

SKYBRIDGE MICHIGAN



THE LONGEST TIMBER-TOWERED SUSPENSION BRIDGE IN THE WORLD



LOCATION

Boyne Mountain Resort, Boyne Falls, Michigan, USA

COMMISSIONED

October 2022

CONSTRUCTION TIME FRAME

12 months, plus 3 months pre-fabrication

LENGTH OF BRIDGE

1,200 ft overall; 1,023 ft / 312 m suspended deck

DECK WIDTH

5 ft / 1.5 m

LENGTH OF INSTALLED GLASS

36 ft / 11 m at center of bridge

DECK HEIGHT ABOVE GROUND

118 ft / 36 m at highest point

MATERIALS

Glulams, Sawn Lumber, Painted Steel, Galvanized Steel Cables, Pultruded Fiberglass Grating, Structural Glass

STORY

Dubbed “Michigan’s Second Bridge”, SkyBridge Michigan came into being following the success of the Gatlinburg SkyBridge at Boyne Mountain Resort’s sister property in Tennessee. Inspired by the logging tradition of northern Michigan, the timbers were sourced from a four generation family-owned logging and sawmill company located right at the foot of the mountain. The two foundations each contain a massive 1.3 million pounds/590 tonnes of concrete. The towers stand 52 ft/15.8 m tall, weigh in at 111,000 pounds/50 tonnes each, and have 8,000+ bolts securing the wood members. The main cables are 3 in/7.6 cm structural strand with an MBS of 1,076,000 lbs/453 tonnes, supporting a 8,260 sq ft/767 sq m walking deck, including a 36 ft/11 m stretch of structural glass. Open in October 2022, our client is excited to offer their guests a brand new adventure while enjoying expansive views of northern Michigan.

DESIGNER & BUILDER

Experiential Resources (ERi)

STRUCTURAL ENGINEER

Troy Garland, P.E., S.E.

PEER REVIEW ENGINEER

Pat Machin, P.E

GEOTECHNICAL ENGINEER

Soils & Structures

SURVEYOR

Gosling Czubak

FOUNDATION INSTALLATION

DrillWorks Deep Foundations

TIMBER SUPPLY

Matelski Lumber Company

MAIN CABLE MANUFACTURER

SPS Inc.

OWNER

Boyne Mountain Resort

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FOUNDATIONS

- There are 17 helical piles in each tower foundation, and 10 helical piles in each tension block footing (where the main cable is anchored), for a total of 27 piles per abutment. The piles are 4.5 in/11.4 cm in diameter and are about 40 ft/12 m deep into the ground.
- The sacrificial test piles were stressed to over 200,000 lbs/90.7 tonnes.
- There are 168 anchor rods (1.5 in/3.8 cm in diameter) embedded in the concrete for each tower. These connect to the tower baseplates.
- There are 32 anchor rods (2 in/5 cm in diameter) embedded in the concrete that anchor the main cable tensioner plates (eight anchor rods per tensioner assembly).
- Each bridge abutment contains over 1.3 million lbs/590 tonnes of concrete - about 2,673,000 lbs/1,212 tonnes of concrete total for the whole bridge.

TOWERS

- The towers are about 52 ft /15.8 m tall and 70 ft/21.3 m long.
- There are 133 timber members per tower; 92 of glulam and 41 of solid sawn lumber.
- There are 63 steel brackets per tower that connect the timber members (not including the baseplates) and between the two towers there are over 8,000 bolts in the brackets alone.
- Each tower weighs over 111,000 lbs/50 tonnes and is anchored to the foundation with baseplates made from 1 in/2.5 cm thick steel.

MAIN CABLES & TENSIONERS

- The main cables are 3 in/7.6 cm galvanized steel structural strand, each with a minimum breaking strength (MBS) of 1,076,000 lbs/488 tonnes.
- Each cable is 1,183 ft/360.5 m long, weighs about 23,000 lbs/10.4 tonnes, and was pre-stressed to 107,000 lbs/48.5 tonnes.
- The main cable tensioner assemblies are made from 2.5 in/6.3 cm steel plate, 3.25 in/8.2 cm tension rods, and each assembly connecting the main cables to the anchors weighs about 1,500 lbs/680 kg.

WIND GUY & SUSPENDER CABLES

- The two primary wind guy cables are 6x19 IWRC galvanized steel cables, 1 in/2.5 cm in diameter and about 800 ft/243.8 m in length.
- There are 130 intermediate wind guy cables (65 per side) that connect the primary wind guy cables to the bridge.
- There are 334 total suspender cables (167 per side) that connect to the main bridge cables and support the walking deck of the bridge.
- Both the suspender cables and the intermediate wind guy cables are 6x26 WS EIPS IWRC galvanized steel cables, .5 in/1.2 cm in diameter.

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BRIDGE DECK, GLASS & RAILINGS

- The bridge deck is 118 ft/40 m above the ground at the highest point.
- The suspended walking surface of the bridge is 1,023 ft/312 m long, 5 ft/1.5 m wide, and is decked with pultruded grating that has an open area of 50%.
- There are 57 steel deck frames that support the walking deck, each about 18 ft/5.5 m long and weighing in at about 1,500 lbs/680 kg each.
- There is 36 ft/11 m of structural glass walking surface at the center span of the bridge.
- The glass has three layers and is 1.25 in/3.2 cm thick.
- The railings of the bridge are 44.5 in/1.1 m tall and are made of stainless steel wire netting supported by 5/16 in/.8 cm stainless steel wire rope.
- In addition to the railings, there is a top rail 5 ft/1.5 m above the bridge deck that is made of sustainable Kebony wood.

MISCELLANEOUS FACTS

- The design phase of the SkyBridge Michigan project took six months.
- Construction onsite commenced in July 2021, was paused in December 2021 for the winter season, recommenced in April 2022, and was completed in October 2022.
- Total construction time was twelve months, plus three months of pre-fabrication.
- Todd Domeck (pronounced dah-meck), ERI's Chief Designer and majority owner, has designed several significant suspension bridges including both SkyBridge Michigan and the Gatlinburg SkyBridge.
- Troy Garland, the Engineer of Record for SkyBridge Michigan, also served as the Peer Review Engineer for the Gatlinburg SkyBridge - and he's a Michigander!
- There are more than 150,000 pieces of individual hardware on the bridge.
- In order to accommodate the 8,000+ bolts that needed to go into the towers, the ERI construction crew had to drill the equivalent of over 2.5 miles/4 kilometers worth of bolt holes through the timbers.
- The ERI crew kept hydrated by drinking plenty of water and 90+ cases of Kirkland Sports Drink through the course of construction. They also attribute their success on this project to continuous availability of snacks on the jobsite, particularly Welch's Fruit Snacks (estimated 1,700+ packs consumed).
- Over the course of the project the ERI leadership team purchased in excess of 800 lbs/362 kilograms of meat and the ERI crew spent over 1,200 hours collectively preparing and smoking said meat (and making amazing side dishes from scratch). Recipes available upon request.



FEWER WALLS. MORE BRIDGES.

