



# LEED SILVER CRITERIA

## ARMED FORCES RESERVE CENTER

Project Type:	Military Training Facility
Location:	San Marcos, Tex.
Owner:	Texas State Army Reserve and National Guard
Architect:	PBS&J Architecture, an Atkins company, Austin, Tex.
Engineer:	PBS&J Architecture, an Atkins company, Austin, Tex.
Precast Structural Engineer:	Schwab Structural Engineering Inc., Austin, Tex.
Design/Build Contractor:	Satterfield & Pontikes Construction Inc., Austin Tex.
Precaster Structural Components:	Heldenfels Enterprises Inc., San Marcos, Tex.
Precaster Hollowcore Planks::	Gate Precast Company, Pearland, Tex.
Precast Erector:	Precast Erectors Inc., Hurst, Tex.



### OVERVIEW

A training facility for 600 members of two U.S. Army Reserve units and four Texas National Guard units, the facility consists of three main buildings: a two-story training center, maintenance garage and heated storage facility.

The 56,000-square-foot, two-story main building contains offices, training facilities, and an attached, one-level assembly center. Flooring in the main office area consists of 8-in. and 10-in. hollowcore planks in a raised office system designed to provide additional clearance for MEP (mechanical/electrical/plumbing) components. The attached assembly area utilized 24-in. double-tees for both the flooring and for the roof, where a 70-ft clear span was needed.

A 23,700-square-foot Operational Maintenance Shop contains maintenance bays with heavy HS-20 load requirements and required a clear roof span of more than 70 feet. The roof consists of 24-in. double-tees. A 6-in.-thick deck was designed to handle floor loading. Load-bearing precast columns support bridge crane tracks over the maintenance bays.

Measuring 28,500 sq. ft, a heated storage building contains an arms storage vault. The vault section was cast-in-place on precast grade beams. The rest of the structure is total precast construction using precast grade beams with 24-in., double-tee floor and roof.

Total precast concrete construction was selected because of its ability to meet an accelerated construction schedule, and its inherent flexibility, durability, and sustainability. The project incorporates precast concrete grade beams, as well as precast column and beam structural framing, hollow-core planks, double-tees, and load-bearing exterior CarbonCast High Performance insulated wall panels. Panels were erected in a vertical fashion. The precast concrete components were cast while site preparation was underway.

Building Information Modeling (BIM) was utilized to coordinate architectural design, structural elements, fire protection, and MEP components. TEKLA (software from Tekla Corp.) was used to develop the precast superstructure, which was then integrated into the REVIT (software for Microsoft Windows from Autodesk) BIM model. Design assistance was provided by the precast manufacturer to maximize the repetition of pieces, optimize internal connections, and determine grade sizing for the anticipated loads of the structure.

**24** INCH

Depth of the double-tees in the total precast concrete system

**82.4** PERCENT

Amount of construction waste diverted from the landfill

**30** PERCENT

Recycled content of all construction materials used in the project

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Project includes training center, maintenance garage, and heated storage facility.

Photo: PBS&J Architecture.



With precast components, 82.4% of construction waste could be diverted from landfill.

Photo: PBS&J Architecture.



Total precast construction helped project meet LEED Silver and Force Protection standards.

Photo: PBS&J Architecture.

"This early coordination helped to ensure the MEP fitted properly when the [precast concrete] pieces arrived," said Steve Moller, senior architect and project manager, PBS&J Architecture. "Once the precast components were designed and approved, there was no reason to review those design elements again. There was no second-guessing or reconsiderations of the roof slope or window configuration. That saved time."

The entire foundation of the main building was in place within 21 days. All structural elements for the building were delivered and erected within 14 days. Precast erection for the entire complex was completed in 2½ months, despite extensive rainfall.

## PRECAST CONCRETE'S CONTRIBUTION TO SECURE CONSTRUCTION PRACTICES

All three buildings were constructed utilizing a total precast concrete building system designed to meet LEED Silver criteria and the U.S. Army Department of Defense Anti-Terrorism, Force Protection (AT/FP) standards required of Federal projects.

Due to poor soil conditions, much of the construction work centered on providing a secure foundation. The location is near a geological fault that rises 200 ft near the site's edge, leaving black clay soil at the site and high rock nearby. The expansive clay soils required that 10 ft of soil be excavated and replaced with select fill to achieve an expected potential vertical rise of 1 in. Rather than the traditional method of excavation and embankment with slab on grade, the contractor employed a precast suspended foundation with voids.

"The double-tee slabs used in the foundation rest on cast-in-place piers driven 30 ft. into the rock," explained Gil Heldenfels, vice president and general manager, Heldenfels Enterprises Inc. The framing design transferred vertical and shear loads to the foundation via three connection types. For continuous beam to beam connections, the beams meet and bear directly on the piers. For corner or junction connections of more than two beams, a pier cap distributes the loads to the piers. For load bearing columns, the grade beams were set into haunches on the column directly bearing on the piers.

Precast concrete has many favorable qualities with regard to blast response. Concrete has the mass, strength and high-ductility characteristics desirable in achieving high-energy absorption. Rigid façades, such as those achieved with precast components, provide exceptional strength to the building through in-place shear characteristics and arching action. Precast concrete systems can be readily designed to mitigate the effects of a bomb blast and satisfy General Services Administration (GSA) and DOD requirements.

Precast concrete manufacturers have developed designs that provide ductility, redundancy, and load distribution, and that allow structures to undergo plastic deformation. These are designs that include redundant or secondary structural support systems; structural elements that transfer loads from a damaged region to adjacent regions; additional reinforcement; strengthened gravity connection detailing that provides continuity across joints; floor systems capable of withstanding load reversals due to explosive effects; and exterior wall elements that span vertically to minimize blast loads on columns. For details, see the PCI Designer's Notebook series on "Blast Considerations" at [www.pci.org](http://www.pci.org).

## PRECAST CONCRETE'S CONTRIBUTION TO SUSTAINABLE CONSTRUCTION PRACTICES

According to Kimberly Walton, LEED AP BD+C, ID+C, sustainability project engineer for PBS&J Architecture, the project met all the prerequisites required for ventilation, energy performance, erosion and sedimentation control.

### Sustainable Sites:

Bicycle racks and showers were provided, as well as nine parking spaces for carpool vehicles and nine spaces for fuel-efficient vehicles. Storm-water runoff is controlled and conveyed to on-site detention ponds for protection of the downstream channels.

To reduce the heat island effect, concrete paving covers more than half of the hardscape. The standing seam metal roof is a highly-reflective red on steep slope areas and white on low slope areas. LEED credits were received for providing open space and use of native vegetation. Four times the building footprint, or 44% of the site, is native vegetation.

### Water Efficiency:

No landscape irrigation system is required and low-flow plumbing fixtures were specified. Indoor water use reduction totaled 54%.

### Energy & Atmosphere:

The project received six LEED points for a 30.6% energy-cost savings.

### Materials & Resources:

In all, 82.4% of construction waste was diverted from the landfill. Of all materials, including all precast concrete components, 18% were regionally sourced. Materials contain 30% recycled content, including fly ash in the concrete. The precast concrete also includes 80% post-consumer and 15% preconsumer recycled rebar.

Sustainability was a major goal during the construction process as well. An on site waste management program diverted over 80% of construction waste from landfill. In addition, non-essential lighting was turned off during weekends and at night.

### Indoor Environmental Quality:

Paints, coatings, carpeting, and adhesives are all low-emitting VOC materials. Use of CO<sub>2</sub> and thermal comfort controls provided additional points.



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