SOLUTIONS | Case Study

One of the key project managers commented on the Five Star® Hybrid Grout solution: "It was very quick. Support has been awesome, especially from a larger company to be able to react that quickly from a technical side, was very impressive. That really helped support us to get everything approved. I'm pretty much singing your praise. I'd go with Five Star even under columns and anything else from now on."

Loma Linda Campus Transformation Project

Loma Linda, CA

Products:

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

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FIVE STAR

Build on our strength

Loma Linda Campus Transformation Project

Date of Project: August 2017

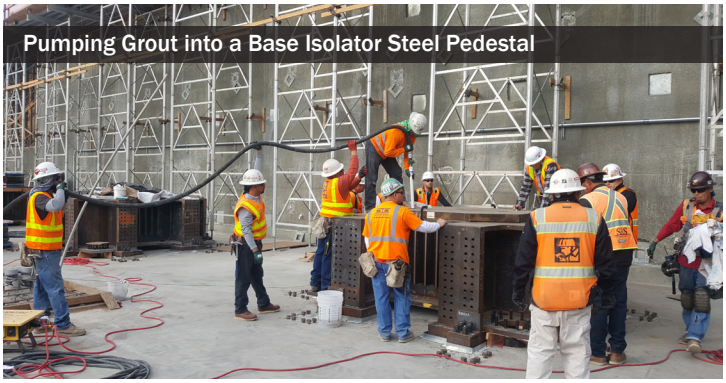
Project Owner: Loma Linda University Medical Center

Project Contractor: McCarthy Building Companies, Inc.

Market/Environment: Medical Facility; Seismic

Substrate: Various: isolators (steel base & concrete); pedestals; concrete with steel

Size of Project: 8,500 bags of Hybrid Grout



Pumping Grout into a Base Isolator Steel Pedestal

The Challenge

The Loma Linda Campus Transformation Project posed several unique challenges. The most obvious challenge being the stringent seismic specifications for one of the most unique hospital structures in California. Four seismic faults and numerous offset gullies, linear ridges, and other fault-related features surround Loma Linda Medical Center. In addition to its proximity to fault lines, the size, weight, and type of structure increase the complexity for not only the design and OSHPD (Office of Statewide Health Planning and Development) plan review process; it is also due to the expedited schedule for construction.

The building structure is seismically isolated on triple friction pendulum bearings. These bearings rest atop an isolator assembly containing a top and bottom grout joint. Each of the 123 "base isolator" assemblies are made of steel, filled with concrete, and supported by 8 "base isolator steel pedestal shims" also resting atop a grout bed. To provide protection in the event of travel on a vertical plane, grout will be utilized to secure bushings serving as guides to stainless steel pins that will keep the pedestals aligned during a seismic event. Five Star® Hybrid Grout and other grout manufacturers' products were rigorously tested for all four of these critical applications. After months of trials and evaluations, Five Star Hybrid Grout was approved for all grouting applications at Loma Linda Hospital. True to life mock-ups were built and tested for each of the grout assemblies. Almost a full truckload of Five Star Hybrid Grout was consumed during the testing process.

The Five Star Hybrid Grout would have to exhibit many characteristics that are not easily achieved under the conditions unique to this project. Due to concerns of possible fire presence in the event of a massive earthquake, an epoxy grout was not permitted. A cement-based grout was the only option, as cement can handle higher temperatures than epoxies. However, reaching the high PSI requirements, the strict EBA specifications and the high flow characteristics needed for the large volume of fill with a cement grout is not a simple task.

The base isolator required a top and bottom grout joint. The bottom joint is the "base isolator grout joint" with a 10,000 psi minimum and a 2" grout bed totaling approximately 10 cubic feet. This 2" clearance made for a slightly easier grout installation .... in comparison to the top joint, or "steel node to base isolator grout joint," which only afforded a 1" clearance with an 18" diameter steel shim located in the center of the formwork the grout had to flow around. All of this combined with an increased minimum strength requirement of 13,000 psi and roughly 6 cubic feet of grout. Both joints required a 95% EBA minimum with no void larger than 1 square inch. Each joint would be disassembled and inspected for compliance throughout the duration of the project.

Five Star® 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 during an "in-house" mock-up replicating the base isolator grouting found onsite at Loma Linda. This equipment was a crucial component in providing a successful grout installation. The Five Star Hybrid Grout was mixed, pumped through over 75' of hose and placed within minutes per base isolator joint. The long length of hose enabled the grouting of 10 or more isolators before needing the crane to move all equipment and platform. This allowed for a schedule that was not only met, but exceeded.

Each of the base isolator assemblies included 8 "base isolator steel pedestal shims" which required just as much attention as the base isolator joints, although a much smaller footprint made for easier grout placement. The base isolator steel pedestal shims shared the same stringent EBA and minimum strength requirements as the base isolator joints with a tight clearance of ¾" – 1" for grout fill. This application required only .39 cubic feet of Five Star Hybrid Grout per shim. Due to the small amount of grout needed per shim, it was important that a bucket-mixed procedure was achievable and successful. A headbox was used to successfully flow the Five Star Hybrid Grout under the base isolator steel pedestal shims.

Protection from movement on the vertical plane will be achieved through the fourth and final grouting application found in each of the base isolator assemblies. If the foundation were to travel in the vertical plane during a seismic event, the base isolators would be held in alignment through a system of bushings and stainless-steel pins. The Five Star Hybrid Grout will be utilized in securing the bushings which serve as a guide to the pins that keep the base isolator steel pedestal shims aligned. This final phase of the project will consume roughly 50% of all grout required for the base isolator assemblies.

FIVE STAR® SERVICES

- Design-A-Spec™ engineering specification assistance
- Technical on-call center with field and project experienced staff
- Field support representatives for on-site consultation
- Corporate research laboratory available to customize products for unique applications

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