West Virginia Air Traffic Control Tower Martinsburg, West Virginia

This article describes the design and construction of an 128 ft 4 in.–tall (29.1 m) attractive air traffic control tower and building that used precast concrete almost exclusively.

Photo courtesy of Ron Solomon©.

The new West Virginia Air Traffic Control Tower in Martinsburg, W.Va., is an 11-story, 128 ft 4 in.–tall (29.1 m) structure. The tower is flanked by an attached one-story mechanical and electrical building and storage yard.

The structure was sited, designed, and constructed to serve both a military base and the adjacent civilian airport. The tower was the first of 10 planned buildings constructed in a campuswide conversion of the base to support the future fleet of C-5 military aircraft that will arrive shortly.

From the beginning, both the West Virginia Air National Guard (the owner) and HSMM (the architect/engineer of record) felt strongly that the tower's building material should be precast concrete. The designers selected precast concrete for several reasons:

- Economy: it was possible to combine the exterior surface and the structural frame of the tower into a single system.
- Flexibility: it allows for the inclusion of precise detailing and architectural features.
- High quality: built from this material, the structure will sustain long-term durability and minimal maintenance.

The contract for building the project was awarded to Clark Construction Group of Bethesda, Md. (the general contractor). Closely assisting the contractor was the precaster, Sidley Precast Group of Thompson, Ohio. During the course of the project, Sidley provided many cost- and time-saving ideas.

The tower is constructed almost entirely of precast concrete, with three exceptions:

- The cab is made of steel in order to attain greater visibility and lightness.
- The first floor exterior is made of brick because the "Base Design Guide," also prepared by HSMM, specified that brick be used at the base of all buildings on campus.
- A few interior partitions on some floors of the tower use other materials.

Apart from these exceptions, the remainder of the tower exterior, tower frame, and vertical circulation are built entirely of precast concrete.

The form and design of the tower are deceptively simple: a slender, almost square shaft topped by a hexagonal cab to house the air-traffic controllers. Around the cab is a catwalk to allow maintenance of the cab windows. The tower is designed and detailed so that the cab appears to rest on four canted precast concrete arches—one at each face of the shaft—that in turn sit on four precast corner capitals just below the tower's eighth floor.

The brick base of the tower is capped with a precast concrete band that wraps the perimeter of the structure, visually supporting the main portion of the shaft. The shaft is beige, but the exterior portion of each face of the tower is red to complement the red brick base and create the illusion of columns supporting the column capitals below the arches.

While the tower appears to be supported by a brick masonry base, the structure of the tower is made of precast concrete from the foundation to the catwalk level. The precast con-

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crete panels at the tower's base are thinner than the panels at the higher levels. As brick masonry was laid, the masonry's outside faces were aligned with the edge of the precast panels above. Beyond the brick masonry, the precast concrete band plays a dual role. It provides a design solution for the masonry's termination and keeps water or any moisture from entering the brick cavity behind.

While the form of the tower appears simple, designing the 30-ft-high (9.1 m) hexagonal volume of the cap on top of the 75-ft-high (22.9 m) square shaft proved exceptionally challenging. Because the precast concrete is continuous from foundation to catwalk, the canted arches and other precast components designed to transition the shaft to the cab are hung from the tower on a structure designed by the precaster.

These pieces are the only precast components in the tower that are non-loadbearing. However, the flexibility afforded by using precast concrete in a non-structural way offered a design solution that creates smooth transitions of the tower elements through the use of consistent materials.

The catwalk of the tower is the precast concrete top of the design. A simple 10-ft-high (3 m) band of precast concrete with two simple continuous horizontal reveals forms both a base for the lighter steel cab and a guardrail for the catwalk. A single scupper in each face of the catwalk provides drainage for any rainfall accumulation.

The scale of the main portion of the shaft is reduced through the use of reveals, vertically at the center of the shaft and horizontally at each floor level of the tower. Therefore, while the tower appears to be constructed of many pieces of material, the reality is that each face of the main shaft is actually constructed of only a few components of precast concrete.

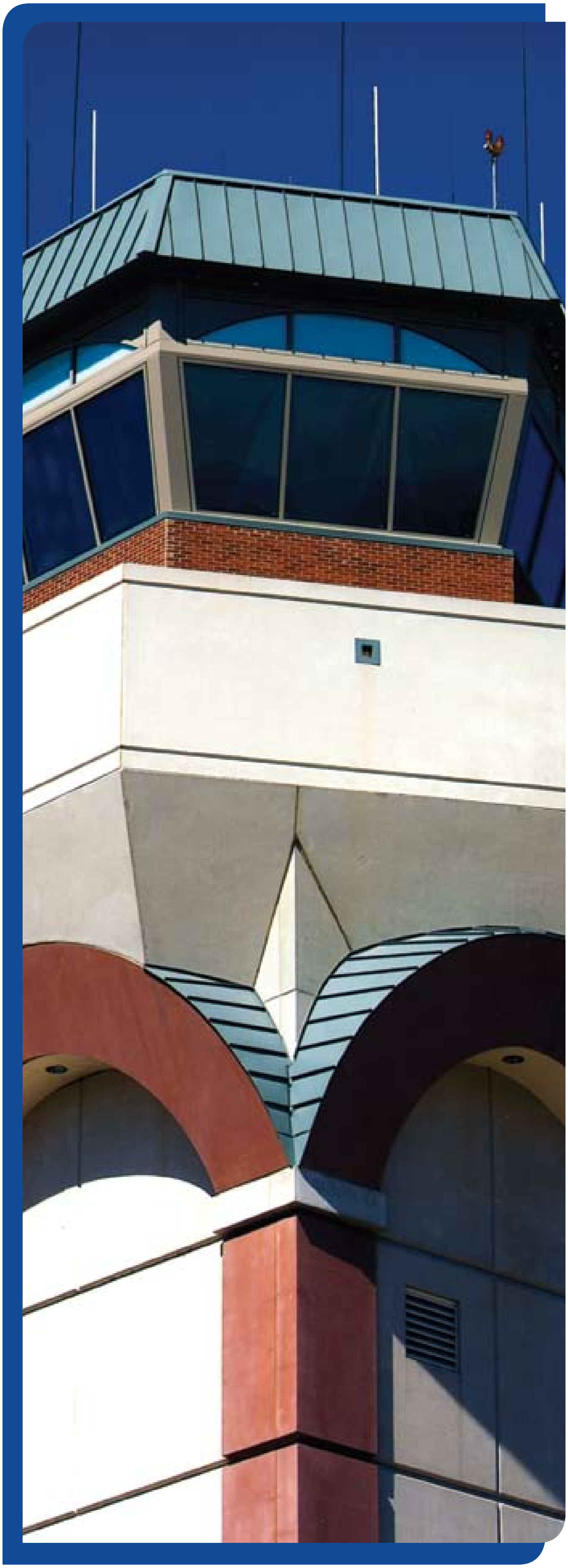
To illustrate this, each side of the shaft above the base appears to be a series of five stacked beige panels centered between five stacked red panels. The panels are, of course, continuous across each face of the tower, but the design options afforded by the precast concrete support the design intent while providing for economical and timely construction. This can be clearly seen in the reveals that are cast into the precast concrete panels to simulate joints and multiple colors in a single piece.

Similarly, nonflat pieces of precast concrete, like those forming the capitals at the eighth floor, provide added detail even though they are simply part of a larger scheme. In the case of the tower, precast concrete helped the designers visually create design complexity without unnecessarily complicating the construction process.

The following precast concrete components were used in the tower: arches, beams, coping, fascia panels, loadbearing shaft panels, solid slabs, stairs, and medallions. For dimensions, quantities, and other details, see **Table 1**.

The precast components were manufactured by Sidley at its plant in Thompson. Assisting the precaster in the preparation of shop drawings and other details was precast specialty engineer Budai Engineering Inc. of Richmond Heights, Ohio.

The precast components were transported by tractor trailer to the project site over a distance of about 400 miles (650 km).



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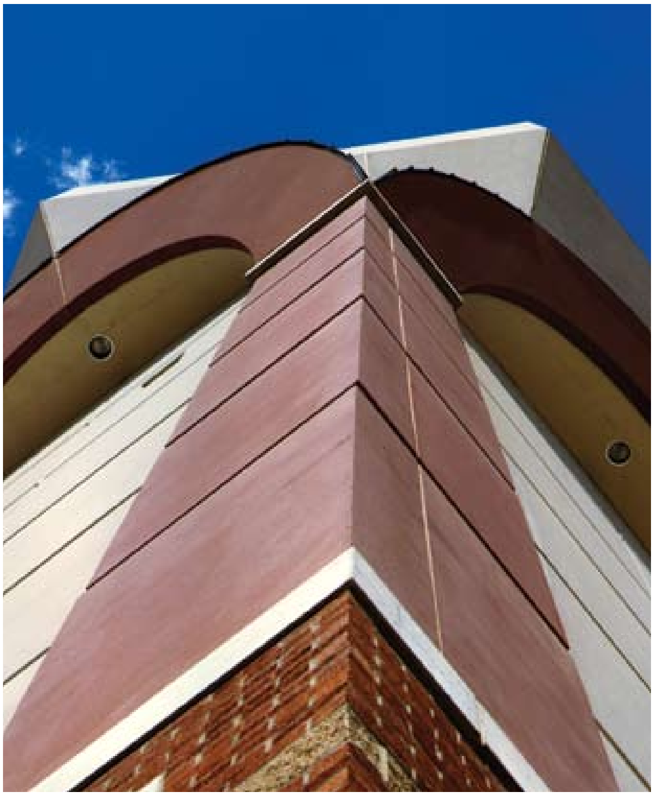

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Design of the project began in February 2003 and was completed a year later. Production of the precast components occurred in March and April of 2005, and erection of the tower started in May 2005. During erection, the five stacked panels were simply laid on top of one another, requiring a crew of less than 10 to do the work. This process was much less labor intensive than if the design had called for cast-in-place concrete construction. Remarkably, the small crew was able to erect the majority of the tower within two weeks, reducing labor and equipment costs considerably.

The total cost of the project was $4.99 million.

Today, the air traffic control tower is operating smoothly and all parties concerned are pleased with the new facility.

CREDITS

Owner: West Virginia Air National Guard; Martinsburg, W.Va.
Architect/Engineer of Record: HSMM; Washington, D.C.
General Contractor: Clark Construction Group; Bethesda, Md.
Precaster: Sidley Precast Group; Thompson, Ohio
Precast Specialty Engineer: Budai Engineering Inc.; Richmond Heights, Ohio

Table 1. Number and Dimensions of Precast Concrete Components

Components	Dimensions	Quantity	Area, ft^2
Stairs	4 ft × 11 ft 9 in.	18	1175
Solid slabs (6 in. thick)	1 ft 10 in. × 16 ft × 6 in. 2 ft 6 in × 11 ft × 6 in. 9 ft × 11 ft × 6 in.	36	3023
Loadbearing shaft panels	10 ft 6 in. × 25 ft 4 in. × 1 ft 11 ft 1 in. × 24 ft 8 in. × 1 ft 7 ft 3 in. × 28 ft × 1 ft 6 in. 10 ft 6 in. × 28 ft × 1 ft 11 ft 1 in. × 28 ft × 1 ft	50	12,588
Arches (8 in. thick)	8 ft × 19 ft × 8 in. 8 ft × 21 ft × 8 in.	8	848
Panels (8 in. thick)	10 ft 5 in. × 9 ft × 8 in. 7 ft 3 in. × 16 ft × 8 in. 10 ft 4 in. × 16 ft × 8 in.	10	1175
Fascia panels	23 ft × 10 ft 6 in. × 8 in.	6	1449
Beams	18 in. × 20 in. × 10 ft 8 in. 26 in. × 20 in. × 27 ft 6 in.	27	444
Coping	4 in. × 7 in. × 3 ft 4 in. 8 in. × 2 ft × 4 ft 10 in.	54	218
Medallions	5 in. × 5 in. × 4 in.	28	6

Note: 1 ft = 0.3048 m; 1 in. = 25.4 mm.