Shockey Precast Goes Underground in Philly

The PennFIRST Patient Pavilion underground parking structure began as a feasibility question posed to Shockey Precast’s Vice President of Engineering two years ago. Could an underground precast concrete parking garage ultimately support the 1.5 million square-foot patient pavilion that was to be constructed above it? After in-depth study and evaluation, the answer was a resounding “Yes” and Shockey Precast became part of the PennFIRST project team that included HDR, Foster+Partners,
Two years after that challenge was presented, Shockey Precast completed precast erection of the PennFIRST Patient Pavilion underground precast parking structure and loading docks. Our portion of the project finished on March 5, 2018, with several leave-out pieces completed on July 7, and construction of the steel framing for the new patient pavilion well underway.

Shockey Precast has completed several underground parking garages over the years, but a project of this scope was new territory and is rare for anyone in the precast industry. Going 67 feet underground to build a parking deck that would eventually support a 1.5 million square foot structure above it offered its own unique challenges. Prior to the start of precast erection, the perimeter of the excavation was supported with steel piles and wooden lagging with waterproofing installed over the temporary lagging. And while the support was provided by others, Shockey Precast was responsible for bringing the concept of blindside waterproofing and near zero over-excavation to the design team – a concept that helped secure us a place on the team.

An underground parking structure would typically be constructed as a cast-in-place, monolithic structure, but Shockey Precast engineers offered a new twist to the design: cast-in-place concrete emulation with precast elements. Emulative detailing is defined as the design of connection systems in a precast concrete structure so that its structural performance is equivalent to that of a conventionally designed, cast-in-place, monolithic concrete structure. This method is consistent with ACI 550.1R-09 “Guide to Emulating Cast-in-Place Detailing for Seismic Design of Precast Concrete Structures” and is judged by ACI to be applicable to any structural system where monolithic structural concrete would also be appropriate. The structure was designed and detailed to meet the requirements of the applicable building code as if it were to be constructed of monolithic cast-in-place reinforced concrete; however, the structure was divided into structural elements of sizes and shapes that could be plant fabricated, transported, and safely and efficiently erected onsite. As described by David Orndorff, Shockey Precast’s Vice President of Engineering, the basement walls of the PennFIRST Patient Pavilion parking structure were born as precast, but now live on as a cast-in-place concrete structure.

Precast perimeter walls as well as interior precast vertical and horizontal pieces were installed throughout using a crawler crane, which was assembled within the parking structure’s excavated footprint. The crawler crane was assembled utilizing a 500-ton hydro crane, with outriggers supported by micro-piles to allow the adjacent public road to remain open. One bay was left out to allow for removal of the crawler crane and the
remaining precast erection was completed using a hydro crane and a tower crane. After precast erection, the horizontal precast spanning pieces received four inches of bonded cast-in-place topping. A flowable fill mix was placed between the waterproofing and the precast perimeter walls to fill the void. Over time, as the sheeting and shoring deteriorates, the precast walls connected into the horizontal-spanning precast elements with the bonded cast-in-place will transfer those surcharge loads as well as lateral loads distributed from the pavilion above.

The project consisted of 1,137 pieces of precast with a maximum piece weight of 82,000 lbs. Shockey Precast produced 220,000 SF of double Ts, 17,000 SF of flat slabs, and 125,000 SF of walls. The five-level underground parking garage includes 689 parking spaces, two stair towers, a series of elevator shafts, two precast cisterns, as well as provisions for fuel tanks, a network, locksmith, materials management, and IT.

In the dense region of western Philadelphia where this project is located, over 80% of the labor for Shockey's scope occurred at our Winchester, VA manufacturing facility, to provide better control over schedule, quality, and safety. From a design feasibility question posed more than two years ago, the PennFIRST Patient Pavilion underground parking structure now represents Shockey Precast’s ability to effectively respond to new challenges and create solutions that meet the changing demands of our customers.

[Click here](#) for a time-lapse video of the parking structure construction.

---

**Shockey Precast, a Metromont Company** is a manufacturer and provider of structural and architectural precast concrete located in Winchester, Virginia. A regional leader in parking structures, data centers, design-build, and wall panel projects for nearly 60 years, Shockey Precast has completed nearly 4,000 precast projects in the Mid-Atlantic region, including more than 400 parking structures and more than 5 million SF of data centers. A charter member of the Precast/Prestressed Concrete Institute, Shockey Precast is a PCI-Certified Plant and a PCI-Certified Erection. The company was acquired in February 2018 by Metromont Corporation, a precast manufacturer with headquarters in Greenville, South Carolina and now operates as a division of Metromont. For more information, visit [www.shockeyprecast.com](http://www.shockeyprecast.com) and [www.metromont.com](http://www.metromont.com).