PROVING A SUSTAINABLE Solution at Schofield Barracks

Connecting integrated framing assemblies and insulating concrete forms helped to deliver energy efficiency and blast resistance at Schofield Barracks in Hawaii.

By Joe Keith, P.E., M.SAME, and Chris Keith, Ph.D.

Sitting on a 17,725-acre site on the island of Oahu, Schofield Barracks is the largest U.S. Army post on Hawaii and the home of the 25th Infantry Division. In 2011, the U.S. Army Corps of Engineers (USACE) completed construction of two mirror-image barracks on the site, each one consisting of five stories and designed for around 100 single soldiers. The design-build general contractor and construction manager was Absher Construction and the architect was Tetra Tech.

By all accounts, the Schofield Barracks project was, and is, a rousing success. In 2015 it was certified with LEED Gold status, led by the role of a distinct building envelope—consisting of insulating concrete forms (ICFs) and integrated framing assemblies (IFAs)—in meeting the goals for energy efficiency and structural stability.

ENERGY EFFICIENCY

Energy efficiency was one of the main goals for the project—particularly as it relates to the building envelope. As a result, the design team chose to construct the two buildings using ICFs rather than concrete masonry units, using IFAs at the exterior and interior door openings, and some interior window openings. With this approach, Schofield Barracks would become USACE's first ICF/IFA building.

In ICF construction, hollow blocks consisting of two expanded polystyrene panels, held together by webbing, are stacked on top of one another. Typically, rebar is strategically aligned in the resulting cavity via webbing in the block, and concrete is then placed into the cavity. When the concrete cures, the blocks remain in place, providing a layer of expanded polystyrene panel insulation on both sides of the concrete wall and negating the need for any further insulation. This method was initially implemented in residential construction and has several benefits over alternatives, including enhanced structural stability and energy efficiency.

The enhanced structural stability has been demonstrated in real-world situations where ICF homes have survived hurricanes that destroyed non-ICF residences as well as in laboratory contexts like at Texas Tech University's Wind Science & Engineering Research Center.

Construction of a five-story building at Schofield Barracks, Hawaii. The facility was certified LEED Gold in 2015.
PHOTOS COURTESY STALA INTEGRATED ASSEMBLIES

Integrated framing assembly being used for doors at Schofield Barracks.

COMMERCIAL-GRADE APPROACH

ICFs have become an increasingly popular method of energy-efficient commercial construction. The National Ready Mix Concrete Association featured ICFs in its "Build with Strength" campaign and a 2014 master's thesis at the Air Force Institute of Technology similarly concluded with a recommendation of ICFs for energy efficient and sustainable military construction, even while acknowledging the possibility of higher initial costs. As part of this trend, IFAs are being used as a specialty product on ICF projects to address problems with door and window openings.

ICFs were originally designed for residential construction, especially for cold-weather environments where the benefits of their energy efficiency can be maximized and tropical areas where the benefits of their structural stability can be maximized.

For door and window openings, typically wood or vinyl bucks were used to preserve the opening during the concrete placement. After the concrete sets, frames were either installed over the buck or the buck was removed and frames were field-adjusted to fit each individual opening. Although not very efficient, this process was bearable for residential jobs with minimal door and window openings and flexible deadlines.

Things have changed. ICFs are now being used for commercial construction, to the point that for almost a decade commercial work has made up over half of the ICF global market. On commercial jobs, with hundreds of door and window openings, the process of removing the buck and installing a frame into an opening that has already set is not time-efficient. IFAs were designed and engineered as a commercial-grade solution to this problem. They are hollow metal frames that can anchor into the footer and are thus installed prior to the concrete placement, keeping the opening true. ICF block is placed into the IFAs, which serve as the bucking for the installation of the wall system, and they remain in place during and after the placement. IFAs are delivered to the job-site prepped for hardware, and are ready for doors or window installation much sooner in the project construction. Custom-made designs, such as radial frames, are available and they also coordinate with trades like drywall.

Most important, because the concrete is placed around them, the thermal seal is tighter, leaving less room for air infiltration. A thermal break IFA is also available that increases energy efficiency.

ACHIEVING EXCELLENCE

On its LEED Gold certification in October 2015, the Schofield Barracks project scored 39/69. In that assessment, a bulk of points was acquired in the "Energy & Atmosphere" category, where Schofield scored 12/17. The distribution of those 12 points over the subcategories is telling.

There are six subcategories with varying amounts of points available to be earned. In "On-site Renewable Energy," Schofield received 1 out of 3 points. In "Enhanced Commissioning," it received 0 out of 1. In "Enhanced Refrigerant Management," it received 1 out of 1. In "Measurement and Verification," it received 0 out of 1, as it did also for "Green Power."

In stark contrast, in the "Optimize Energy Performance" subcategory, Schofield scored 10 out of 10, meaning that 83 percent of its overall Energy & Atmosphere score was due to its energy performance. The intent of measuring this subcategory, per the U.S. Green Building Council, is to "achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use."

As the two primary components of the thermal envelope, the ICFs and IFAs were major contributors.

BLAST REQUIREMENTS

ICFs and IFAs contributed not only to the barracks' energy efficiency, but also contributed heavily to their ability to meet Department of Defense specifications for anti-terrorism construction.

Unified Facilities Criteria 4-10-01, "DOD Minimum Antiterrorism Standards for Buildings" gives those minimum standards for all military buildings, including new construction projects. The capacity of ICFs to meet these blast requirements has been recognized for some time. Less recognized is that IFAs also enhance a building's ability to meet these requirements.

THE FUTURE AWAITS

ICF construction remains somewhat of a newcomer to the public sector and military construction scenes, and lack of understanding among construction professionals remains a barrier to its increased utilization.

The combination of IFAs and ICFs is newer still. But as is evident at Schofield Barracks, the advantages of their combination in a sustainable and energy-efficient thermal envelope, which has been shown and tested in laboratories, is now being proven in the field.

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