# Bridge over river Guadalquivir, SE-40 highway

Seville, Spain / 2018-2023

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| Structural type | Preliminary Design |
| Owner | Ministerio de Transportes, Movilidad y Agenda Urbana |
| Client | AYESA |
| Scope | preliminary project |

Here is the English translation without formatting:

CONTEXT
A bridge is always the most economical solution, with the lowest maintenance burden and the least risk in terms of cost, schedule, and construction uncertainties, for crossing a large river.
The basic constraints can be summarized as follows: navigation clearance for large vessels; limited longitudinal slopes to ensure the functionality of the bridge; and environmental and landscape constraints.

GENERAL CONCEPT
The proposed solution for the main spans of the crossing consists of a through-truss structure located below the deck at the pier zones and above the deck at mid-span. In this way, maximum clearance is achieved in the central area without being limited by the superstructure.
From a landscape perspective, the through-truss solution offers a visual balance, as it creates a very clean structural profile with no large elements either above or below the deck level. One of the major advantages of this solution is that it allows for a reduced structural depth below the deck (3.00 m) at mid-span, which shortens the length of access ramps compared to other solutions where part of the structure lies below the deck.

DESIGN
The structure consists of two 1165-meter-long access viaducts and a main bridge of 612 meters, comprising a central span of 312 meters and two side spans of 150 meters. The access viaducts are made up of two parallel structures, as the carriageways are slightly separated. They feature typical spans of 80 meters in areas with tall piers and 50 meters in areas with medium and short piers. Each deck is 20.50 meters wide and can accommodate an expanded carriageway with four 3.50-meter-wide lanes and inner and outer shoulders of 1.00 meter each, in addition to safety barriers and a 3.00-meter-wide outer sidewalk that could be used by pedestrians, cyclists, and for maintenance purposes.
Initially, the access viaducts have been designed with a composite box girder solution for its lighter weight and the resulting savings in piers and foundations.
The main bridge is designed as a steel through-truss, with the depth located above or below the deck depending on the area, in accordance with structural logic. The truss is placed in the central space to more effectively and efficiently resolve the river crossing.
The trusses consist of a main chord with variable depth and width, with sufficient dimensions to allow for proper inspection. The deck is a closed steel box girder on which a 0.25-meter-thick slab is placed.
The truss diagonals are designed with a rectangular section. The minimum dimension is placed in the elevation view, where the risk of instability is lower due to the coexistence of compression and tension elements, while the transverse dimension is larger to control out-of-plane instability.
Torsional effects are addressed thanks to the closed-section design and the presence of a double truss in the area most subjected to torsion, near the piers.

EPITOME
The proposed structure provides the required maritime clearance. The bridge is a robust solution both structurally and economically. The proposed alternative contributes to the humanization of the landscape through a bold yet formally restrained public work. The project adheres to the Vitruvian principles of *utilitas*, *firmitas*, and *venustas* attributed to public construction. In short, the bridge proposed here is a reliable, fast, economical, and safe solution that provides an effective engineering response for crossing the Guadalquivir River.


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