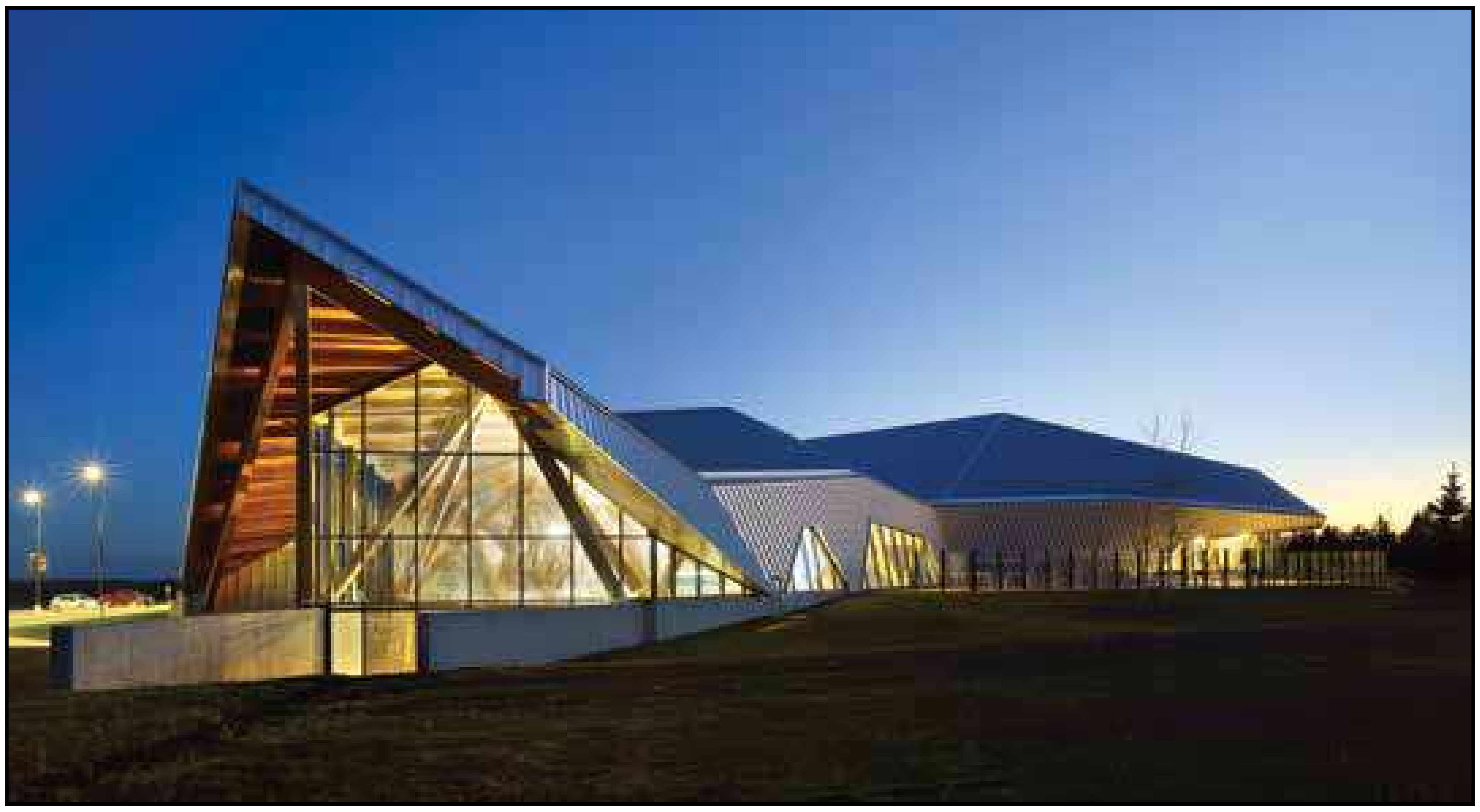
2016 WOOD DESIGN AWARDS - WINNER

Wood Innovation

Stephen Teeple, Teeple Architects Inc., Toronto, ON
Brian Bengert, Architecture Tkalcic Bengert, Edmonton, AB
Philip J. Currie Dinosaur Museum, Wembley, AB



"The use of new technology to utilize wood as a viable large structural system results in an architectural achievement that is both beautiful and functional."

- jury comments

High resolution images available. Please e-mail mmclaughlin@wood-works.ca

The Philip J. Currie Dinosaur Museum aspires to become an internationally significant centre of paleontology in fossil-rich northern Alberta. Visitors move through a sequence of spaces and experiences that form an architectural narrative that parallels the fascinating story of the Pipestone Creek dinosaur bone-bed.

New technology was developed to construct the wood structure and, in particular, the nodes where up to eight large beams meet at a single point. The design team developed a technique – used here for the very first time – of laminating plywood to create structural connections. Each node is built-up from 180 layers of 16-mm Douglas fir plywood.

The extensive use of wood, much of it sourced from local mountain pine beetle-killed forests, the barn-like post-and-beam structure and the raw aluminum cladding reflect Peace River's history of agriculture and forestry. Pine beetle glulam members were chosen for support columns and beams, with the complex topology of elements coming together at the nodes. Plywood timber creates a warm environment and, in an oblique manner, this giant wood exoskeleton has a form of symbiosis with the dinosaur skeletons (material once living, now dead).

The glulam struts did not pose large difficulty in design, but the connection nodes certainly did. Initial concepts included both solid timber nodes and mass glulam pieces fastened together structurally, but these options were not efficient structurally due to the high forces coming at these nodes in all directions. The design team's unique solution was to slice each node into hundreds of CNC plywood layers, connected with a complex network of stainless steel screws.

Similar to 3D printing, this concept stacks layers of plywood to create a complex three-dimensional shape from a series of 2D shapes. The shapes were "stamped" using a CNC machine onto ordinary 4x8-inch sheets of plywood, arrayed to minimize waste. These nodes were a groundbreaking venture into the engineering of timber connections, as they exhibited a unique structural behaviour caused by the use of plywood.

Tests were done to examine the strength capacity and failure mechanisms of the nodes using beams made of built-up layers of plywood, glued and stapled together in a manner similar to the make-up of the nodes. By testing with and without screw reinforcement, stress parameters could be deduced that could inform the structural analysis of the nodes themselves.

Fabrication itself involved both intensive quality control and highly detailed shop drawings showing exactly where the CNC pieces of plywood for each unique node would sit, as well as the placement and installation angle for each of the screws providing tensile strength.

Strategies including displacement ventilation, a highly insulated building envelope system that eliminates cold bridging, and LED exhibition lighting to minimize energy use. The most striking green feature though is the wood structure. Wood is a renewable resource, has a low embodied energy and is a good carbon storage mechanism. This project breaks new ground by pushing the possibilities of wood as a viable and sustainable structural system for large buildings in Canada.