Reprinted from **THE MILITARY ENGINEER,** Vol. 97, No. 637, September/October 2005

TIME-SAVING Lean Design

Meeting the needs of the Army's new BCTs required building a complete brigade complex in 142 days.

By Keith Kowadlo and Chris Ions

Changing world events are influencing the already rapid pace of U.S. military reorganization. As the U.S. Army continues its transformation from a defensive "Cold War" posture against former Warsaw Pact countries toward an expeditionary Army focused on the Global War on Terrorism, each active duty Army division is scheduled to reorganize into modular Brigade Combat Teams (BCTs). BCTs are smaller, more lethal and more rapidly deployable units that will be able to more quickly respond to regional combatant commanders.

Upon its return from Iraq, the 3rd Infantry Division (Mechanized) was one of the first divisions to be reorganized. Apart from the basic challenge of reorganizing was the question of where to house the additional soldiers and equipment needed. To meet this challenge, the Ft. Stewart, Fla., Directorate of Public Works joined forces with the U.S. Army Corps of Engineers, Huntsville and Savannah districts, and the Southeast Regional Office of the Installation Management Agency. Together they expeditiously defined the scope of work, identified a suitable contract delivery mechanism and acquired necessary environmental approvals.

The Need for Speed

With the government's preparatory work complete, the challenge of product delivery now belonged to private industry; the scope of work included design-build delivery of a $73 million brigade complex in 142 days. In addition, 102 acres of the base had to be cleared, utilities installed, and furniture for offices, barracks and maintenance facilities delivered, assembled and set up.

The project pioneered the use of "relocatable facilities"—the most cost-effective means to achieve quick installation in this aggressive work schedule. Although commercially available, there were no standard designs for relocatables; thus innovative approaches were required during programming, design and construction.

The complex included three distinct areas. A barracks complex would house 852 soldiers, including separate laundry facilities and interconnecting roadways for fire trucks and maintenance personnel. An operations complex would serve 20 company operations facilities, 20 arms vaults and three battalion headquarters. And, two maintenance complexes would provide parking and maintenance support for tracked and wheeled vehicles.

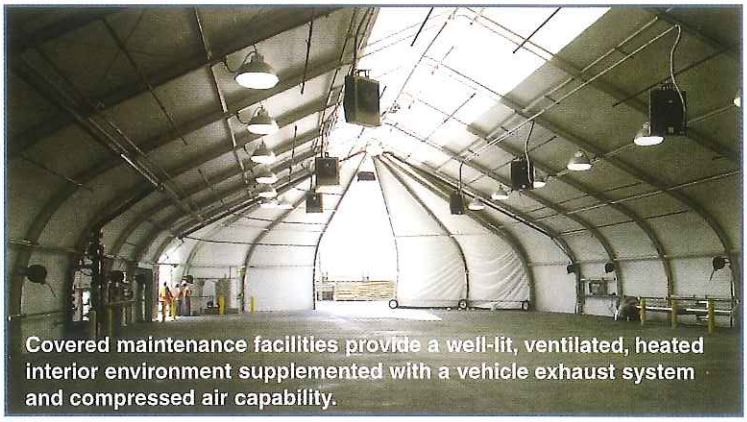
The barracks complex was a 39-acre site, ideally configured for utility distribution, rough-in placement and staging of construction workflows. Upon delivery, 14-ft by 56-ft self-contained relocatables were married up to partner relocatables to form basic living units. Each living unit is subdivided into "A" and "B" units to house three soldiers. Subunits have private entrances, separate utility hook-ups, and a common bath and kitchen.

The company operations and battalion headquarters complex required site clearing, grading and utility installation to serve the company operations buildings, arms vaults, three battalion headquarters and associated parking, sidewalks and lighting.

The company operations building consisted of four administration relocatables paired up to four additional supply/storage relocatables to form a single unit. These supply/storage relocatables were oriented along a 100-ft-wide service yard for efficient load-out, vehicle access and proximity to the arms

Barracks are arranged in clusters of 10 modules, 14-ft apart, end-to-end, in two parallel rows. When delivered from the factory, each 14-ft by 56-ft module is married up to its partner module to form a living unit.

Photos courtesy LS3P Associates Ltd.



Covered maintenance facilities provide a well-lit, ventilated, heated interior environment supplemented with a vehicle exhaust system and compressed air capability.

vaults. The company administration module provides private offices for the commander, executive officer and first sergeant.

Similar in design, the three battalion headquarters, connected by an elevated wooden walkway, provide private offices, a conference room, a break area, showers and a 60-soldier classroom.

The vehicle maintenance complexes mirror each other in both size and capability to meet the needs of a mechanized infantry or armor battalion. Each complex facilitates the orderly movement of tracked vehicles from hardstand parking through the three covered maintenance facilities. Other workflow processes designed into the complexes included vehicular delivery of spare parts to a conveniently located receiving platform, storage and issuance of tools, and movement and parking of privately owned vehicles (POVs). Each complex's administrative and repair building has 10 modular buildings connected by an elevated wooden walkway.

Anti-terrorism and force protection (AT/FP) requirements consisted primarily of proper standoff distances, use of laminated glass in the barracks modules and employment of a "Big Voice" mass notification system at each site.

Starting Off on the Right Foot

The design-build team of Clark Design/Build LLC and LS3P Associates Ltd., responded to this emergency procurement by using a "lean design philosophy" early in the charrette process, developing a design concept within five days and delivering the cost proposal seven days later. The day following issuance of notice to proceed, the design-build team was mobilized.

Three distinct factors led the project: commitment, lean design philosophy and the understanding of the "Two Ts."

The commitment of all parties was advanced via a formal partnering relationship between the government and contractor. Government and contractor project trailers were located side-by-side for close communication and daily meetings. The architectural team was co-located in the construction trailer to review submittals on the spot, immediately respond to requests for information and produce construction drawings when needed.

Incorporating the lean design philosophy early in the Charrette Process ensured proper definition of scope requirements and was instrumental in delineating the government's expectations. This enabled rapid development of construction schedules, procurement tasks and cost estimates, minimizing modifications and empowering design-build decisions on a daily basis. The benefit of lean design was that it quickly brought together the right people, with the right design backgrounds and attitudes who had the authority to make tough financial decisions and move the project forward.

The final factor was the philosophy of the "Two Ts"—a term that describes the leadership imperative of maintaining "Trust" in the horizontal hierarchy, even as the "Truth," or client requirements, change daily. The "Two Ts" also applied to the vertical hierarchy between government and design-build partners, and between the design-build team and its subcontractors.

Implementing Design

One of the initial design activities was to collaborate with GE Modular Space in designing floor plans for the 17 different functional layouts necessary to support the brigade complex. It also was important to understand the relocatable workflow, from initial security access at entrance gates, moving the units to staging yards and maneuvering them into final position for rough-in connections, with much of the work being done at night.

Next, a functional site layout was needed, taking into account utility distribution, POV parking, AT/FP standoff distances, storm water management and erosion control. The fire code provisions of the Uniform Building Code and National Fire Protection Association guided the design of zoned and clustered relocatables.

Lastly, a realistic commissioning schedule had to be developed that addressed the life/safety systems testing, punch list corrective action teams, furniture installation, final cleaning and turnover. It also had to accommodate the partnering team's decisions of quality standards for the relocatables, since they were a commercially available product being used off-the-shelf for the first time by the government.

Proof of Success

Under the traditional construction process, this project would have cost about $140 million and taken years instead of months to complete. However, at the end of the 142-day construction schedule, and four hurricanes later, the Clark-LS3P Design-Build team received the official government acceptance notice and soldiers began moving in. There were less than 100 requests for information, few contract modifications, no time lost accidents and no claims.

The undeniable proof of the project's success is its recent selection by the Associated General Contractors as the 2004 "Build America Award" in the design-build category—an honor often referred to as the "Academy Awards of the Construction Industry." TME

Keith Kowadlo is Design Quality Control Engineer and Chris Ions is Architect of Record, LS3P Associates Ltd., Charlotte, N.C.; 704-333-6686, or keithkowadlo@ls3p.com and chrisions@ls3p.com, respectively.