

Inspiring sustainable thinking



2014 CCE AWARDS SUBMISSION

WildPlay® Elements Parks in Kelowna, Primal Swing

Category:	Special Projects
Client:	WildPlay Ltd.
Owner:	WildPlay Kelowna
Consultants :	Ryzuk Geotechnical Talbot Mackenzie & Associates – Consulting Arborists Higginson Consulting
Contractors:	Macdonald & Lawrence Timber Framing Ltd.

April 2014





RIDERS EXPERIENCE
A THRILLING
PENDULUM RIDE
ABOVE A CANYON
AT SPEEDS UP
TO 100 KM/HR

WildPlay Kelowna

Beautiful Surroundings and One Crazy Swing

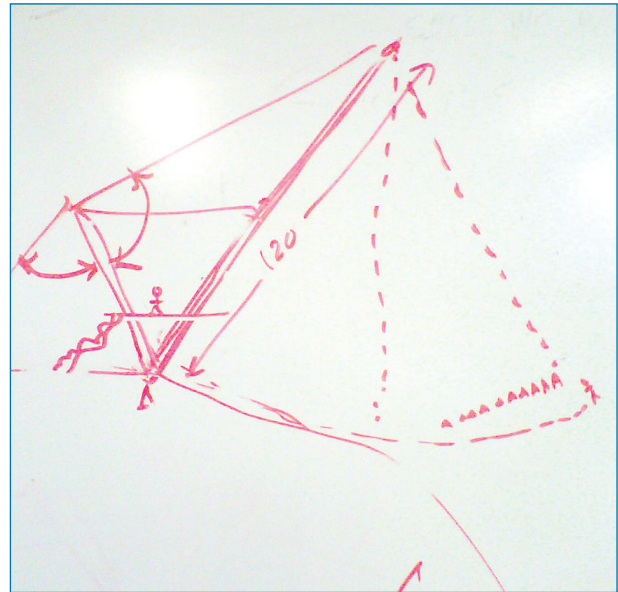
Designed by ISL Engineering and Land Services (ISL), the unique 30 metre long Primal Swing pushes the limits of timber design while providing one to two riders with a thrilling pendulum ride above a canyon at speeds up to 100 km/hr. It is believed to be the largest timber and steel swing in the world.

The swing is one of the draws that brings people to WildPlay's exciting new Element Park in Kelowna, BC. For additional thrills, the park also features ziplines, suspension bridges, and a high ropes adventure course. Working with project partner Macdonald & Lawrence Timber Framing (M&L), ISL provided structural engineering services from conceptual planning and design through to construction administration on all park elements. This design-build team also developed the ten DragonFLY ziplines for "swift flights above native grasslands, creeks, and canyons"—the longest of which is 195 metres (640 ft)—plus five suspension bridges and an exciting Monkido[®] high ropes adventure course. On the course, the longest canopy suspension bridge is 36 metres (118 ft) and up to 15 metres (49 ft) off the ground. The whole adventure park was also designed to fit into the natural setting, using timber as the main construction material, making use of existing site trees, while being low impact and mitigating damage to the environment as a key value of the client.

WOULDN'T IT BE GREAT IF...

The seed of a great, innovative idea can come out of an ordinary, everyday situation. Early in 2012, the idea for one of the park's key features, the Primal Swing, came out of a casual chat over a drink among old climbing friends. The conversation between Gord Macdonald (M&L) and Tom Benson (CEO of WildPlay Parks Kelowna), turned to "wouldn't it be great if..." and so began the story of the largest swing of its type in the world.

The team then brought in Robin Zirnhelt, P.Eng., of ISL Engineering and Land Services to help develop the idea and make the concept a safe, buildable structure. The road to developing the concept included lots of crazy ideas, sketchpads and whiteboards in design charrette format... then 3D modelling from rough concept to modelling for every bolt and screw. The three of them formed the design-build team, who worked to identify must-have's for the project.



An early concept sketch (thrill factor included!)

The Vision

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| 1 | Build the tallest possible swing in timber as a unique attraction | 2 | Be industry leaders in setting the safety standards for adventure experiences | 3 | Minimize environmental impact and optimize experience |
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The 30m long Primal Swing is the largest timber and steel swing in the world



DEFINING THE THRILL FACTOR

The Client's Goals

Beyond the project must-have's, the design-build team had to ensure the project reflected WildPlay's mission and values in order to fully meet the client's needs. These were the goals that shaped the project. Creative engineering and responsible, efficient material selections helped reflect the client's values and mission in every aspect of the adventure elements.

WildPlay's Mission is "...to engage people in active outdoor adventure experiences—challenging everyone's perception of life's possibilities, and inspiring limitless evolution."

**1000 VISITORS
IN THE FIRST
FIVE MONTHS
OF OPENING!**

WildPlay's Values:

"Evolving the human" (social and safety)

We create challenging opportunities to ensure [people] have an empowering, transforming experience...we deliver the thrill of primal fun & games through best-of-breed practices and no one gets hurt.

"Tasting the dirt" (environmental)

If you don't know Mother Earth, you won't take care of her. We stretch to take care of the environment in realistic ways that are achievable. In our circle of influence, we grow the next generation of caretakers by trying to establish their sense of kinship with natural spaces.

"Sharing the fruit" (economic)

The labour of our business should result in an obvious and tangible benefit to our neighbours. Our clan and guests link us to our communities, on and off our dirt.

— (WildPlay, Kelowna, 2013)



Monkido® Course and DragonFLY Zipline — limiting the footprint

ENGINEERING AN EXPERIENCE

Some big challenges needed to be overcome to achieve the client's goals. The architectural theme of all WildPlay park structures is to be connected to the natural environment. Wood was chosen as the main material to reflect that goal, both as a natural material and a local renewable resource. The team believed the end result was also more cost-effective. Once the decision about wood was made, three key challenges needed to be resolved: address the required detailing in design, deliver the park structures with only a small environmental footprint, and design and construct the tallest swing possible within safety parameters.

High Level of Detailing

A high level of detail was required in designing the park's adventure structures to meet their intended design life. The wood for the park structures included exposed, untreated Douglas fir and yellow cedar timber. ISL's structural engineering team used Building Information Modelling (BIM) to model the structures from every angle and provide the level of detail required in the design drawings. The design drawings were very detailed, allowing for precise coordination, layout, fabrication and assembly. Through the modelling, ISL was able to include detail down to each bolt and screw, including geodetic references, elevations, and field data of tree locations. M&L was also integral to the process, providing the precise milling and the quality of timber required to go from design to build. Among other durability details, the end grain of the timber was protected and all connections were designed to drain and not trap moisture so as to protect the integrity of the wood.



The Primal Swing was supported on micro-piles to reduce ground disturbance and the risk of site erosion

Leave a Small Footprint

To reflect WildPlay's values, the structures needed to be connected safely to the environment with the smallest possible footprint. The Primal Swing was supported on micro-piles to reduce ground disturbance and the risk of site erosion.

The Monkido® high ropes challenge course uses trees, platforms and embedded poles with small footprints. It required the timber to be embedded in the ground in key places and the structures to be

“CAN'T BELIEVE THIS IS IN WOOD. ALL INNOVATIVE ENGINEERING. KICKS OPEN THE DOOR AND BLOWS AWAY ASSUMPTIONS ABOUT WOOD'S POSSIBILITIES.”

— JURY COMMENTS, 2014 WOODWORKS! CANADA WOOD COUNCIL
(WOOD DESIGN AWARDS — WOOD INNOVATION — WINNER)

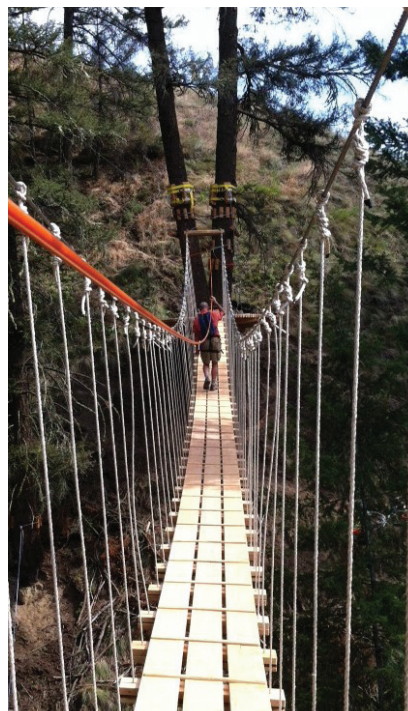


connected to living trees where possible. For extra durability, the embedded poles were flashed, sealed with bentonite ground caps, and chemically treated with benign borate impel rods. Efficiency and cost-effectiveness were achieved by standardizing the design and construction of similar connections in the course. For example, the team was able to standardize game line to tree connections, tree and pole connections, platform construction details and guyline connections.

The DragonFLY zipline course required long-span ziplines and platforms constructed of wood large enough to hold 12 people. These structures had to be hung from living trees without embedding fasteners that could damage the trees. This involved detailing how the suspension structures connected to trees with opposing guylines. The layout was detailed in survey to work with the natural setting and limit disturbance to the environment. The platform connections were carefully designed to clamp on and use friction rather than mechanical fasteners to connect to the trees, thereby limiting damage to the trees. Each platform connection was load tested to prove safe loading.



The DragonFLY zipline platform connections were designed to clamp on using friction rather than mechanical fasteners, limiting damage to the trees



Monkido® Course

Innovating the Ride of a Lifetime

A key feature of the WildPlay Park is the unique 100-foot long (30 m) Primal Swing designed by ISL. The swing is an adrenaline junkie's piece of heaven, that also pushes the limits of timber engineering design. There is nothing like it in the world.

Built using 120-foot long (36.6 m) Douglas fir timbers reinforced with steel and cable trussing, the swing suspends single or tandem riders high above the cliff side and then drops them into a free-fall pendulum ride out across the canyon, offering incredible views of Kelowna and Okanagan Lake.

When designing and building something unique, challenges are expected. A swing structure like this would typically be built of steel. As the first challenge, the team needed to design the tallest swing possible for the park's Primal Swing feature using west coast timber. The design and implementation challenges for this included sourcing and transporting the longest available solid sawn timber (120 feet), and designing the swing to support the required loadings safely.

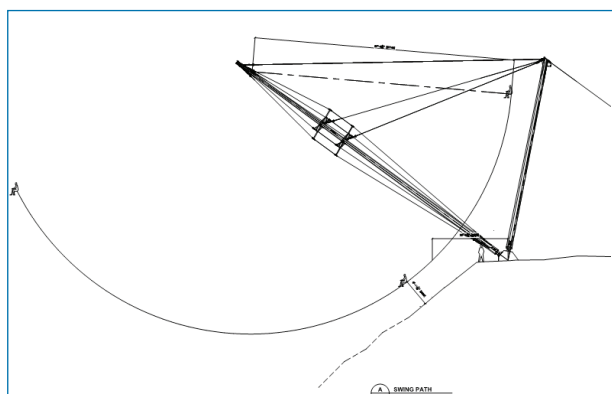
The challenge with unique structures like this is that there aren't any specific design codes. Under the British Columbia Safety Authority (BCSA), the closest structures would be elevators and chair lifts. The only guidance is that it must conform to good engineering practice, so it is left up to the design engineer to design appropriately. The team prepared the standard for this swing by using references from the BCSA, along with CSA material codes for steel, concrete and timber, and then applying appropriate loads and safety margins. The BCSA then reviewed

the documents and inspected the completed structures from a safety perspective.

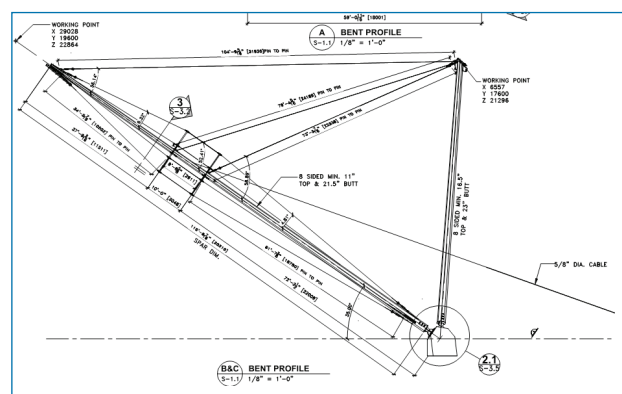
Even before the project moved into detailed design, the Primal Swing required very detailed analysis to support two people swinging over a ravine safely. The timber for the swing had to be of a very long length to provide the experience of swinging over the ravine, but this long length also meant that each timber was relatively slender. Strength was built into the timber design by using huge, whole pieces of sawn timber and trussing the whole structure with steel rope to reduce buckling in the timber members and keep them straight in their A-frame configuration.

Each timber was milled with a specified taper to an eight-sided shape. Milling to this shape allowed the engineer to know the precise geometry for putting the timber structure together and to use the most amount of original log possible while giving the structure the same architectural feel of all the park's structures. A custom-built sawmill was used to cut the required length and shape. The resulting tall, slender structure required attention to the connection detailing, layout, pre-stressing and installation sequence engineering. All of these design considerations were integral to achieving the required strength, serviceability and durability to support the loadings.

This one-of-a-kind wood structure demonstrates innovation by pushing the limits of what can be constructed of a single piece of sawn timber. It also demonstrates a creative, fun use of high quality, west coast Douglas fir timber by using this local timber in an awe-inspiring structure set up to thrill its participants.



Swing Profile



Truss Layout Drawing

*The Primal Swing*

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Three-dimensional trussing

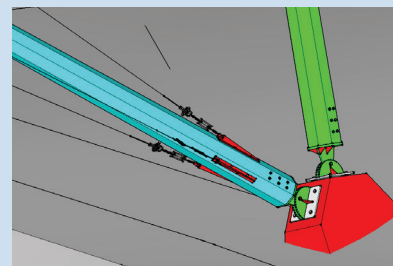
of the timber was used to address the slender timber at this very long length, reducing the buckling length of the compression members and keeping them straight in their A-frame configuration.

Unique Timber Milling

The timbers were milled with a specified taper to an eight-sided shape utilizing a custom-built sawmill that would cut the required length and shape.

The eight-sided structural

shape is a tall, slender structure, requiring attention to the connection detailing, layout, pre-stressing and installation sequence engineering.

*Assembling the steel trussing around the 8-sided timber**BIM model showing base detail*

CONCLUSION

Sometimes the seed of an innovative idea is just a casual chat among friends. But, this seed needs a team with the right skills, ingenuity, and dedication to make it not just grow but flourish. This project benefitted from a client who was open to new ideas, and a design-build team with the specific timber design, structural engineering, and building know-how to make it happen.

The team met the client's needs by delivering adventure elements that used sustainable materials (wood from the region), by using clever engineering and high quality construction, and ultimately, by attracting guests for an economically viable adventure park.

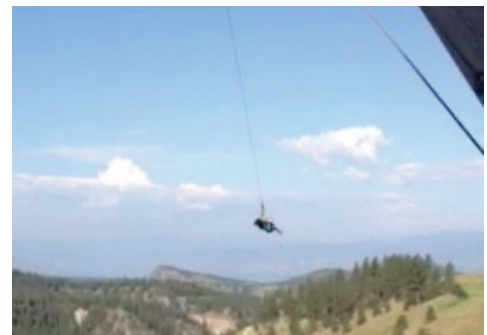
Today, WildPlay Kelowna's Primal Swing is the talk of the town. The park opened on schedule in July 30, 2012, and the swing itself has had 1000 visitors in just the first five months! Just as expected, the

park is attracting clients, performing as intended and providing fulfilling, safe experiences for adventure seekers. In the words of one visitor: "Beautiful Surroundings and One Crazy Swing!" (TripAdvisor Canada, June 2013). During its April to October season, the park continues to attract visitors from scout groups and corporate challenge teams to international thrill-seekers from afar. Now BC's Okanagan Valley can draw in a new type of tourist (beyond the wine-tasters): the adventure tourist.

The project would not have been possible without the ingenuity of the structural engineer, the detailing of the timber designers and constructors, and the willingness of the client. The park, and its one-of-a-kind swing, provides an added incentive for people to get outdoors and experience nature. And, just as WildPlay values state: "If you don't know Mother Earth, you won't take care of her."



The Primal Swing in action



**"BEAUTIFUL
SURROUNDINGS
AND ONE
CRAZY SWING!"**

— TRIP ADVISOR
(11 JUNE 2013)



WILDPLAY KELOWNA & PRIMAL SWING — AT A GLANCE!

innovation and advancing engineering	<ul style="list-style-type: none"> Designed the tallest swing possible in timber to support all required loadings without a design standard for this unique structure Prepared the standard for this swing by using references from the CSA material codes including those for steel, concrete and timber, and then applying appropriate loads and safety margins Swing demonstrates innovation by pushing the limits of what can be constructed of a single piece of sawn timber Whole park demonstrates a creative, fun use of high quality, west coast Douglas fir timber
complexity	<ul style="list-style-type: none"> For the Primal Swing, no design standard existed for this type of swing structure Design and implementation challenges for the swing included sourcing and transporting the longest available solid sawn timber (120 feet), and designing the swing to support the required loadings, safely High level of design detail required for all park structures (down to each bolt and screw) — achieved by using BIM modelling to include geodetic references, elevations and field data of tree locations
social and economic benefits	<ul style="list-style-type: none"> Attracts visitors from outside the region to spend time in the area, expanding the tourism market from the usual wine-tasting groups to adventure seekers The experience is empowering for visitors as they challenge themselves to overcome their fears on aerial courses, ziplines and, on the ultimate thrill ride — the primal swing Adventure elements are built to be safe, fun and foster team and outdoor skills for youth and adults alike Uses regionally available timber as a key construction material, supporting the forestry industry
environmental benefits	<ul style="list-style-type: none"> Layout for the Monkido® high ropes challenge course was detailed in survey to work with the natural setting and limit disturbance to the environment Platform connections for the DragonFLY course were detailed to clamp on and use friction rather than mechanical fasteners to connect to the trees, thereby limiting damage to the trees Primal Swing was supported on micro-piles to reduce ground disturbance and the risk of site erosion Whole project encourages kids and adults to get out and experience the outdoors and nature, making them more likely to be its stewards and take care of/value the natural environment
meeting the client's needs	<ul style="list-style-type: none"> 1000 visitors in first five months of opening! Be industry leaders in setting the standard for safety — every DragonFLY zipline platform was load tested to prove safe loading Design and construction met the budget, schedule and the client's experience expectations from “evolving the human” (social and safety aspects) to “tasting the dirt” (environmental benefits) and “sharing the fruit” (economic benefits)