



## Butterfly Wings. An innovative bowstring concept to span the Ebro River in Logroño (Spain)

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## Summary

Las Norias footbridge design is the result of a competition (25 proposals) to solve the connection of two existing neighbourhoods of the city of Logroño separated by the Ebro River. The bridge is an innovative type of bowstring arch that, looking for the minimum environmental impact, clears the river with a single 102-m span. Its deck width varies between 5,0 m and 10,0 m, looking for a suitable adaptation to the landings, and its arches rise 11,0 m over the deck, which is suspended from them by spiral-strand cables. These cables are contained in cylindrical surfaces due to the lean of the arches and the curved edges of the deck. The deck, with an innovative design, is made up of a post-tensioned timber slab, lying over a double-Y-shaped steel spine with variable depth. The cross section of the arches is also variable, with maximum depth and minimum width at their springings and the inverse proportions at the centre, in order to avoid out-of-plane buckling.

**Keywords:** Long-span footbridge, bowstring arch; steel; stress-laminated wood deck; out-of-plane buckling; butterfly wings; aesthetics; structural architecture.

## 1. Introduction

The city of Logroño, with its about 160.000 inhabitants, is the small capital of La Rioja region, located in the northern part of Spain, and well known because of its important production of high quality red wine. The city has historically grown along the south bank of the Ebro River, the first of Spain in terms of water flow. The development of new neighbourhoods on the left bank of the river demands the design and execution of new crossing areas.

To that effect, the Logroño City Council organised a competition to solve the pedestrian linking between the neighbourhoods of El Cubo on the right bank and El Campillo on the left bank (next to the popular Las Norias sports facilities). They are separated by the Ebro River in an area of the city with low permeability, where the distance between the nearest crossings is 1200 m. This fact makes evident the need of a new bridge to give cohesion to the urban fabric. The location defined in the tender document situated the new footbridge approximately half the distance between the two closest existing crossings (Fig. 1). The bridge is located in a green but also urban area, as links, next to the city centre, a park (right bank) with a fluvial promenade with dense vegetation (left bank). There is a difference of height between the two landing areas of about 2 m and the width of the river in the section to be spanned is about 100 m.

The design of Arenas & Asociados in Joint Venture with DH Ingeniería was selected from a field of 25 proposals.

## 2. Restraints and basis of design

The designed solution is the result of a series of imposed restraints, basically geometrical and hydraulic in this case, and of some bases it were decided to adopt after reflecting on the spatial, social and cultural context that surrounds the project.