Korean Presbyterian Church

EDMONTON, ALBERTA

Canadian Wood Council
Conseil canadien du bois

wood WORKS!
Project of the Canadian Wood Council

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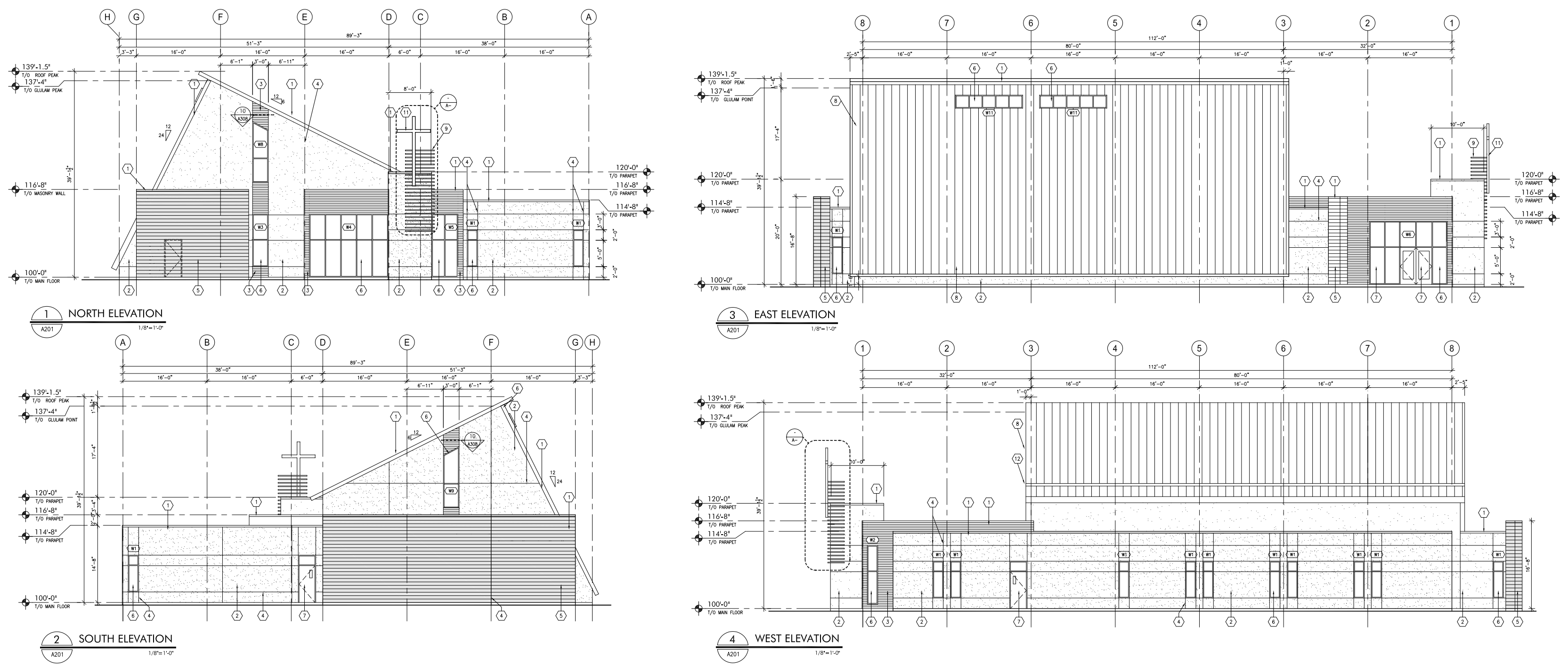
1.0 INTRODUCTION

Although there has been a Korean Christian community in Edmonton for more than 20 years, until the completion of this church it conducted its services and other operations from rented accommodation. The new church is located in an industrial park, in the southeast quadrant of the city, on a site purchased from the City of Edmonton. This building constitutes the first phase of a two phase project that will eventually also include a community centre.

Cover Photo: Steve Nagy Photography

Photo (Right): Steve Nagy Photography



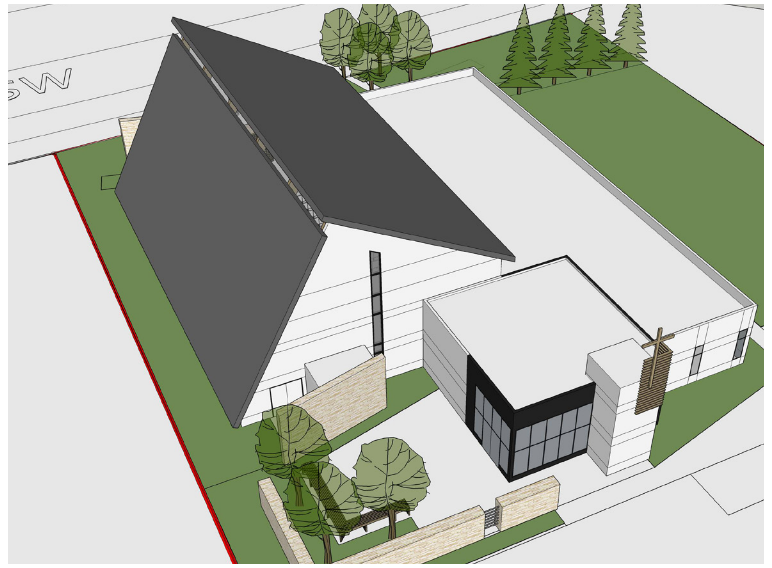
2.0 ARCHITECTURE

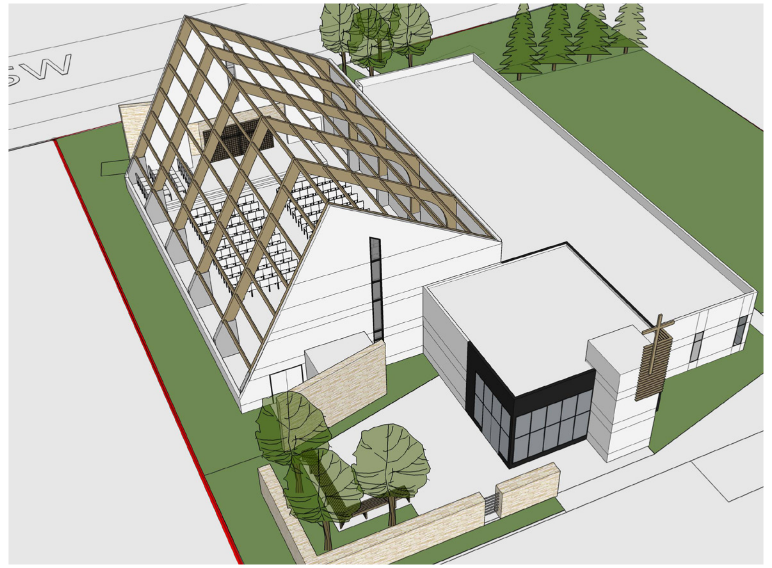
The physical location of the project held little in the way of inspiration, with the level, open site fronting an arterial road and surrounded by unremarkable industrial and commercial buildings. By the same token, it imposed few constraints — anything was possible within the limits of the client's modest budget.

While the client community conducts its services in the Korean language and often wears Korean dress, it wanted a contemporary building that would express the congregation's Canadian values and aspirations, rather than overtly reflecting its Korean heritage and building tradition.

The building program was initially 12,000sf (1115m^2) spread over two storeys, but budget constraints prompted a return to first principles. Restricting the building to a single storey eliminated the need for stairs and elevators, saving both money and space; while reducing the overall area to less than 10,000sf (930m^2) eliminated the need for sprinklers. Architecturally, a single storey solution also increased the opportunity to give the sanctuary a strong formal expression in contrast to the low, flat roofed support spaces. As built, the program includes a 4000sf (372m^2) worship space accessed from a glazed entrance lobby or narthex, with the remainder of the 9600sf floor area taken up by ancillary spaces that include offices, education rooms, kitchen facilities and washrooms.

The worship space is designed to be visually warm and welcoming, with both the structure and finishes entirely of wood and concrete. Windows on the east and west walls, together with a skylight on the north slope of the roof, let in abundant natural light. Great care was taken to ensure that the glulam roof structure and exposed wood roof decking are clean and uncluttered. To this end, artificial lighting takes the form of uplighters mounted on the concrete buttresses that support the roof structure.





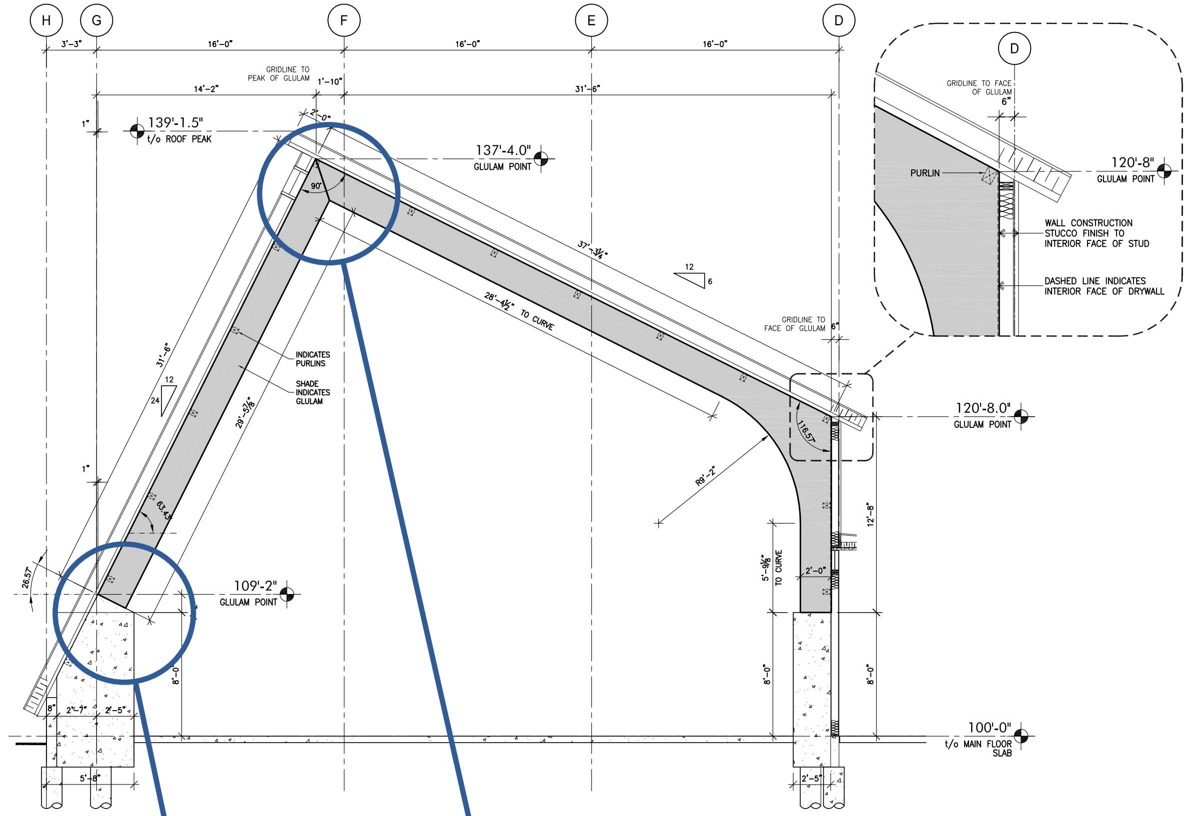
Photos: Brian Allsopp Architect Ltd

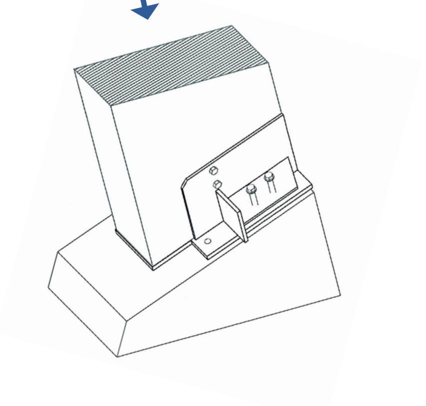
Externally, the building is clad in a combination of pre-finished, corrugated metal sheet and an exterior insulation finishing system (EIFS), secured to non-load bearing 2x6 wood frame walls that infill between the steel columns of the ancillary spaces. While the church has no steeple in the traditional sense, a small tower adjacent to the glazed entrance lobby is extended by a vertical trellis of painted spruce boards, upon which is mounted a cross of clear finished cedar.

3.0 FIRE AND LIFE SAFETY

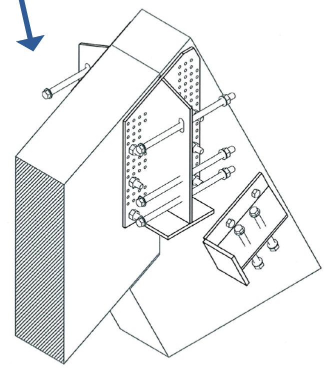
The Korean Presbyterian church is classified as a Group A, Division 2 Assembly Occupancy under the National Building Code of Canada. With an area of less than 10,000sf (930m^2), a height of one storey, and facing two streets, the building is permitted to be of either combustible or non-combustible construction and requires no sprinklering.

Photo: Steve Nagy Photography





(FIGURE 1) BASE CONNECTION



(FIGURE 2) GLULAM PEAK CONNECTION

4.0 STRUCTURE

The church complex employs two distinct forms of construction: a conventional light steel frame and I-joist system in the flat roofed portion of the building where the structure is concealed; and a system of glulam arches and purlins with wood decking in the sanctuary area where the structure is exposed.

The worship space is an 80ft x 50ft (26m x 16m) rectangle, whose cross section is a composite of a Tudor arch and an A-frame. This creates a dramatic interior space that is functional and cost effective. The shallower slope on the south side of the sanctuary helps reduce snow accumulation on the adjacent flat roofed area, while the steep slope of the north roof, extending down almost to ground level, eliminates the need for a wall on that side of the building. On the north side, the inclined glulam beams spring from 8ft high concrete buttresses, while on the south side the Tudor arch elements are supported on concrete columns.

Wood was an extremely cost effective solution for the high volume of the worship space. Initially estimated by the construction manager at a cost of $165,000, the final cost came in at $150,000 – a savings of 10%. The primary Douglas fir glulam structural elements are spaced at 16ft (4.88 m) centres, with Douglas fir glulam purlins running between them at 6ft 8in (2.03m) centres. This spacing permitted the use of solid 2x6 SPF tongue and groove decking (rather than the more expensive 3x6 thick material commonly used for this purpose). A layer of plywood is added to the decking to achieve diaphragm action in the roof.

The design team worked with the glulam fabricator to devise elegant and efficient exposed plate connection details where the glulam elements spring from their concrete supports, and concealed knife plate connections at the apex of the roof.

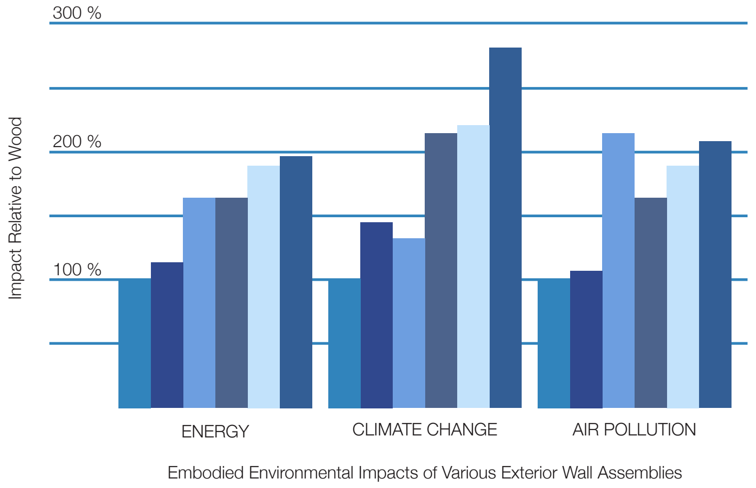
5.0 WOOD AND SUSTAINABILITY

While the client did not have the budget necessary to pursue certification under the LEED NC Program, the building does incorporate basic sustainable design principles including a well insulated envelope, ample daylighting, and the use of durable, locally-sourced materials.

The construction, renovation and operation of buildings consume more of the earth's resources than any other human activity. Each year, at least 40% of the raw materials and energy produced in the world are used in the building sector. This produces millions of tones of:

- Greenhouse gases
- Toxic emissions
- Water pollutants
- Solid waste

LIFE CYCLE ASSESSMENT: WOOD IS A GOOD CHOICE



(FIGURE 1)
Life cycle assessment is a rigorous and systematic approach that thoroughly quantifies environmental impacts. It is currently the best method to determine the "greenness" of a product. Numerous life cycle assessment studies worldwide have shown that wood products yield clear environmental advantages over other building materials and scientific analysis shows that wood has the lowest environmental footprint of all major building materials.

Photo: Steve Nagy Photography

The most widely accepted method for evaluating these impacts is Life Cycle Assessment (LCA). Life cycle assessment is accepted around the world as an impartial way to evaluate and compare the environmental impacts of different building materials, products and complete structures over their lifetime — from material processing and manufacturing, through transportation, installation, building operation, decommissioning and eventual disposal.

Unfortunately, LCA is not yet completely incorporated into many green building rating systems in use in North America. Yet, when it is applied to building construction, in almost every situation life cycle assessment confirms that wood is the most environmentally responsible building material. For these reasons, and because of the local availability of glulam fabrication, wood was a natural choice for the Korean Presbyterian Church.

Increasingly important in the evaluation of sustainable design in building construction is the use of carbon accounting. One innovative and rigorous approach, called the Living Building Challenge, was launched by the Cascadia Region Green Building Council in 2007. The Challenge not only requires buildings to be net-zero in their energy and water use throughout their operational life, but also to be carbon neutral in their construction. This means that the carbon impacts of extracting, processing, transporting and installing all building materials, products and systems must be calculated and that their sum must be zero or less. Although the Living Building challenge does offer a path to carbon neutrality through the purchase of carbon offsets, the Canadian contenders scheduled for completion in 2011 all incorporate large quantities of wood.

This is because growing trees use sunlight to sequester carbon dioxide to create cellulose, the main component of wood fibre, and this CO_2 is stored within the wood, even when it is converted to construction lumber. The amount of CO_2 required to create a cubic metre of wood varies according to the density of the species in question. However as a point of reference, approximately 0.9 tonnes of CO_2 is used to grow every cubic metre (423 board ft) of SPF wood fibre. This carbon remains sequestered as the tree is processed into durable wood products. Even when impacts from the modest energy inputs required for processing and transportation are included wood has a very low carbon footprint compared with other building materials. In many cases, this footprint can be negative, and the presence of wood in a building helps offset the carbon footprint of other building materials.

Although carbon accounting was not a client requirement for this project, calculations for structure carbon footprint were made based on the volume and mass of material used. In this case materials considered were the glulam beams as well as the plywood and OSB used in the construction of the project. As a result the wood used in the structure sequesters more than 75 tonnes of CO_2e, even accounting for the wood production emissions. However, the wood used displaced the emissions that would have been made had other materials been used in place of wood. The substitution effect of using wood results in a net CO_2e reduction of 355 mT. In other words, 355 tonnes of CO_2e are not in the atmosphere because wood was used. As a point of reference, a car built to 2010 Canadian emission standards will emit 1 tonne of CO_2 when driven a distance (5000 kilometres((so the carbon sequestered in this building is equivalent to about 307 return car trips between Vancouver and Halifax).

6.0 CONCLUSION

On this small project with its modest budget, wood proved to be both an expressive and economical solution. A combination of engineered wood and solid sawn lumber lent itself to a variety of applications: interior and exterior, structural and non-structural, exposed and concealed. Wood's environmental advantages, including its superior life cycle performance and ability to sequester and store carbon will become increasingly important as the building industry moves toward the new paradigm of carbon neutral construction.

7.0 PROJECT CREDITS

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8.0 PROJECT STATISTICS

Gross floor area: 9321sf (866 m^2)
Approximate project cost: $1.8 million

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Project of the Canadian Wood Council

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