

Controlled Modulus Columns Fast-Track a Military Hospital

The Fort Belvoir Community Hospital, just south of Washington, D.C., is on a fast-track to open in August 2010, as mandated by a 2005 Base Realignment and Closure authorization. The \$800 million, 1.3 million sq ft military construction project is being managed by the Corps of Engineers and will be part of an integrated health care network providing medical services to the nation's wounded soldiers and their families.

The project required ground improvement to support the high-bearing load of the facility, which is a series of five, multi-story buildings connected to form one structure, plus two parking garages, one anchoring each end. The initial RFP called for rammed aggregate pier (RAP) ground improvement for foundation support. In the Washington, D.C. metro area, **DGI-Menard (Menard)** has successfully provided alternative ground improvement schemes to RAPs for the past four years. The Turner-Gilbane JV for the project asked the firm to propose an alternative and chose Menard's patented Controlled Modulus Column (CMC) as the best value.

According to the firm, CMC is an environmentally sound and economical solution for strengthening ground and increasing its load bearing capacity. The method also provides faster installation as well as flexibility for excavation of utilities and improved sustainability through limited site import/export. The RAP solution would have generated significant offsite soil and required the import of a large amount of stone fill, using significantly more fuel as compared to the more efficient CMC solution.

High-Bearing Capacity

CMCs have been used extensively in Europe since 1994, but are still a relatively new technique in the U.S. Menard needed to assure the Corps of the viability of the technique. According to Justin LaBrozzi, project engineer with Menard, the company went through a rigorous design process to demonstrate that the CMCs would work at the high-bearing pressure

and still meet the Corps of Engineers' performance criteria. The design team ran a series of proprietary Menard footing settlement calculation models and then confirmed the analysis with a third-party review by GEI Consultants, using a Finite Element Model. The results were very close to the predictions of the Menard model. The design was then empirically confirmed with several single element load tests.

The Corps had already designed and specified spread footings for the project when the CMC option was proposed. To support the buildings, footings and walls, Menard demonstrated that the proper CMC spacing and patterns under the foundations would not dictate a change to the footing designs. The spread footings were specified for 7,000 or 8,000 psf, depending on the structure. Since the buildings were built near existing grade or cut down in some locations, no significant settlement was expected below the slab-on-grade, so no ground improvement was required under the slabs. Menard designed a dense array of elements under each foundation support. The footing design originally laid out by the Corps' design team didn't need any other modification to accommodate the CMC alternative ground improvement support scheme.

Although there was no physical connection to the structure, there was a load transfer platform between the CMCs and the footings. The result, LaBrozzi points out, is that an increased load per element as compared to the original RAP solution meant fewer elements to install and a faster schedule.

Flexible Excavation and Sustainability

Menard's design allowed excavation close to the CMCs and limited interactions with utility contractors, providing a time-saving advantage for this fast-track project.

"Because CMCs are a grouted element, they provide their own confinement, allowing flexibility for excavation around the footings for utilities or expanding the



Aerial photo of site

earthwork operations," explains Mike Carey, project manager for Menard. "RAPs, on the other hand, rely on the stiffness of the surrounding soils to provide lateral confinement of the aggregates. So, if you dig too close you will loosen the confinement and the ability for the element to carry the load."

"When CMCs are formed," points out Carey, "the auger displaces the soil laterally, with virtually no vibration and no spoil, eliminating the need to dispose of contaminated soils at times and providing a sustainable solution."

In addition to the limited spoil removal, Menard supported Turner-Gilbane in its pursuit of LEED certification by obtaining LEED credits for Recycled Content and Regional Materials.

"We were able to certify that we replaced as much of the cement in the grout — as the design would allow — with slag cement or fly ash, which have a negligible carbon footprint compared to cement," says LaBrozzi.

Carey adds that the ready-mix supplier manufactured onsite, not only limiting transportation and fuel use, but also significantly improving the schedule because the trucks didn't have to go through the tight security on the military site.

The Base Realignment and Closure authorization is moving quickly to improve the medical facilities for military personnel. Menard's design for 4,900 CMCs at Fort Belvoir plays a major role in expediting the schedule with the added benefit of sustainability for this fast-tracked project.