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Retractable Roof Fortress Kufstein

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Retractable Roof

Fortress Kufstein

covered area:	2.000 m²
construction costs:	2.500.000,00 €
start of design phase:	February 2005
start of construction:	October 2005
completion:	May 2006

picture credits: pro.media kommunikation

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Fortress Kufstein

In the narrow northern Valley of the Inn the fortress of Kufstein had been erected as a defence fortification during the Middle Ages. Today it attracts a great amount of tourists. In the 1990´s because of the overgrowing vegetation, parts of the historic building structure were close to decay. Therefore in 1997 the „Top City Kufstein“ was founded to reactivate the fort and put in on the market. Besides of the gradual restauration, the businesses food and open air events became established, especially in the southern courtyard of the Josefsburg.

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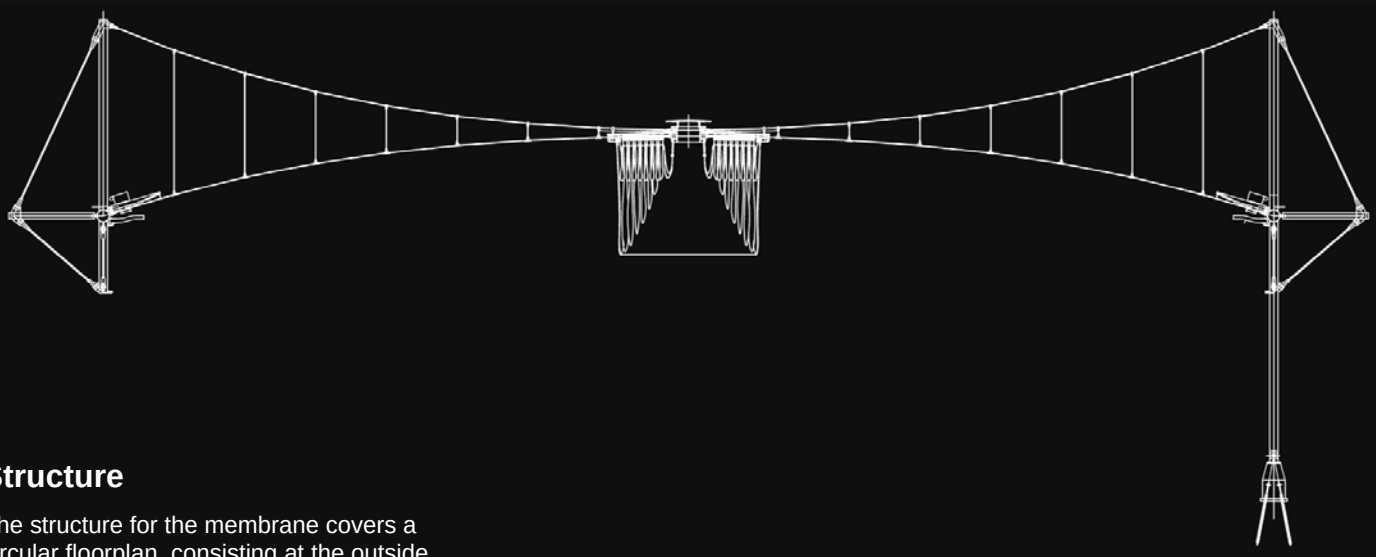
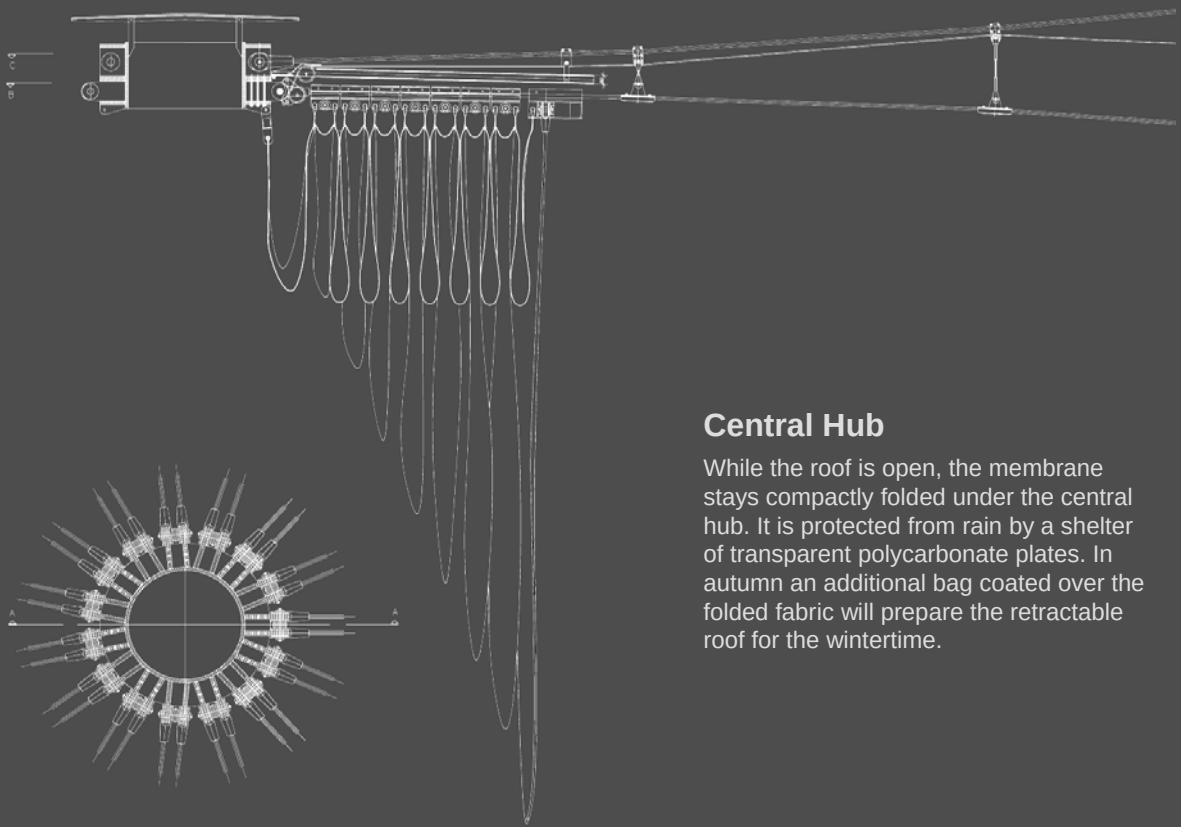
Design Concept

Simultaniously by the fact of having more and more high quality events, the risk for ticket cancellations grew because of unpredictable weather conditions: The result was financial loss. Therefore the idea of a mobile shelter in the case of rain arose, protecting as big an area of the courtyard as possible. Further requirements were set by the officials for landmark sites not allowing any kind of anchorage into the existing fort. At the same time any new structure was not supposed to interfere with the visual appearance of the location. To comply with these facts, the designers developed a delicate, centrical cable structure. A membrane located in its center can be unfolded during bad weather conditions, similar to a huge umbrella. Covering a 2.000 sqm area, the umbrella can be opened or closed within 4 minutes.



Structure

The structure for the membrane covers a circular floorplan, consisting at the outside of a polygonal pressure ring, not dissimilar to a 52 m diameter „bicycle wheel“, composed of 15 equal segments. In its nodal points the ring is supported by 15 columns, located at the borderline of the courtyard just in front of the casemates. Within the pressure ring, 15 upper and lower spoke cables are running in radial direction, connected by vertical wires to a crescent-shaped geometry. The upper spoke cables are fixed at the top end of the columns, the lower at the nodes of the pressure ring, composing a hub in its center. The bicycle wheel is an efficient, highly prestressed bearing structure, that besides of the wind load, brings only vertical loads to the foundations. Because of the landmark site requirements not allowing the columns to be founded on the casemates, 5 of the 15 columns are constructed as floating columns, suspended by 30 crossing diagonal cables. At the lower end of the floating columns a circumferential ringcable shorts the traction at the top of the columns via brackets. The columns together with the circular thrust ring appear similar to a „tiara“, floating above the courtyard.



Central Hub

While the roof is open, the membrane stays compactly folded under the central hub. It is protected from rain by a shelter of transparent polycarbonate plates. In autumn an additional bag coated over the folded fabric will prepare the retractable roof for the wintertime.

Membrane

The textile membrane consists of an innovative PTFE-fabric with high tensile stress. PTFE-fabric is characterized by many high quality features compared to conventional material for membranes, as for example its durability of more than 15 years, its flexibility, and its resistance to buckling as well as its high transparency of about 40%. PTFE is resistant to ultraviolet spectra, chemical inert and therefore withstanding quite well to damaging environmental influences. The surface is easy to clean, dirt particles adhere barely. Together with the high transmission of light, long-lasting, excellent optical characteristics of the aesthetic fabric are achieved.

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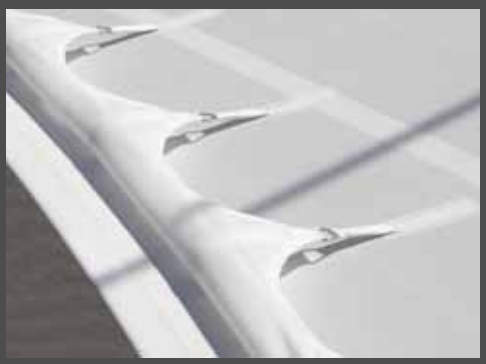

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Being opened the membrane drains to the outer edge. From there the rainwater is lead through a flexible gutter, fixed to the membrane, towards the columns. Funnel shaped hopper heads, made of stainless steel, and stack pipes with negative pressure fixed inside of the structural steel columns lead the rain water to the drainage duct system.

Driving System

Via sliding carriages the membrane is suspended point by point on the lower spoke cables. Each outermost carriage of every membrane segment is fixed to an endless cable, that runs over deflecting reels along the radial cables. The membrane is moved by 15 synchronously working engines which are placed on the outer edge of the membrane, automatically controlled by a central unit. Contactless sensors supervise the behaviour of the membrane, the motion itself as well as the tension of the membrane Moved by electrical cable winches, the membrane is stressed by 15 hydraulic cylinders, pressing the outer sliding carriages into position. The required tension is controlled seperately for every segment of the membrane.

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Initially designed as protection against atmospheric conditions, two further aspect became important for the project. The acustics are improved by the opened membrane and the textile roof can be iluminated by various colors during the night. Therefore the unique location is emphasized by architecture, music and light.

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earth works:	Ing. Hans Bodner GmbH, Kufstein
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driving system:	ECCON Engineering Computer Consulting, Nenzing
membrane:	Hightex GmbH, Rimsting
fabric manufacturer:	W.L. Gore & Associates GmbH, Putzbrunn
electrical installation:	ECK Stadtwerke Kufstein
stage-/media facilities:	Kraftwerk Licht und Tontechnik GmbH, Wels