

# LOMA LINDA CAMPUS TRANSFORMATION PROJECT

## JOB DETAILS:

### MARKET:

Healthcare

### PRODUCT:

Five Star Hybrid Grout  
Five Star Structural Concrete  
Five Star Structural Concrete V/O  
Five Star Structural Concrete ES

### DATE:

August 2017

### LOCATION:

Loma Linda, California

### QUANTITY:

8,500 bags of Hybrid Grout

### CONTRACTOR:

McCarthy Building  
Companies, Inc.

### SUBSTRATE:

Various: isolators; pedestals;  
concrete with steel



**Pumping Grout into a  
Base Isolator Steel Pedestal**

## THE CHALLENGE

The Loma Linda Campus Transformation Project posed several unique challenges, most obviously being the stringent seismic specifications required for Hospitals under Californian Building code, which are designed to ensure they remain operational after a seismic event. The Loma Linda Campus is surrounded by four seismic faults, numerous offset gullies, linear ridges, and other fault-related features. In addition to its proximity to fault lines, the construction schedule, size, weight and type of structure increased the complexity of the design and OSHPD (Office of Statewide Health Planning and Development) plan review processes.

The finished 16 storey, 693 bed hospital will be the second largest in California and has been designed to allow for 82 inches of horizontal and 8 inches of vertical movement in a seismic event. This seismic isolation is achieved using triple friction pendulum bearings, each of which sits on an isolator assembly containing a top and bottom grout joint. The 126 "base isolators" are constructed from steel, filled with concrete, and supported by eight "base isolator steel pedestal shims" which also sit on a grout bed. To provide protection in the event of travel in a vertical plane, grout is also utilized to secure bushings, serving as guides, to stainless steel pins that keep the pedestals aligned during a seismic event.

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A rigorous testing regime was carried out for all four of the critical applications noted above, with full scale mock-ups built and tested for each of the grout assemblies. After months of trials and evaluations, Five Star Hybrid Grout was approved for all grouting applications at Loma Linda Hospital, due to the scale of the project, testing alone consumed almost a full truckload of Five Star Hybrid Grout.

Five Star Hybrid Grout was required to exhibit many characteristics that were dictated by the unique conditions of this project. These included concerns over possible fire in the event of a massive earthquake, which required a cement-based grout due to superior temperature resistance when compared to other grout types (ie epoxies). Combined with reaching the high strengths, strict EBA (effective bearing area) specifications and high flow characteristics needed for the large volume of fill required, which lead to the development of this unique cement based product.

The base isolators required grout in two locations. The bottom “base isolator grout joint” required a 10,000 psi (68.9 MPa) minimum with a 2”(50 mm) grout bed totaling approximately 10 cubic feet (283 litres). This 2” clearance made for an easier grout installation, particularly when compared to the top joint, or “steel node to base isolator grout joint,” which only afforded a 1”(25 mm) clearance with an 18” diameter steel shim located in the center of the formwork, around which the grout was required to flow. To increase the difficulty further, there was an increased minimum strength requirement of 13,000 psi (89.6 MPa) and roughly 6 cubic feet (169 litres) of grout per location. Both joints required a minimum of 95% EBA with no void larger than 1 square inch. Each joint would be disassembled and inspected for compliance throughout project.

## THE SOLUTION

A large combination mixer pump was utilized for the mixing and pumping of the Five Star Hybrid Grout during the base isolator grouting. This style of pump was tested and recommended by Five Star Technical Services following an “in-house” mock-up replicating the grouting conditions found on-site. This equipment was a crucial component in providing a successful grout installation.

Five Star Hybrid Grout was mixed and pumped through 75’ of hose and placed within minutes per joint. Running this length of hose enabled the grouting of 10 or more isolators before needing to move the mixing and pumping equipment. This placement strategy allowed the grout crew to quickly and efficiently grout the isolators, beating the proposed construction schedule.

Each of the eight “base isolator steel pedestal shims” required just as much attention as the base isolator joints, and although their much smaller footprint made for easier grout placement, they were subject to the same stringent EBA and minimum strength requirements, but with a tighter clearance of  $\frac{3}{4}$ ” – 1”. This application required only 0.39 cubic feet (11 litres) of Five Star Hybrid Grout per shim. Due to this small volume of grout, it was important that the Hybrid Grout could be easily bucket-mixed. To further aid the application, a headbox was used to successfully flow the Five Star Hybrid Grout under each base isolator steel pedestal shim.

The grouting project was successfully completed with Five Star Hybrid Grout much more quickly than expected, earning praise from the Project Management Team for the level of support and speed of application.