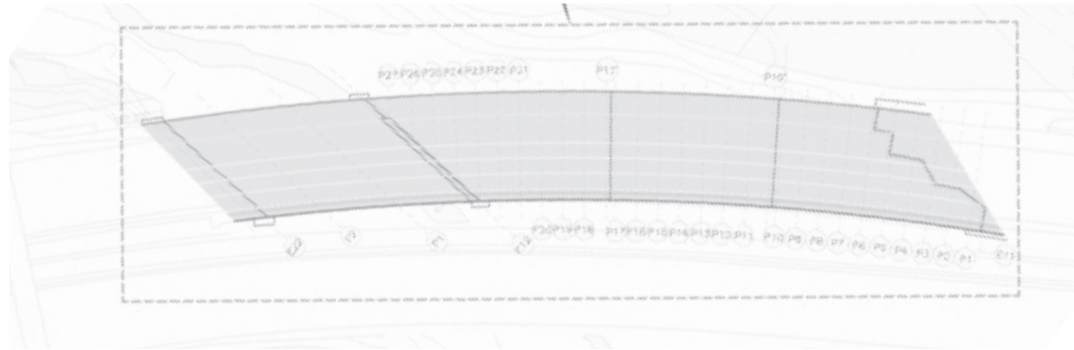


A-6 Motorway Bridge over Manzanares River

Madrid



CLIENT	Madrid City Council
PROJECT DATE	2014
LOCATION	Madrid, Spain
FIELD OF ACTION	Construction project and technical assistance during construction

DESCRIPTION OF THE STRUCTURE

The bridge over Manzanares River, located in Madrid, is divided into two different parts: the first one is an access structure (over the flood areas) and the second one, a three-span bridge that crosses over the riverbed.

This bridge was built in two stages, one in 1934, originally designed by the civil engineer Carlos Fernández Casado, and a widening stage in 1982, reaching the structure until 160 m length. The total width of the deck is 25.30 m, 16.80 m corresponding to the preserved original work.

The first part of the structure consists of a 30 cm depth continuous reinforced concrete slab. The piers are distributed in 29 axes, each 5x5 m (138 totally). The deck is divided into three sections by two transverse expansion-joints. Each column consists of a



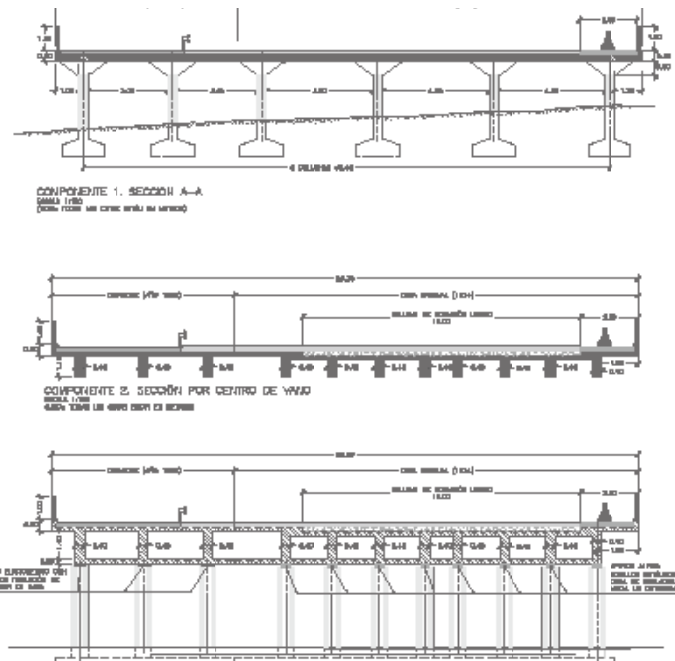
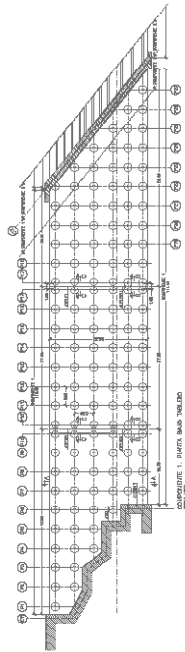
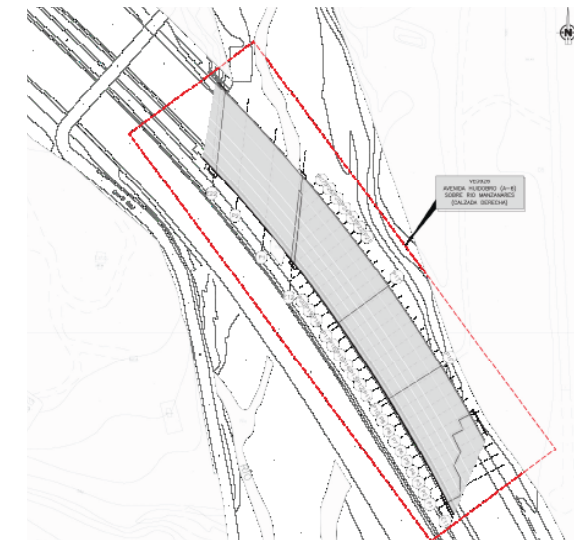
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40 cm diameter shaft and a truncated cone capital in which the diameter changes from 0.40 to 2.00 m in 0.60 m height. Its foundation is made up by four reinforced concrete piles with 0.30x9.00 m square section and pile-caps of 2x2 m.

The section over the river has three spans of 15, 20 and 15 m. The section near the intermediate bearings is a ribbed reinforced concrete slab. The original bridge is made of eight ribs of variable depth between 1.00 m and 1.60 m. Transversally, the 40 cm depth beams are separated about 2 m.

The damages and the deterioration processes detected are following listed by construction elements.

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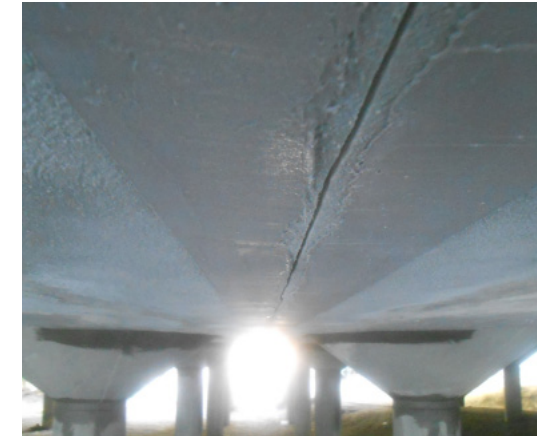
Madrid

On the deck: there were losses of the concrete cover due to corrosion, generating flakes with exposed rebar in almost all the spans; moisture stains and leaks; efflorescence and loss of the slab protective treatment, due to bad waterproofing and the climatic action.

In the piers: there were also flakes with exposed rebar in the capitals due to corrosion (almost all the piers of the original bridge); as well as several cracks in shafts and capitals.

In the abutments and wing-walls: moisture stains, leaks and loss of protective treatment due to bad waterproofing of the expansion-joint corresponding to the front bearing wall of the enlargement as well to the retaining wall of the original work; cracks on the masonry lining of the front bearing wall of the abutment 1 of the original work, on the left side of the abutment 2 on the front bearing wall and the front wall of the abutment 2 of the widening; moisture stains and efflorescence because of a bad waterproofing of the expansion-joint.

In the handrail: corrosion in some steel elements and also broken due to impacts.



Before repair actions



After repair actions

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REPAIR ACTIONS

The damaged areas of the structure were rehabilitated with lime mortar. Due to the general loss of the concrete cover, the advanced progress of the carbonation process and the high porosity of the concrete, the walls had to be waterproofed and protected by applying flexible two-component coating with a cementitious base of a minimum dry thickness of 2mm. That coating works as an anticarbonation barrier and is resistant to the chlorides penetration.

The project also includes the replacement of all the expansion-joints by a water collection Hypalon band. Also a water drip element was done placing an angular galvanized steel profile on both sides of the deck.

Finally, all the damaged rail sections were repaired and repainted.



Before repair actions



After repair actions

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