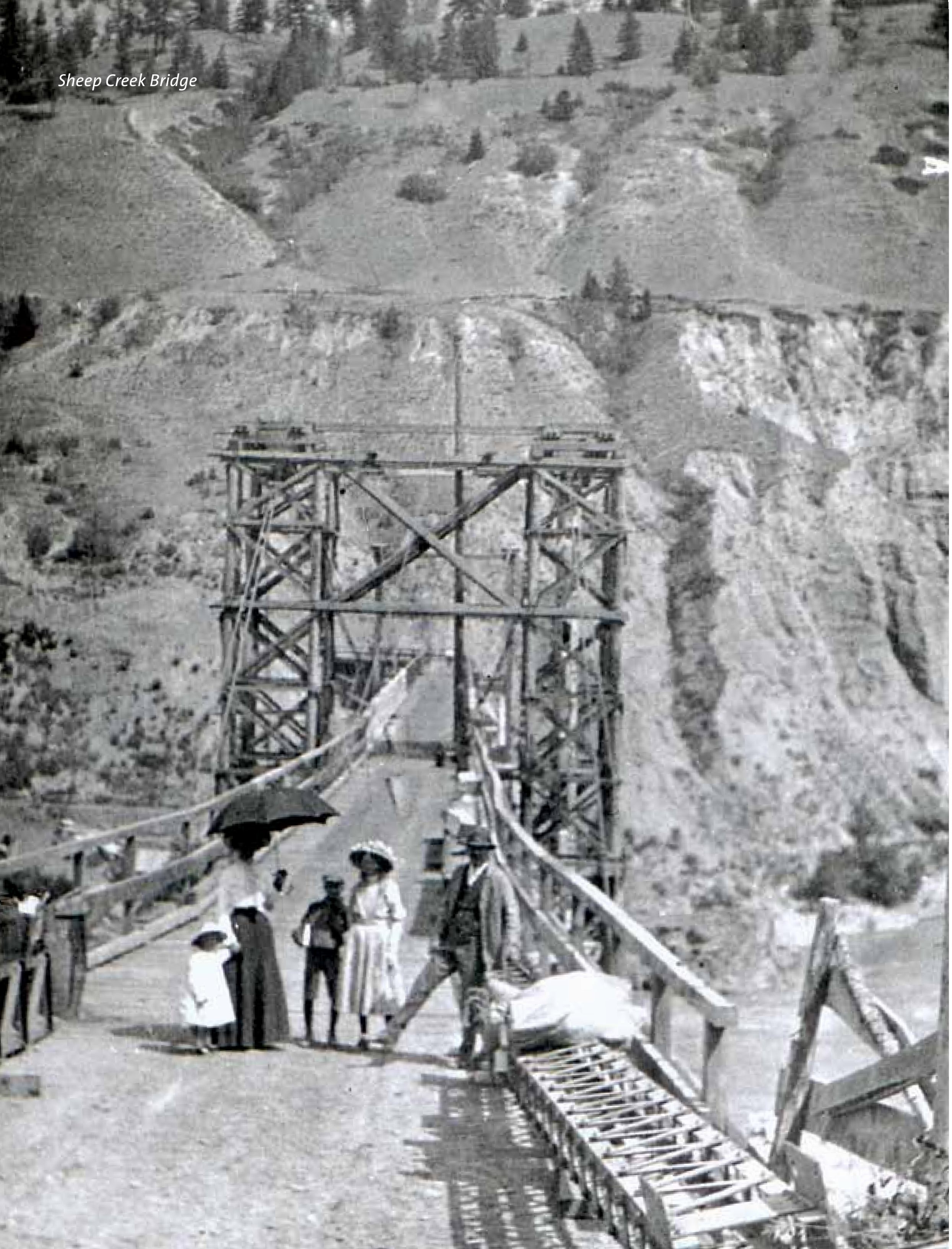
British Columbia has long been recognized as a transportation hub and a pivotal point for the movement of goods between North America and the Pacific Rim. Indeed its status as a province of Canada owes much to this strategic importance. The agreement to join the confederation of Canada in 1871 was based on the commitment of the federal government to extend the transcontinental railroad to the Pacific Coast. This could not have been achieved without the use of innovative wood structures.

As the railroad pushed westward, the challenging mountain terrain called for great ingenuity in overcoming the many geographic obstacles. The most versatile structure for spanning gullies, valleys, rivers, and swamps was the wooden trestle — a series of closely spaced, triangulated wooden supports, known as bents, that were connected longitudinally by diagonal braces — which served as the foundation for the railbed.

Engineering masterpieces abound in the mountains of British Columbia and it was not uncommon for a short stretch of track to include numerous crossing structures of unprecedented length and height.

THE HISTORY OF GLACIER NATIONAL PARK NOTES:

"At Mountain Creek, [railroad engineer James] Ross's forces built a trestle which stretched across a gap in the valley wall for 331 metres [1,086 ft] and stood 50 metres [164 ft] above the mountain torrent. A few kilometres farther up the line at Stoney Creek, a bridge was constructed which towered 64 metres [210 ft] above its [footings]. This bridge was heralded by the engineers of the day as the highest such structure in the world."



Sheep Creek Bridge

Innovation in the use of wood continued, as traditional craft techniques were modified and refined with the introduction of other complementary materials and technologies. Epitomizing this increasingly sophisticated understanding of timber engineering was a trio of wooden suspension bridges over the Fraser River— at Sheep Creek, Gang Ranch, and Lillooet— designed by structural engineer J. A. L. Waddell.

With the exception of steel cables and iron bolts and connectors, the entire 330-ft (100-m) span of the 1903 Sheep Creek Bridge was made of wood. The deck comprised a series of identical prefabricated panels, ingeniously designed so that all the timber rail and deck components could be individually replaced without decommissioning the structure. Now about 100 years old, the bridge at Lillooet survives intact and still provides access to the lands of the Lillooet First Nation.

Wood was also the material of choice for constructing the railroad stations that became a focal point for every town on the line. As gateways to and from the outside world, these structures took on a symbolic importance beyond their sometimes modest scale. Exploiting the flexibility of the newly perfected, light, wood-frame construction, they were executed in the exuberant architectural styles of the day.

One of the best surviving wood-frame stations is in Cranbrook, a town in the East Kootenay region that developed after the arrival of the railroad in 1898, and which remains an important administrative centre for railroad operations. The station was built in 1900 in the Victorian style, although it has undergone much modernization since. It is adjacent to the Canadian Museum of Rail Travel, which hopes one day to add the station to its site, and restore it to its original splendour.

Replaced in large structures by industrial materials like steel and concrete, heavy timber construction nonetheless made a brief reappearance during World War II when these materials were in

Boundary Bay Airport

Hangar

Terminal

short supply. In 1941, a vast hangar was completed at Boundary Bay Airport, which was part of a new air force base south of Vancouver. The hangar, which is still in use today, is noted for its heavy timber bowstring trusses, and full-height sliding doors that allow both ends of the building to be completely open.

The construction of this hangar was the last big achievement in what can now be seen as British Columbia's first great wood-building age. This era, which extended through the province's first century, was characterized by an innovative approach to design born of engineering excellence and a deep understanding of the physical characteristics of wood. It was this accumulated knowledge and the practical expertise of engineers and builders that made possible the realization of transportation structures of all kinds.

In January 2010, a new terminal was opened at the airport. The 15,000 ft^2 (1,400 m^2) facility includes a glulam-framed roof.

REVIVING WOOD-BUILDING TRADITION

The introduction of the National Building Code of Canada in the 1940s institutionalized a separation between wood and other materials, in effect creating two architectural traditions. The first, consisting of all-wood buildings, has relied heavily on the flexibility of site construction; while the second, consisting of non-wood buildings, has more readily incorporated advanced technology and prefabrication techniques.

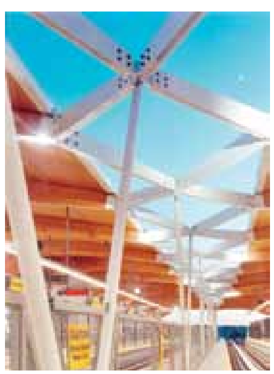
However, the move to performance-based building codes is underway, and the wood industry has introduced new engineered wood products whose dimensional stability and predictable performance facilitate integration with other industrial materials. As a result, a new generation of hybrid structures is emerging.

Many of these structures successfully articulate the complementary roles of wood and steel, with this interplay contributing to a new and coherent architectural language.

Advances in engineered wood products, manufacturing techniques, and fire behaviour modelling have made wood in its various forms a viable material for use in large-scale buildings, and in non-traditional applications.

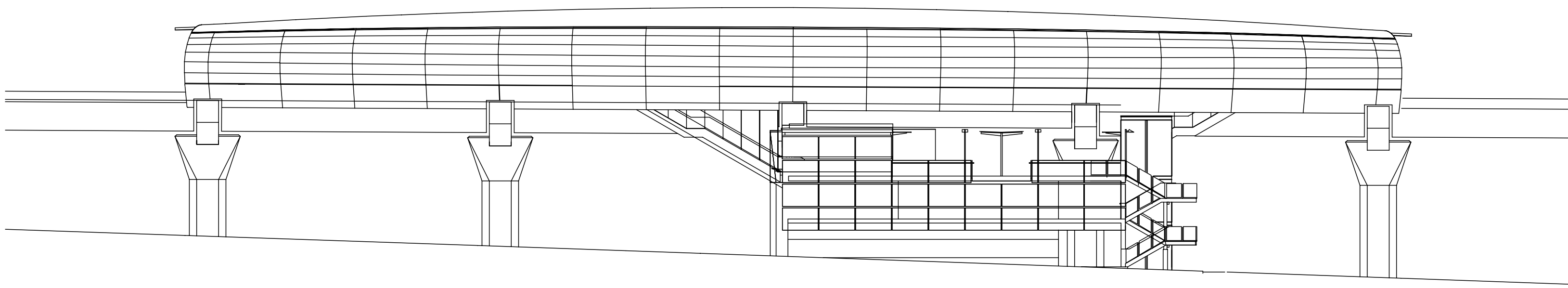
Still a strategic gateway between North America and the world, British Columbia continues to export its wood products, but now also provides design and fabrication expertise. With a growing portfolio of successful institutional and commercial projects, the province's wood industry is now an acknowledged world leader. The structures in this case study are ample testimony to the reawakened interest in wood, and to the unique qualities and unlimited potential of the material.

RAPID TRANSIT STATIONS



BRENTWOOD TOWN CENTRE STATION, BURNABY, BC

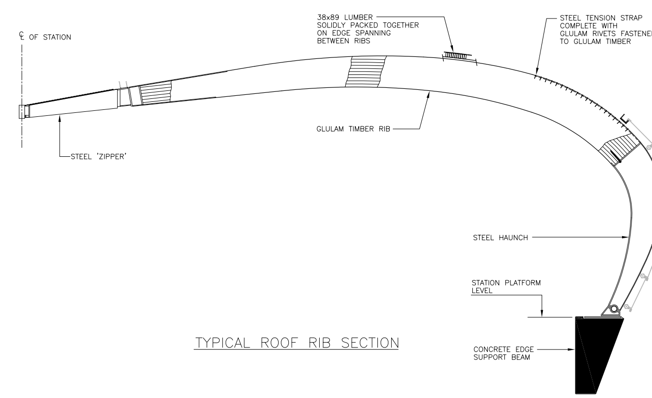
Considered from the outset to be the signature structure of metro Vancouver's Millennium Line, Brentwood Town Centre Station has a uniquely prominent location, being set 30 ft (9 m) above the median of Lougheed Highway, and visible from all sides. Accessible from below by a mezzanine land bridge that crosses the highway from nearby Brentwood Mall, the station's striking double-curved form hovers above the highway like a spaceship.

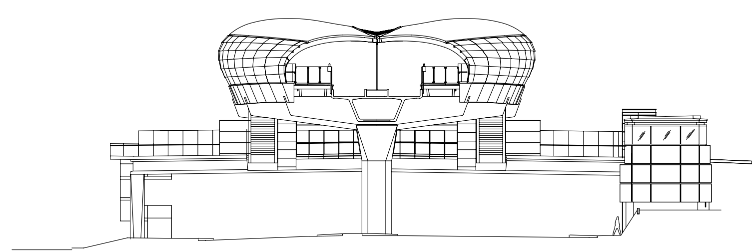


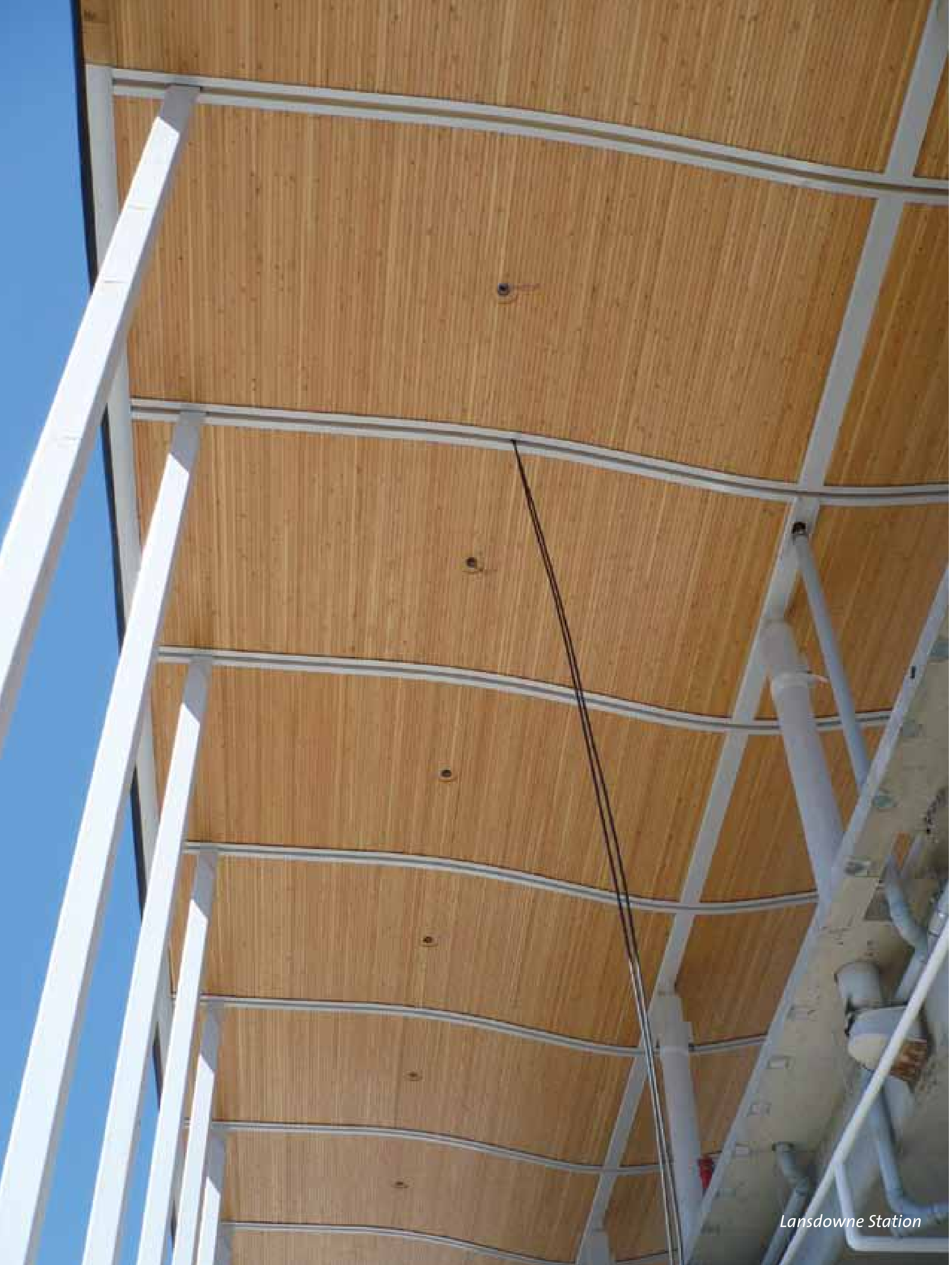
The station structure is an intriguing combination of high and low tech. The double-curved form could not be defined mathematically, so it had to be designed using 3D computer software. This proved cost-effective because architects, engineers, and contractors used the same 3D model for design, shop drawing, and layout purposes. The model also permitted many design options to be compared at an early stage in the project, and thus optimal solutions could be found. Although the glazing follows a double curve, the model made it possible to design a swiveling supporting clip that permitted 70% of the glazed area to be covered with flat panels of a standard size.

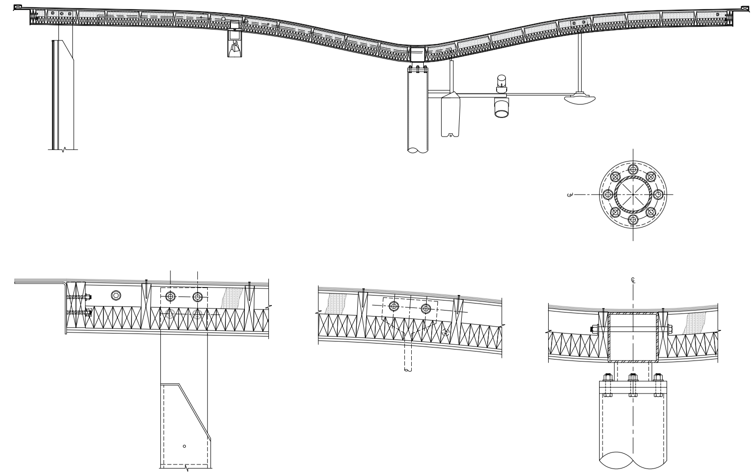
Above the glazing, however, the technology jumps back in time by a century or more, with the glass giving way to a solid wood roof built from 2 x 4-in (38 x 89-mm) Douglas-fir material laid side by side on edge and spiked together — a technique that was commonly used for constructing the floors of early warehouse buildings.

The precision of the computer and the time-honoured craft of site carpentry proved to be an effective combination. The ribs of the two canopies are connected via a structural gutter to steel cross-bracing and V-shaped steel struts that create a system of moment frames and that transfer lateral loads across the central void. The complementary properties of steel and wood dictate the architectural language, with steel used where the structure is exposed to the elements and wood where it is not.






Lansdowne Station

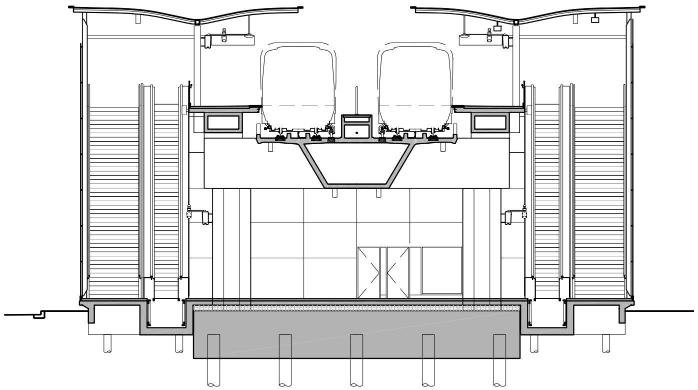


CANADA LINE STATIONS, RICHMOND AND VANCOUVER, BC

The design approach taken for the stations on Vancouver's latest transit line is a hybrid based on the lessons learned from previous projects. As such, it lies somewhere between the standardized 'kit of parts' approach used for stations on the Expo Line, and the customized, individual approach used for the Millennium Line stations.

The project was tendered using a design-build form of contract, with engineers taking the lead role. 'Families' of three or four stations were included in each tender package with the expectation that they would be similar if not identical in their design. While the client stressed that the Canada Line stations should be attractive and welcoming, the bottom line on this project was economy. Judiciously-used wood has achieved the first objective in four of the stations—Brighouse, Aberdeen, Lansdowne and Marine Drive—without compromising the second objective. Each station has an economical concrete platform slab, and a steel superstructure above which wood is used to bring warmth and character to the platform canopies.

The solution comprises a series of identical solid-wood modular panels, which are either flat or formed into a gentle curve and fitted into a frame of steel channel sections. The panels, sized to facilitate transportation from the manufacturing site to the installation site are



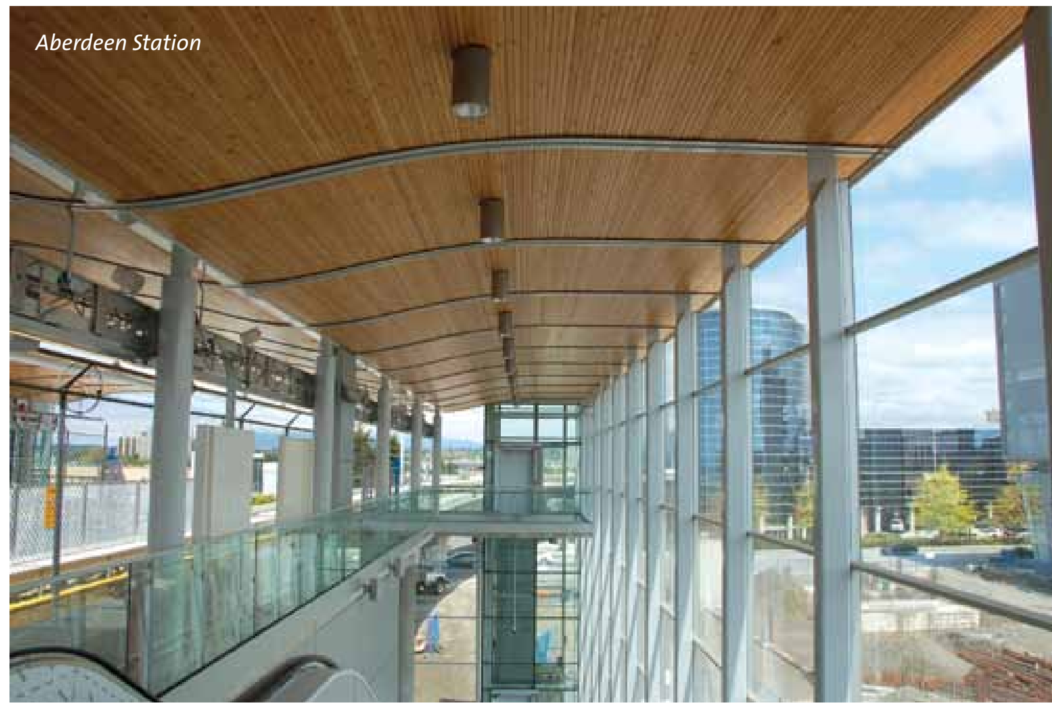
approximately 8 x 34 ft (2.4 x 10.5 m) and are made up of 2 x 4-in (38 x 89-mm) Douglas-fir members laminated face to face. Within this basic structure a 2 x 8-in (38 x 189-mm) member occurs at approximately 12-in (300-mm) centres that project above the plane of the panel to provide a nailing surface for the plywood diaphragm and to create a void behind the finished roof plane in which to conceal conduit and other services.

The panels were prefabricated off site to ensure the highest quality of the finished product and to facilitate rapid erection. The panels were lifted into place by crane, with each station roof taking less than a week to complete.

The success of these roof systems—which are low-tech and locally fabricated, using local materials—has profound implications. The systems are replicable or adaptable to a wide variety of scales and applications, offer quality control and reduced construction time, and require only modest investment in manufacturing infrastructure.

The Canada Line project was completed under budget and ahead of schedule, opening in August 2009, in time for the 2010 Olympic and Paralympic Winter Games.

Aberdeen Station



AIRPORT TERMINALS

PRINCE GEORGE AIRPORT EXPANSION, PRINCE GEORGE, BC

Prince George is the largest city in northern British Columbia. It has been a centre for forestry for more than a century, but in recent years the city has successfully broadened its economic base with the establishment of the University of Northern British Columbia and with the growth of wilderness tourism which attracts thousands of visitors each year from Europe. These developments, together with post-9/11 global security concerns, prompted the upgrading and expansion of its small regional airport terminal.

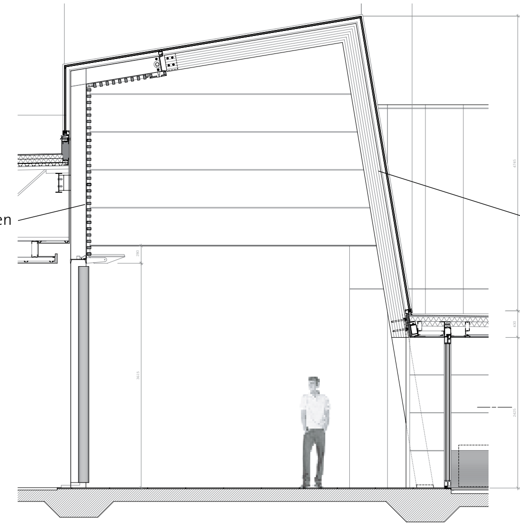
The two-phase expansion included the construction of domestic departure and arrival lounges, new security areas and baggage handling facilities for both domestic and international flights, and an international arrival lounge complete with customs offices. In renovating and expanding the existing facility, the challenge was to develop a design solution that would integrate new and existing

parts of the building and at the same time capture the character and aspirations of the Prince George region.

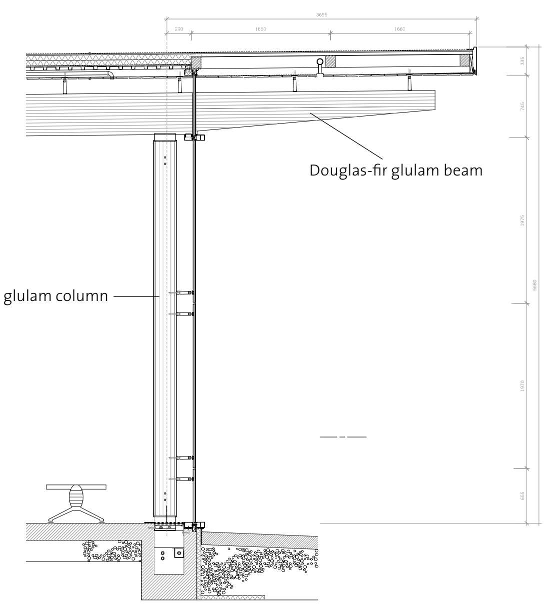
The expanded building program is organized around a linear concourse that serves to connect and unify the old and new parts of the building. An elegant system of Douglas-fir glulam and steel portal frames lifts a continuous glass skylight above the surrounding flat roofs, bringing daylight into the heart of the building. Bands of horizontal Douglas-fir sunscreens, mounted alternately on the east and west sides of the spine, filter the light and create an ever-changing shadow play on the walls and floor of the concourse.

In the departure lounge, elliptical Douglas-fir glulam columns and ductile iron castings support a high-performance glass curtain wall that provides passengers with sweeping views of the airside apron and surrounding forest. The glulam columns were fabricated locally using a five-axis computer numerically controlled (CNC) milling machine. The purity of the structure is emphasized by the use of discreet, narrow-head, stainless steel pin connections. And the beauty of the premium glulam material is enhanced by the use of colourless polyurethane glue which eliminates the black lines between laminations that have long been characteristic of glulam construction.

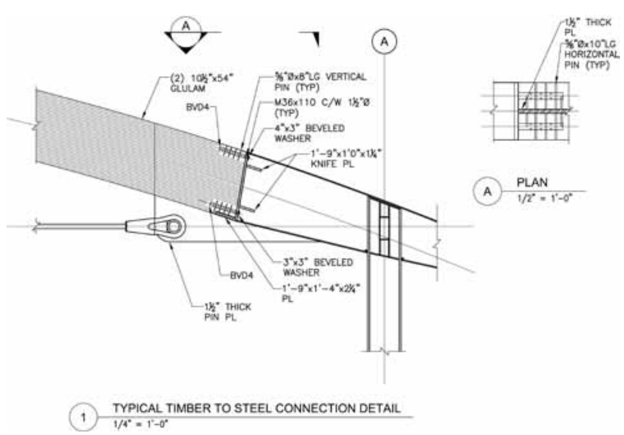
As the most important gateway to the city, the new airport has successfully redefined the image of Prince George. The elegance and economy of expression celebrate the precision of contemporary craftsmanship and the increased emphasis now being placed on value-added, engineered wood products and environmental stewardship.



SECTION THROUGH CONCOURSE



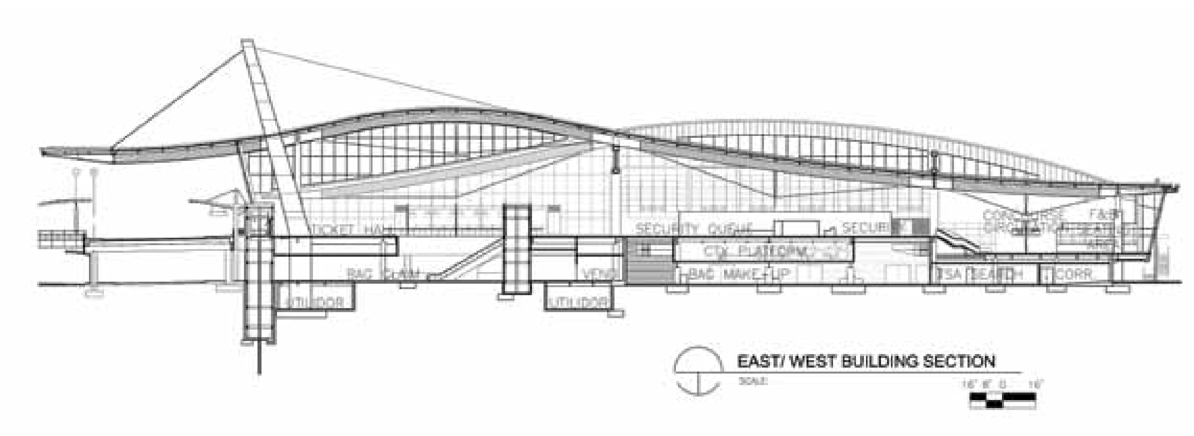
DEPARTURE LOUNGE SECTION AT CURTAIN WALL

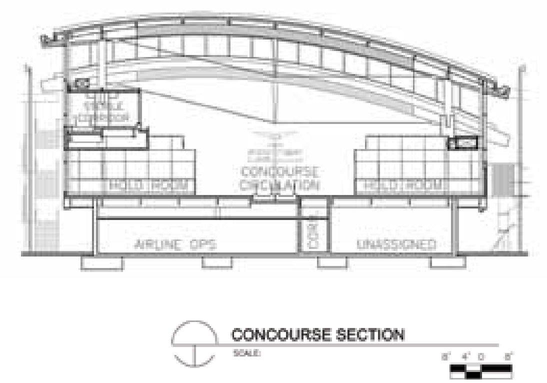


TERMINAL 2, RALEIGH-DURHAM INTERNATIONAL AIRPORT, RALEIGH-DURHAM, NORTH CAROLINA

Terminal 2 at Raleigh-Durham International celebrates the airport's role as a gateway to North Carolina and the high-tech Research Triangle Park. Opened in October 2008, it was designed to increase capacity and maximize flexibility. With the completion of its south concourse expected in early 2011, Terminal 2 will be equipped with 32 gates and accommodate up to 11.4 million passengers per year.

Rejecting the cold, cavernous feel common to so many modern airports, the design team created a very high-tech structural system that





stimulates feelings of warmth and welcome. Unlike an exposed metal structure, the wood trusses humanize the space with a cozy, personal feel that offers travelers a sense of comfort.

The roof forms were sculpted to reflect the rolling hills of North Carolina's Piedmont region. The wood trusses pay homage to the region's indigenous furniture and craft industries, as well as the native tree species from the surrounding countryside. The lenticular trusses were chosen to shape and support the curvilinear roof in the most efficient manner, thus creating flexible, column-free spaces.

Terminal 2's trusses were formed using laminated wood timbers, custom steel connections, and coil lock cables to create lenticular trusses that allow for long-span, column-free spaces. The trusses in the security area and the ticketing hall span 154 ft (47 m) while those in the concourse span 88 ft (27 m) and run the entire length of the concourse at 30-ft (9-m) intervals. A total of 80 trusses were installed throughout the building.

Because airports are often susceptible to shifts in technology, passenger trends, and operational requirements—such as ticketing and security — the Terminal 2's column-free, long-span structure allows flexibility in allocation and management of the facilities.

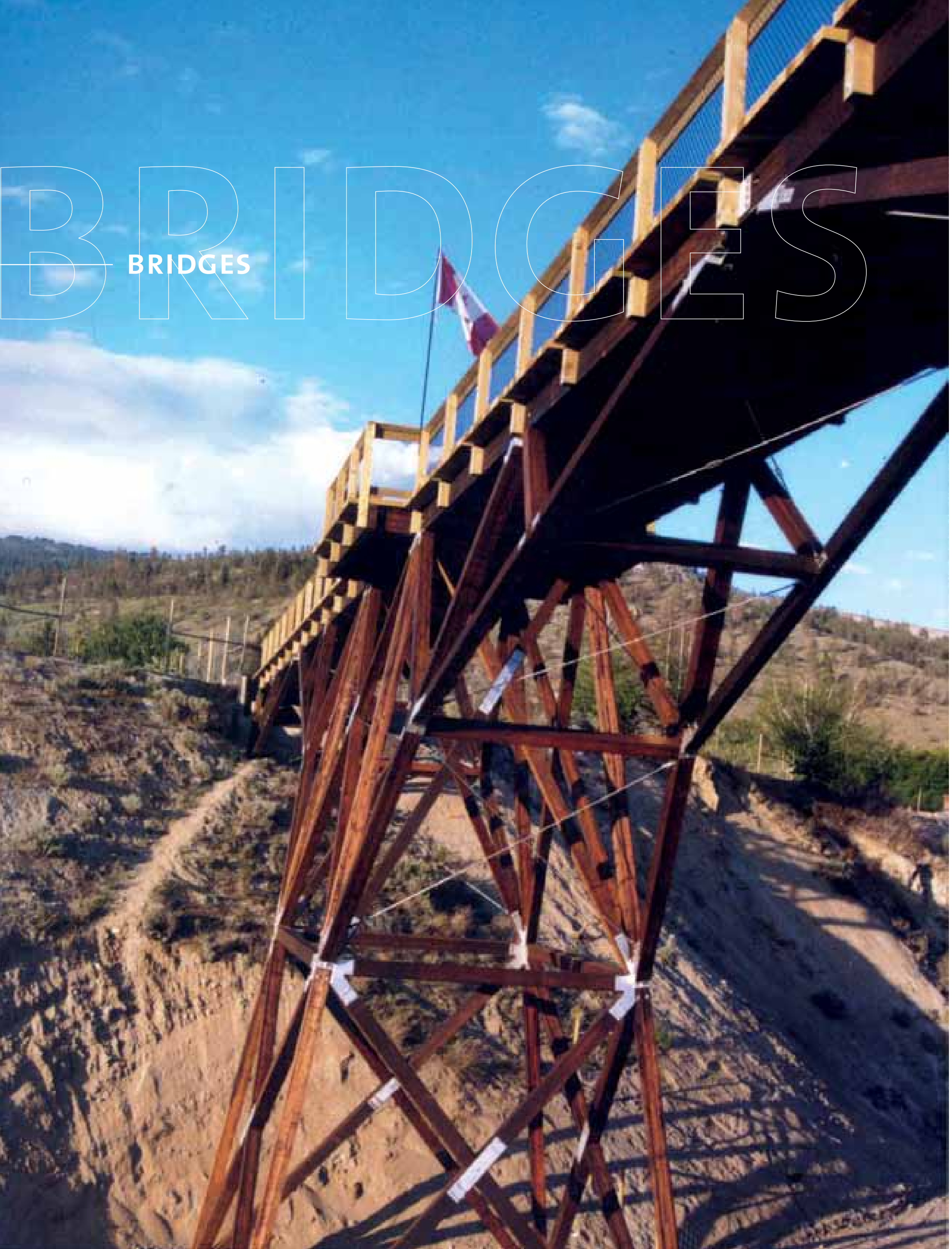
All building materials, including the Douglas-fir wood trusses, were specially selected for their durability and low maintenance. Due to its superior structural characteristics, Douglas-fir was substituted for the originally specified southern yellow pine. Because steel prices were very high at the time, choosing wood over steel offered the owner the potential to save a significant amount of money.

The design team knew how an all-steel structure would perform, but the proposed hybrid wood and steel trusses had never been implemented like this before. Thus, the research and development component of the design was important.

Among the technical challenges, the large 154-ft (47-m) long, 20-ft (6.5-m) deep king-post trusses were designed to span without any bridging, which required that a significant out-of-plane moment be transferred through the centre splice connections while allowing shrinkage to take place. This made it mandatory to carry the king-post steel through the mid-splice connection, which makes it very difficult to allow for shrinkage. Shrinkage at the king-post location was dealt with by allowing the upper portion of the connection to slide freely over the king post stub, while allowing the out-of-plane moment to be transferred to the roof purlins. Shrinkage at the truss tails was dealt with by reinforcing the glulam sections with long self-tapping lag screws and waxing the end grain of the arch to reduce friction stresses.

The glued-in rod connection originally proposed by the US-based project engineer proved too costly to build because it required extremely tight fabrication tolerances and a considerable amount of shop time. To address budget concerns, the team brought in a British Columbia-based timber engineer who redesigned the connection using proprietary Bertsche connectors.

Using the redesigned connection system, and other minor modifications, the design team tested a full-size mockup in a materials testing lab at North Carolina State University to confirm that the trusses would perform as predicted. The results were positive and, with the modifications incorporated into the contract, a savings of $1.5 million (more than 20%) was realized on the original timber subcontract.



BRIDGES

ANDREW McCULLOCH TRESTLE, NARAMATA, BC

The Trans Canada Trail is an ambitious national project that will unite existing walking and biking trails located across the country into a single network. When complete it will be the longest recreational trail in the world totalling more than 11,200 mi (18,000 km) in length. Much of it will run along disused rail beds and rights of way.

On the route of the former Kettle Valley Railway, in the southern interior of British Columbia, the Andrew McCulloch Trestle carries the trail across a 300-ft (90-m) creek bed on two 50-ft (15-m) high pylons. The entire structure is made from pressure-treated Douglas-fir glulams stained to evoke the creosote-coated trestles of the 19th and early 20th centuries. CNC machining of the wood components was carried out in nearby Penticton.

The form of the bridge takes advantage of the natural strength of wood by putting most of the members in compression. Arches under each span transmit loads into the tower bases and abutments. The connections, like those of the Lillooet suspension bridge designed nearly a century earlier, are configured to prevent any member ends from being exposed to weather. They are spaced to allow for air circulation and have sloping end cuts to promote drainage away from the wood members. Plate connections are also sloped.

CNC technology has not only facilitated improvements in the performance and reliability of traditional connection systems such as bolts, but has also made possible a new generation of high-efficiency, pre-engineered connection systems. Accordingly, the Andrew McCulloch Trestle features the first North American application of proprietary Bertsche tension connectors imported from Germany.

The main connection element is a shaped steel shaft that is inserted into the base of each vertical support prior to erection, leaving a flush-mounted threaded connection exposed. The shaft is kept in place by a set of steel dowels that interlock with the shaft and the timber member. A non-shrink grout is then poured into the connection to fill the voids between the timber and the connector. These connectors and others like them, can greatly reduce the design time required for detailing wood structures, and so make them more competitive with alternative systems.

KINGSWAY PEDESTRIAN BRIDGE, BURNABY, BC

The City of Burnaby, a large municipality within metro Vancouver, wanted to construct a signature pedestrian bridge across Kingsway, one of the city's main thoroughfares. After considering several possible solutions, the design team opted for a simple and elegant single-arch span from which the walkway would be suspended on steel tension rods.

In the interests of economy, buttresses were avoided and instead the arch is tied using the walkway itself to resist the outward thrust. The bridge was to be partially covered, which offered the opportunity of introducing wood into the design.

Using an approach similar to that taken for the Brentwood Station, the arch has steel haunches where the structure is exposed to the elements, and these transition to glulam where protection from the weather is provided by the roof. Pedestrians approaching from either end of the bridge are presented with an elegant tapering silhouette created by the Douglas-fir glulam arches that are pinched together at the crown. To achieve a lightness of appearance and to minimize the structural depth, six shallow arches are used rather than a single deep arch on either side.

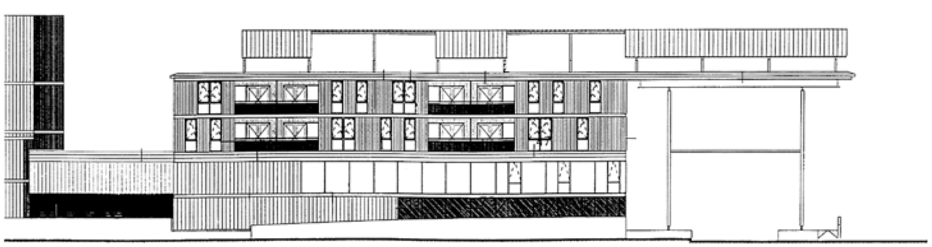
To combat the bi-axial stress created by pinching the arches together at the crown, the outermost members (which are required to bend the furthest), are made up of two narrower 3-in (75-mm) thick glulams — rather than a single 6-in (150-mm) thick member. These thinner members were considerably more flexible, but due to being only 2 ft (600 mm) deep and 100 ft (30 m) long, handling of these components was a delicate operation.

The entire wood portion of the bridge, including the tapering roof panels, was prefabricated in a parking lot adjacent to the site. When lowered into place, the two sections of the exterior arches (as well as the wider intermediate ones) were squeezed together and held in place with tension rods. Prefabricated roof panels were then dropped into place.

The glulam arches support HSS beams that project slightly beyond the edges of the roof. Steel rods attached to these beams support the precast concrete walkway. These sections, together with internal wood blocking between the glulams, serve to transfer some of the vertical loads away from the outermost arches.

EXPORTING

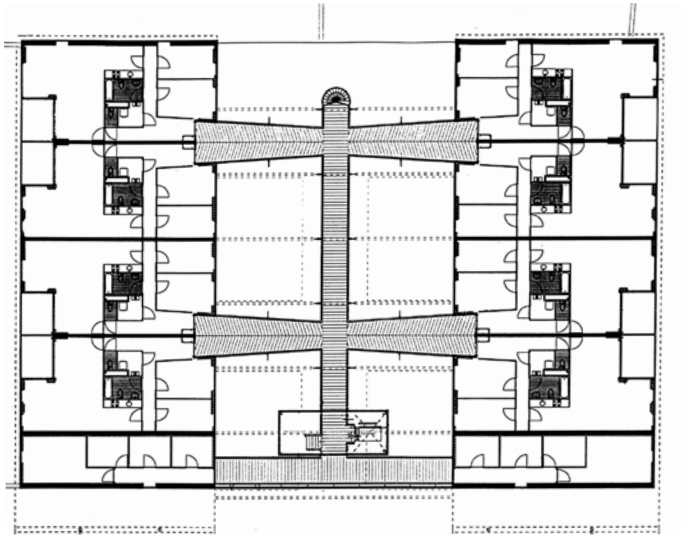
EXPORTING BRITISH COLUMBIA'S WOOD PRODUCTS AND BUILDING EXPERTISE



IJSSELSTEIN TRAM STATION, IJSSELSTEIN, UTRECHT, NETHERLANDS

The precedent set by the use of wood in Vancouver's transit stations has been followed by leading architects in both Asia and Europe.

Since the 19th century, railway station construction in Europe has been dominated by steel. But mixed-use development at IJsselstein, which includes not only a tram station but retail shops and residential apartments, has broken with this tradition. The familiar but impersonal steel vault has been replaced by a shallow curved roof of glulam arch construction. The arches spring from lower flat roofs that flank the

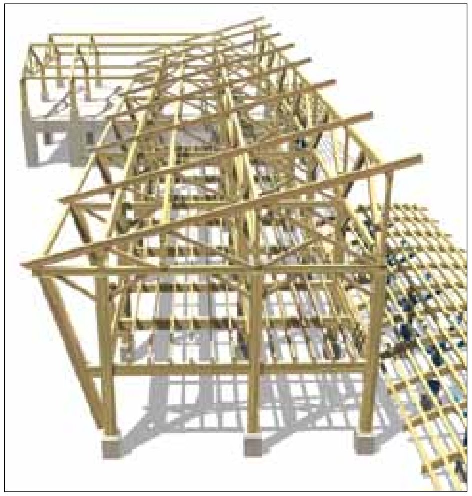


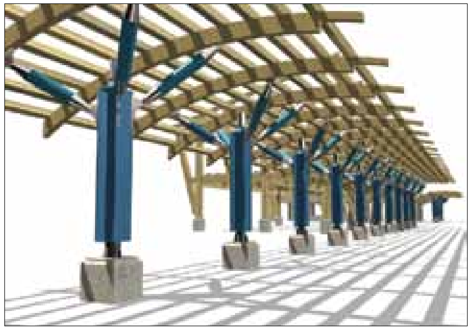
central vault, with the space between the beams being left open to form a clerestory.

Beneath the flat roofs are suspended canopies made from western red cedar boards from British Columbia. The three roofs, supported only on slender steel columns, project dramatically from the building to hover above the tram tracks. As it penetrates the plan, the central roof covers a courtyard around which are ranged apartments connected by a footbridge suspended from the glulam arches on steel rods.

The project is located adjacent to a new community centre that is constructed almost entirely of glass. This material has been carried through to the tram station—glass wraps the ground-level shops and creates a light and transparent podium above which the apartments appear to float. Maximizing the contrast in the material palette, the apartments are clad primarily in crisply detailed, vertical, western red cedar boards.


2





ALISHAN RAILWAY STATION, CHIAYI COUNTY, TAIWAN

Canada has long been the world's leading exporter of wood and wood products, and continues to supply high-quality structural and finishing materials to countries around the globe — notably the developing economies of Asia. In the last two decades, British Columbia's design and fabrication expertise has also become highly sought after.

In Taiwan, a new railway station in the Alishan National Scenic Area has been built entirely with materials, engineering, and fabrication services from British Columbia. Although Taiwan has an historic tradition of finely crafted wood architecture, little of that expertise is evident in contemporary buildings, the vast majority of which are constructed of concrete. When expertise in wood design is required the Taiwanese source it in the global marketplace.

The project was let as a design–build contract with a fixed price for engineering, fabrication and erection services. The architectural concept required that the Douglas-fir glulam platform canopies be open and transparent, with no shear walls obstructing the views—a significant challenge given Taiwan's exacting seismic code. The solution is a system of tree-like columns cantilevered from the concrete slab, and employing Bertsche connectors similar to those used on the Andrew McCulloch Trestle to resist the considerable uplift forces.

The entire structure was prefabricated in British Columbia, including installation of the Bertsche connectors, and shipped to the site for erection. Because of the steel-to-steel nature of the connection detail, coordination with the site-poured concrete was straightforward.

Brentwood Skytrain Station

WOOD AND SUSTAINABILITY

British Columbia architects and engineers increasingly favour wood for both its enduring characteristics of strength and beauty, and for its environmental benefits. Low embodied energy was a factor in the selection of solid sawn lumber for the roofs of Brentwood Town Centre and the Canada Line Stations; and influenced the choice of locally fabricated glulam in the Kingsway Pedestrian Bridge. At the Prince George Airport the use of wood was designed to communicate the continued importance of the material to the region, and its careful detailing to express the new concern for stewardship of the resource.

In days past, the use of wood for transportation structures was a matter of expedience: the material was abundant, accessible, strong, flexible, and easy to work. Today, it retains all of these virtues, but its value as a construction material has been further enhanced by the growing appreciation of the important environmental role it can play.

Sustainably managed forests provide a completely renewable resource that has the unique advantage of acting as a long-term storage mechanism for atmospheric carbon dioxide. A combination of sustainable forest management (harvesting, replanting and healthy growth), along with the fact that wood products have a lighter environmental footprint than other building materials, means that using wood, renewing forests and growing trees helps reduce the amount of greenhouse gases in the atmosphere.

Prince George Airport

PROJECT CREDITS

BRITISH COLUMBIA WOOD PRODUCTS TRADITION

PHOTOGRAPHS COURTESY OF:
Alpha Aviation Inc.
Royal BC Museum BC Archives:
Inside Cover: Image C-00132 Railroad Trestle
P. 1: Image G-05100 Stoney Creek
P. 1: Image F-5620 Cranbrook Station
P.2: Image E-09963 Lillooet Bridge
KK Law
Wikipedia Commons

BOUNDARY BAY AIRPORT TERMINAL

CLIENT
Alpha Aviation

ARCHITECT
Ulrich Laska Architectural Corporation

STRUCTURAL / TIMBER ENGINEER
Kerkhoff Engineering Ltd.

FABRICATOR
Structurlam Products Ltd.

PHOTOGRAPHER
KK Law

BRENTWOOD TOWN CENTRE STATION

CLIENT
Rapid Transit Project Office

ARCHITECT
Busby Perkins+Will Architects Co.

STRUCTURAL / TIMBER ENGINEER
Fast & Epp Structural Engineers

FABRICATOR
Structurlam Products Ltd.

PHOTOGRAPHERS
Busby Perkins+Will Architects Co.
Nic Lehoux

CANADA LINE STATIONS

CLIENT
In Transit BC

ARCHITECTS
Busby Perkins+Will Architects Co.
(Richmond-Brighouse, Aberdeen, and Landsdowne Stations)
VIA Architecture (Marine Drive Station)

STRUCTURAL / TIMBER ENGINEER
Fast & Epp Structural Engineers

FABRICATORS
Solid Rock Steel Fabricating Co. Ltd.
HR Contracting

PHOTOGRAPHERS
Busby Perkins+Will Architects Co.
Fast & Epp Structural Engineers
Stephan Pasche

PRINCE GEORGE AIRPORT EXPANSION

CLIENT
Prince George Airport Authority

ARCHITECT
mcfarlane | green | biggar

STRUCTURAL / TIMBER ENGINEER
Equilibrium Consulting Inc.

FABRICATOR
Structurlam Products Ltd.

PHOTOGRAPHER
mcfarlane | green | biggar

TERMINAL 2, RALEIGH-DURHAM INTERNATIONAL AIRPORT

CLIENT
Raleigh-Durham Airport Authority

ARCHITECT
Fentress Architects

STRUCTURAL / TIMBER ENGINEER
Equilibrium Consulting Inc.

FABRICATOR
Structurlam Products Ltd.

PHOTOGRAPHER
Nick Merrick © Hedrich Blessing

GRAPHICS/SECTIONS
© 2010 Fentress Architects

ANDREW MCCULLOCH TRESTLE

CLIENTS
Trails BC
Wine Country Walkways Society

STRUCTURAL / TIMBER ENGINEER
Equilibrium Consulting Inc.

FABRICATOR
Structurlam Products Ltd.

PHOTOGRAPHER
Mark Rufiange

KINGSWAY PEDESTRIAN BRIDGE

CLIENT
City of Burnaby

ARCHITECT
Busby Perkins+Will Architects Co.

STRUCTURAL / TIMBER ENGINEER
Fast & Epp Structural Engineers

FABRICATORS
Structurlam Products Inc. (Glulam)
Dominion Construction Inc. (Roof Panels)

PHOTOGRAPHERS
Fast & Epp Structural Engineers
Stephan Pasche

IJSSELSTEIN TRAM STATION

CLIENT
Ahold Vastgoed bv

ARCHITECT
Kraaijvanger • Urbis

STRUCTURAL / TIMBER ENGINEER
De Bindt raadgevend ingeneurs

FABRICATOR
Aan de Stegge Bouw & Werktuigbouw

PHOTOGRAPHER
Jan Derwig

ALISHAN RAILWAY STATION

CLIENT
Chiayi Forest District Office

ARCHITECT
C.F. Yang Architect

STRUCTURAL / TIMBER ENGINEER
Equilibrium Consulting Inc.

FABRICATOR
Structurlam Products Ltd.

PHOTOGRAPHER
Structurlam Products Ltd.

Raleigh-Durham International Airport

FOR TECHNICAL INQUIRIES
www.wood-works.ca
1-877-929-9663

NSPORTATION