OUTDOOR INFANTRY IMMERSION TRAINER

CAMP LEJEUNE, N.C.

The Outdoor Infantry Immersion Trainer (OIIT) in Camp Lejeune, N.C., looks like a war zone, and that is intentional. The facility is designed to give Marines a hyperrealistic training experience by replicating a generic North African village with shell-damaged buildings, sound and light systems, smell generators, and role players who can be friend or foe.

"Precast concrete was used for the OIIT buildings in order to ensure they could withstand the wear and tear of Marines in full tactical gear taking part in intense drills every day in a coastal climate," says Joshua Schmitt, project manager for GATE Precast in Ashland City, Tenn.

The OIIT is capable of small-unit training as well as platoon and squad leader decision-making assessments. Urban structures are paired with nonlive fire training systems, virtual simulation, and video instrumentation for after-action review. The 5-acre complex includes 51 one- and two-story buildings and 129 rooms. Battlefield-effects systems simulate rocket-propelled grenades, improvised explosive devices, and other explosives. For example, there is a sound system; a centrally controlled, light-emitting diode system that replicates candlelight; and a smell-generation system. The training system can support many types of scenarios.

Relocatable Structures

Schmitt says precast concrete was the only solution that satisfied all the unique needs of the U.S. Marine Corps. The project requirements included the ability for all structures to be relocatable. Precasting the concrete into transportable sizes and shapes that enable future relocation was the only feasible solution, says Schmitt.

"It was necessary to disassemble the buildings, transport them, and reassemble them, using integral footings and bolted connections to ensure their functionality," he says. "By using a

The new Outdoor Infantry Immersion Trainer (OIIT) at Camp Lejeune, N.C., provides a hyperrealistic environment for Marines to hone their skills. The OIIT replicates a generic North African village with precast concrete buildings that were fabricated and finished to look damaged and rundown. ***Photos:*** *Sauer Construction.*

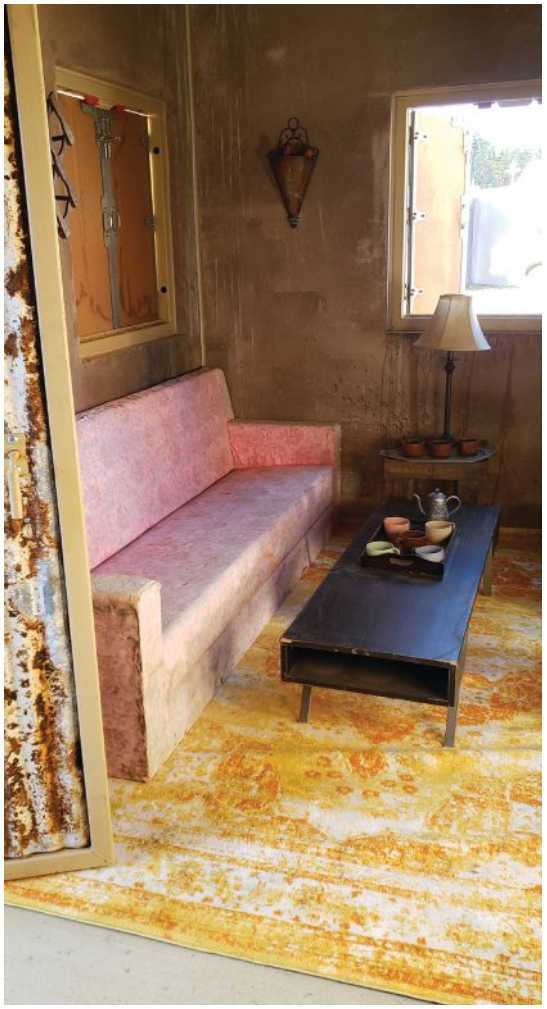
SAVING TIME AND LABOR

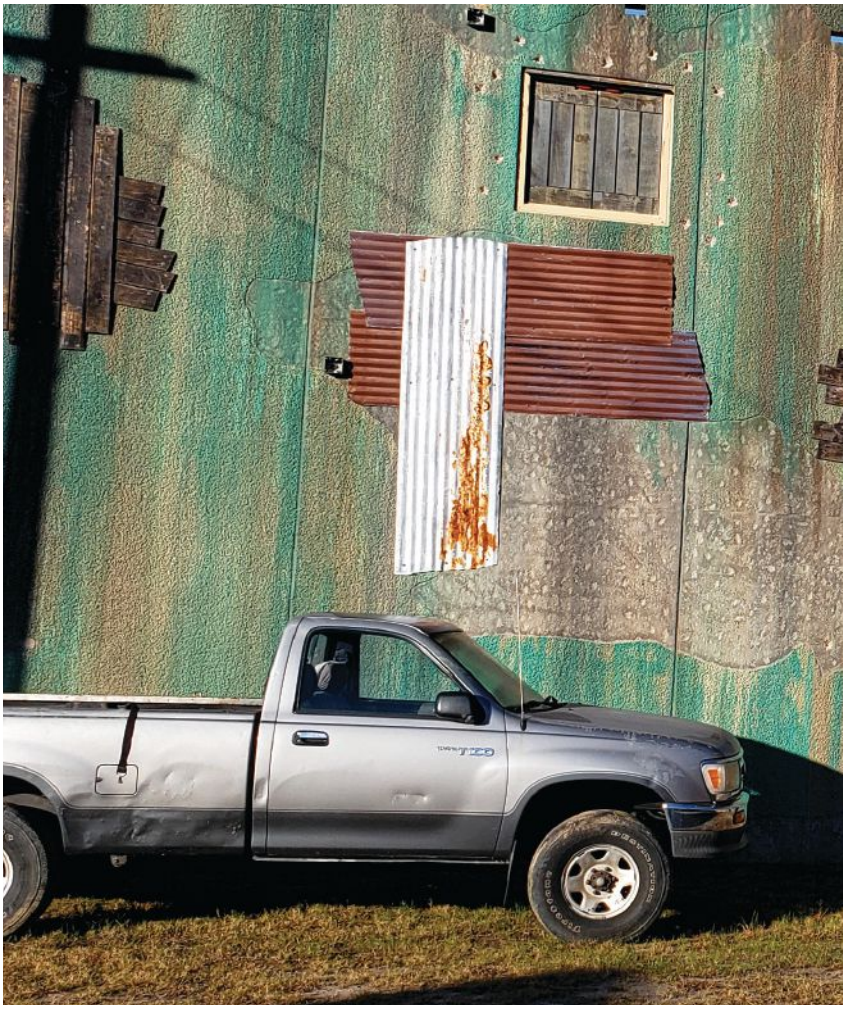
As the live-load portion of the Outdoor Infantry Immersion Trainer design was heavy, the project team did intensive analysis of the 6-in. floor slabs. "Many of the floor slabs were pretensioned due to the use of discrete button haunches and Rapid-Loks," says project manager Joshua Schmitt of GATE Precast.

GATE Precast used discrete button haunches on the rear face and Rapid-Loks by Meadow Burke on the front face as a lean method of supporting the roof and second-story slabs. The button haunches and Rapid-Loks saved hours of labor and additional formwork, Schmitt says.

The Rapid-Lok system consists of a steel or concrete-replicated bearing corbel that locks into an embed plate cast into the structural wall. This creates a steel projection in the wall that acts as a shelf capable of carrying the weight of double tees, stairs, beams, and other precast concrete components.

A discrete bearing also made sense when a connection needed to be positioned in the middle of an opening. Flipping the connection to the underside of the floor slab, under the opening, saved the mechanical, electrical, and plumbing contractors time that is usually required to avoid the continuous corbel when running conduit.





Left: Interiors of the buildings were propped with furniture, art, and other accessories for greater realism.

Right: The labyrinth of buildings in the village is "intentionally chaotic," says Joshua Schmitt of GATE Precast. Access to certain buildings is only through the second floor or the roof. The doors are designed to be repeatedly broken down during drills and quickly replaced. Some façades have painted finishes that resemble crumbling stucco. ***Photos:*** *Sauer Construction.*

minimal amount of welding, the connections could be removed and returned to their original location with no additional welding needed in the future."

Using precast concrete was the perfect way to create buildings that were relocatable. "The wall panels had an integral footing poured at the bottom of the panels and set onto a gravel base, eliminating the need for any cast-in-place concrete on the site," says Schmitt.

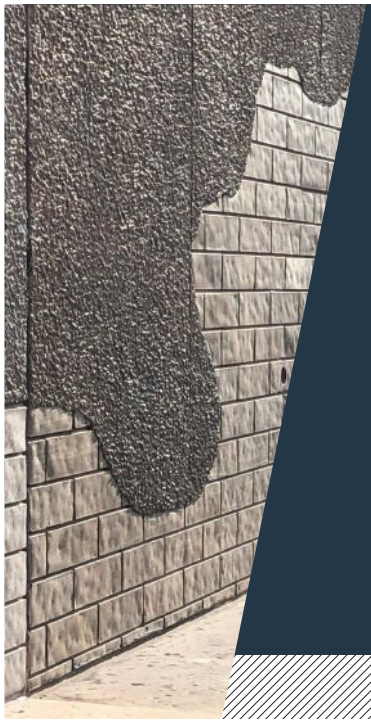
The integral footing made the walls freestanding, with no connections to the foundation. "All the precast-to-precast connections were bolted to allow for the panels to be easily moved," he says.

Most panels were shipped on their side edges, but about 20% had to be shipped flat. This posed an extra challenge because of the integrated footer. GATE Precast developed an innovative series of "teeter totters" in a variety of conditions depending on panel size and shape, which negated the camber and accounted for the extra height of the footers. The teeter-totter technique allowed the panels to absorb the twisting of the trailer better than just bearing flat on wood blocks, says Schmitt.

Making the New Look Old

The buildings are total–precast concrete, including the footers, walls, floor slabs, and roofs. Despite their rundown, damaged appearance (there are holes in some of the walls), they are made with high-quality precast concrete components that ensure durability. To create the look of a war-torn North African village, the project team used a wide variety of mixture colors, four types of formliners, and customized formwork. Using these same tools, the look of the village can be changed as necessary.

"Precast played a critical role in the project because it has that functionality," says Colin Stephens, project manager for the contractor, Jacksonville, Fla.-based Sauer Construction. "And it's hyperrealistic" because many developing countries are largely built with concrete.



PRECAST CONCRETE CHECKS ALL BOXES FOR RESILIENCE

GATE Precast of Ashland City, Tenn., fabricated and erected the precast concrete components for the Outdoor Infantry Immersion Trainer in Camp Lejeune, N.C., a unique facility for Marine training. Precast concrete was chosen due to the wear and tear caused by the coastal climate and the Marines' intense daily drills.

Joshua Schmitt, project manager for GATE Precast, notes that precast concrete is a material with numerous resilient attributes, including:

- improved storm resistance,
- improved fire resistance,
- improved blast resistance,
- improved safety and security of occupants,
- increased service life/durability,
- improved indoor air quality (due to no mold, no volatile organic compounds, and rapid enclosure of structure),
- reduced long-term life-cycle costs.

Components were trucked from GATE Precast's facility in Tennessee to North Carolina, so they had to be durable, says James Wright, project superintendent. "They also hold up to severe storms with high waves and lots of rain," Wright says.

Photos: *Sauer Construction.*

PROJECT SPOTLIGHT

OUTDOOR INFANTRY IMMERSION TRAINER

- Location: Camp Lejeune, N.C.
- Size: 209,167 ft^2
- Owner: U.S. Marine Corps, Orlando, Fla.
- Architect: LS3P, Charleston, S.C.
- Contractor: Sauer Construction, Jacksonville, Fla.
- Structural Engineer: MMSA, Greenville, S.C.
- Precast Concrete Specialty Engineer: GATE Precast, Ashland City, Tenn.
- PCI-Certified Precast Concrete Producer: GATE Precast, Ashland City, Tenn.
- PCI-Certified Erector: E.E. Marr Erectors, Baltimore, Md.
- Precast Concrete Components: 1324 wall panels; 171 floor and roof slabs

Stephens says large numbers of people can occupy the village simultaneously, plus vehicles. Marines can jump from a helicopter and descend from a rope onto a rooftop. Rappel points installed on the multistory roofs accommodate insertion and rappel-training techniques.

Building with precast concrete on a project as unique as the OIIT was a learning curve for Sauer. The floors and walls were cast separately and assembled on-site like Lego blocks, with an integral footer between the wall sections. And even though three and a half months of rain and high winds delayed activity on the site, the village portion of the project was finished on time, Stephens says.

Schmitt says there was some replication in the buildings, but for the most part each panel was one of a kind. "The variety of colors and formliners required coordination between the detailers and craftspeople to ensure these patterns and colors lined up from one panel to the next," he says.

Once the buildings were installed on-site, artists painted the exterior of the panels to enhance their authenticity. An atmospheric expert from Hollywood was brought in to coordinate the colors and textures. "We made the brand-new precast look like it had been out there for 50 years," says Stephens. Charleston, S.C.-based architect LS3P and the precast concrete producer worked together to determine the desired levels of roughness and texture throughout the village.

Architect Roy Selvidge, principal at LS3P, says the layout is more organic than rectilinear to challenge Marines as they move through the buildings. "The rooms are of various sizes, and you don't really have a clear view through them," says Selvidge.

The village itself is a labyrinth of buildings that are not square to the road or evenly spaced, says Schmitt. "It's intentionally chaotic," he says. "Things like the height and length of stair steps, and the sizes of door and window openings, are not what you would normally find in a construction project."

The types of buildings in the village vary and include intact and well-maintained areas, mosques, markets, and brick-faced government buildings as well as damaged or neglected areas where the paint is mismatched and resembles crumbling stucco.