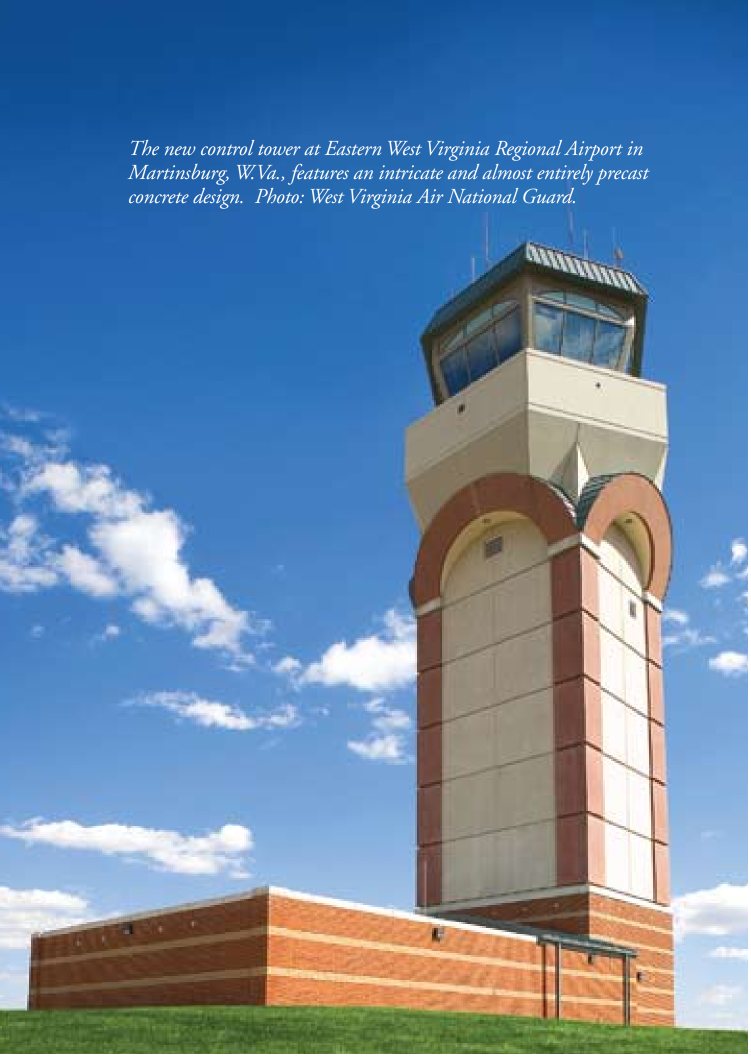

The new control tower at Eastern West Virginia Regional Airport in Martinsburg, W.Va., features an intricate and almost entirely precast concrete design. Photo: West Virginia Air National Guard.

Airport Projects Take Flight

— Robert Ebisch

Security, speed and durability are leading a range of airport projects to incorporate precast concrete components of many types

Environmental factors, including the noise, wind loads, dirt and fumes of an airport, offer special challenges that designers are finding precast concrete components can easily meet. Its flexibility in creating designs and ability to provide detail and color within large single panels make it an economical alternative in prestigious structures in the highly visible airport landscape. And its durability and strong image enhance its security and safety attributes.

Two recent projects show the range of ways that designers are using the components in airport designs. The control tower at Eastern West Virginia Regional Airport in Martinsburg, W.Va., and the terminal building for Meridian Teterboro, formerly Million Air, at Teterboro Airport in northern New Jersey show how precast concrete can create durable and architecturally distinguished structures with the speed and economy that owners appreciate.

Precast's ability to allow the architect's creativity to take flight can be seen in the visually arresting control tower at the Eastern West Virginia Regional Airport. Owners wanted the prominent 11-story structure, containing 9,400 square feet of space, to provide a durable and attractive appearance while meeting the typical highly specialized functional needs.

"Precast was ultimately selected because of distinct advantages over cast-in-place as far as erection time and work on the site itself," explains Joe Wells, senior vice president for Hayes, Seay, Mattern & Mattern (HSMM) in Washington, D.C. "It also allowed us to use a variety of finishes and colors to meet the site's aesthetic design requirements." The structure, which features a total-precast concrete structure, included 237 precast concrete components, including stairs, 6-inch solid slabs, load-bearing shaft panels, arches, 8-inch panels, fascia panels, beams, coping and medallions.

'[Precast] allowed us to use a variety of finishes and colors to meet the site's aesthetic design requirements.'

The airport serves both civilian travel and the West Virginia Air National Guard. HSMM prepared a master plan for conversion of the National Guard base to accommodate the super-large C5 cargo aircraft. Because the tower, the first of 10 planned buildings and the tallest structure for 50 miles, would be so prominent on the

Creating the panels in the precaster's plant allowed virtually unlimited creativity

skyline, the design intent was to distinguish it with a distinct base, middle and top that identified it as a special structure, Wells says.

"The geometry transforms itself as it rises, to accept a structural steel cab on top for the air traffic controllers," Wells says. "Creating that design produced a number of challenges for the precaster during erection but they were challenges that the company accepted, and they did a phenomenal job of placing those elements with a high degree of pretension."

The airport environment itself made precast a natural selection, Wells notes. Precast simplified the construction process needed to meet the noise-abatement requirements. Plus, the strength of precast provided structural value in resisting wind loads on the tall tower.

A major reason for specifying precast concrete was the economy in combining the exterior finish and structure into a single system, according to the architect. The tower shaft consists of 10 load-bearing panels stacked on each of the tower's four sides, seven courses of which are entirely or partially visible to the exterior. The appearance of many more pieces within each single piece was created with the use of reveals cast into the panels to simulate joints, multiple colors and devices such as a 4-inch offset between the beige flat and the red corner of each panel.

"Since all of those effects were created in the precaster's plant, it allowed us virtually unlimited creativity as to the kinds of impact you can create," says Wells. "And you're doing all that while minimizing field labor."

Red material poured in the dimensions of the shaft's corners provided the illusion of supporting columns. Red precast arches and sloping panels beneath the tower's cab offer the added illusion that the top is supported by arches rather than the steel structure that underlies them.

The red of the arches and shaft corners provides color continuity with the tower's base, Wells explains. The base appears to be a red-brick, first-floor exterior but is in fact brick laid up against precast panels and aligned vertically with the

FACT SHEET

Project: *Eastern West Virginia Regional Air Traffic Control Tower*

Type: *Airport control tower structure and exterior*

Location: *Martinsburg, W. Va.*

Owner: *West Virginia Air National Guard*

Architect: *Hayes, Seay, Mattern & Mattern Inc. (HSMM), Washington, D.C.*

General Contractor: *Clark Construction Group, Bethesda, Md.*

Structural Engineer: *Hayes, Seay, Mattern & Mattern Inc. (HSMM), Washington, D.C.*

Mechanical Engineer: *Hayes, Seay, Mattern & Mattern Inc. (HSMM), Washington, D.C.*

Electrical Engineer: *Hayes, Seay, Mattern & Mattern Inc. (HSMM), Washington, D.C.*

Precaster: *Sidley Precast Group, Thompson, Ohio*

Precast Specialty Engineer: *Budai Engineering Inc., Richmond Heights, Ohio*

Components: *237 precast components, including stairs, 6-inch solid slabs, load-bearing shaft panels, arches, 8-inch panels, fascia panels, beams, coping and medallions.*

Project Construction Cost: *$4,990,000, including demolition of original tower*

Assembling the top of the tower required detailed planning, complicated rigging and skilled crane work due to the use of sloping panels, canted arch pieces and structural steel angle attachments 100 feet in the air. Photo: Sidley Precast Group.

The hexagonal structure appears to rest on canted, precast arches atop a red-accented beige shaft. Photo: Sidley Precast Group.

'The way this came together at the top was like a jigsaw puzzle.'

red corners. The red-brick base was stipulated by the master plan for all buildings in the base conversion.

Counting other load-bearing panels interior to the structure, the tower was almost entirely made of structural and architectural precast. The most notable exception — and the project's greatest challenge — was the tower's top, basically a hexagon on top of a box. Making it more complicated, the tower shaft is not a square but a rectangle roughly 25 feet by 30 feet. That meant that the arch pieces were of different diameters, and the precast panels around the hexagon were not all the same size.

"The geometry and detailing had to be visualized in three dimensions," explains Bill Hess, project manager for Sidley Precast Group in Thompson, Ohio. "It had to be done very precisely, and that was true for the erection as well. It was out of the ordinary and had to be done right, but it went together very well."

The arches were placed first, with each arch half connecting to the capitals and the hexagonal steel superstructure surrounding the rectangular tower. The outward-sloping panels were fitted to the tops of the arches and the corners of the shaft. On other portions of the project, about seven precast components could be set per day, estimates Jesse Rice, project executive with Clark Construction Group in Bethesda, Md., the general contractor.

Rigging cables for the 230-ton crawler crane and figuring out how to get each piece in place for the structural steel angle attachments was a challenge, he says. "There were lots of different angles, because you're not just dealing with a box. Plus, it's not installed straight up and down. The bottom is tilted inward. Just getting it 100 feet in the air with men working from lifts was a challenge. The way this came together at the top was like a jigsaw puzzle."

The majority of the tower, however, was erected by a crew of 10 men within two weeks, and the entire project was completed in just over two months.

New Airport Terminal

Owners of Meridian Teterboro wanted to fly first class when they commissioned a 25,000-square-foot terminal at Teterboro Airport, and the designers turned to precast concrete to meet the variety of needs that were required.

"The owner wanted something that didn't look like concrete," says David Zugale, the Boonton, N.J.-based architect on the project. The precast concrete spandrels and insulated panels that Zugale designed for cladding provided "a tasteful twenty-first century façade that will look good for decades." The goal was to create a distinctive appearance, he notes. "It's a strategy of making people stand up and notice what's going on there. Part of our job is making our clients stand out."

The architect considered limestone veneer, brick masonry and concrete masonry units of various types and finishes. The precast solution proved to be as much as 20% less expensive than a stone veneer and offered an advantage over stone or masonry for durability in an airport environment, he says. The mortar in masonry joints, for example, starts showing dirt and stains from fumes in a short time and is more difficult to clean.

"We were looking for a finish that is durable and cleanable without too much fuss," he says. "Precast was in the game from the beginning. With the harsh, long-term exposure required at an airport, it's not unusual to find people trying to power-wash their buildings after only 10 years." Precast's hard, dense surface can withstand the kind of pounding and stain damage an airport provides, and it can be cleaned with just water spray, Zugale says. The Million Air Terminal panels were lightly sandblasted, but their concrete density was well preserved, he adds.

'[Precast concrete] provided a tasteful twenty-first century façade that will look good for decades.'

After considering several options, designers chose precast concrete spandrels and insulating panels to clad the Meridian Teterboro terminal at Teterboro Airport due to its aesthetics, durability and economy — it was as much as 20% less than alternatives.

Sound attenuation was another consideration. "Precast gave us superior sound isolation," Zugale says. "It's very quiet inside the terminal building." It also provided good color control, he notes, and therefore worked well with the terminal's other materials and colors. These included aluminum, light-green glass and hunter-green-painted trim, pink granite dimensional stone at the base and pink-toned precast elements high on the building.

The structure includes some stainless-steel panels to cap the building at the roofline on the north side. "We know those metal panels are about twice the price of comparable concrete," Zugale says, "but we had specific aesthetic reasons for using them there as part of the overall design."

The project was part of a $100-million airport redevelopment, Zugale notes. One of the biggest challenges was fitting acres of hangar and 25,000 square feet of terminal facilities into a constricted space. The tight footprint necessitated having the two buildings constructed right against each other.

"Architecturally, the biggest problem was making the terminal building, which was tiny by comparison with the hangar, have enough importance to be seen across the airport," he says. "We wanted the terminal building to stand out as a different and attractive element."

The new terminal was built next to the old terminal and hangar, an existing steel building. When the new terminal was finished, the old structure was demolished and replaced by the new hangar, which was then connected to the new terminal with access on two levels. The aesthetic tie-in to the hangar was made by a 2'9"-high strip of carnelian granite trim around the terminal's base, with the color continued onto the hangar by a 9-foot-high red-gray masonry base. The granite base was made flush with the wall above by a 2-inch recess cast into the concrete.

Overall, construction of the terminal and hangar took 18 months. The terminal took 12 months to finish, with precast erection coming at the end of the first quarter of work. The precast cladding part of the

FACT SHEET

Project: *Meridian Teterboro Terminal Building*

Type: *Airport terminal for chartered planes and jets*

Location: *Teterboro, N.J.*

Owner: *Meridian Teterboro*

Architect: *David Zugale Architect, Boonton, N.J.*

General Contractor: *Fitzpatrick & Associates, Tinton Falls, N.J.*

Structural Engineer: *Di Stasio & Van Buren Inc., Mountainside, N.J.*

Mechanical Engineer: *Linwood Engineering Associates P.A., New Milford, N.J.*

Precaster: *High Concrete Structures Inc., Denver, Pa.*

Components: *132 precast components including six columns with haunches, 88 spandrels, 30 insulated wall panels, four mock-ups and four miscellaneous components.*

Project Construction Cost: *$9.5 million*

Precast erection took less than a month, half the time it would have taken with a masonry solution.

The terminal's ornate, architectural use of precast includes "T"-shaped columns used as accent pieces on the structure's north side. Photo: David Zugale.

job was assisted by the precaster's first use of Tekla modeling software, which allowed them to model the application of precast to the building's frame in three dimensions. This helped the team to "avoid moment connections in the steel frame that can sometimes be difficult to decipher from traditional shop drawings," the architect says.

Precast erection took less than a month, half the time it would have taken with a masonry solution, Zugale notes. That speed was a particular benefit in this project since construction was taking up valuable airport ramp space.

"The beauty of precast, we've always found, is the speed," says Mike Hintz, president of Fitzpatrick & Associates, the Tinton Falls, N.J.-based general contractor. He credits the owner with recognizing both the durability and low maintenance of the final product, as well as the economy of installation in choosing the precast solution. "Your exterior wall is up and finished, which allows you to follow right up with the other building elements and get the building enclosed more quickly."

The terminal had a large number of different panel profiles, including features such as unusual double-form pieces, precast spandrel panels and an engineered slab to create an outward-sloping balcony railing on the terminal's east end. The precaster, High Concrete Structures, worked with the architect and the structural engineer, Di Stasio & Van Buren in Mountainside, N.J., to create an economical design.

"They wanted a unique elevation visible from the street on one end of the building with a lot of shaped pieces," says Mike Achilles, northern regional sales director for High Concrete Structures, Denver, Pa. "It was unusual due to the number of panels and recesses, the returns on some panels, plus all the connections and little pieces fitting together, as well as the sloping balcony panel."

Achilles pointed out that precast's repetition could be exploited to create a more dramatic appearance. "I told them up front that, if they wanted to use those special pieces, we should do them on the opposite side of the building, too, so we could pour the same pieces twice and cut costs, even though that's the runway side of the building." The result was a building attractive on all sides and built for less cost than if the runway side had been made less visually distinctive.

High Concrete did a great job in offering suggestions, says Zugale. "They were called upon to come up with a way of putting this together that preserved the aesthetic intent of all those profiles and do it within a reasonable cost," he says. "They got more repetitive use out of the formwork for more complicated forms by reversing them, oversizing and working up bulkheads to shorten them. They were very clever in the way they put the formwork together for this job."

The terminal project was also notable for the use of carbon-fiber technology in precast architectural panels. The job used 30 panels reinforced with carbon fiber "C-Grid," using 5 inches of concrete vs. 8 inches for conventional cladding for a 25% reduction in weight. That reduction was important on the south façade, where cladding the third floor made it necessary to lift eight panels, each 25 feet by 12 feet in size, over the projection of the lower two floors where the building was to connect with the new hangar.

It was also important on the north façade of the building, where it enabled reductions in substructure. That facing, away from the hangar, was enhanced with detailing that includes architectural "T"-shaped (in a horizontal cross-section) columns that were made entirely from precast. They rise up the building façade free of the internal steel columns and stop at the bottom of the window level on the third floor.

"Concrete will take the shape of any form you make," says Zugale. "To that extent, you have a lot of flexibility in the profiles and architectural details of the pieces you're creating." ■

At the terminal building for Meridian Teterboro at Teterboro Airport in northern New Jersey, the aesthetic effect of carnelian granite along the building's base is carried to the adjoining terminal by a 9-foot-high band of sand-blasted concrete masonry. Photo: David Zugale.

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