Virgin Islands seawall meets requirements for 50-year design life

In 2017, American Bridge Co. contacted WSP USA Inc. in Federal Way, Wash., to provide value-engineering design services for the seawall portion of the Veterans Drive improvements in St. Thomas, U.S. Virgin Islands.

The project consisted of the reconstruction and widening of approximately a half mile of Veterans Drive. The original design of the seawall consisted of a modular block option, which was found to be difficult to construct.

WSP provided a technically feasible, constructible, and economical gravity precast structurally reinforced concrete retaining wall alternative that provided quality and allowed American Bridge to minimize expensive on-site labor. WSP was then engaged to perform the full design and develop construction documents for this seawall option.

The seawall comprises individual standard precast concrete wall units composed of a tapered base slab, wall stem, and single/double counterforts that were as tall as 16 ft (5 m).

The wall units have a cast-in-place tie beam and precast concrete coping all along the alignment. The wall units were placed in water as deep as 8 ft (2.4 m) and are made of predefined lengths to limit weights. Special corner units at right-angle intersections along the alignment were also made of precast concrete.

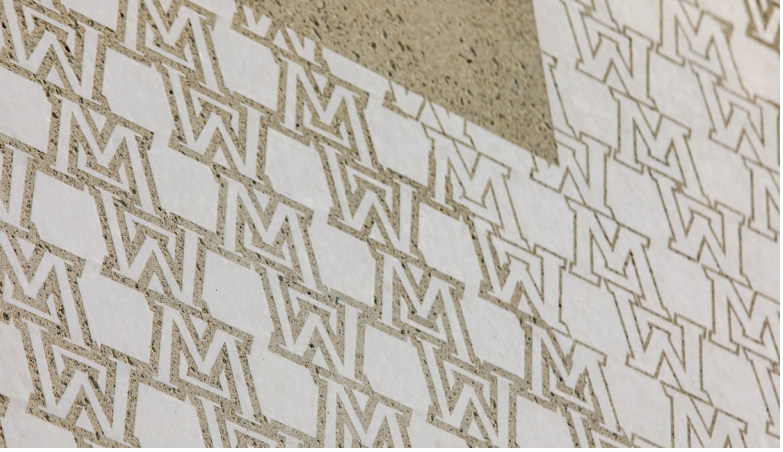
The seawall required a special pigmented face and troweled finish, which was achieved through the inclusion of a special precast concrete formliner. WSP provided design calculations and drawings and also worked with the precaster, Coastal Precast Systems of Chesapeake, Va., to define element shapes and sizes and provide input on fabrication, shipping, handling, and installation.

"The precast concrete wall units formed a long seawall along the St. Thomas waterfront that support Veterans Drive," says Viswanath Kumar, senior vice president of WSP and principal in charge of the Veterans Drive project. "As such, the retaining wall was subject to loading from fill, paving, utilities, traffic, and ocean waves."

A cast-in-place, variable-depth concrete tie beam was built over the wall units and topped by precast concrete coping units. The main design challenge, Kumar says, was to design the counterfort wall units as large as possible and still limit the number of wall types. The shorter walls were longer in plan but had two stems and only one design condition. The taller walls were shorter in plan but had one stem and three design conditions for height variation.

"The face wall thickness and rib thickness were kept same for all the four design variations," Kumar says. "The footing and rib height was different for all the four design types. Since the alignment was curved in some places, the footing had to be skewed to make them fit with each other." Close coordination between the designer and producer solved the challenges. The final geometry of the individual units was left under the producer's control, with final checking by the designer.

Coastal Precast Systems, WSP USA Inc., and American Bridge Co. worked together to coordinate the construction of the Veterans Drive seawall in St. Thomas, with components made in Virginia and shipped by barge to the Virgin Islands. Courtesy of WSP/American Bridge.



Mid-States Concrete Industries used Graphic Concrete technology to create the pattern on the low-maintenance precast concrete panels for the new Maine West High School field house. Photography by Peer Canvas.

The exposed wall surface required an architectural finish, which was provided by a formliner. "All the reinforcing was made of stainless steel for the 50-year design life," he says. "The designer and producer worked closely to optimize steel quantity and reduce waste. Only three sizes of reinforcing bars were used, which simplified detailing and fabrication."

Transportation and delivery also posed some challenges. "Because the precast units were made in Virginia and barged to St. Thomas in two large batches, the producer and general contractor had to carefully coordinate the order and placement of the units on the barge," Kumar says. "Due to the lack of dry land storage space at the construction site, the units were stored on the seabed close to where they were to be eventually placed by a barge-mounted crane."

The main challenge for installation was preparing the seabed by excavating poor soils and filling with a select granular base, which was achieved by a laser-guided excavator with GPS control.

—William Atkinson

New technology used to create patterns in concrete for high school field house

Maine West High School in Des Plaines, Ill., needed a new 40,000 ft^2 (3700 m^2) field house with basketball courts, an indoor track, a long jump area, and a batting cage that drops down from the ceiling. The goals of the project were to provide a cost-effective solution that would also deliver a unique appearance with a low-maintenance and durable design.

The design team originally considered using a metal panel with polycarbonate accents to create a unique design that represented the school; however, the team found that a precast concrete wall panel design featuring Graphic Concrete technology would offer far greater cost savings and lower maintenance costs. It selected Mid-States Concrete Industries of South Beloit, Ill., as the precaster.

Relatively new to the United States, Graphic Concrete technology allows designers to impart durable patterns and images onto precast concrete surfaces, allowing a wide new range of design possibilities. Patterns or images are transferred as a surface retarder via a membrane placed at the bottom of the form. Concrete is then cast on top of the membrane. After the concrete is cured and extracted from the form, the retarder is washed away with a high-pressure washer, revealing an image that results from the contrast between the smooth surface and the exposed aggregate surface.

The designers used the technology to cast the school's initials and full name in an artistic pattern onto one hundred and nine 10 by 40 ft (3 by 12 m) composite panels. A sandblasted, ribbed formliner was also used, which tied the new structure to the existing structural design. The wall panels include 4 in. (100 mm) thick foam insulation, as well as white cement, pigment, standard limestone aggregate, and locally sourced sand.

The precast concrete wall panels took about three months to manufacture and were erected in just two weeks in the fall, while school was in session. The precast concrete was set on cast-in-place footings, and then the precast concrete walls became the structure for the envelope. The quick installation allowed the general contractor to get other trades on-site quickly to keep the project moving along.

Although the project went smoothly, a few challenges were met relatively easily. "We worked side by side with the customer and the architect to keep the project within budget," says Colin Jones, with the preconstruction department at Mid-States. "One of the things we worked through was creating a design that could mirror itself to allow for repetition in production."

In terms of the precast concrete production process, faces of the panels had to be poured within a certain time frame on the paper to achieve the sharpest image possible. "Unlike acid-washed or sandblasted panels, these had to be pressure-washed within a certain time period as well, or the face would not wash off to show the design as clearly as intended," Jones says.

With regard to the installation, "You always try to be as careful as you can when installing panels to prevent chipping, but we were especially careful during transportation and installation, as a patch would have been very hard to blend in with the design and detail on the panels," Jones says. "We didn't have any issues."

—William Atkinson

For Maine West High School's new field house in Des Plaines, Ill., Mid-States Concrete Industries used Graphic Concrete technology to create a one-of-a-kind design. Photography by Peer Canvas.