Sport stadium at Karlsruhe: Ice skating hall at Munich

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Ice Skating Hall at Munich

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The 69 m span of the main stadium could have easily been covered by simple steel girders requiring a depth of about 2.5 m. However by suspending this roof by means of a cable structure and hence creating in addition to the end supports two inner supports for these girders, their depth could be reduced to half of that, i.e. 1.25 m. Thus the whole structure becomes much less heavy with favourable architectural consequences as well for the interior impression as for the outer view of the hall. Detailed comparison revealed that this improvement of the design could be achieved without additional costs.

The cable structure is of the same type as a self-anchored suspension bridge. Its two masts are octagonal and tapering steel tubes carrying 15,000 kN each. The two main cables and the two guy cables of each mast, which are anchored by soil anchors, consists of two locked coil ropes of 82 mm diameter each. The suspender cables' diameters are 33 mm. All saddles, joints and anchorages are made from cast steel.

The steel grid consists of girders with 1/2 IPB chords and tubular diagonals with diameters between 42 and 70 mm. They are fully welded without any gusset plates. Horizontal stiffening of the grid is provided at its periphery by four vertical trusses having prestressed diagonals made from thin rods. The outer columns following the facade are hinge supported at their base and their top. The grid is covered with corrugated sheets.

The grid was conventionally erected on temporary trestles and loosely connected with the cable structure. The whole roof was simultaneously lifted from its temporary supports and prestressed by hydraulically jacking up the two masts.

The total structural steel quantity for the main hall, including the cables and masts, is only 65 kg/m². For the appendix with its extremely light suspended girders of 18 m span, even 28 kg/m² are needed only.

An already existing ice skating rink has been covered by a translucent cable net structure. The prestressed cables of the nets are suspended between an arch along the axis of symmetry of the structure and edge cables on guyed masts along its circumference. The arch which primarily acts in compression and which is stabilized by the cable net itself is designed as a space truss with triangular cross section. Its members are steel tubes with diameters of 245 mm for the chords and 83 mm for the diagonals. The two-layer-cable nets are formed by galvanized double strands, 11.5 mm diameter each, fixed with aluminium clamps at a mesh width of 75 cm. Their edge cables are locked coil ropes with 60 mm diameter. They are anchored or supported by cast steel joints and knots. As compared to other cable net structures including the adjacent cable net roof for the 1972 Olympic Games, where the facades are usually independent steel structures, in this case the facade has been integrated into the structure: prestressed cables of the same type as used for the cable nets are suspended between the edge cables and the ground. Glass panels are attached directly to them. Such a "membrane facade" consumes a minimum of material and permits an almost unobstructed view from the inside into the surrounding landscape.

The cable net is covered by a wooden grid which carries a white and translucent PVC-coated polyester fabric. The grid spacing is 75/75 cm corresponding to the net in the upper part of the roof along the arch, and narrows continuously towards the lower edges, where the snow weight is a maximum due to the small slope of the roof. This grid scheme contributes to the very generous and pleasing interior of the hall with its increasing translucency from the periphery towards the elevated center. There the eye-shaped slots between the edge cables of the two nets and their suspenders from the arch are covered with clear glass. This permits the arch to be seen from the inside of the hall and makes evident that this is one of the rare cases where the structure is the building or where form follows function.

TWO NEW CABLE ROOFS OVER SPORTS ARENAS IN GERMANY

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