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8. Olympic '90 – Stadium Rome (Italy)

Owner:	*C.O.N.I. (Italian Olympic Committee)*
Designers:	*Ing. Giorgio Caloisi* *Ing. Massimo Majowiecki* *Arch. Joseph Zucker*
Contractors:	*Olimpico '90 S.c.r.l., with:* *COGEFAR – IM. CO – C.C.C. – C.P.C. – C.G.S.*
Works duration:	*20 months*
Service date:	*April 1990*

General

The actual stadium, originally built for the 1960 Olympic Games, is now almost completely reconstructed. The grandstands have been substituted with new pre-fabricated prestressed concrete elements, increasing the total occupancy to 85000 spectators.

From the structural point of view the most impresive part of the stadium is the roofing structural system.

Description

Principally due to the existing boundary conditions the designers adopted an innovative design for the roofing of a football stadium: a simple supported closed ring structural system of 308 m main diameter.

The system is formed mainly of:
- a radial distribution of cable trusses
- an inner tension cable ring
- an external space framed tubular compression ring
- a PTFE (Poly Tetra Fluoro Ethilene) membrane covering system.

The cable trusses

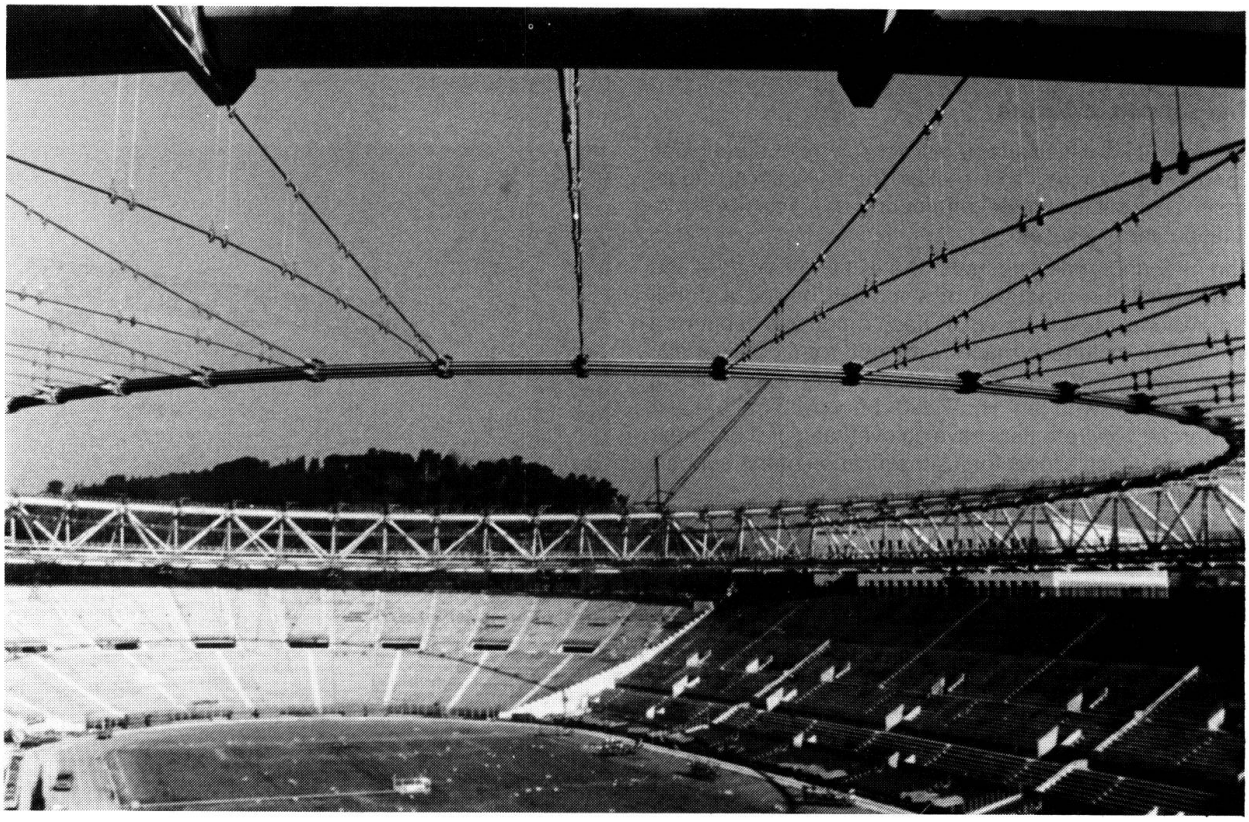
The cable trusses are radially oriented from the two center points from which all the geometry of the stadium is generated. An upper spiral zinc coated steel cable from 64 mm to 87 mm diameter, a lower stabilizing cable from 47 mm to 74 mm diameter and vertically oriented connecting cables of 19 mm diameter form the two families of cables trusses. They are connected to the inner and outer ring radially spaced at 2.36' to 7.60'.

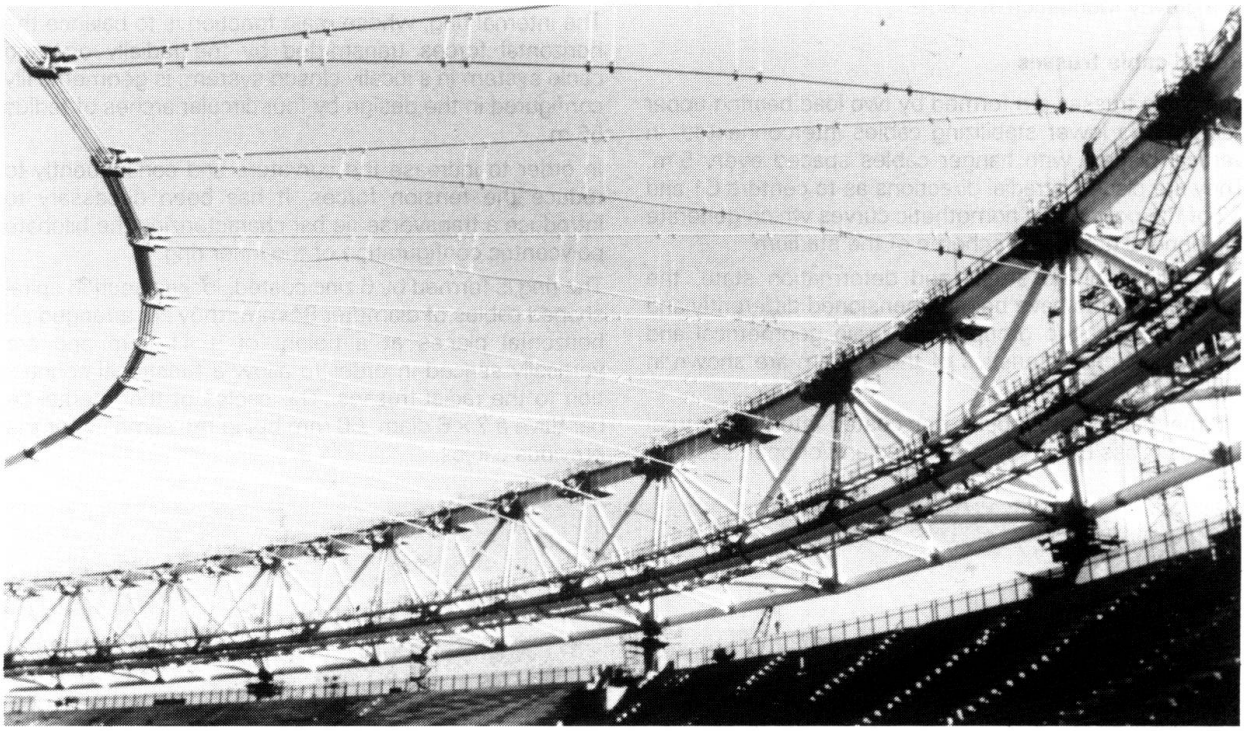
The inner ring

In order to accomodate the designed central hole by the inner ring the prestressing level of cable trusses was varied accordingly.

The forces transmitted by the cable trusses are collected by the inner ring which «closes» the forces with 12.87 mm diameter cables. The ring configuration in plan view is drawn by two circular tangent lines of 165.80 m and 52.69 m respectively and is placed at + 29 m from the playing area.

Special friction joints have been designed for the connection between ring and cable trusses.





The outer anchorage ring

The upper and lower radial cables are connected to the internal points of the space frame ring. The main dimensions of the ring are 307.94 m in longitudinal axis and 237.22 m for the transverse axis.

The section of the ring is triangular 12.50 m high and 10.50 m over base and in the vertices are placed tubular steel profiles with external diameters from 1400 mm to 1000 mm and 70 mm to 18 mm thickness.

The ring is supported by 12 steel columns and 4 stair column boxes. The support system allows horizontal diplacements for static deformations. The dynamic drag forces are resisted by a passive control system of hydraulic jacks.

Membrane covering

The membrane covering is placed at the level of the lower cables and is supported by a system of parallel – U shaped frames. Cone-shaped membrane elements are placed inside the external ring.

The plan dimensions of the membrane panels are 10×50 m for the internals and 10×12 m the cone-shaped unit placed in the external ring.

The membrane is realized in fiber-glass coated with PTFE (Teflon). The shape was obtained with the help of computer programs in order to fit the boundary geometrical conditions and fixed pre-stress level.

(Giorgio Caloisi, Massimo Majowiecki)