

Inspiring sustainable thinking



2016 CCE AWARDS SUBMISSION

Tomamu Cloudwalk

Category:	International
Client/Owner:	Hoshino Resorts
Subconsultant:	Ryzuk Geotechnical
Contractor:	Macdonald & Lawrence Timber Framing

April 2016





Unkai -Japanese for 'Sea of Clouds'

"When you look at Japanese traditional architecture, you have to look at Japanese culture and its relationship with nature. You can actually live in a harmonious, close contact with nature - this is very unique to Japan".

Tadao Ando, Japanese Architect

BACKGROUND - A COMFORT ZONE

Designing and constructing projects in regions we are intimately familiar with is a protective cocoon. We have a strong understanding of our locations' histories and culture, our designs follow familiar lines. This comfortable philosophy requires a systemic mental and cultural shift once you engage in a project that is not in your familiar territory.

In the case of the Cloudwalk, it is a project in a country over 8000 km away - Japan.



Installation of spoke elements

PHASE ONE - THE DUALITY OF INSPIRATION

Hoshino Resorts is a Japanese-based international operator of ryokan (Japanese Inn) that was founded in 1904. It has expanded across Japan and Asia with an eco-friendly policy that uses organic local produce at its restaurants, utilizes self-sufficient energy usage and promotes the theme of: *What would Japan be like if it continued to modernize without the influence of the West*? In many ways, this philosophy is an extension of the strong Japanese belief in the harmonious relationship with nature and sustainable design.

In 2013, Hoshino Resorts was looking for a companion enhancement to the successful Unkai Terrace. This terrace provides a vast panorama of the ever-changing Unkai (Sea of Clouds) and the mountains of Hidaka and Tokachi. The structure they envisioned would provide visitors the opportunity to experience an open air walkway that could be enjoyed at any time of the day – in essence, a Cloudwalk. They engaged local design expertise to design a steel cantilevered structure to provide an airy feeling at the shoulder precipice of the mountain. This design had been awarded and was progressing to construction when a Canadian contact found inspiration in a Canadian project offering a similar experience – the Sea to Sky Gondola and their timber viewing platforms and suspension bridge near Squamish, BC.

The original concept Hoshino Resorts envisioned was similar in nature to other contemporary viewing decks such as the Capilano Cliffwalk in Vancouver or the Glacier Skywalk on the Icefields Parkway in Jasper National Park, which are steel and glass structures. Once they saw the potential of the timber structures designed and built by Macdonald & Lawrence Timber Framing with Structural design by ISL, they engaged the team to create and price an alternate design. It was determined that a wood and timber framed structure provided a better design, blended with the natural surroundings, is more cost effective and was in line with the principles of Hoshino Resorts.

PHASE TWO - ONE DESIGN, TWO PHILOSOPHIES

While engineering utilizes mathematic formulas as the universal language, the application of standards with which these principles are applied vary from country to country. The design standard that is practiced in Japan in regards to timber, concrete and steel construction is Allowable Stress Design (ASD), while the Canadian design standard is Limit States Design with a Load and Resistance Factor Design (LRFD) approach.

With the design and materials being developed and manufactured in Canada, and the overall construction being completed in Japan, it was imperative that these two design standards seamlessly meshed and became one complete design package. To facilitate this, the Canadian design calculations were translated and vetted through a Japanese peer review process to ensure it met with ASD standards. Once the peer review was completed, the final design calculations were submitted to the Japanese authority for permit and review.



Installation of deck panels



Completed cloudwalk



PHASE THREE - A MINIMALIST APPROACH

From the very inception of the project, the design philosophy was to create the timber cloudwalk so as to provide an enhanced view of the Unkai, and be an attraction to separate this resort from its neighbours.

This meant designing the structure so that it would have a minimalist and open feel to it, but still have the structural integrity to be suspended over a cliff face that was 1100 meters above sea level and be exposed to high winds and snow accumulation associated with mountainous regions.

PHASE FOUR – DESIGNING A CLOUD

The Cloudwalk was constructed of several principal structural elements; main spar poles, spoke poles, walkway deck panels, cable guy wires, concrete foundation columns and concrete foundation blocks.

In parallel with the detailed analysis for both static and dynamic loading conditions, a great deal of consideration was employed in the choice of timber construction materials and the critically important connection detailing, which prevents water from entering or draining from connections.

In recent years, Alaskan Yellow Cedar (AYC) has been used in restorations of Japanese temples. Its natural durability and lack of chemical treatment or finishes firmly fits into the natural sustainable elements that both ISL and the Hoshino Resorts believe are important. AYC has very similar properties to the native Japanese wood species – Hinoki. Both Hinoki and AYC are cypress species but indigenous to opposite sides of the Pacific.

The main spar and spoke poles are both solid second growth Alaskan Yellow Cedar which are sawn into 12 sides and 8 sided cross sections respectively. With the 3 main spars measuring 10325 mm each in length.

The walkway deck panels are constructed of gluelaminated AYC boards each 19 mm x 130 mm. The total size of the walkway panels is 130 mm thick x 1250 mm wide with various curve radii. The deck panels are covered with a waterproof membrane, drainage layer and a wearing deck of 19 mm radial decking boards cut to a consistent taper.



Opening Day

The cables used in the structure are 6x26 IWRC XIP (steel core, high breaking strength) galvanized wire rope. Two cable sizes have been selected for the structure; 5/8" diameter and 3/4" diameter.

The "spoke" elements are AYC poles which are milled to an 8 sided cross section. These measure 330 mm across the flat dimension of the cross section.

Because spokes are loaded in a combination of axial (lengthwise) and bending (column end), which cause normal stresses on the column cross-sections, interaction equations have been used to account for the amplification of moments due to second order effects and stresses in the member.

The final design was a structurally efficient, simple and cost effective and designed to withstand the various elements (high wind, snow and earthquake conditions) and visitor loads, but it also has a light, cloud like aesthetic.

The design also had to fit within the shipping parameters of a 40' sea container and be pre-fabricated without error. Drawings detailed down to the last screw, nail and bolt with exact working points for site coordination were paramount to the success of the installation, and were completed without any issues or on site corrections required. The design and fabrication was clean, efficient and accurate and matched the perfection of the Japanese contractors work on the cast-in-place concrete piers.





PHASE FIVE - 8000 KM OF COMMUNICATION AND LOGISTICS

"The single biggest problem in communication is the illusion that it has taken place."

George Bernard Shaw

In this age of interconnectivity and distances compressed by fibre optic, speed of light communication, design and constructing projects for locations thousands of miles away still require the very basic tenant of project management and organization – effective communication.

The Cloudwalk project required a systematic approach to keeping communications effective and timely, especially considering the time difference in Japan being over 13 hours ahead and the native language not being English.

Both ISL and Macdonald & Lawrence employed a Japanese translator, who had experience with engineering designs and principles, and worked with English speaking employees of the Hoshino Resorts who also provided essential translation for the Hoshino Resorts project team.

PHASE SIX – BECOMING FULL CIRCLE

The Cloudwalk project is a culmination of both technical and cultural design challenges. A serendipitous Canadian inspiration changed the functional design direction from a steel and glass structure to a walkable iconic timber framed viewing platform that provided the residents and visitors of Hokkaido the opportunity to experience the culturally significant phenomenon of Unkai.

Equally important was designing and building a sustainable structure that fit organically into the landscape. By utilizing untreated Alaskan Yellow Cedar, it will over time blend even more into its environment and appear as if was always a part of this cliff-side location.

TOMAMU CLOUDWALK - AT A GLANCE!

Social/ Economic Benefits	 Design aligned with both Hoshino Resort's eco-friendly policy and the strong Japanese belief in the harmonious relationship with nature and sustainable design on which the policy is based. Gives visitors the opportunity to experience the culturally significant phenomenon of unkai. Minimalist and open feel leads visitors to feel closer to nature. Use of Alaskan Yellow Cedar honours the Japanese history of using untreated exposed lumber in their structures. Wood and timber design was efficient and cost effective.
	 Design separates the resort from its neighbours and competition within the tourism industry.
Technology Transfer	 While originally Hoshino Resorts had engaged and awarded local design expertise to design a steel cantilevered structure, a Canadian contact found inspiration in the Sea to Sky Gondola near Squamish, BC. Macdonald & Lawrence Timber Framing and ISL were selected for
	our expertise in timber design and construction. The design and materials were developed and manufactured in Canada while the overall construction had to be completed on site in Japan.
Environmental Benefits	 Design aligned with Hoshino Resort's eco-friendly policy and the Japanese belief in the harmonious relationship with nature and sustainable design.
	 Use of Alaskan Yellow Cedar was a sustainable choice because it is a slow growing, decay-resistant species known for being a durable, termite- resistant and natural alternative to pressure-treated lumber.
Complexity	 With the design and materials developed and manufactured in Canada and the overall structure completed in Japan, these two design standards had to become on complete package.
	 Design had to fit within the shipping parameters of a 40' sea container and be prefabricated without error.
	 The project required a systematic approach to keeping communications effective and timely, especially given that Japan is over 13 hours ahead and the native language is not English.
Meeting the Owner's Need	 Provided an enhanced view of the unkai, separating the resort from its neighbours.
	 The final design is structurally efficient, simple and cost effective and designed to withstand the various elements (high wind, snow and earthquake conditions) and visitor loads, but it also has a light cloudlike aesthetic.
	• Design successfully fit within the shipping parameters of a 40' sea container and was pre-fabricated without error.