Precast Helps Keep STATIONS On The Right Track

— Donald P. Merwin

The new rail station at Secaucus Junction, the largest station built on the East Coast since the 1930s, offers a dramatic structure that made efficient use of its site and materials. Among those materials were precast concrete components, which are being used in many train station projects today in a variety of ways, including both architectural and structural applications.

The project created a variety of key challenges, according to Benjamin J. Suriano, an engineer and program manager for New Jersey Transit Corp. The $450-million project, named for New Jersey's senior senator, Frank R. Lautenberg, includes a four-story building of 300,000 square feet and five platforms for passenger boarding. It links 10 of New Jersey Transit's 11 train lines and is said to reduce commuting time from the northern part of the state into New York City by 15 minutes or more. It was built at the intersection of the Northeast Corridor, which also carries Amtrak and freight traffic, and the Main line, a few miles north of Newark. A total of 400 trains a day pass through the junction.

Millennium Park
Chicago, Ill.
McDonough Associates Inc., Chicago

Several examples show how construction time and costs are reduced with precast concrete rail station components

The station's exterior walls are made of 800 architectural precast panels, which reduced the time of construction, saved money and enhanced the safety of construction crews who were working close to the active rails, according to Mark Sheeleigh, partner with Brennan Beer Gorman Architects of New York City, the project's architect.

"Precast panels allowed for appropriately scaled projections and ornamentation, which were possible only with precast," he says. "Other possibilities were simply too expensive. Precast concrete panels offer excellent durability and ease of maintenance, two key concerns of the client."

The 800 precast panels contain 1,500 cubic yards of concrete (total 135,000 square feet) and were manufactured with a strength of 5,000 pounds per square inch, according to Sheeleigh. They were fabricated and erected by Coreslab Structures in Thomaston, Conn.

Platforms Also Precast

In addition to the station, precast was specified for the north and south platforms of the Northeast Corridor line. At the concourse level, structural framing consists of 34-inch-deep precast, prestressed double tees and girders. The concourse level, with a 75-foot-high rotunda, is the primary transfer point between trains and provides waiting areas, ticketing facilities, public restrooms, offices and future retail spaces. It was designed to convey a "sense of grandeur found in historic train stations," Sheeleigh says.

The project created space to increase the number of tracks on both the Northeast Corridor and the Main lines to four from two, and to add 14 peak-period commuter trains between New York and Newark, a 25 percent increase in the number of trains running at that time. The transit hub was planned to accommodate the future construction of 3.5 million square

Largo Town Center Station
Largo, Md.
Hayes, Seay, Mattern & Mattern Inc. (HSMM), Roanoke, Va. / STV Inc., New York, a joint venture

Frank R. Lautenberg Rail Station
Secaucus Junction, N.J.
Brennan Beer Gorman Architects, New York, N.Y.

The boarding platform, one of five at the Frank R. Lautenberg Rail Station in Secaucus Junction, N.J., leads to the train station, which was clad with precast concrete architectural panels. The station is the largest built in the East since the 1930s.

Fact Sheet

Project: *Frank R. Lautenberg Rail Station*

Type: *Railroad station*

Location: *Secaucus Junction, N.J.*

Designer: *Brennan Beer Gorman Architects, New York, N.Y.*

Engineer: *Thornton-Tomasetti, Newark, N.J.*

Contractor: *Terminal Construction Corp., Woodbridge, N.J.*

Owner: *New Jersey Transit Corp.*

Precaster: *Coreslab Structures, Thomaston, Conn.*

Precast components: *800 architectural panels, 350 double tees, 120 girders, 110 beams, 20 box girders*

Project cost: *$450 million*

feet of commercial space, to be built both over and alongside the new station.

The station "will hopefully inspire additional transit-centered development that will profit New Jersey residents and businesses, as well as the environment," Sheeleigh says. "We had a good experience with precast and would consider using it wherever monumental profiles are called for."

Washington Metro Features Precast

Expansion of the commuter system operated by the Washington Metropolitan Area Transit Authority (Metro) was achieved with an eye toward uniformity by matching its new stations with existing ones, at ground level, elevated and underground. To meet that requirement, the Largo Town Center station, the new eastern terminus of the Blue Line, was constructed almost entirely of precast concrete components.

The elevated station stands on caissons of cast-in-place concrete, supporting a platform made of precast concrete, which represented the Metro's first use of the material for station platforms on the 86-station system. Precast girders also support the rails and the platform, while precast concrete noise-attenuation panels were attached to the cast-in-place deck above the girders.

Metro's requirements of durability, appearance, cost and brief construction time "all weighed toward a design solution featuring precast concrete," says Harold W. Plott, principal associate with the engineering firm of Hayes, Seay, Mattern &

Mattern, Inc., of Roanoke, Va. "Precast saved us both time and money. One advantage it offered was that the components were manufactured off-site under close quality-control conditions while we were doing site preparation and foundation work. That parallel construction significantly reduced overall construction time."

Nine Months Saved

About nine months were saved in the schedule by using precast concrete components, estimates David Harper, general manager at the precaster, Atlantic Metrocast Inc. of Portsmouth, Va., LEAP Associates International assisted with the girder design. The designer used a computer program called Conspan LA, created for highway bridges, to create the girder design. The program saved time in determining loadings and other features of the girders, says Kamal Chaudhari, project engineer for LEAP.

The construction was part of an overall $456-million extension of the Blue Line and was designed for 10,000 commuters a day, according to Colin Myers, a civil engineer with Metro. Work also included two parking structures accommodating a total of 2,200 cars, both constructed with all-precast concrete designs, one on either side of the tracks. Helping to speed the project, Atlantic Metrocast divided precast manufacture between two plants, each within a relatively short distance of the project.

"There is a very strong possibility that precast will be used in future train stations," says HSMM's Plott. "A 25-mile Metro line to Dulles Airport, requiring 10 or 11 stations, is on the drawing boards, and they'll be looking for any way they can to economize."

Precast Aids Millennium Park

Yet another application of precast concrete helped make Chicago's new Millennium Park a reality. Much of the 24.5-acre park, located along Michigan Avenue in downtown Chicago, is built over railroad tracks and two parking garages, a feat made possible by the use of precast concrete components.

Design work on the $450-million project began in 1998 and the first challenge arose quickly: How to build a new structure over continuously operating commuter-train lines powered by overhead wires carrying 15,000 volts of electricity? "Concrete was a safer bet than steel beams because of the overhead electric catenary wires," says Karl Hanson, the project's structural engineer. "You don't want to touch those wires with steel beams!"

Precast channel beams immediately became the material of choice, says Hanson, an associate with McDonough Associates Inc. of Chicago, principal engineer for the project. Constructing concrete formwork over the railroads would have been difficult if not impossible. A double-tee type beam offered a

'Precast concrete panels offer excellent durability and ease of maintenance.'

Fact Sheet

Project: *Largo Town Center station*

Type: *Commuter rail station*

Location: *Largo, Md.*

Designer: *Hayes, Seay, Mattern & Mattern Inc. (HSMM), Roanoke, Va. / STV Inc., New York, a joint venture*

Engineer: *HSMM, Inc., Roanoke, Va.*

Contractor: *Clark-Kiewit, a joint venture, Bethesda, Md.*

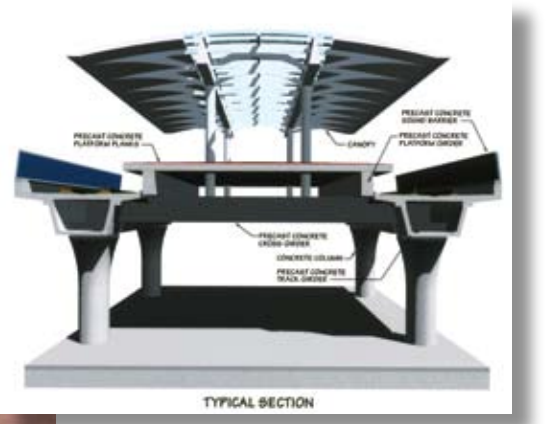
Owner: *Washington Metropolitan Area Transit Authority*

Precaster: *Atlantic Metrocast Inc., Portsmouth, Va.*

Precast components: *36 track girders, 19 cross girders, 36 platform girders, 12 RB girders, 96 platform planks*

Project cost: *$35 million*

The precast concrete boarding platform, the first of its kind in the Washington, D.C., Metro system, is flanked by two parking structures with all-precast concrete structural systems at the Largo Town Center station.



The 24.5-acre Millennium Park in downtown Chicago features a supporting platform made of specially designed large precast double tees.

perfect solution, eliminating the need for formwork.

The result was the creation of what the McDonough firm called a "super double tee" that measured 6 feet wide, 3 feet deep and up to 45 feet long, with two 12-inch-wide stems. The beams were placed side by side, then angles spaced at 5 feet on-center were field-welded, connecting the beams. This base also provided a heavy-duty work platform for constructing the park, consisting of waterproof membranes, drainage structures, soil, landscaping and architectural elements overhead.

Prestress Engineering Corp. of Prairie Grove, Ill., the precaster on the project, designed forms expressly for the super double tees, notes Terry Muntz of Prestress. "These were not conventional double tees. They were going to be supporting a lot of dirt on top of them, which added a lot of load stress." Setting the double tees had to be accomplished at night because there were fewer trains then, he adds.

Approximately 800 double tees were cast. They were built to withstand uniform distributed loads of 600 psf, 12 times greater than the 50 psf design loads of beams typically used in parking structures, he says. The structural system supports as much as 4 feet of topsoil (2.7 billion pounds were put down), more than 1,000 trees, the Frank Gehry-designed Pritzker Music Pavilion, the 110-ton Cloud Gate sculpture (known as "the bean" due to its shape), plus buildings, walls and the occasional construction truck. The precast concrete used in the double tees had a compressive strenth of 6,000 psi.

Other Options Considered

"We didn't automatically go with precast," says Hanson. "We thought about steel beams, but we decided that with precast double tees, we could [erect them] side-by-side and then we could walk on them. Concrete is an insulator against stray electric currents that might have been picked up in the steel beams. Also it's stiffer than steel and we didn't want it bouncy."

The double-tee arrangement throughout the railroad tracks "had to fit together like a jigsaw puzzle because of the irregular track layout. It's a testimony to the precast fabricator's ability, considering the vastness and complexity of the project." Because of soft soil conditions more than 900 caissons had to be augured 80 feet down to hardpan in order to support the double tees.

In addition to building over tracks carrying the Metra electric lines and the Chicago, South Shore and South Bend electric interurban, Millennium Park also covers an existing 1,800-car parking structure and a new 2,200-car facility. The park was part of a larger project that included a refurbished station at the end of the electric line across the street from the park, space for four additional tracks for future expansion, a dedicated busway to connect with hotels, a link to the city's underground pedestrian walkways and reconstruction of viaducts carrying streets at the north and south ends of the park.

"This project demonstrates the ability of design professionals to respond to technological, aesthetic and site constraints imposed on a project in developing a mutually acceptable solution to complex design problems." Hanson says. The park opened in phases starting in November 2002 and was dedicated on July 16, 2004.

These stations show some of the ways in which precast concrete components are being used to help design train stations that serve both today and tomorrow's needs. Whether architectural or structural needs are required, precast concrete can help the station project a strong image and fit in with its surroundings — even if those surroundings are underground. ■

Fact Sheet

Project: *Millennium Park*

Type: *Support for park over railroad tracks, garages*

Location: *Chicago*

Designer/engineer: *McDonough Associates Inc., Chicago*

Contractor: *Walsh Construction Co., Chicago*

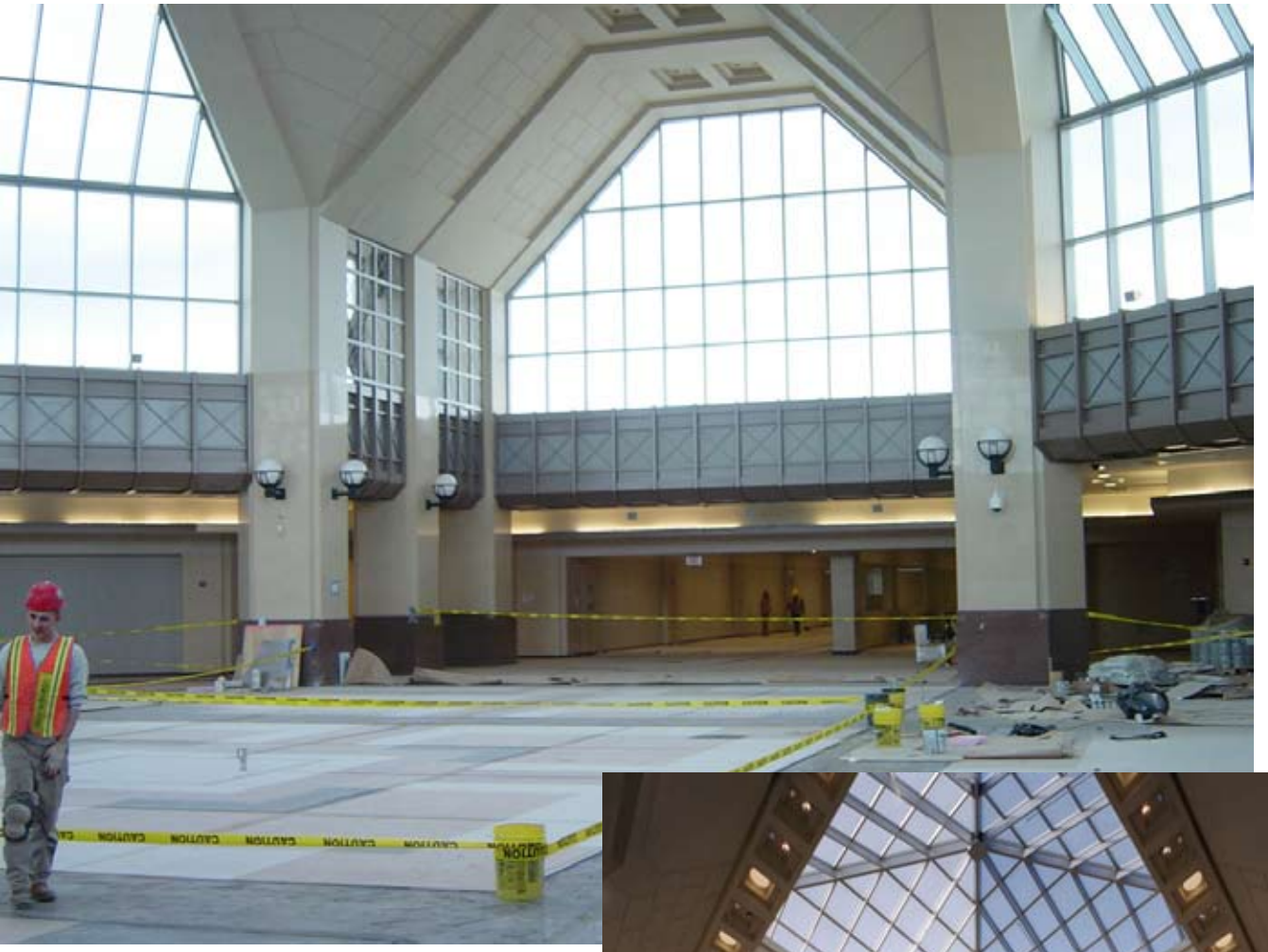
Owner: *City of Chicago*

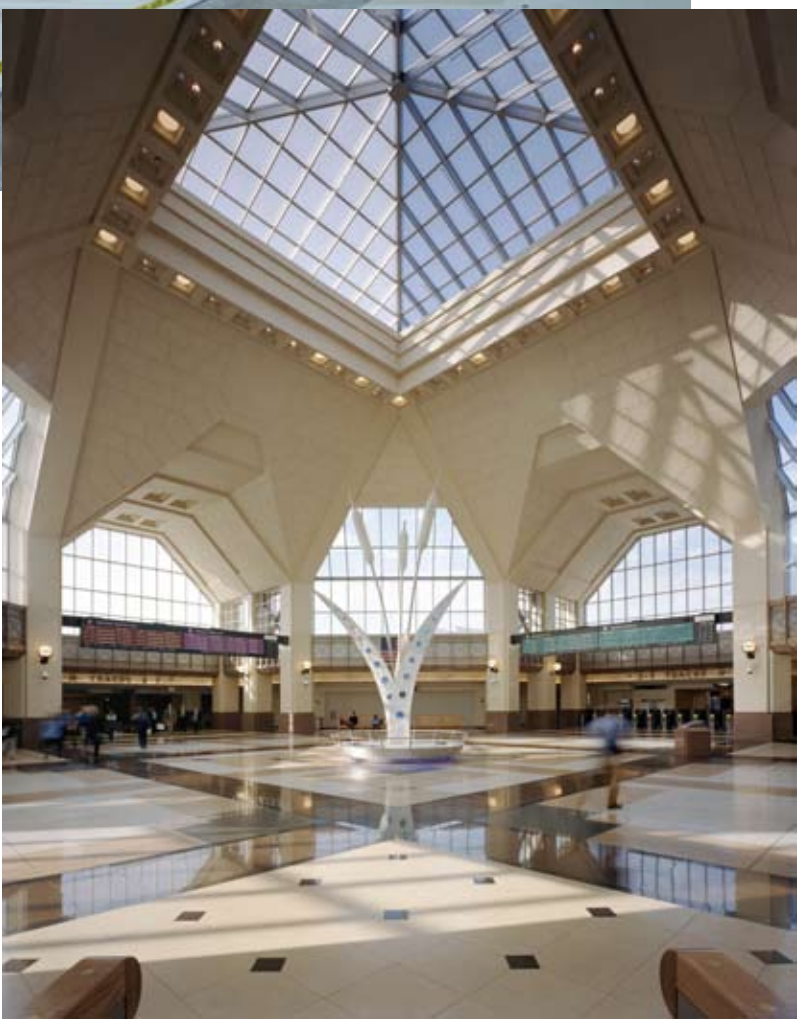
Precaster: *Prestress Engineering Corp., Prairie Grove, Ill.*

Precast components: *Approximately 800 channel beams*

Project cost: *$450 million*

For more information on this or other projects visit *www.pci.org/ascent.*





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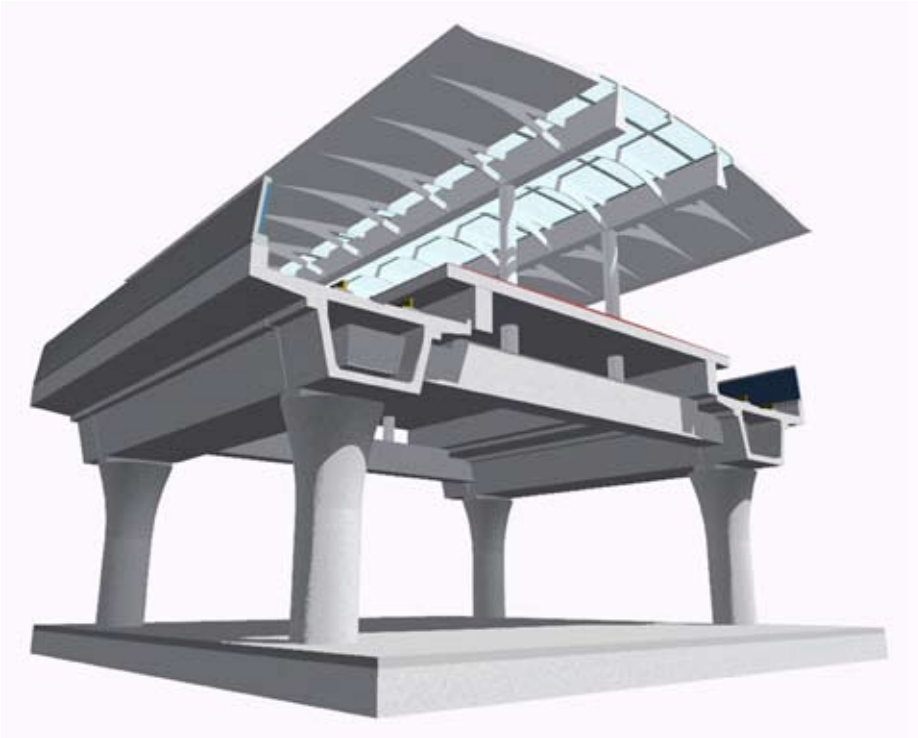


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