



Cem-FIL® GRC Renovation

Santiago Bernabeu Football Stadium

INTRODUCTION:

The Santiago Bernabeu Stadium, home of the world-renowned Real Madrid Football Club, was enlarged in the 1990's to meet the UEFA requirements on spectator seating.

This was the second refurbishment for the famous stadium which was built in 1950. It was first refurbished using GRC architectural components ahead of the World Cup Championships held in Madrid in 1982. At that time some 20,000m² of GRC components were specified for column cladding, inner and outer detailing to the roof canopy and modular portico units.

FACTS:

- Refurbished twice with GRC
- 20,000m² GRC cladding prior to 1982 World Cup
- 17,000m² GRC cladding used in 1990's to accommodate expansion and change in UEFA regulations

Fig. 1: The Original Stadium, as constructed in 1950

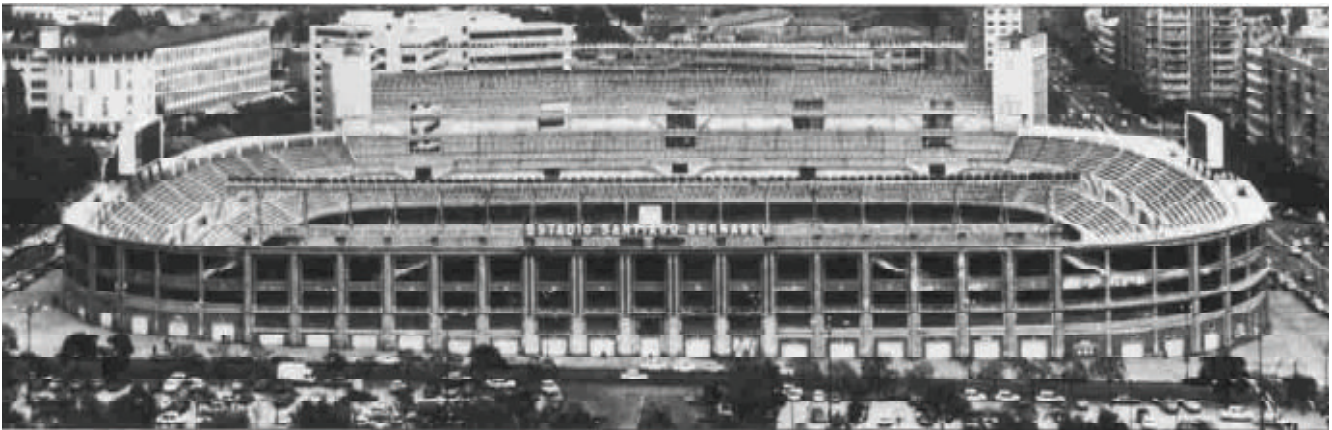


Fig. 2: After the first refurbishment, for the World Cup Championships in 1982

The new enlargement, to meet the UEFA regulations on spectator seating, made it necessary to extend the stadium upward and outward to create a second tier of seating. In order to achieve this economically, the existing steel structure was extended and this in turn, placed a maximum weight limitation of 53kg/m² on the cladding panels to be used.

GRC provided a perfect solution despite the relatively large spans to be covered in some areas of the structure and the projected heavy wind loading. Due to the large panel size the average joint size was 24mm. The contract called for a variety of GRC components which were manufactured by Cem-FIL® GRC producer Huarte SA.

"More than 17,000m² of GRC was produced for this second refurbishment". "Careful panel design enabled mould utilisation to be maximised".

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GRC PANELS:

A number of differing cladding panels, both flat and slightly curved were produced in sandwich form, to a maximum size of 10m². Careful analysis was performed of the projected wind loading over the aerodynamic shape of the roof structure, and panels were fixed to the existing purlins by means of simple fish plates and angle bars.

IN FILL PANELS: The extension of the metallic structure called for a number of single skin infill panels to mask any alignment problems between the structure itself and the existing load-bearing pillars. Three different panel sizes were produced.

STAIR CLADDING: The construction of additional access stairways to the new stadium made it necessary to use GRC cladding on several elevations. The front elevation was clad in curved sandwich panels and the top cladding has a slightly conical shape to aid water runoff. Panel fixings used steel plates attached to the metal stairway support structure.

PERMANENT FORMWORK: Formwork panels in single skin GRC were installed around the top of the structural pillars where the metal spars interconnect, so that additional concrete could be poured to seal the joints.

MARQUEE ELEMENTS: These were simple single skin panels used essentially to replace panels damaged during reconstruction work and to fill in the gaps produced by the increase on the inner roof diameter.

TICKET BOOTH AND ENTRANCE DOOR ELEMENTS: Simple sandwich panels were produced to clad the ticket booth and stadium entrance door areas situated between every other concrete pillar at ground level.



Figs. 3 & 4: The Santiago Bernebeu Stadium after the second refurbishment to new meet UEFA Regulations

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