Viaduct over Genil River. Granada External Bypass

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Summary

The viaduct over the Genil River is a road bridge built as part of the Albolote-Santa Fe Segment (Granada) of the A44 Highway in Sierra Nevada. It consists of three spans 15 m + 80 m + 15 m long making a total length of 110 m. Three concrete tied arches are placed in the main span. The central arch, with a sag of 16,6 m, remains in a vertical position while the lateral arches at both sides are sloped towards the inside of the deck, 10 degrees with respect to the vertical. The superstructure is 41,20 m wide and consists of three longitudinal prestressed concrete beams. The exterior beams consist of a solid section 1,30 m deep while the interior beam consists of a box girder 1,50 m deep. The reinforced concrete slab is supported by transversal prestressed girders. The viaduct is placed in high risk seismic zone, being the acceleration 0,33 g.

Keywords: Prestressing, conceptual design, seismic design, arch, aesthetics, buckling.

1. Introduction

The viaduct over the Genil River materializes the transition of the A44 Highway manage lane. The bridge is 110 m long divided into three spans 15 + 80 + 15 m long, respectively.

The projected bridge typology has the aim of providing the viaduct over the Genil River with a strong personality, not only making the bridge as a part of the surroundings but enhancing it and turning it into a visual milestone for the users, of both the A44 and the A329 highways.

Span configuration of the viaduct has been highly restricted due to some particular project features, such as the minimum vertical clearance to the river and the drainage requirements. Both conditions have been solved by implementing a 80 m long span over the river with a 1,50 m depth below the grade line, and a total drainage width of 110 m.

Likewise, the odd features of this viaduct has suggested to design the superstructure width for a possible future widening 4 + 3 traffic lanes but, at the same time, due to structural requirements the deck must be symmetric, hence the superstructure is ready to house a future widening of 4 + 4 traffic lanes, making a total deck width of 41,20 m.

The viaduct design consists of a tied arch main span that keeps the continuity with shorter spans at both sides. The high width of the superstructure make it almost impossible to find a solution with an isolate central arch, since the transversal flexure would lead to highly deep longitudinal beams. This way, the central arch is placed in the main span along with two shorter lateral arches that relieve the transversal flexure and share out the deck load to both concrete exterior tie beams 1,30 m deep.

In the elevation view of the viaduct, the lateral arches, which are smaller than the central one, are designed in a way that enhances the presence of the central arch, as much for the size comparison as for the hangers design. In the transversal section, the exterior arches bend towards the inside of the deck 10 degrees with respect to the vertical, so they gather up and gain the space created between the arches, creating a stronger feeling of the structure as a whole.

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