

Timber bridges in Spain

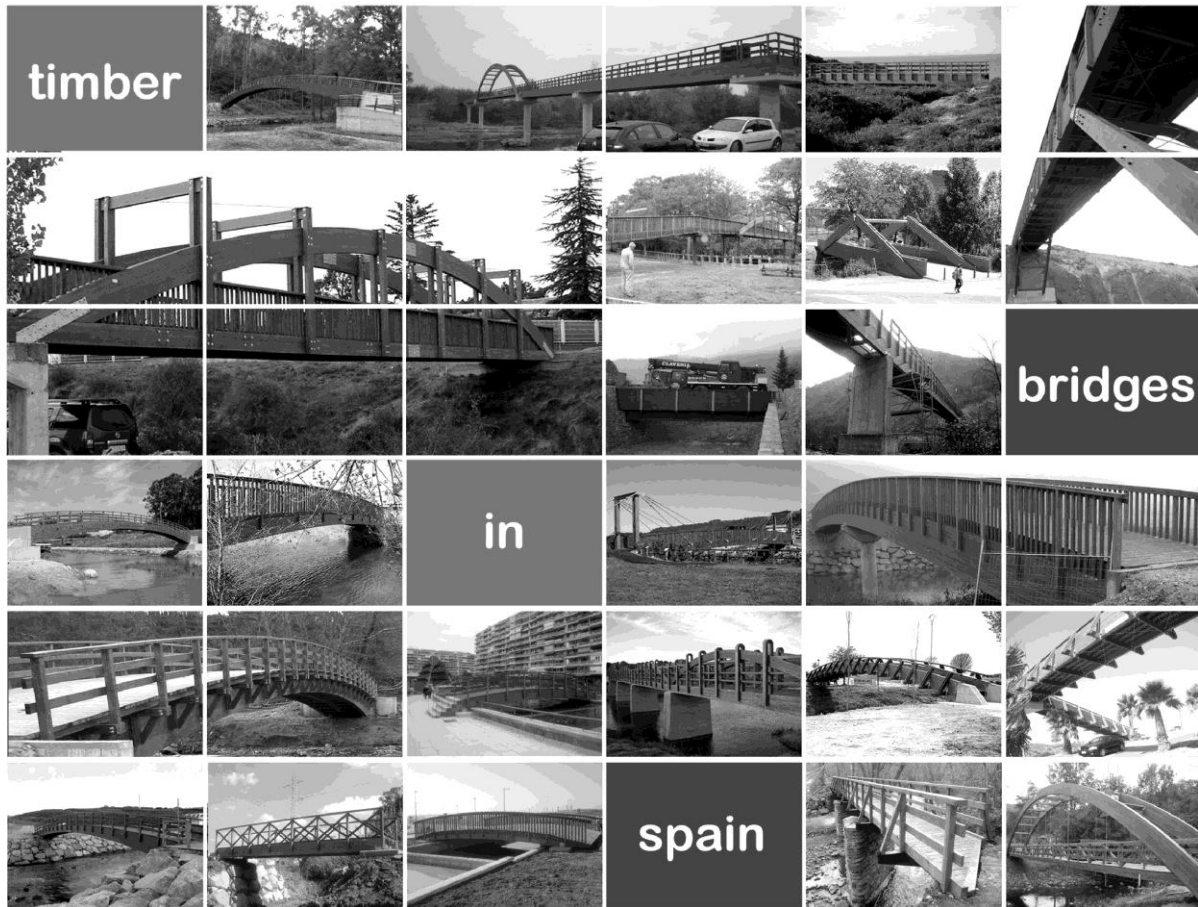
Holzbrücken in Spanien

Des ponts en bois en Espagne

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The use of wood in construction in Spain has been increasing slowly in recent years although, for right understanding, it has to be considered as well our historical delay on this matter compared with our neighbors at the North and Central Europe.

Paradoxically, timber in Spain was in fact a material traditionally used in construction for centuries but, during twentieth century, timber had virtually disappeared being replaced by concrete and steel as preferred structural element.

One of the main obstacles is the idea, generally accepted, that consider wood as a material with very poor durability. This "concern" was also associated with the idea of complex and continuous maintenance works having a high cost impact.

In the particular case of bridges and walkways, which are structures fully exposed to the weather, it was necessary a long time before the use of timber could be generalized.

In fact, the vast majority of timber bridges in Spain have been placed less than 10 years ago.

Having described the scenario, I will make an overview of the timber bridges placed in Spain, almost exclusively pedestrian, classifying its structural types from lower to higher complexity.

1. Simple pedestrian bridges

Starting with the simplest bridges, suitable for spans up to 20 or 30 meters, we found this common walkway.

The structural scheme is very simple: Two main beams, braced longitudinally with a system of brace beams and cross of Saint Andrew.

The board transmits loads directly to the beams, which work by following a simple flexural isostatic model.

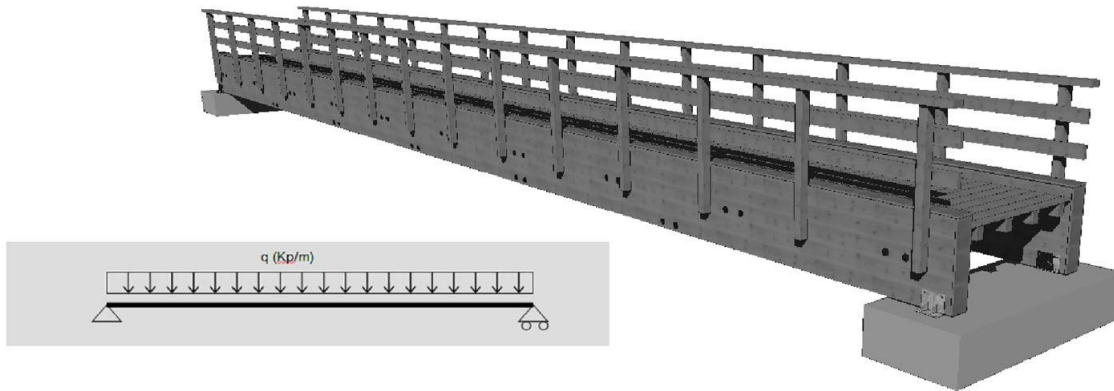


Figure 1: Scheme of a simple pedestrian bridge

Usually, the board is placed on top of the beams, thus the bracing system ensures stability by limiting the lateral shift of the main beams, which are working mainly in bending.



Figure 2: A curved simple pedestrian bridge with the deck above the beams

In other cases, in order to reduce the height of the board and use the beams as a hand-rail, the board is placed between the beams at the bottom, in this case other systems are used primarily to stabilize the compressed part of the beams



Figure 3: Superior stabilization by steel fittings

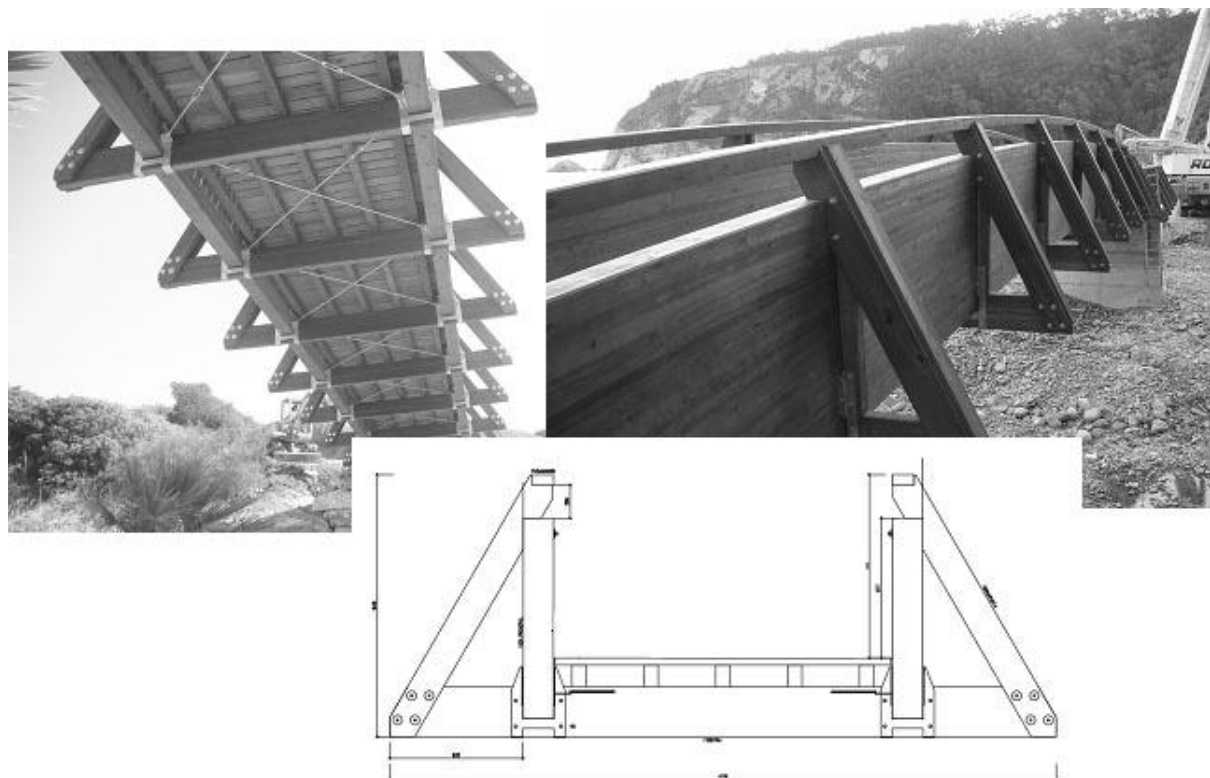


Figure 4: Superior stabilization by side braces

2. Arch bridges

From 20-30 metres span, arch bridges, two or three hinged, are an optimal structural system.



Figure 5: A 45 meters three hinged arch bridge

In this case, the main elements are two arch of timber. The bracing system is the same: braces and St. Andrew's crosses, which should ensure stability against buckling



Figure 6: Bracing system

3. Bow-string bridges

For longer spans, the bow-string bridges are very common in Spain. The biggest drawback of arch bridges is that the maximum slope may limit their accessibility, especially for bridges with lengths up to 30 or 40 meters. However, in the bow-string bridge, the board can be completely flat:



Figure 7: 55 meters span bowstring bridge

In these bridges, the structure of the board is suspended from a pair of archs. The bracing of the archs can be done either through a system of braces or by the relative inclination of pairs of arch rigidly attached with metal elements.



Figure 8: 50 meters bowstring bridge with the archs indlined

Despite having an excellent structural performance, and a relatively low volume of timber, the main drawback of this type of bridges is the difficulty of transport and assembly

4. Truss bridges and tied-arch bridges



Figure 9: Example of a small truss bridge

This type is less common than others before mentioned. Some of the truss bridges built in Spain use to be because transportation needs. They are designed as prefabricated structures with dimensions being easily able to be transported. Final placement is done since assembly can be carried out also quite easily.



Figure 10: Transportation of a tied-arch bridge

Another important advantage of this type of bridges, even at large spans, is because they can greatly simplify the necessary foundations since they transmit only vertical loads.

5. Mixed structural types

This example of a 60 meters length footbridge over a highway combine several of the structural types discussed above.



Figure 11: 60 meters walkway over the A8 motorway

The main truss is designed so that it can be manufactured and transported, so that the assembly can be made in a few hours

Its structure is combined by an arch that extends to the foundations transmitting the loads efficiently.

6. New and future bridges

Currently in production, this footbridge with 100 meters long with a maximum span of 50 meters, has the main beams working as cables with great tension. Its installation is scheduled for the end of this year.

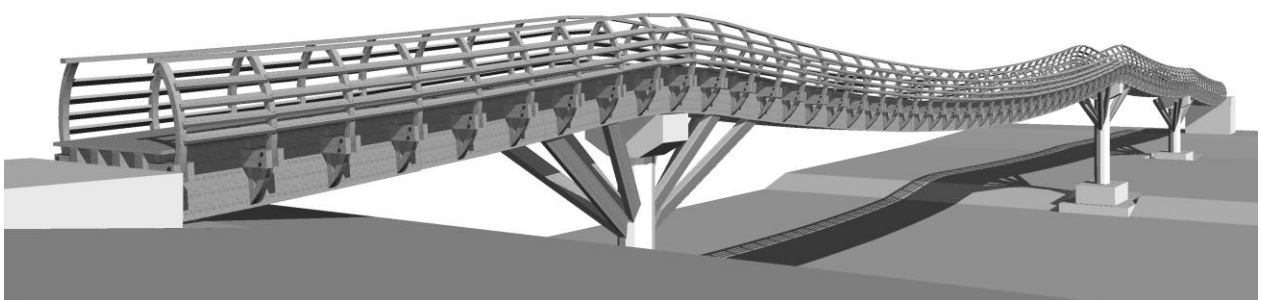


Figure 12: Future bridge over Duero River

In all these bridges, I have had the chance to participate in its design, which have been manufactured by the company Media Madera, where I'm working from 12 years ago.

All of them have been built in the last 10 years, so we can say that construction of timber bridges in Spain is still in its infancy.

We hope a rapid growth and a very promising future