Analysis and Design of the Almonte Bridge

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Summary

The high speed line Madrid-Extremadura crosses Almonte River through Alcántara reservoir with a viaduct, a great arch of high performance concrete. The main span of this structure is 384 meters. This span will turn the bridge in 2015, when it is scheduled to be completed, into the first arch bridge for High speed railway in the world. This paper explains the exceptional techniques outside the usual engineer work to reach its design and construction.

Keywords: arch bridge, high speed railway, high performance concrete, cantilever, instrumentation.

1. Introduction

The Bridge on the Almonte River at the Alcántara reservoir is an arch bridge with a main span of 384 m and a total length of 996 m. It will become, once completed, the longest span in a high-speed railway and the third longest arch in concrete in the world. Its design and construction include many special features and demand complex analysis methods that are unusual, but in this case become crucial.

2. Special features of this structure

The specifications on a bridge for high speed rail are much greater than those of a road bridge, for example, greater dynamic effects by passing convoys or significant horizontal loads or fatigue. All these cannot be disregarded. All these specifications must be combined with strict functional considerations, in order to obtain a service level of the structure that shall not be limited at any time: small deflections and accelerations and a length between expansion joints limited for technological reasons. Given these characteristics and limitations, the spans above 100 m have been unusual in high-speed rail bridges, but this structure falls within an exceptional span for the topographic features of the site.

Despite the uniqueness of the main span, this bridge is formed with a typical railway box deck with maximum spans of 45 m and 3.10 m depth along its 996 m. These spans are constructed using the system of movable formwork on piers, so it is the arch element, and its zone of structural influence, where it has been necessary to implement more elaborate construction methods. Specifically the arch is constructed by a cantilever method with temporary stay cables from two temporary steel towers.

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