

The balanced beam of Riccardo Morandi: from its conception to experimental investigations

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Abstract

The paper focuses on the structural scheme of the balanced beam experimented by Riccardo Morandi around the sixties. This scheme was studied and adopted by Morandi in various structures, both bridges and buildings, such as the bridge over the Vella in Sulmona, the bridge over the Cerami river in Enna, the overpass of the Via Olimpica in Rome, but above all in the hypogeum pavilion of Torino Esposizioni in Turin.

The underground Pavilion designed by Morandi in 1958 in Turin, as an expansion of the Exhibition Center dedicated to hosting the industrial vehicle section of the Turin Automobile Show, is one of his most artistic buildings. At the same time it is one of his most complex structural artifacts [1,2].

The hypogeum is inspired by the underground Lourdes Cathedral designed by Pierre Vago and Eugène Freyssinet, and it consists of a single wide space, 69 m in width and 151 m in length, located 8 m below ground level.

The static scheme adopt a solution frequently used by Morandi in those years: the balanced beam. The scheme consists in post-tensioned beams on inclined supports, with two cantilevering side spans subsequently anchored by post-tensioned tendons at their ends, which exert a balancing effect on the bending moments in the main span.

The novelty introduced by Morandi in the hypogeum is that the intersection of the balanced post-tensioned beams, which are no more parallel, but are diagonally directed and reciprocally interconnected in order to obtain a spatial structure. At the same time the structure gains an high overall rigidity and lateral stability, contrasting the instability of the thin beams (16 cm).

The paper starts with a brief introduction on the structural scheme of the balanced beam adopted by Riccardo Morandi. It will then focuses on the underground pavilion built in Turin, by analyzing the original drawings and technical reports written by Morandi.

In the third part of the paper, the result of an experimental campaign carried out on the building, and on its structural elements, will be presented and discussed.

References

- [1] Morandi, R. “La struttura del nuovo Padiglione di Torino Esposizioni”, *L’Architettura*, March 1960, pp. 784-785.
- [2] AITEC, Prestressed concrete structures in Italy, FIP, 4th Intern. Congress, 1962, pp. 321-326.