Design and Erection of two recent urban Cable-stayed Bridges in Spain

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Summary

Two urban cable stayed bridges designed by Arenas & Asociados have finished its construction in 2007. “Las Rozas” Bridge, in the outskirts of Madrid, with 102 m span, and the Science and Technology Park of Cantabria Bridge (PCTCAN), in Santander, with 72 m span. They are both Asymmetrical cable stayed bridges with central plans of stays and decks over 20 m wide, and they are both meant to become iconic gates of entrance to the city of Las Rozas and to the new Technology Park in Santander, because of its conceptual design.

Keywords: Cable stayed; asymmetrical; Spain; inclined mast; iconic structures, tensioning procedure; rigid counter stays.

1. Introduction

Within a 6 months lapse in 2007 two cable stayed bridges have finished construction in Spain, both designed by Arenas & Asociados and both with many similarities, but a unique character. They are located at the city entrances of las Rozas (Madrid) and Santander (Cantabria), over busy highways. They are both asymmetrical cables stayed bridges with central plans of stays, but they differ in mast and counter stays design, with a complete different approach: rigid steel counter stays in las Rozas, and two open plans of cable counter stays in Santander.

2. Las Rozas bridge (Madrid)

2.1 Location and design

This contest awarded design will become the main access to the city of Las Rozas, over passing the A-6 highway 20 km north of Madrid. The crossing is skewed 20º to the traffic, which together with potential future enlargement of the road, results in a 102 m span (330 feet). Asymmetric cable stayed bridge scheme is chosen because of deck depth restrictions, and the will of the structure to become a symbol for the city, meant to outstand in a semi industrial environment.

2.2 Geometry of the structure

The bridge transversal section includes two lanes of traffic on each sense, and a wide central walkway. The deck central suspension is made throug two vertical plans of stays separated 72 cm. The structural cross section is a composite section with 150 cm height steel central girder, and a 22 cm concrete slab supported on transversal ribs with a curved profile. The bridge, with a main span of 102 meter, is stayed by means of 9 couples of inclined cables, all arising from the head of a steel spatial frame. The steel frame is made up of two transversely inclined triangular elements, whose upper common vertex is the point where a vertical steel plate is placed, which allow, with socket type final anchorages, the successive cables to be anchored.

2.3 Method of erection

Main activities of erection procedure are the positioning of steel structure of the deck and mast using cranes, and positioning and tensioning of the stays in only one sequence using isotension.

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Fig. 1: View of las Rozas Bridge from the A-6 highway

3. Science and Technology Park of Cantabria Bridge (Santander)

3.1 Location and design

Located in the North coast of Spain, Santander, with about 180.000 inhabitants, is the capital of Cantabria, and an important port area. The new Science and Technology Park of Cantabria (PCTCAN) is being built on the city entrance. The new bridge is an overpass allowing communication between both sides of the highway and constitutes an important access point for the Technology Park. Also the new bridge is meant to become an icon to identify the PCTCAN and to signal the city entrance. Asymmetric cable stayed scheme with central inclined mast is chosen.

Fig. 2: View of the finished Science and Technology Park Bridge (Santander)

3.2 Geometry of the structure

This new bridge giving access to the Technological Park of Cantabria in Santander, is an asymmetric cable stayed bridge, flying over the highway in the city entrance. The central mast is inclined forward and receives three plans of stays, one to the front, and two open laterally to be anchored in a buried counterweight. The bridge has a total length of 97 m between abutments, of which 72 m constitute the main free span, and 32 are part of the final abutment including the counterweight. A concrete cantilever links the abutment and the composite deck, which is fixed to it by means of prestressed bars to the cantilever. The decks is suspended using 9 stays, anchored to the inclined mast, which is held by two groups of 6 counter stays, anchored to the abutment at both sides of the road.

3.3 Method of erection

The method of erection for the main span consists in positioning of the steel portions of the deck on temporary supports, and welding of these portions together. The mast is erected in two portions after completing the deck and counter weight abutment. Positioning and tensioning sequence is studied to avoid extra charging of temporary supports.