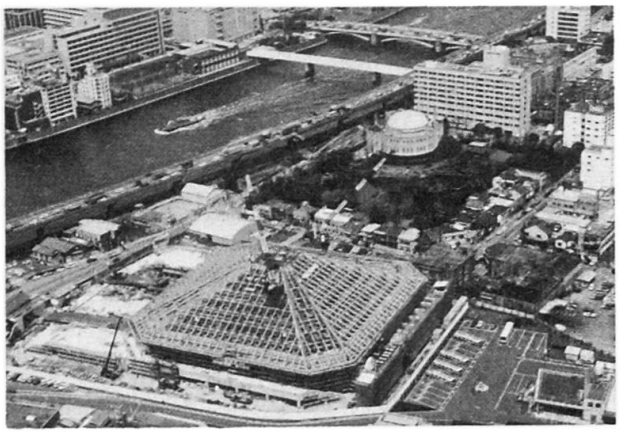
Zeitschrift: IABSE structures = Constructions AIPC = IVBH Bauwerke
Band: 10 (1986)
Heft: C-36: Structures in Japan

Artikel: Indoor sumo arena complex, Tokyo
Autor: Ban, S
DOI: https://doi.org/10.5169/seals-19848

1. Indoor Sumo Arena Complex, Tokyo

Owner:	*The Japan Sumo Association*
Architects:	*Arch. Design Dept., Kajima Corporation; Takashi Sugiyama, Architect & Associates*
Structural Engineer:	*Structural Eng. Dept., Kajima Corporation*
Contractor:	*Kajima Corporation*
Total Floor Area:	*35700 m²*
Number of Floors:	*3 above ground, 2 in basement*
Maximum Height:	*39.5 m*
Number of Seats:	*11000*
Total Weight of Steel in the Roof:	*1700 metric tons*
Construction Period:	*20 months*
Service Date:	*January, 1985*



Space frame under construction

Introduction

Early in 1985, New Ryogoku Kokugikan, a new indoor «Sumo» arena, made its majestic appearance at Ryogoku beside the Sumida River in the western part of central Tokyo.

Kokugikan literally means National Sports Hall. «Sumo» is a Japanese-style wrestling and is the national sport of Japan. The former Kokugikan at Kuramae had been familiar to the Japanese people for over 30 years, but because of its deterioration in recent years, the Japanese Sumo Association decided to build a new Kokugikan in 1982. Ryogoku was selected as the new site since it has been the mecca of this sport, and it had also been the location of the former Kokugikan before being replaced by the one at Kuramae in 1951. The former Ryogoku Kokugikan had been famous for its huge steel rib dome, and the owner wanted to have a spectacular space frame for the new Kokugikan's roof structure.

The size of the truncated pyramid shaped roof of the new Kokugikan is 94 m² chamfered at the four corners. The shape reminds people of modern Japanese-style roof. Refined interior design (i.e. the aesthetics of the exposed space frame) as well as the rationality, safety and feasibility of the structure have been pursued.

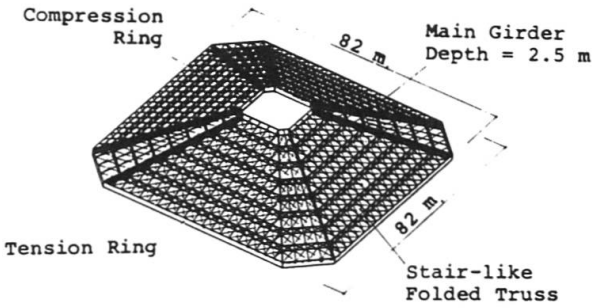
General view of the Kokugikan

Outline of the Structural System

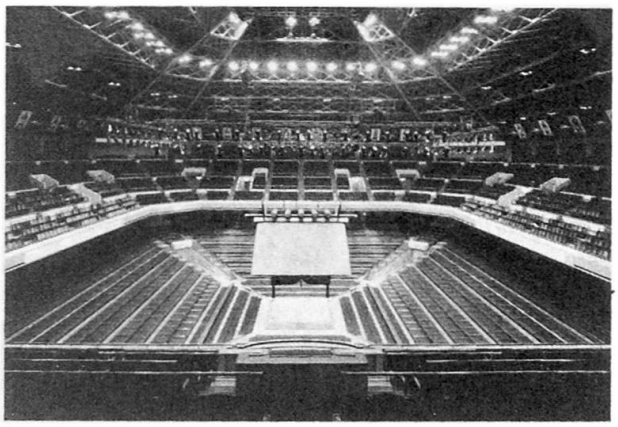
A compression ring, a tension ring, four pairs of main girders, and trusses between the main girders are the principal structural elements of this structure. The shape of the rings are square chamfered at the four corners, i.e. octagonal. The compression ring at the top and the tension ring at the bottom are connected at each corner by a pair of main girders. Girders are confined by stair-like folded trusses. These trusses not only act as sub-beams but also as sub-rings, which reduce the flexural moments of the main girders. Since all elements of this structure are designed to be laid in either a horizontal or a vertical plane, connections between the elements are significantly simplified, and consequently the productivity and the efficiency are very high. Each chord and web members of trusses consists of a pair of structural tees, back to back. For chord members, additional plates are sandwiched between the tees in order to minimize the sizes of chord members. By utilizing the sandwiched plates, most of the chord and web members are designed to have the same overall dimensions. The powerfulness of the main girders is emphasized by their contrast with the sharpness of the truss members.

The total weight of the roof is 3000 metric tons. In order not to restrain the horizontal movement after the removal of temporary supports, high strength brass-steel alloy plates are placed under the base plates of the eight main girders. For the transfer of the horizontal force, due to earthquake or strong wind, from the roof to the lower structure, stoppers are set in the tangential direction of the ring at the movable supports under the tension ring.

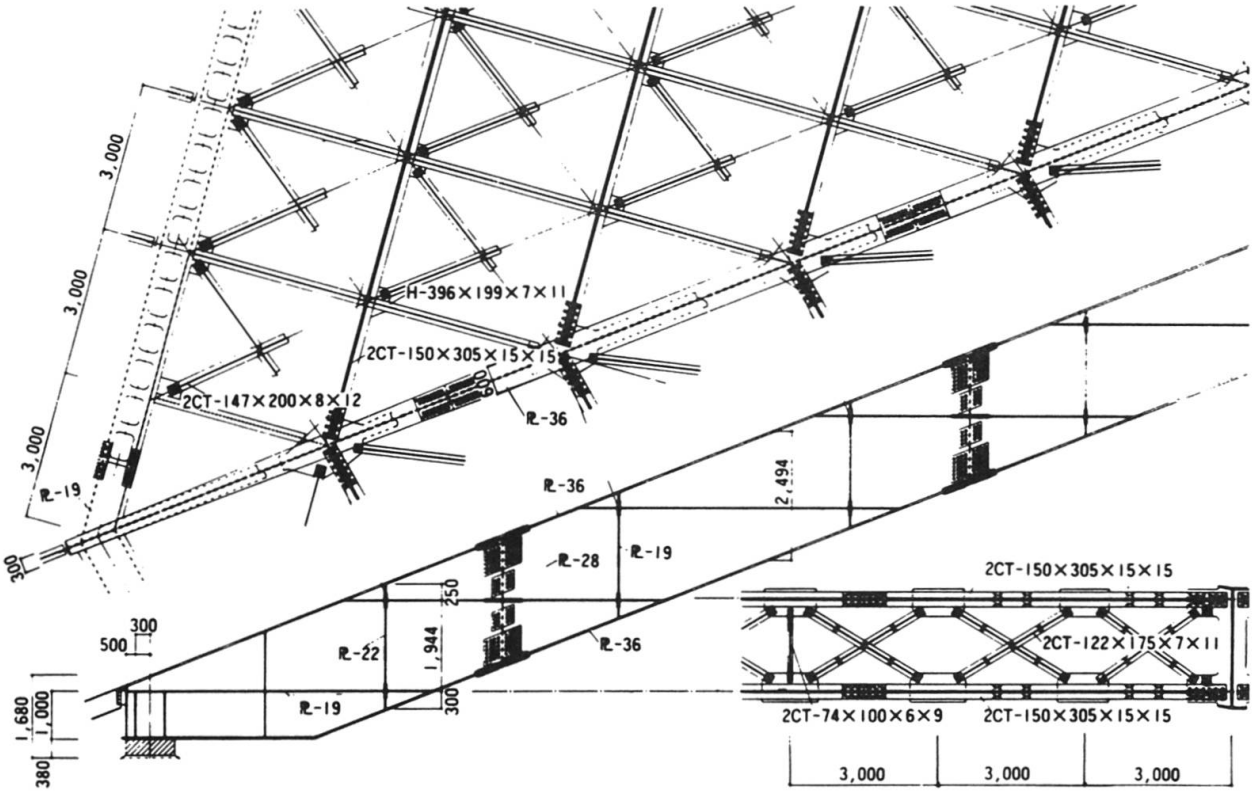
(S. Ban)



Structural system



Interior view of arena



Detail of the space frame