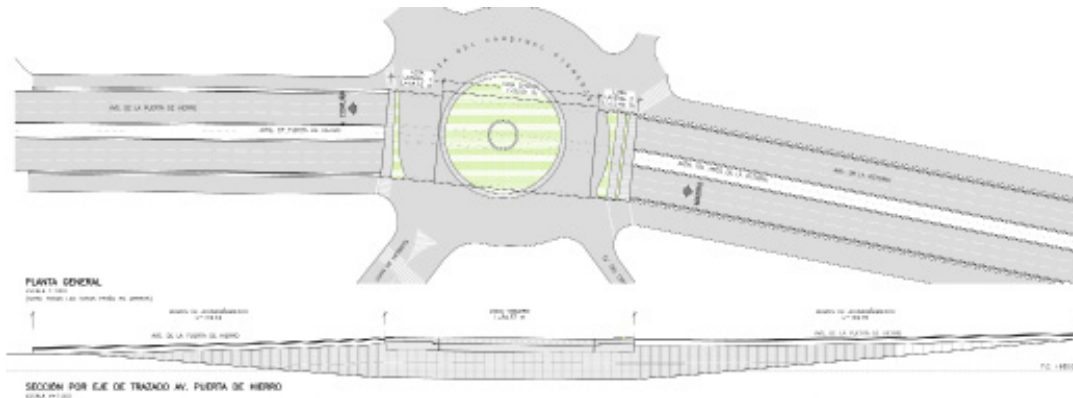


Restoration of Cardenal Cisneros Square, A-6 Motorway Madrid



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

DESCRIPTION OF THE STRUCTURE

This structure allows the underpass of the A-6 Motorway under Cardenal Cisneros Square, located in University City of Madrid. It consists on the one hand of an original slab built in 1975, with 25.00 m span.

This slab was enlarged in 1995 both longitudinally (4.40 m to the abutment No. 1, with the same depth of 1.10 m) and transversally, with a slab of 13.00 m width (right enlargement, towards Madrid) and 18.00 m width (left enlargement, to A Coruna), reducing the depth of the slab to 0.80 m. There are four expansion-joints, in the abutments two transverse and two longitudinal between the original slab and each enlargement.

The original walls of the underpass are made with diaphragm walls, where rest the concrete slab. The new retaining walls, with 0.8 and 0.6 m thick (required on the west

side to extend the structure) are free at the crown and in the underpass area the slab rests upon them by neoprene bearings. The total length of the diaphragm walls, are lined by brickmasonry (242.50 m). These walls of variable height between 0.20 and 5.20 m have no foundation and are crowned with prefabricated cornices. There are IPN-160 horizontal profiles, only when the heights are higher than 2.85 m, and they are not anchored to the slurry wall.

The damages of this structure consisted mainly of a significant deformation of the slabs, and the consequent appearance of fissures, presence of moisture, patinas and efflorescence. On the masonry linings of the walls a horizontal shift of its coronation (overturning) have been noticed, besides the break of the brick bonding.

The deck deformation, both the original slab and the lateral enlargements (up to the 25 cm), was combined with the presence of efflorescence and patinas on its underside, due to the filtrations through longitudinal expansion-joints and the lack of a water drip element, as well as the leaks through the cracks of the slab.

Other damages were also founded in other elements: the deformation of the hand-rails, the breaking and the alteration of the expansion-joints on the platform of the square, etc.



Before the works



Before the works

Restoration of Cardenal Cisneros Square, A-6 Motorway

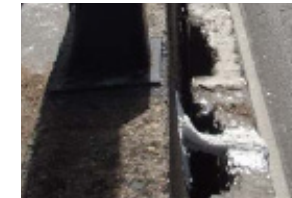


After the works



After the works

Main damage in the structural elements





Before and after the works: traffic barrier



Restoration of Cardenal Cisneros Square, A-6 Motorway Madrid

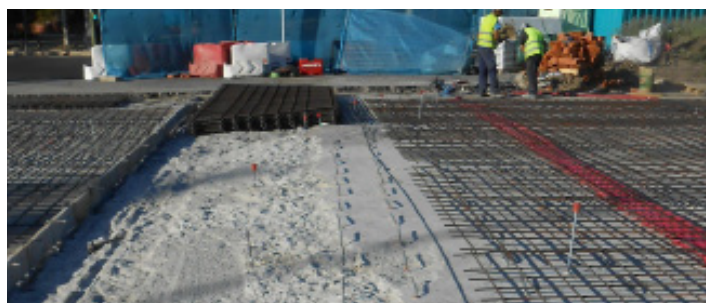
As a result of the detected damages, a materials study and structural assessment were carried out, in order to determine the required actions to restore an adequate structural and functional safety level of the work. In addition, between the paved road and the sidewalk, a steel parapet for the pedestrian protection was built.

REPAIR ACTIONS

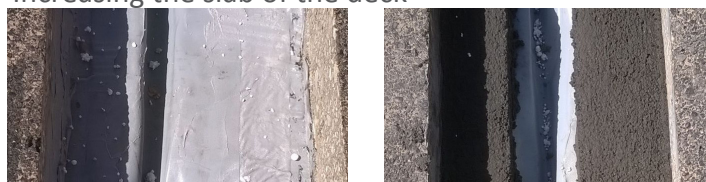
The deck depth was increased from the upper face of the slab, recovering through concrete part of the current overthickness of the existing pavement with reinforced concrete properly anchored to the current one with embedded reinforcing bars into epoxy resin.

All the facing walls were cleaned by water-jetting, the fissures were sealed on both sides of the deck and a water drip element was done in its underside. In addition, it was carried out the replacement of the expansion-joints with elastic band.

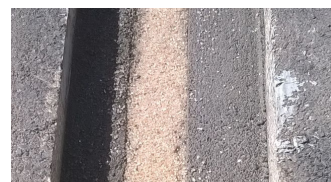
The linings of the masonry walls were fixed to the diaphragm walls, in order to ensure its stability, steel plates with omega section were anchored to the piles. Also the linings have been crowned by an angular profile anchored to the concrete barriers.

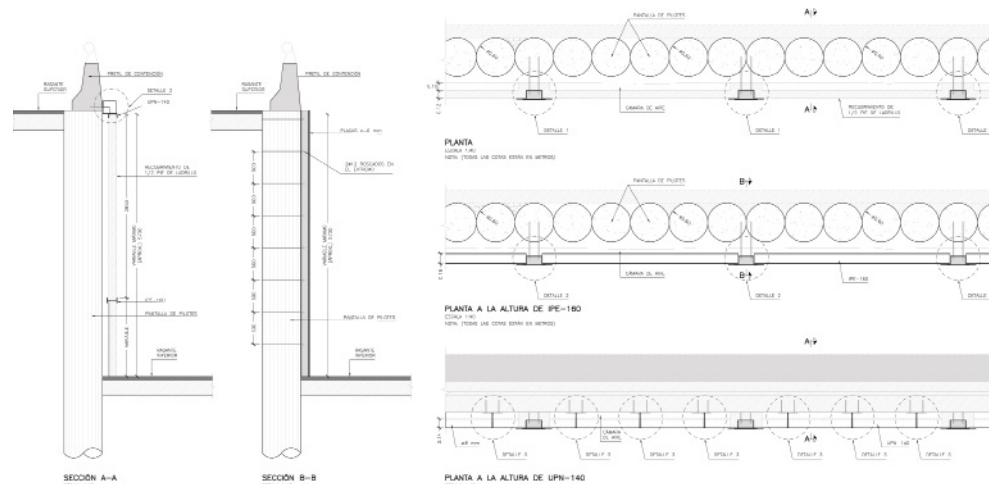


Increasing the slab of the deck



Replacing the expansion joints





Before the works



After i the works



Before the works



After the works

Restoration of Cardenal Cisneros Square, A-6 Motorway Madrid



Process of the different carried out works