Case Studies

Skywalk with Glass Floor and Glass Balustrade over the Sunwapta Valley

Glacier Discovery Walk in Alberta, Canada

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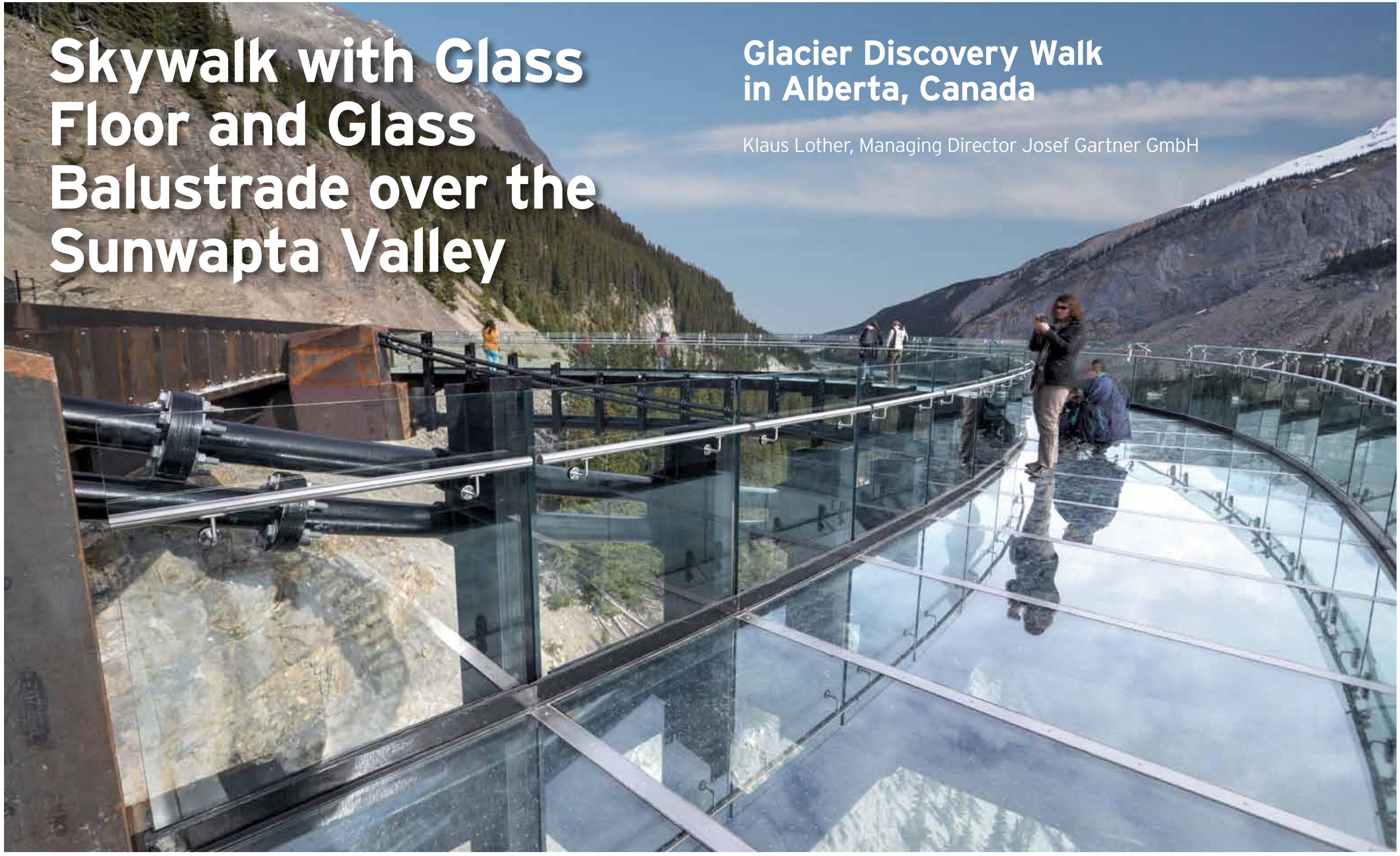


At a height of 280 m, the Glacier Discovery Walk swings over the Sunwapta Valley in the shape of a horseshoe. With its glass floor and glass balustrade the Skywalk offers unforgettable views of the Canadian Rocky Mountains. Since the opening on 1st May 2014, over 300,000 people have visited the Glacier, the Sunwapta River and the Columbia ice field with the largest accumulation of ice in the south of the Arctic Circle.

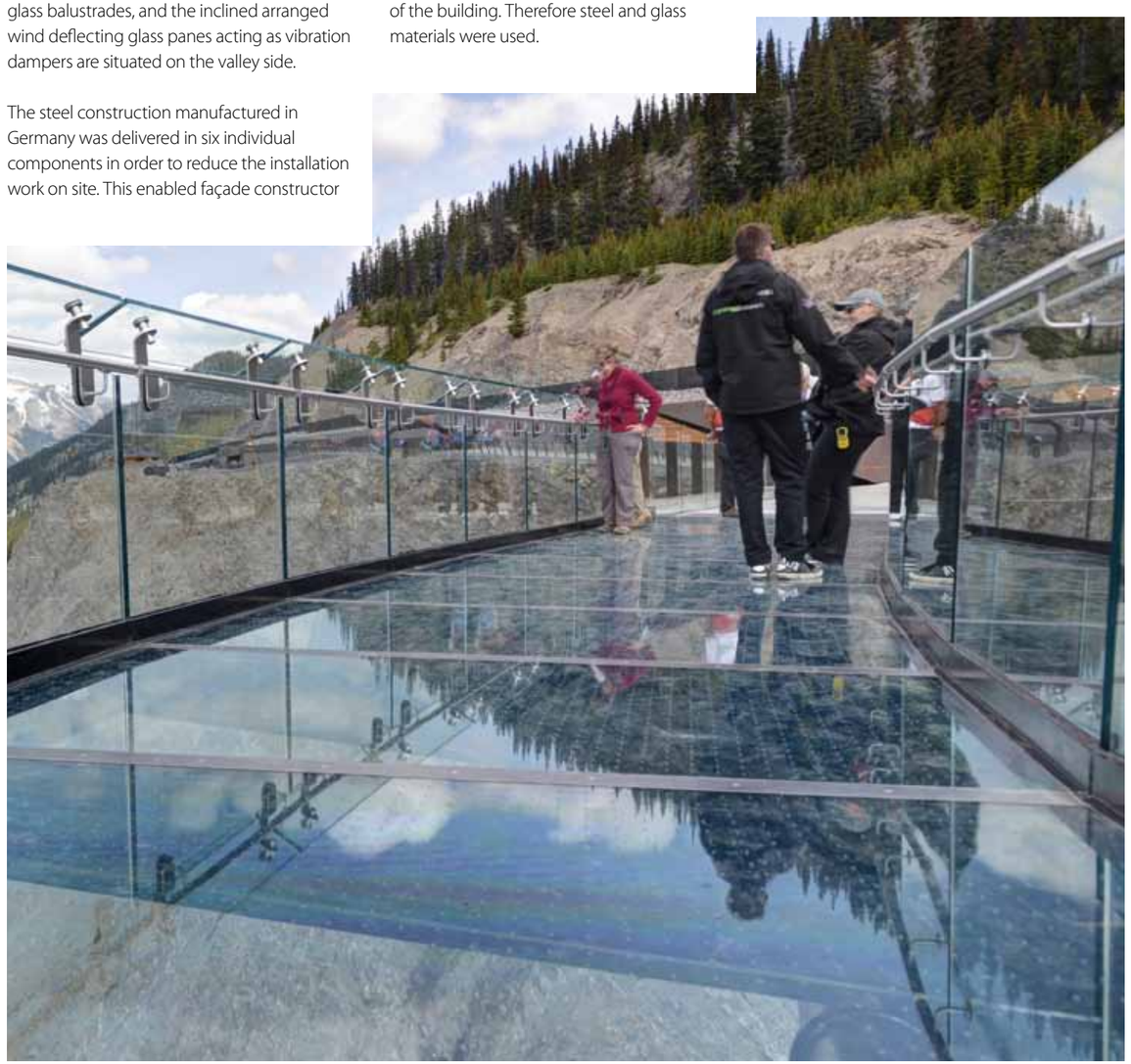
Expecting a lot of visitors the structural supporting glass was provided with a simply exchangeable wear and tear layer. Point fixed handrails are positioned above the clamped glass balustrades, and the inclined arranged wind deflecting glass panes acting as vibration dampers are situated on the valley side.

The steel construction manufactured in Germany was delivered in six individual components in order to reduce the installation work on site. This enabled façade constructor Gartner to realize the project within six months from placing the order to finalization of the installation works.

An Environmental Compatible Building: First Prize at the World Architectural Festival

By means of the Glacier Skywalk, Brewster Travel Canada as client and operators intend to increase the attraction of the Jasper National Park as Canada's largest national park that was declared a UNESCO World Heritage Site. The design of the skywalk was also inspired by the impressing natural environment. The main objective was the environmental compatibility of the building. Therefore steel and glass materials were used.

The tours to the Skywalk start at the Columbia Glacier Discovery Center with information about the unique ecosystem. The newly created 400 m long and barrier-free visitor's path runs along the edge of a cliff and offers visitors panoramic views of the Sunwapta Valley. A walk over the panorama platform with its glass floor forms a highlight for visitors who are free from giddiness. This horseshoe-shaped Glacier Discovery Walk with an approx. 2.6 m wide glass walkway has an overhang of about 14 m and an opening width of around 23 m. With their bridge design Read Jones Christoffersen Ltd. won together with the architectural office Sturgess Architecture the first prize in the category „Future Projects" at the „World Architectural Fesival" in Calgary. In March 2013 construction manager PCL placed an order with Josef Gartner's office in Würzburg for the manufacture and installation of the glazed part of the skywalk with the steel construction, the glass floors and glass balustrades. From workshop planning to installation Gartner was given a period of only six months to complete the works prior to the first snowfall and cold spell in the Rocky Mountains.



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Steel Support Structure of Rectangular Hollow Sections, Circular Tubes and Sheets

Up to the projecting connections of the steel bridge the steel construction has been designed as eccentric steel structure. Supporting concrete blocks with high strength 10 to 20 m long steel rods are rigidly anchored within the mountain rocks. Two trapezoidal steel box girders which are connected by a steel bridge construction are fixed with screws onto these concrete blocks.

The glass bridge is connected to the steel structure anchored in the rock. Short-cut pressure tubes and tension rods anchored on top act self-supporting onto the suspended component. The connection points of the tension rods which run in two three-dimensionally bent circular tubes are located at the level of the glass banister. The lowest point of the cable course in the centre of the bridge was put far below the glass floor in order to limit the tensile forces. The 2.6 m wide walkway consists of a horizontal Vierendeel steel frame.

The whole construction was installed with a cross slope to guide rainwater from the bridge towards the mountain side.

The supporting steel structure of the Skywalk was manufactured of rectangular hollow sections, circular tubes and sheet panels. The steel was wet coated in RAL 9011, graphit black. This construction was altered by Gartner in such a way that it was prefabricated in six individual components and delivered to Canada in project specific transportation stillages. As a result, the installation works on site and costs could be reduced as less welding works were necessary. The stillages with transport sizes of 12 m x 2.4 m x 4 m were designed in such a way that they could be modified on site to support stillages for installation.

Lifting-In of the Bridge Construction in One Piece

The six individual components were welded together on the future visitor parking area approx. 500 m away from the construction site. The load bearing structure of the bridge was then transported as one unit on a low loader from the preassembly area to the installation site and lifted in position also in one piece by means of a crawler crane with 800 tons. With scaffolds suspended at the two anchor blocks the fixers were able to install the construction.

After all bolt and screw connections had been closed the bridge was lifted to the specified level and the steel tension cables were inserted in the conduits and tightened accordingly. Each of these 2 x 9 steel cables with a diameter of 15 mm consists of seven uncoated individual wires. After uniformly adjusting the pretension in all ropes the bridge became self-supporting.

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The construction with its flexible joints of the support structure, the pre-tensioned cables and the light construction as well as the use as pedestrian bridge and the exposed site in the high mountains make the Skywalk extremely vulnerable to vibrations. Four mass vibration dampers were installed and blocked to the steel construction below the walkway which shall prevent the construction from "swaying" by the visitor traffic. After the installation of glass floors and glass balustrades the vibration dampers were calibrated by means of sensors attached at various points of the bridge.

Glass Floor with Trapezoidal Glass and Transparent Wear and Tear Surface

The approx. 90 sqm large glass floor consists of 25 trapezoidal glass panes. The glass panes with a size of 2.6 m x 1.2 m are supported on four sides. The load bearing glass is laminated with 3 x 10 mm heat strengthened glass with 1.52 mm SentryGlas.

Wear and tear of the glass floor was especially calculated for the expected amount of visitors and visiting frequency. Therefore the transparent wear and tear coating was applied to the structurally bearing glass where it can be replaced easily and cost-effectively. A floating wear and tear or sacrifice pane is situated on top of the load bearing glass. It consists of 6 mm fully toughened glass with a non-slip ceramic frit and a glued polyester interlayer. Both panes are separately sealed with silicone all around and protected from horizontal slipping.

Spandrel Glazing with Stainless Steel Handrails and Wind Deflecting Glass Panes

The glass balustrades initially serve as protection for the visitors but should also offer a certain thrill. This is the reason why clamped glass balustrades were chosen with a height of 1,200 mm. Stainless steel handrails fixed with point fixings run underneath the upper glass edge at a height of 950 mm

After wind tunnel tests on the whole building, the initial detail planning of the balustrades had to be changed, as the building tended to flutter and sway under wind pressure. The vibration dampers alone, installed for reducing person induced vibrations, could not stop these phenomena. For architectural reasons it was finally decided upon a transparent wind deflecting system on the upper edges of the glass balustrades. These inclined arranged 300 mm wide laminated glass units, which were installed by means of point fixings on top of the spandrel glazing on the valley side, reduce swaying at wind pressure. The 80 sqm spandrel glazing and the wind deflecting glass consist of laminated glass with 2 x 10 mm heat strengthening and a 1.52 mm SGP interlayer.

More detailed information:
http://www.brewster.ca/rocky-mountains/destinations/columbia-icefield/activities/glacier-skywalk/