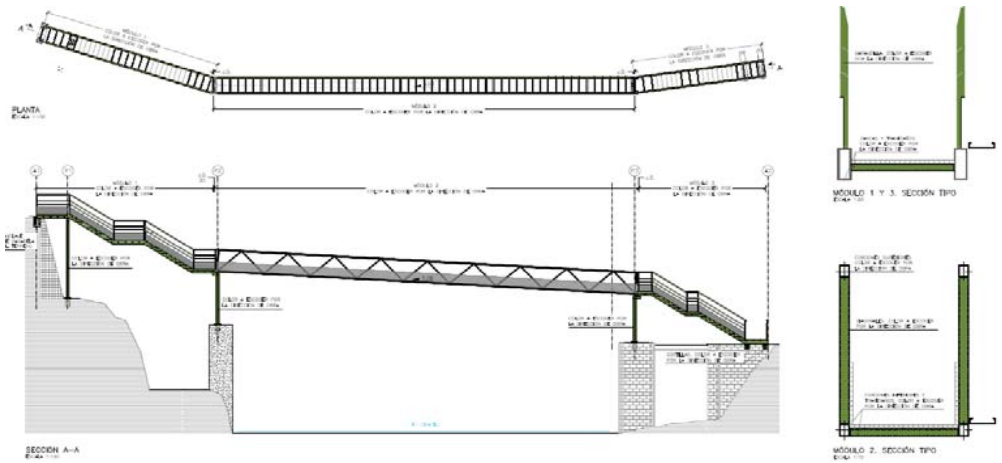
CONSTRUCTION PROJECT AND CONSTRUCTION MANAGEMENT



Villanuevas Footbridge.

Teruel, Spain

CLIENT	**IBERDROLA**
DATE	**2015**
LOCATION	**España**
FIELD OF ACTION	**Construction project and Construction Assistance**

Villanuevas weir / dam, regulates the Mijares River channel in its pass through Teruel; just near the border with the province of Castellon. The sluice gates of the weir are operated from the opposite bank of the one which has got has the pedestrian access. Therefore, due to maintenance and operation reasons as well as to ensure the safety of the operators, Iberdrola, the company responsible for the facilities operation, considered necessary building a footbridge to connect the pedestrian access point with the weir sluice gates.

The steel footbridge designed by INES, has 3 different modules spanning an overall distance of 43 m with a constant width of 1.00 m. The two end modules are solved

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with two stair flights, which structure is based on two 250x100 mm tubular beams connected with crossbars, whereas the central module spans 25.00 m and it is designed as a Warren lattice type, 1.35 m thick.

The footbridge has got 4 supports, three of them made with piers approximately 5.00 m high, using HEB-160 or HEB-180, depending on the support. The fourth support is undertaken with two cantilevers that are anchored to the existing masonry structure. The footbridge has an isostatic configuration.

The main determining factors when designing the footbridge were:

- Height difference between both points to be communicated:

There is a height difference of 8 m between the two points to be connected. For this reason we have introduced two flights of stairs at both ends. With this configuration, the central lattice can be run with a slope of 5.5%. As it has not got public access, the footbridge does not need to meet the handicap requirements established by the current standards.

- Minimal height conditioned by the 50 years return period avenue: The minimum height established by this criterion is 708.47 m, while the spillway is at elevation 700.50 m. This has conditioned the piers height as well as the slopes of the two stairs flights.

- Bearing points- existing structures:

Prior to the footbridge construction, there were three elements that have conditioned the design of the new structure bearing supports. The entrance area features a masonry wall as a land containment that did not provide any bearing guarantee. This leaded to leaving the section at this point as cantilevered, secured with a ground anchor to ensure it does not rise. The first bearing support is placed over rock, shortly after finishing the mentioned masonry wall, coinciding with the end of the first stairs plateau. The second bearing support was designed taking advantage from an existing concrete brick structure, which in its origin was a bottom drain of the weir. Such concrete brick structure is filled with an injection of cement mortar with a fluid grout to ensure its bearing behavior. The third and fourth bearing supports take advantage of an existing masonry structure which strength is sufficient to withstand the new loads without requiring any intervention except the anchoring.

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- Construction process:

The weir site hinders the construction process for the following reasons. First, the access road limits the length of the pieces to be transported as well as the crane that can enter the site to mount in place the different footbridge sections. Furthermore, the working area at site has limited dimensions, which hinders the working conditions. Finally, the height difference between the different site points and the distance between them, make necessary to use a crane with an arm of more than 50 m length. As a result of the study conducted, the sections were transported up to 12.50 m long, adapting certain points of the access road. This allowed building the central section by welding two pieces on site and avoiding the drawbacks of the introduction of auxiliary structures on the river bed.

The main features of this project are:

- Structure slenderness:

Not being a footbridge for public use, allowed performing it 1.00 m wide. This together with the defined design has resulted in a very slender structure.

- Easy installation:

The assembly was very simple because of being an isostatic structure composed by very light sections, which each could be mounted as a single structure. They just required the preparation and positioning of the piers and their anchors.

Although other structural type would have been more spectacular, the chosen design met the constraints of budget, assembly and functionality. It is recalled that the footbridge use is reduced to maintenance tasks related with a hydroelectric facility as well as it is located in the countryside.

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