Engineering Structures for Life

TRANSPORTS - BRIDGES & VIADUCTS

Bridge over Ave River

ABOUT

The Bridge over Ave River is a structure located on the A11 highway, which connects Braga to Guimarães, in the Celeirós – Guimarães Oeste section, and can be divided into:

- Approach viaduct on the right bank, with 8 spans of 16 m, for a total of 128 m;
- Crossing zone (bridge) with a total development of 120 m;
- Approach viaduct on the left bank, with 2 spans of 16 m, totalling 32 m.

The structural solutions are distinct for the bridge and access viaducts.

FACTS

Year: 2000-2002
Client: Ascendi
Services: Detailed design, Structural Engineering, Foundations design, Geological and geotechnical studies, Consulting and on-site technical support

TEAM

LOCATION

Braga-Guimarães, Portugal

Structural solutions

BRIDGE

The deck uses precast solutions, with two (twice two) box girders, Maprel Alvisa C170, connected by intermediate slabs with 0,30 m of thickness, including pre-slab, for a total height of 2,0 m.

As the width of the river was very significant, the dimension of the precast beams was controlled by introducing inclined columns, described below. Four support alignments were planned for the structure foundation, with the central alignments along the banks of Ave River. These central columns bifurcate to create the V-shaped columns that support the box girders.

The actual number of spans at deck level is equal to 5.

To resist transverse horizontal loads the resistant structure is materialized by four quadrilaterals, in which the lateral parts are the columns, the parts on the top are the transverse girders and the ones on the base are the

foundations.

In order to optimize the use of prefabrication, it was decided to coordinate the bearings so that the central span, the spans over the columns and the columns are the same for each of the longitudinal alignments of the box girders. The differences are integrally absorbed in the extreme spans, with beams of different lengths.

The columns have a cross section of 0.80 m x 2.20 m. These elements are concreted "*in situ*", in order to be connected rigidly with the pile caps.

The support elements of the intermediate abutments are materialized by isolated pile columns, with 1.20 m in diameter, located exactly under the axes of the box girders. They are primarily intended to absorb vertical forces.

APPROACH VIADUCTS

The roadway platform is divided into two carriageways each one in a single deck separated by 0.10 m. Each deck has a total width of 14.95 m. The decks are supported on the bearing frames, which are common to the two decks. On the edges, the decks are supported by the abutments and the intermediate supports of the central bridge without structural continuity.

Each of the approach viaducts consists of two prestressed reinforced concrete decks, largely precast.

The deck is composed of I-shaped precast beams, prestressed by pre-tensioning, which support the pre-slabs. The pre-slabs serve as self-support form for the *in situ* concrete layer. Each deck is composed of 8 I-shaped beams, spaced at 1.90 m. The cantilever at the edge has a development of 0.75 m.

The longitudinal beams have a height of 0.75 m, and are made of MAPREL Type I75.

The bearing elements of the deck are materialised by:

- Deck bearing frame, with four columns of circular cross-section, Ø1,0 m, surmounted by a cross beam with 1.40 m height;
- Foundations of bearing frames, which are shallow or deep foundations, depending on the soil conditions. Due to the small height of the structure and to its small spans, it was decided to use piled columns, in cases where the deep foundation was necessary.
- Counterfort abutments.

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