Design Project

Alamillo Bridge

designed by
Santiago Calatrava

ARCH 631 Architectural Structures III
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Santiago Calatrava merges the boundaries between engineering and architecture, art and function. He has gained an international reputation for integrating technology and aesthetics, producing dynamic structural forms that challenge traditional practice in both architecture and engineering.
Conceptual Idea

Calatrava is inspired by natural forms in movement — waves undulating, trees bending to the wind, flower petals opening. Especially, he focuses on the human body.

“One draws the human body to understand the movement, the gesture. The space, the landscape, the human landscape, and topology are important for me. These will inspire or bring the essence to a project. So, for myself I venerate the human body.”
The Rules of the Bridge Design

1> Asymmetric Cable-Stayed Bridge

Inclined pylon

→ It makes a counter-force and enhances the asymmetry

→ International geometric arrangement of the return anchorage cables
Alamillo Bridge

**Structural Type:** cable-stayed bridge
asymmetric, inclined pylon, no backstays

**Function:** road bridge

**Location:** Sevilla, Spain

Crosses: Guadalquivir River
Built: 1992

**Part of Expo 1992**

Persons involved: Santiago Calatrava Valls

**Technical Data**


**Dimensions**

Main span-250 m
Pylon height-162 m

This is only cable-supported bridge that is not back-anchored.

This bridge is balanced solely through added weights.
When Spain chose to host Expo '92 on a large but deserted island in the Guadalquivir River in Seville, building new bridges to the island became a big part of the Expo preparations. Four new bridges were built, of which Calatrava designed two.

The Alamillo bridge is on by far the largest scale. It is a road bridge at the north end of La Cartuja island on which the Expo was held, with a 142m high pylon that has become a landmark visible from Seville's old town.

Calatrava's original design was for a symmetrical pair of bridges either side of La Cartuja island, 1.5 km apart along the same main road. In fact only one of the two was built; alone, the Alamillo bridge's striking feature is its forcefully asymmetric design. Its single pylon inclines away from the river, and supports the 200m span with thirteen pairs of cables. The weight of the concrete and steel pylon provides a counterbalance for the bridge deck.

The single plane of cables support a beam down the middle of the road, maintaining the bridge's image of a harp. The roadway itself is cantilevered out from the beam.
ALAMILLO Bridge (Puente del Alamillo)

“The calculation of stresses can only serve to check and to correct the sizes of structural members as conceived and proposed by the intuition of the designer. The work itself is never born from calculation.”

Eduardo Torraja
Philosophy of Structures
The Alamillo Bridge Completed in just thirty-one months for the 1992 World’s Fair in Seville, Spain, was instantly recognized as a landmark, joining the list of numerous memorable historic structures in this remarkable city.

**Design Concept**

In the case if the Alamillo Bridge, the images – a Harp, a ship’s mast, a swan might come to mind. Deeper reflection, however, on the structural *raison d’être* of the bridge — carrying horizontal weight — requires a more robust metaphor.

The simple image of the human body bearing a weight on its back recasts our perception of the bridge by the strong relationship between the cables and the horizontal deck.
Calatrava tries to express the kinetic movement of the static members in a structure.

In the Alamillo Bridge, he shows his intention strongly with the concrete-filled steel pylon inclined at 58 degrees. He had the pylon that is divided with several pieces and accumulated for the structural solution and allowed the weight of the pylon to counterbalance the deck.

He created a new type of cable-stayed bridge. Spanning 200 meters, thirteen pairs of stay cables support a hexagonal, steel bowbeam over the Meandro San Jeronimo River.
Structural Analysis of Alamillo Bridge
ACCUMULATION OF FORCES

BASIC STRUCTURE VS KINETIC STRUCTURE

\[ (M_1 + M_2 + M_3) \]
\[ + \]
\[ (M_1' + M_2' + M_3') \]
\[ = 0 \]

A LONG SPAN HORIZONTAL MEMBER ACTING LIKE A BEAM NEVER BEHERES THE FLOW OF A RIVER

THANK YOU!