DOI: 10.24904/footbridge2017.09776

DESIGN OF RAOS FOOTBRIDGE OVER THE A-67 MOTORWAY, SANTADER (SPAIN)

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Summary

As part of the project “Santander’s Bay Cycle Path”, Arenas & Asociados was commissioned the design of a pedestrian and cycle bridge that should allow the connection between the neighborhoods of Nueva Montaña and Raos, in Santander (North of Spain). This paper tries to synthesize the main characteristics of the project.

The new footbridge is 210 m long, with a central steel structure section of 106 m and two reinforced concrete access ramps, with a 6% slope and lengths of 43 and 61 m. The structure has a slightly curved plan directrix, so to produce the minimum disruption to the existing infrastructures, maintaining the required distances and clearances.

The U-shaped main composite section, with a 1.20 m depth, allows the crossing over the A-67 motorway and two railway tracks, with two spans of 36 m. The grade-axis of the structure respects the vertical clearances of 5.50 m over the motorway, and 7.0 m and 6.5 m respectively over ADIF and FEVE tracks.

The identity of the footbridge is its central main support, in a double V-shaped steel element, forming a tetrapod that supports both edge girders of the deck. The V pier has an opening of 15 m, reducing the effective main spans to an approximately length of 29 m, thereby reducing depths and efforts on the deck.

Keywords: footbridge; cycle-lane; tetrapod; composite section; clearances

1. Introduction

The current development of a pedestrian and cyclist path along the perimeter of Santander’s Bay, has faced diverse difficulties due to the numerous existing obstacles. It merges in an industrial and port facilities area, with restricted access areas, junctions and crossovers.

One of the main problems is the fracture supposed by the A-67 Motorway and ADIF and FEVE railway tracks. Thus, Arenas & Asociados was commissioned the design of a pedestrian and cycle bridge that should cross over these infrastructures, allowing the connection between the neighborhoods of Nueva Montaña and Raos.

The footbridge joins the existing bike lane heading to “El Corte Inglés” Mall from Santander city center, with the already constructed path at the other side of the motorway which surrounds the airport and the industrial area of Raos.

The structure designed by Arenas & Asociados, tries to minimize the affections to the existing infrastructures, maintaining the required clearances of 5.5 m over the motorway, 7.0 m over ADIF’s rail track (Iberian gauge=1668 mm) and 6.5 m over FEVE’s track (metric gauge). It also takes into account the aeronautical requirements due to the proximity of Seve Ballesteros’ Airport.

2. The structure

The footbridge, with a total length of 210 m, is composed by three clearly differentiated parts because of its structural approaches: the north and south abutments, about 15 m long; the north and south ramps, 43 m (8+9+9+9+8) and 61 m (8+9+9+9+9+8) long respectively, along which the height is increased; and finally a 106 m (17+36+36+17) long composite-section footbridge, crossing over the existing infrastructures (Fig. 1).

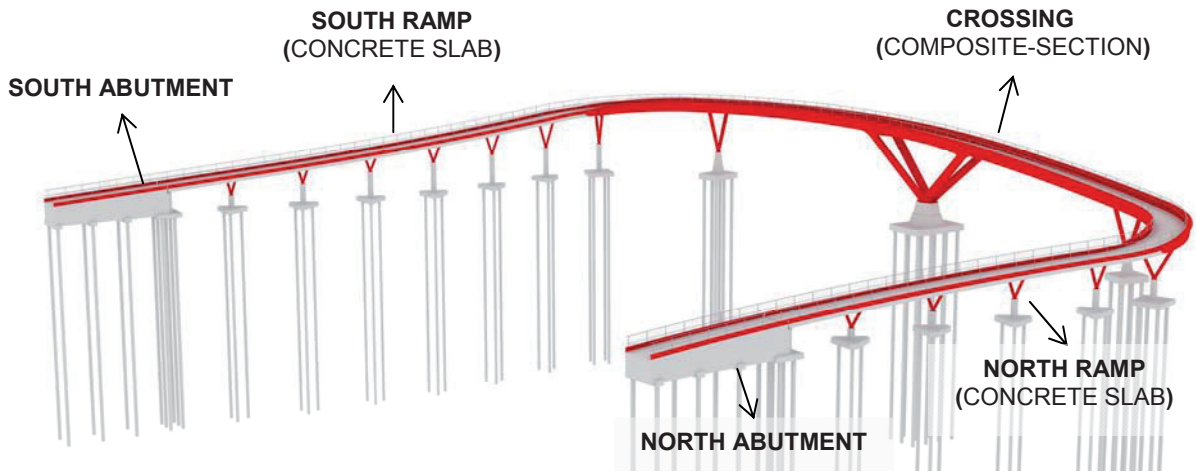

Fig. 1. General description of the footbridge

The perpendicular crossing over the lower infrastructures is undertaken making use of a steel-deck solution. We consider this solution as the most suitable due to the easy pre-fabrication of the steel elements and their quick installation, reducing the affection to the lower tracks. The deck is finally materialized using precast slabs, which allow working with the high traffic intensity of the A-67 motorway. The type section is formed by two 1.20 m deep steel box girders, with the outer face inclined, and linked by transverse beams every 2.40 m. The upper plate has a slight inclination outwards to avoid ponding, and a fold in its interior part to hide the path’s lighting beneath the handrail.

Pier 7 is the identity of Raos Footbridge. It is composed by a central tetrapod around which the rest of the elements are ordered. In elevation, the V has an upper opening of 15 m, so that the length of the central spans is reduced from 36 m to 29 m, improving the behavior of the deck structure.

The upper side of the tetrapod is embedded to the longitudinal nerves of the steel deck, providing continuity to the plates’ plane towards the lower vertex, where they converge. From this point, the tetrapod is supported on a hexagonal concrete plinth placed between the railway track and the A-67. This base, with variable inclined flat faces, has its height divided in two small steps. It has required deep foundations, made by 12 driven piles.

3. Discussion and Conclusions

At the time of submitting this paper, the footbridge is under construction. The connection of two areas divided for long time, has been strongly demanded. Once completed, we expect these requirements are accomplished by the new footbridge and people will feel of it as a gateway to the city of Santander.