

COLLABORATIONS

FCC Construcción **collaborations**
in certification of **I+D+i** actions





The National R+D Department manages the certification process of innovative actions of the different work centres, once completed. During the certification process, the voluntary collaboration of the different work centres involved in each project is needed to make it possible.

This entire certification process entails important advantages for the company:

- Be able to show R+D+i projects in bidding processes and other contracts covering these types of activities, providing additional points in numerous public tenders.
- Obtain tax deductions for R+D+i in corporate tax.
- Increase the areas of activity in R+D+i covered by the R+D+i Management System certificates in accordance with the UNE 166002:2021 AENOR

In this previous year (2022), the following certifications have been completed:

A-33 Highway. Section: Junction C-3223 to Yecla-Junction N-344: “execution of a continuous two-layer concrete pavement”

REMODELING OF SANTIAGO BERNABEU STADIUM: “Controlled Support Devices for large Civil Structures”

REMODELING OF SANTIAGO BERNABEU STADIUM: “Development of a structural fixing device for the cladding of a three-Dimensional Facade”

2V74 PROJECT OF THE SALAMANCA HOSPITAL: “Development of a dynamic confinement system with bubble for removal of bituminous pavement with asbestos”



R&D+i Management System Certificate

A-33 Highway

Section: Junction C-3223 to Yecla-Junction N-344: “execution of a continuous two-layer concrete pavemen”



The certification bearing the name of **“TECHNOLOGICAL INNOVATION”** has been obtained thanks to the help and collaboration of the Yecla site personnel and the Materials and Pavements Department of the Technical Services of FCC Construction.

The project is based on the execution of the pavement in a section of the highway, whose upper layer consists of 24 cm of continuous reinforced concrete. A continuous reinforced concrete pavement is developed, built in two layers, extended simultaneously in time, although separated in space (about 20-30 meters). A first phase of the project was developed in 2021 and a second phase was completed in 2022.

In 2022, the project activities have been dedicated to the preparation, construction, and control of several test sections in which research has been carried out to achieve the most suitable dosage formula of concrete based on available materials and the specific paving and compaction plant.

Finally, different tests have been carried out in which the quality of the pavement was checked in respect of traffic loads (flexural strength of the concrete) and functionality (texture, roughness and slip resistance).



**Certificate
Yecla**

SANTIAGO BERNABEU

Remodeling of del Santiago Bernabeu

“Controlled Support Devices for large Civil Structures”



The project has been certified as **“TECHNOLOGICAL INNOVATION”** thanks to the help and collaboration of the Bernabéu construction staff and the Special Works Department of the Technical Services.

The project has been applied in the remodelling works of the Santiago Bernabéu. As a result of the detailed design of the structure an increase in its weight of 8,000 kN was detected, mostly in the façades, which reduced its structural safety coefficient. This required to develop innovative solutions to restore the safety coefficients to their initial required values under the Specification.

The philosophy of the project is to relieve the loads on the structure, creating forces that

act against the gravity applying on it. These forces are set by the designer, in number and position, to adjust and increase the safety coefficient of the structures against self-weight loads and use overloads.

Actions to reinforce the structure were rejected as a solution to the project due to their cost and their difficulties, which were considered insurmountable and impossible to implement.

Finally, the FCC structural specialists came up with an elegant, innovative and easy-to-carry solution, which consisted of preserving the entire designed structure and applying lifting forces to the trusses, equivalent in magnitude to the increase in their weight, in order to compensate for these excesses

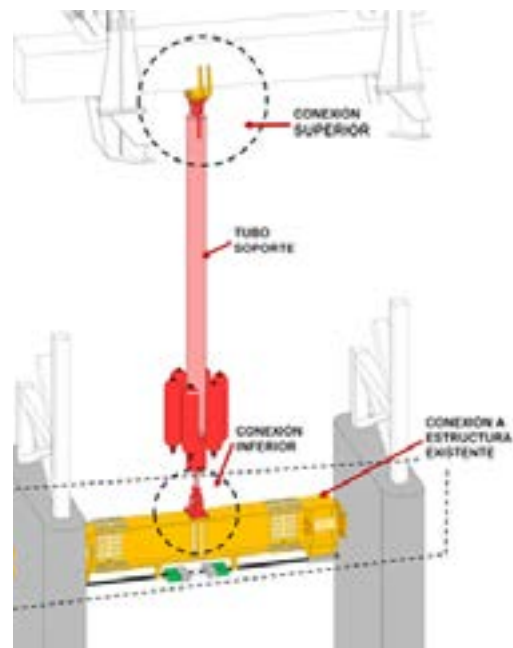
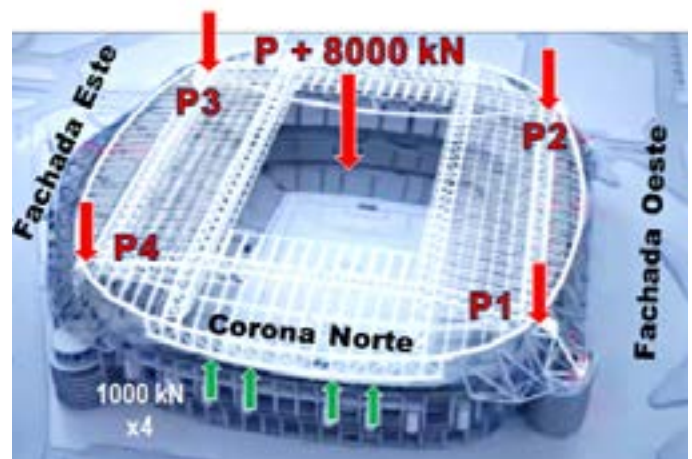
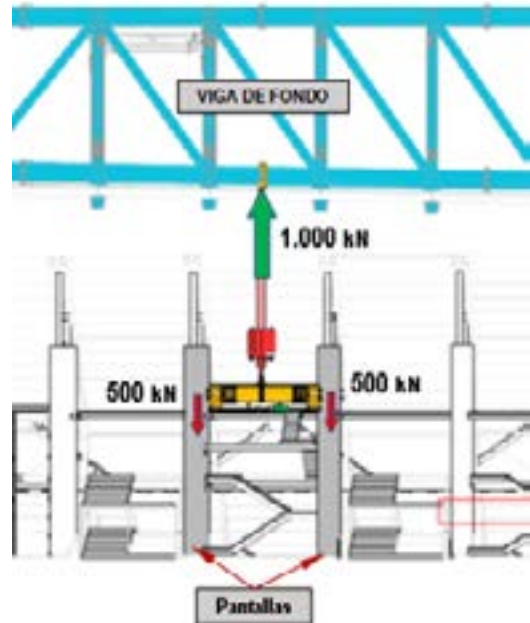
mainly produced by the changes in the North and South facades.

In order to produce these forces a system for their creation had to be chosen, and the execution of a reaction structure was required for their transmission to the ground, which was not, obviously, the same system used as isostatic support of the structure.

A controlled hydraulic system was selected to create the stabilizing forces and the concrete diaphragm walls of the old stadium structure, located on the North and South facades, were used to receive the loads and channel them to the foundation. The use of hydraulic circuits in industry is a practice that is used very frequently nowadays. However, its application in structures and, above all, for the purpose foreseen in this project, was a novelty in Spain and, probably, in the world.

The total number of stabilizing loads was set at 8, placing 4 of them on the concrete diaphragm walls of the old structure, distributed equally on the North and South facades of the stadium and each load was set at 1,000 kN.

During 2022, the design of the hydraulic circuits was carried out and the materials and devices to be used were procured.



**Certificate
Controlled Support**

SANTIAGO BERNABEU

Remodeling of Santiago Bernabeu

“Development of a structural fixing device for the cladding of a three-Dimensional Facade”



It has been certified as “**TECHNOLOGICAL INNOVATION**” thanks to the help and collaboration of the Bernabéu construction staff and the Special Works Department of the Technical Services.

Three-dimensional facades consist of a thin exterior cladding and a support structure that collects the loads received by the cladding and transmits them to the general structure of the building.

The buildings to which this type of facades is normally assigned are usually large, so expansion joints must be provided. Therefore, a specific design is needed for the anchorage of the cladding in the expansion zones that allows its movement, following changes in temperature, without suffering damage,

which is the ultimate goal of the project.

The project undertaken by FCC is developed to define this anchorage system and is carried out in two very specific stages:

- A first stage in which the devices are designed.
- A second stage in which the designs are developed in practice, manufacturing prototypes that will be placed in a chosen demonstrator, which is the Remodelling of the Santiago Bernabéu Stadium.

The first stage was carried out in 2022, the second will take place in 2023.

The design of the fastening is based on

a resistant element which consists of a structural tube of 160 mm in diameter and of variable thickness, normally 10 mm, which is called a stringer. The element of the cladding is fixed to this tube using the frames which are made of aluminum sheets.

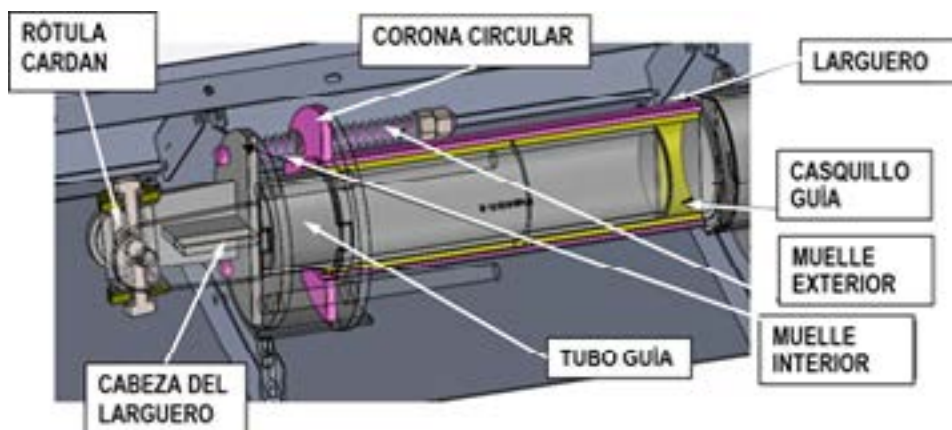
The fastening devices are placed at the ends of the stringer, which are broken down

into a tubular slider system combined with a Cardan ball joint modified with added springs to keep the system in tension.

To check and validate the devices, laboratory tests have been carried out with a prototype in which the two devices have been incorporated at the ends of the stringer.



Certificate Façade



SALAMANCA HOSPITAL

2V74 Project of the Salamanca Hospital

“Development of a dynamic confinement system with bubble for removal of bituminous pavement with asbestos”



It has been certified as “**TECHNOLOGICAL INNOVATION**” thanks to the help and collaboration of the construction staff of the Salamanca Hospital.

The demolition of the old Clinical Hospital of Salamanca was included as part of the works of the Master Plan of the Salamanca Hospital Complex stage III. Prior to demolition, materials containing asbestos were identified, among which PVC pavement binding material, a bituminous product containing chrysolite, was found in an approximate area of 28,000 m².

The problem that arises is that, although the material applied to the pavement is not friable, when it is extracted with mechanical means, milling and shot blasting, it becomes

friable, which requires, according to the regulations, the execution of a dynamic confinement.

The method of confinement in depression (negative pressure) is necessary to preserve the integrity of people who are outside the immediate environment. It is necessary to clean the contaminated air inside through continuous extraction and filtering (24 hours) and the isolation of the confinement envelope to avoid contamination during work.

The proper design of the confinement bubble requires a prior study of the enclosures and their surroundings, delimitation of the areas to be confined and their volume (renewal rate), definition of the necessary clean air

flows, the leak rate and the extraction flow to know the number of necessary extractors. Once designed, the process is as follows:



Removal of all materials that may hinder work and are likely to be contaminated. Execution of barr and formation of barriers and confinement



Removal of material. Contaminant index measure.



Negative pressure and air removal (dynamic confinement/depression). Fume test

