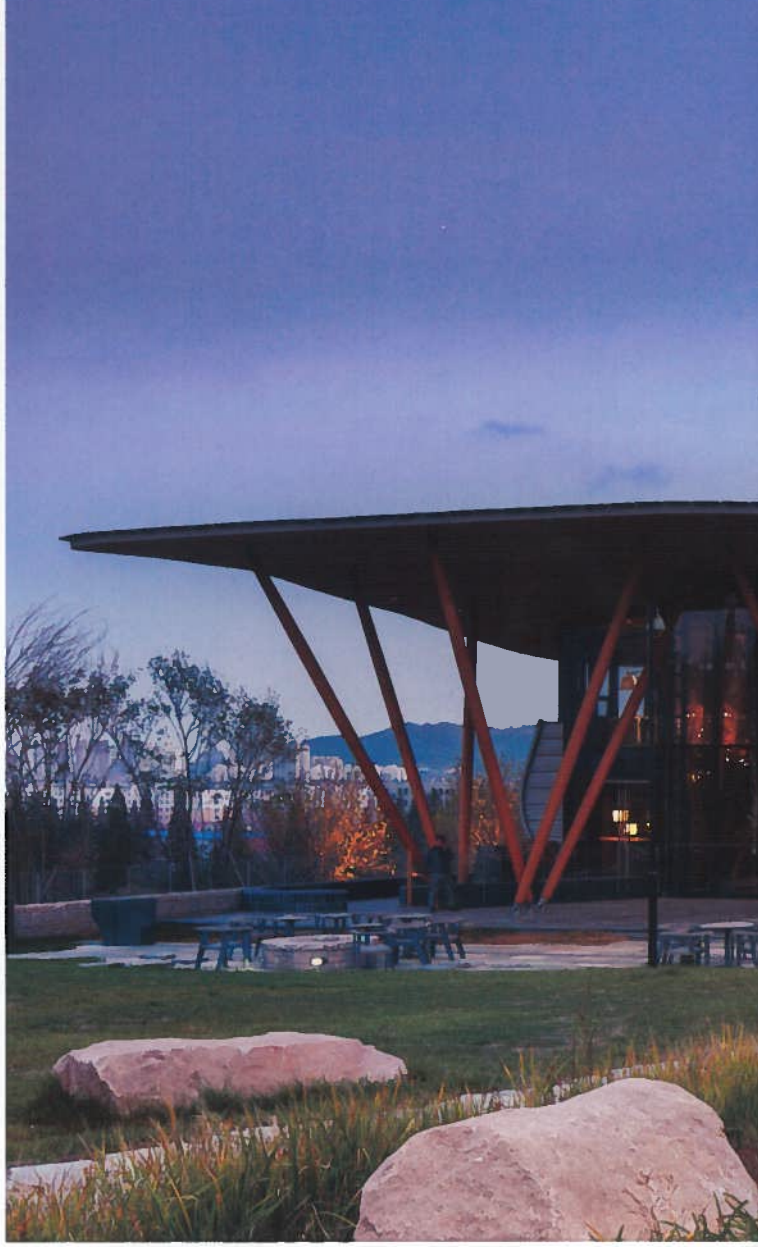
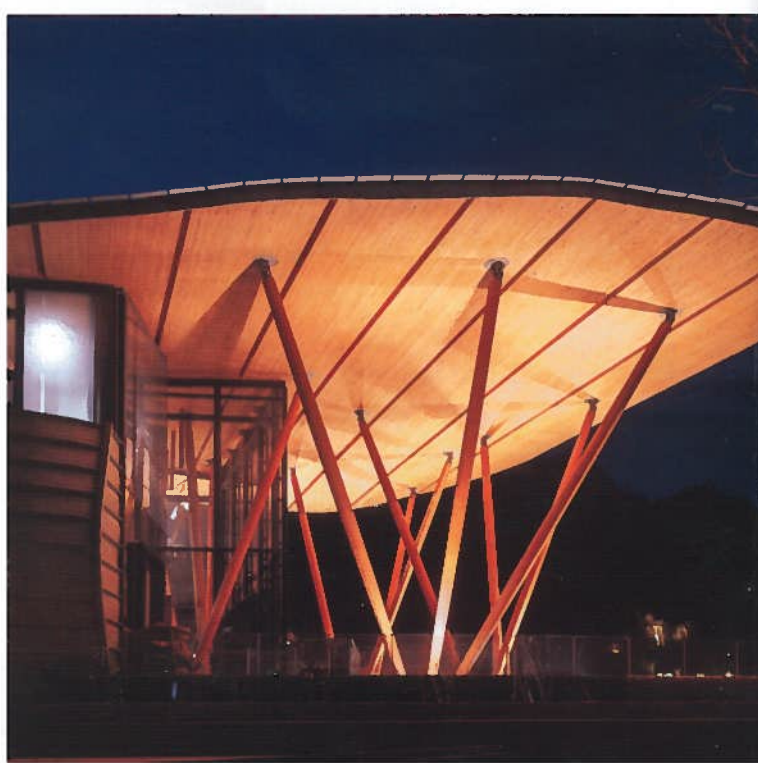


Tsingtao Pearl Visitor Centre

Undulating timber roof caps off structure

Surrounded by a mountain meadow, rocky outcroppings and narrow bands of farmed terraces in coastal China, the 28,000-sq.ft. Tsingtao Pearl Visitor Centre highlights the beauty of the site and serves as a welcome portal to a growing suburban community near Qingdao. Besides the unique form, two things set this building apart from the Chinese norm: it is constructed using ordinary Canadian wood, and it does so in an extraordinary way.



Over the past 20 years, China has shown increasing interest in utilizing the skills of Western architects. However, as the country imports ideas and technology, its insistence that construction be carried out solely by domestic contractors has sometimes resulted in impediments to progress often felt by Western architects left powerless to ensure their designs are successfully communicated and implemented. This project was an experiment in how Western designers can overcome these challenges to see their innovative designs executed in detail, even with a sophisticated form and a building material unfamiliar to locals.

The key was finding a delivery method that could achieve this. With co-operation from one of China's largest developers, and in collaboration with an American architect familiar with timber, a method was devised to parcel construction so that complex components and connections could be designed and fabricated in Canada, while mass wood elements could be assembled according to computer-generated shop drawings by the domestic workforce in China.

The roof structure showcases wood's low embodied energy and carbon sequestering capabilities. A green roof sits atop the solid timber plate roof structure, supported below on clusters of prefabricated timber columns.

The 39 roof panels comprising the solid timber roof were fabricated on-site using nail-laminated dimensional lumber. Many of the 6.5-ft wide panels are up to 131 feet long, necessitating division in two lengths for handling and erection. To avoid visual seams at these joints, a staggered pattern was developed which uses same length pieces to stitch together the two halves in-situ. All of the roughly 25,000 pieces of lumber in

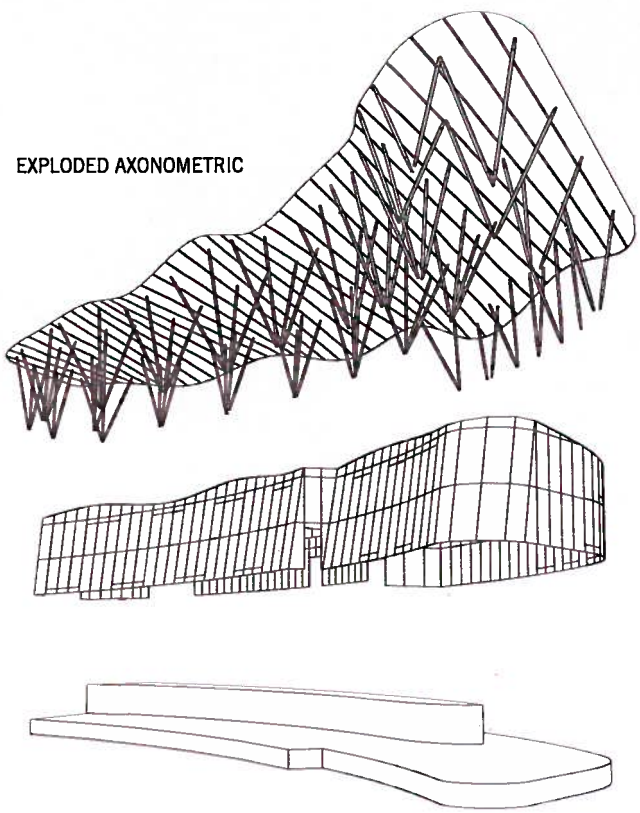
the roof are straight. The undulating surface is capped with several layers of plywood to create rigidity in the direction perpendicular to the lumber. The orthotropic nature of the wood plate was considered in the structural analysis using finite element software.

In Canada, concurrently with the on-site panel manufacture, 93 glue-laminated wood columns of varying length (up to 33 feet long) were individually tapered, milled and fitted with custom universal connectors, and shipped to China. A filigree cable-net assembly comprising small diameter glulam kingposts and thin stainless steel cables undergird the timber panels, enabling them to span up to 49 feet between column supports.

As all of the supporting columns lean in different directions, the slopes of each of the columns were established by iteration to achieve a net balance of forces in the roof in both lateral directions, and in torsion, with the roof diaphragm used to resolve the resulting internal forces.

Parametric 3-D modelling using the latest tools in digital design (Rhino, Grasshopper) early on in the project was central to the realization of the roof's complex, free-form geometry. The parametric model was linked to the structural analysis model, allowing a feedback loop to determine appropriate column frequency and location. This model also allowed interactive design with the architect, providing a detailed 3-D model which eliminated the need for formal working drawings and linked directly to fabrication models and shop drawings downstream.

Extensive prefabrication and planning secured the project's success, as well as compliance with an extremely



EXPLODED AXONOMETRIC

tight schedule, which saw the building wholly designed and constructed in eight months.

This project encourages the use of timber in a country that in the past century has all but forsaken this versatile and sustainable material, despite the rich history of its use in traditional Chinese architecture. Part

of the intention of the project was to introduce Chinese builders, architects and the public to the potential of timber as a building material for projects beyond simple wood-frame residential construction.

CLIENT
Vanke

ARCHITECT
Bohlin Cywinski Jackson
Seattle, WA

TIMBER STRUCTURE DESIGN-BUILDER
StructureCraft Builders Inc.
Delta, BC

STRUCTURAL ENGINEER
Fast + Epp
Vancouver, BC

PHOTOGRAPHY
Bohlin Cywinski Jackson
Nic Lehoux
StructureCraft Builders