Sarah Fister Gale and Rachel J. Detwiler

U.S. Freedom Pavilion

The National World War II Museum in New Orleans, La., is a destination for visitors from around the world. The precast concrete, glass, and steel museum, which features slanted walls of windows showcasing a collection of iconic aircraft from that time, was designed to convey the strength and fortitude of the 16 million American soldiers, sailors, and airmen who fought in World War II, as well as the civilians on the home front who built their weapons, ships, vehicles, and aircraft.

The U.S. Freedom Pavilion/Boeing Center is part of an ongoing 240,000 ft² (22,000 m²) expansion of the entire museum campus in New Orleans and is the tallest building on the site.

"The precast concrete panels are what mostly signify the power within the material palette, but it also gave the opportunity to weave interlocking angular geometries in a very precise manner," says Bartholomew Voorsanger, principal in charge of design at Voorsanger Mathes LLC in New York, N.Y.

Ensuring that the design has the presence to anchor the campus was particularly important because the site is bypassed by a highway off-ramp.

"The challenging context of the siting is dramatically resolved by the 98 ft [30 m] high slanting walls," says Martin Stigsgaard, lead designer at Voorsanger Mathes. "Precast was an excellent architectural material to showcase the strength of the mission of the museum and the purpose for this building," Stigsgaard says.

- As part of the National World War II Museum, the U.S. Freedom Pavilion houses a collection of aircraft, tanks, and other combat vehicles.
- Precast concrete cladding provides the necessary resistance to hurricane-force winds, as well as ease of construction.
- The use of building information management software facilitated visualization of the complex geometry and permitted the design team to resolve potential conflicts before erection and helped determine the erection sequence and confirm the accessibility of connections during erection.

Complex geometry

The sloping facades consist of a series of horizontal precast concrete panels that are 8 ft (2.4 m) high with a 19,000 ft² (1800 m²) footprint. Trapezoids and parallelograms are the two repetitive shapes of the individual precast concrete panels on the building elevations. The use of massive interlocking precast concrete elements allowed the team to create a large-scale surface for the exterior, weaving interlocking angular geometries.

The steel frame of the U.S. Freedom Pavilion in New Orleans, La., was designed to resist hurricane-force winds. Courtesy of Gate Precast Company.

You are about to embark upon the Great Crusade, toward which we have striven these many months. The eyes of the world are upon you. The hopes and prayers of liberty-loving people everywhere march with you. In company with our brave Allies and brothers-in-arms on other Fronts, you will bring about the destruction of the German war machine, the elimination of Nazi tyranny over the oppressed peoples of Europe, and security for ourselves in a free world.

—Dwight D. Eisenhower, D-Day message to the Allied Expeditionary Force

"We were able to work closely with the design team and subcontractors to determine specific design intent for complex areas. The availability of the 3-D steel model was extremely helpful with confirming attachment point locations and where additional support was required," said Jonathan Lazenby, engineering manager of Gate Precast in Monroeville, Ala.

Adding complexity to the design was the fact that there are no 90-degree angles in the precast concrete panels, says Mark Ledkins, vice president of operations for Gate Precast Co., the precaster for the project.

"The horizontal joints align, but they are tapered, and all of the vertical joints are offset," he says.

The use of precast concrete also provided versatility in meeting the project's aesthetic requirements and allowed for increased open space inside the building, eliminating the need for columns and obstructions, Ledkins says.

Structural design

Because New Orleans is subject to hurricanes, it was necessary to design the pavilion to withstand 130 mph (210 kph) winds. Choosing precast concrete for the base design provided the building with the durability to withstand hurricanes and allowed for rapid construction, Stigsgaard says. The design of the connections was relatively straightforward, says Lazenby. The structural steel was arranged so that the connections were not complex and the loads on them were relatively small because they were closely spaced.

At 98 ft (30 m) high, the U.S. Freedom Pavilion is the tallest building on the National World War II campus in New Orleans, La. Courtesy of Jeffery Johnston.

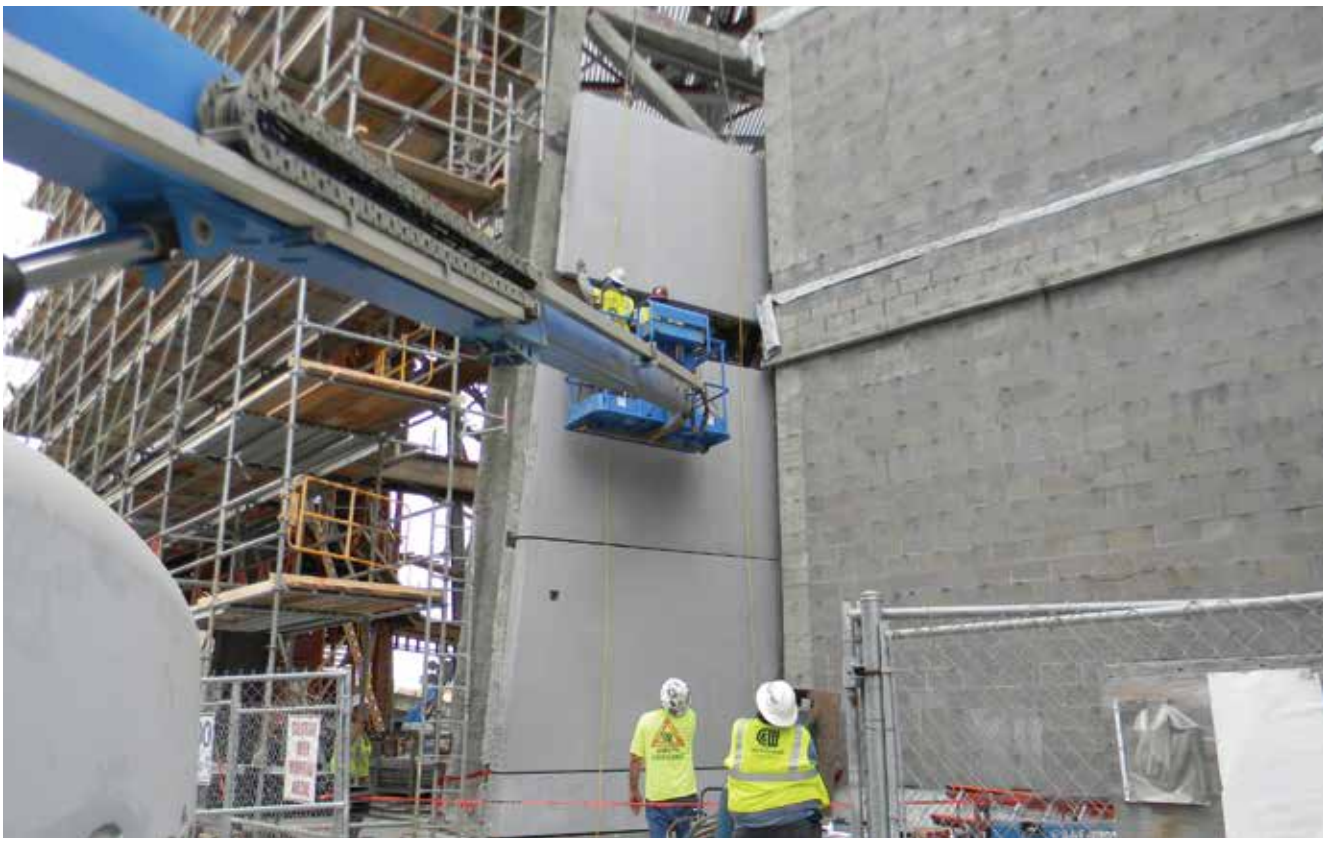
One of the biggest challenges on the project was designing long-span trusses that would be strong enough to sustain the weight of the largest and heaviest airplanes while also having heavy tanks and other equipment displayed on the floor below. The B-17 Flying Fortress is the largest display aircraft hung from a structure anywhere in the country, and it is just one of six planes hanging from trusses inside the pavilion. The others include a B-25J Mitchell bomber, a TBM Avenger, a P-51, a Corsair F4U, and an SBD Dauntless.

Building information modeling (BIM) aided the project in several ways. Lazenby says that BIM "helped tremendously in producing accurate layouts of the multiangular walls, shiplapped vertical joints, and sloped horizontal joints, which in turn made the piece detailing run much smoother." It enabled Gate's engineers to better visualize areas of potential conflict and easily resolve them with the design team.

Erection

"One of the most difficult challenges for this project was erection sequencing due to the large amounts of steel and wrapping precast walls," Lazenby says. BIM helped them determine the piece-by-piece erection sequence and confirm the accessibility of connections during erection.

The site was extremely tight, necessitating a good deal of advanced coordination with the general contractor in locat-



Precast concrete panels form the slanting walls of the U.S. Freedom Pavilion in New Orleans, La. "The horizontal joints align, but they are tapered, and all of the vertical joints are offset," says Mark Ledkins, vice president of operations for Gate Precast Co. Courtesy of Gate Precast Company

ing the crane set ups and delivery of trailers to the crane, says Mitch Dees, project manager at Gate Precast. "We were able to utilize three different setup locations with two different size cranes with different reaches and lifting capacities to be able to reach over existing buildings, MEP [mechanical, electrical, and plumbing] piping, and other equipment to erect the precast panels on the building."

Masonry Arts in Bessemer, Ala., the precast concrete erector, used forklifts and chain falls to erect some of the interior panels, which were under the roof and near the steel beams and columns.

To expedite erection, two separate crews worked simultaneously, Dees says. The use of precast concrete allowed Gate to complete fabrication of all of the panels before erection began.

The U.S. Freedom Pavilion won a PCI Design Award in 2014 for the best government or public building.

Owner: The National WWII Museum, New Orleans, La.

Architect: Voorsanger Mathes LLC, New York, N.Y.

Precaster: Gate Precast Co., Monroeville, Ala.

Engineer of record: Weidlinger Associates, New York, N.Y.

Contractor: Woodward Design + Build, New Orleans, La.

Project cost: $21 million

Project size: 36,000 ft^2 (3350 m^2)

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Abstract

The U.S. Freedom Pavilion/Boeing Center, part of the National World War II Museum in New Orleans, La., houses a collection of aircraft, tanks, and other vehicles used in that conflict. Precast concrete panels cladding the steel frame structure provided the necessary resistance to hurricane-force winds as well as ease of construction. The use of building information management (BIM) software facilitated visualization of the complex geometry and permitted the design team to resolve potential conflicts prior to erection. It also helped determine the piece-by-piece erection sequence and confirm the accessibility of connections during erection. The building won a PCI Design Award in 2014.

Keywords

BIM, building information management, hurricane resistance, museum, PCI Design Awards.

Reader comments

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