Vinalopó River Bridge. Elche (Spain)

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Introduction

The Vinalopó bridge is the result of a design competition which sought to provide a new landmark for the city of Elche.

One of the initial tasks was to deal with the traffic requirements of the local urban environment. It was necessary to build a roundabout on one side of the river in order to solve the traffic problems created by the junction of different avenues. The historical town is located on the opposite side.

Using a unique pylon design, constructed adjacent to the roundabout, the new bridge has created the desired urban improvement. The principal reason for this asymmetric design solution was to try to integrate the bridge into its surroundings. The concept was to build a bridge as transparent as possible, hence, a suspension bridge design was selected.

Within this span-range, a cable-stayed bridge might also have been a good solution. Nevertheless, to achieve an elegant design it was necessary to use two planes of cables to create a slender deck. These two planes of cables however, wouldn't have appeared so elegant when seen from certain perspectives. A suspension bridge design was finally selected.

An urban construction, the structure has been designed in detail and to human scale. An attraction in the form of a small viewing area at the top of the pylon and accessed by an internal staircase was constructed. Additionally, an observation platform under the bridge deck provides unparalleled views of the Elche land and cityscape.

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Structural Concept

The solution adopted was an asymmetrical suspension bridge with a span of 164.50 m. The deck has a total width of 23 m: four lanes 3.5 m each, a central area for the safety barriers, two water pipe lines 2 m wide, and two lateral sidewalks 3 m wide. The deck is suspended by two sets of cables placed in two inclined planes. These cables have their anchorages in two counterweights. One of the anchor blocks is located below the roundabout. This cable layout allows the usage of a unique pylon, located in the axis of the bridge.

The installation cost takes up the bulk of the total cost of cable construction in major suspension bridges. For medium and small bridges, the use of installation machinery is not economically feasible. For short span range, the use of complete prefabricated cables, including head anchorages, is the most economical solution. The use of a set of prefabricated cables instead of a unique cable, also gives the possibility to replace them in the future. In fact, traditionally small cable suspension bridges were erected with this technique.

Fig. 2. Aerial view.

Each main cable of the Elche Bridge is composed of 8 full lock coil cables 125 mm in diameter, with a maximum axial load in service condition of 63 MN. The hangers are also full lock cables 60 mm in diameter; with a maximum axial load of 1023 kN under service loads. The deck has a total width of 23 m and a maximum depth of 0.90 m in the axis of the bridge and 0.60 m in the lateral edges. The deck is composite, the steel part is a multibox structure with 9 longitudinal webs, and transversal webs each 3m. Over all these webs, upper flanges were used.

On top of the steel deck, a connected concrete 0.20-m deep slab has been placed. The deck has been fixed longitudinally to the counterweight located opposite to the pylon. At both ends, the deck has been

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fixed vertically in two directions and transversally. In spite of using a set of cables, a high level of transparency has resulted.

The 44.50-m-tall pylon, has two parallel concrete walls of variable width and thickness, braced with horizontal concrete beams. Inside the pylon, stairs lead to the viewing area located on the top of the pylon. The pylon has a maximum axial force of 174 MN and a longitudinal bending moment of 306 MNm in ultimate limit state. The counterweights are massive concrete elements filled with controlled density soil. The pylon layout and the shape of the cables, with the special clamps gives the bridge a singular appearance.

Construction Method

The bridge was constructed in the following phases:

- construction of counterweights, foundations, and concrete pylon
- erection of main cables.

Fig. 3. The slender deck creates a pleasant lateral elevation.

The cables were placed one by one with the help of auxiliary cables. A small movable frame located at the top of the pylon was used to place each cable in the saddle. After completion of the main cable, steel frames with 8 clamps for each hanger were installed by means of a special device able to roll over the main cables.

Erection of the Deck

The steel part of the deck was erected in 12 m-long segments. After the erection of the whole steel deck, the continuity welds were carried out. The concrete deck slab was placed in one operation to avoid the cracking in the concrete due to a premature hardening.

Tension of the Main Cables

During the construction process, the dead load of the structure acted gradually. That is why it was necessary to increase the tensile force in the

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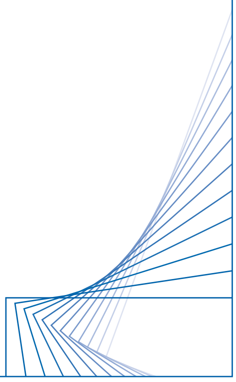

back part of the main cables by stressing to balance the horizontal forces in the top of the pylon. To allow the increase of the main cables in the backside, they were connected to prestressed tendons located inside the back counterweight. The bridge was finally completed with the installation of the traffic railings, wearing surfaces and illumination lights.

Conclusions

The Vinalopó bridge is basically an urban construction to fulfil the traffic requirements and at the same time designed to human scale. The suspension bridge is a transparent and elegant solution which was easily integrated into its surroundings.

For the span of the Elche Bridge, the use of a set of prefabricated cables was the most economical alternative. This solution gives also the possibility to replace the cables in the future.

The Vinalopó bridge is now a new landmark for the city of Elche.

SEI Data Block
Owner:
Generalitat Valenciana
Structural Design:
H. Corres, M. Schlaich, J. Romo
FHECOR Ingenieros Consultores, S.A.
Contractor:
F.C.C. , F.C.C. Construcción, S.A.

Concrete :	0,20 m^3/m^2
Steel in cables:	109 kg/m^2
Steel in deck:	220 kg/m^2
Total cost (USD millions):	10
Service date:	July 2000