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BICONTENTIO SINUS FOOTBRIDGE IN MARTUTENE (SAN SEBASTIÁN)

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Summary

This is the story of a footbridge built using the concept of pre-designed bridges. A new footbridge has been built over the Urumea river in San Sebastián (Spain). It replaces a previous concrete bridge with a pier, and a shorter length with insufficient hydraulic clearance.

The characteristics of the Martutene footbridge include hidden abutments, neutral colors, and it integrates the natural terrain with the support structures. To achieve a more slender appearance, the cross-sections along the length of the structure are very variable. The footbridge consists of three spans: a large one of 62.6m and two small side spans of 2.8m. Combined with two small overhangs on either side, the total length is 71.1m.

The bridge is elastically fixed on both abutments. This connection is accomplished by placing two pinned supports close to each other. One works in compression; the other, in tension. The material used is weathering steel, complemented with stainless steel railings and a wooden deck.

Keywords: pre-designed bridge; parameterization; variable depth; restraining

1. Design approach

The design approach begins with an initial assessment of the site that will receive the future bridge. The shape of the riverside determines the kind of support. A gentle slope is what connects the footbridge to the terrain. Thus, the decision that was taken was to restrain the structure in hidden abutments. Once the structural type was defined, its bending moment diagram originated the shape of the bridge. The existing topography determines the support conditions, and the resulting bending moment diagram of the structure inspires the final shape.

Fig. 3. Bicontentio sinus footbridge, San Sebastián, Spain, 2016

2. Structural concept

The footbridge is a three span beam, with two main longitudinal box girders assembled with secondary cross girders. The anchor plates located on the abutments ensure the transmission of vertical tension reactions of the restraining spans. A double bolt anchor allows the longitudinal movements.

The resistant cross-section is a five-sided polygon. Each of the five vertex of the cross-section meets a curved fiber which describes the longitudinal geometry of the main boxes. Thus, five surfaces are obtained which mimic the bending moment diagram.

Footbridge railing presents a concise and transparent design with supports of corten steel, and stainless steel cables. In major part of bridge main box girders serve as parapet; thus, the railing supports present a variable geometry.

3. Execution

The Footbridge was designed to be easy to assemble, with no temporary supports. Construction in the workshop begins placing supporting crossbar, on which the lower part of the box is placed. Afterwards, stiffening internal frames are placed. These elements serve as guides to generate the final geometry of the bridge, as in the ribs of a boat.

No temporary supports were needed to be placed in the river. The structure is divided into three parts.

The two ends are anchored to the abutments, and assembled in cantilever. After this, the central section over the river is placed, and the three sections are welded.

4. Discussion and Conclusions

The main features of the Martutene footbridge are the following ones: design based on the existing topography, shape that mimics the bending moment diagram, restraining in abutments. The design based on the existing topography allows to hide the abutments, and shows the bridge as an one-off object that connects seamlessly with the terrain.The bending moment diagram silhouette allows to optimise the material, obtaining an elegant an efficient shape.The use of an structure that is restrained on both abutments is versatile from a constructive point of view.

I would like to open a debate with the following questions: Must the design of a bridge correspond to a specific site? Must the site determine the design of the bridge? It is suitable to design a same bridge for different places?

Fig. 3. Bicontentio sinus footbridge, San Sebastián, Spain, 2016