

New system of repair and reinforcement of “violin joists”, with stainless steel

According to a study carried out by the WCO (World Corrosion Organization), worldwide expenditure on repairs to elements affected by corrosion amounts to approximately 3.2% of the world annual GDP, and also according to another CONRENET report, approximately 40% of the repairs of elements affected by reinforcement corrosion fail within the first 10 years. The architecture studio Salmeron & Landmann has carried out the rehabilitation of a building affected by corrosion, located on the beachfront.

Specifically, they are ceramic joists slabs in a basement built in the 50s, with a type of joist known as “VIGUETA VIOLÍN”.

Basement configuration

The data collection allowed us to observe the structural configuration of the basement. The general structure of the building is solved by pillars and beams hanging from reinforced concrete. Although in the basement, besides the presence of a central row of pillars and beams, appear around the perimeter masonry walls, on the beams and walls they support the ceramic joists that form the resistant base of the slab package. (See plant TA02 A) After the visits, we could observe the presence of damages type fissures and cracks, characteristic of the reinforcement oxidation process.

In addition to the original joists (see detail TD02 B), we found 2 types of repairs made years ago, and both types accumulated most of the fissures and cracks observed.

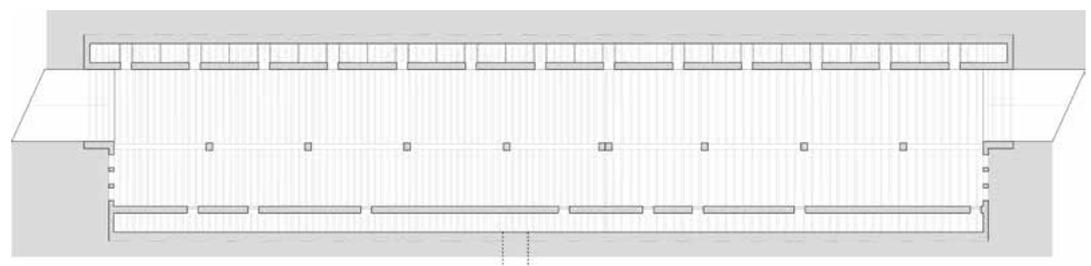
In the SAMPLING COLLECTION section, we will comment on what was found in these repairs. As we can observe in the constructive detail, this type of joist, called “Violin”, is very unique. Due to the geometry of the ceramic piece in which the joist reinforcement is housed, it is unfeasible physically to clean the steel bars around their perimeter, disabling traditional repair actions.

To this uniqueness is added the lack of free height in the basement, which forced us to solve the problem without lowering the free height of the joists.

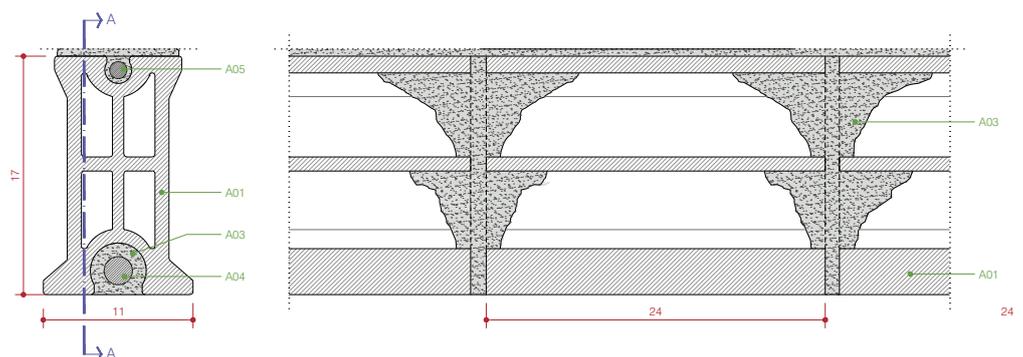


Garage subject to repair

Building subject to repair



TA02 A BASEMENT FLOOR



TD02 B TYPOLOGY of original joist

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BUILDING :

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Sampling collection

In order to understand more clearly the structural system of the basement and the configuration of the repaired joists, a series of testing were carried out in the different types of action found. In the first type of repair, the cracks are located in the centre of the lower face of the beam, indicating the oxidation of the original reinforcement. After the sampling collection, we could see the attempt to clean and protect the carbon steel round bar of origin, observing the blue colour protection in the photos. In the second type of repair, on the underside of the joist, two cracks appear in parallel, indicating the presence of 2 bars added as a supplement to the original joist. In both cases, following the sequence of photos, the constructive detail referring to the type of repair is attached.

Sampling collection

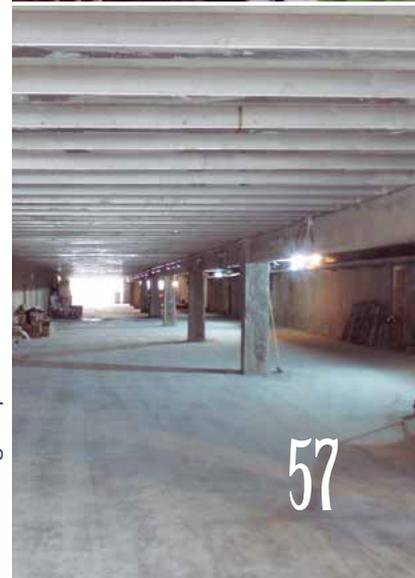


Proposed action

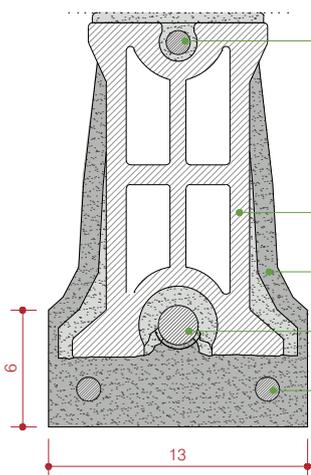
For this situation a repair and reinforcement system is developed with a duplex type stainless steel, economically viable due to its low nickel content, and capable of meeting the new current requirements of mechanical strength (without

loss of free height), fire resistance, and resistance to corrosion by chlorides, with a quality aesthetic finish. Below it is shown the beginning of the work and the constructive details of the different actions to be executed. The execution of the new joists involved having perfectly controlled the redefinition of the reinforcement system on site. Immediately afterwards, the height and the level at which the reinforcement had to be located to leave the necessary space for the pouring of the concrete, especially designed for this intervention, were considered.

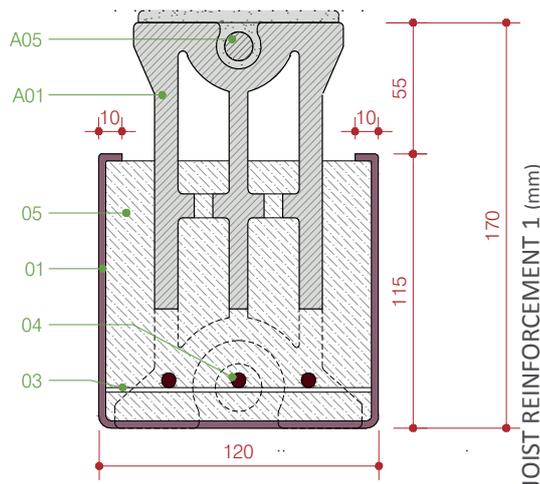
The use of the struts was key to allow the entry into loading of the reinforcement element in addition to allowing its correct positioning during the pour. After waiting for the corresponding setting time, the struts were removed and the whole slab rehabilitation was achieved without lowering the free height of the basement.



FORMER REPAIR



PROPOSED REPAIR



Garage repaired