



Engineering Structures for Life



TRANSPORTS - BRIDGES & VIADUCTS

Andresas Viaduct

ABOUT

This project started from a challenge proposed by Porto's City Council to create a viaduct that would highlight the entrance in this zone of Porto's city. The new avenue, where the Andresas Viaduct is integrated above the Internal Ring Road of Porto (VCI), was part of the UEFA Euro 2004 program, as one of the major constructions built to link a new road connection to Bessa Stadium.

The large traffic flow in the most congested highway artery of the city (VCI), as well as the time available to execute the project and the construction, forced to conceive a fast construction solution with a minimal impact on the city's traffic.

The Andresas Viaduct above the VCI was conceived from the concept of a [steel structure](#), to allow the overcoming of 75 m (105 m with a 45-degree crossing angle) with a single span. Its conception was based on a commitment to the construction process and on the huge challenge of placing the viaducts' deck on the final abutments. The steel solution allowed to reduce the construction time and to express a [sustainable commitment](#) to the construction process, as requested by the client.

FACTS

Year: 2003-2004

Client: Porto's City Council

Services: Detailed design, Structural Engineering, Foundations design, Bridge and Viaduct Engineering, Geological and geotechnical studies, Ground support and earth retaining structures, Instrumentation & Monitoring, Consulting and on-site technical support

TEAM

Paulo Pimenta

LOCATION

Porto, Portugal

Structural solution

The structural solution is composed by a [roadway](#) deck with three lanes and sidewalks separated physically. The available height to the VCI Ring Road required a lower deck, supported on the two lower Warren tridimensional beams, which combined with the external secondary tridimensional beams form a "transparent box" with torsional rigidity that would guarantee the structure stability by itself, but also by the inexistence of superior bracing linking

the two beams.

The 45-degree crossing angle of the structure was responsible for the appearance of tensile forces in the secondary beams bearings. These forces occur by bending moment transformation of the external cross beams into a binary of forces. This phenomenon was balanced through the sealing of the bearings only after the permanent loads' application. These bearings were only required for the imposed loads.

The cross beams consist of a mixed section with spans of 11,65 m spaced from 5 m. They are attached to the lower main beams, promoting some continuity of efforts. The upper and lower main beams are joined by diagonals forming a WARREN-type beam.

The main and secondary beams are finished with high stiffness squares. On the extremities of the viaduct, there are two turrets where the bearings, specifically conceived for this viaduct, are located.

The abutments are in reinforced concrete, with [foundations materialised by piles](#) of 600 mm in diameter. The geometry of the abutments was conditioned by the available space of implantation but also by a direct connection with the limits of the steel structure frame.

Structural challenges

The design and construction of this viaduct covered some peculiarities that deserve a reference. Some of these particularities have already been mentioned in previous points, such as the time for execution, the non-interruption of traffic on the VCI Ring Road below the viaduct, the assembly of the structure and the placement in its final position.

One of the biggest challenges concerning this structure was the need to execute the construction without interrupting the traffic on the VCI below. After studying some alternatives, the design team came up with the idea of assembling the viaduct piece by piece in an area just aside the ring road in order not to interfere with its heavy traffic. The 900 tonnes viaduct was then pushed to its final position overpassing the ring road within two hours overnight, by means of cranes and specific remote controlled trucks. This innovative method was used for the first time in Portugal.

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