



Engineering Structures for Life



BUILDINGS - SPORTS FACILITIES

Porto's Sports Pavilion Renewal and Rehabilitation

ABOUT

The Porto's Sports Pavilion was inaugurated in 1952 to host a Hockey World Championship, before having the roof finished. This iconic building was built occupying the space of the previous landmark: a Crystal Palace dated 1865 inspired by London's original, which was demolished.

The [building](#) denotes the talent of its creators: architect J. Carlos Loureiro and structural engineers A. Santos Soares and J. Delgado de Oliveira. The pavilion has a useable area, on the main floor, of 6.500 m², a capacity to accommodate 5000 seated spectators in demountable stands and was built to house sports competitions, exhibitions and other venues.

As part of the renovation design for the Sports Pavilion, which began in 2008 and was concluded in 2011, Porto City Council awarded the detailed design to the GALP architecture office. GEG was in turn hired by this office for the structural detailed design of the intervention for the renovation and flexibilization of the Sports Pavilion.

This project engaged a deep involvement of our team who was fully dedicated through every stage. The mission was underlined as being of great importance because of the unique opportunity to collaborate with the architect José Carlos Loureiro in the rehabilitation of his most emblematic project.

The [rehabilitation design](#) of the pavilion integrates some changes to the existing structure. The whole intervention had in mind the principle of reversibility preserving the integrity of the original structure. The changes which have the greatest impact are the introduction of new loads such as the installation of permanent stands, the suspension of technical equipment in the dome and the opening of holes in the slabs for buildings' infrastructures.

This rehabilitation intervention fundamentally aims to extend the useful life of the structure.

FACTS

Year: 2009-2011

Client: GALP Architects

Services: Detailed design, Building Engineering, Structural Engineering, Foundations design, Rehabilitation and refurbishment design, Construction planning

TEAM

José Vaz Pinto

Raquel Campos e Matos

LOCATION

Porto, Portugal

Structural solution

It is a [reinforced concrete structure](#) with a circular configuration in plan with a diameter of 90 m supported by 32 radial beams. The building consists of an underground floor, an entrance level floor (elevation 3.3 m) and four levels of access galleries above level 3.3 m.

The Sports Pavilion's main feature is the roof that is a dome made of ribbed reinforced concrete forming a spherical cap covered by copper sheet giving it the characteristic green colour. This dome is formed by thin (8 to 5 cm) two-way reinforced slabs supported by 32 radial beams – the meridians – and 8 circular beams – the parallels. Each slab has four circular skylights. Its apex concludes with a 134 cm wide skylight made of "transparent concrete" (10 cm thin concrete shell with glass elements). The [foundation system](#) of all elements is a shallow foundation.

The two-way slabs are 25 cm thick and are supported by a grid of beams. These slabs applied a technology known as Stahlton slab system that was developed in the United Kingdom in the 1950's. The system developed around a high strength extruded ceramic tile with formed grooves open to the top surface into which longitudinal reinforcement (stressed high tensile wires) and steel ties or stirrups were placed and then the grooves were grouted using a Portland cement grout. In the other direction, the reinforcement is made of mild steel.

The entrance level slab (elevation 3.3 m) is divided into 9 parts by expansion joints, one is circular and defines the central stage area and the other 8 are radial and exist without duplication of structural elements. The four levels of access galleries above level 3.3 m are supported by the column inside the triangular frame. Its unidirectional slabs are also 25 cm thick pre-stressed and supported by a grid of beams. The galleries are also divided by eight radial expansion joints on the same vertical planes of the joints in the 3.3 m level.

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