Maynard H. Jackson Jr. International Terminal Elevated Roadway System

Extensive use of precast concrete enables rapid and cost-effective construction of multi-level bridge and roadway structure at the Atlanta International Airport

by Barry L. Brown, Atkins

The Maynard Holbrook Jackson Jr. International Terminal at Hartsfield-Jackson Atlanta International Airport in Georgia is a major expansion at one of the world's busiest airports. The 40-gate, \$1.4 billion, 1.2 million-ft^2 international terminal is an efficient, state-of-the-art gateway for international passengers traveling through the United States via Atlanta.

But creating the passenger terminal was only one part of the airport expansion project.

A sophisticated transportation system was needed to give terminal access to travelers and terminal employees. So while the new terminal was being built, Maynard Holbrook Jackson Jr. Boulevard was also undergoing a \$100-million reconstruction to smoothly connect Interstate 75 to the new terminal. The project involved designing and managing the construction of the 1-mile-long, elevated concrete roadway structure that gives direct access to the terminal and terminal parking.

The elevated roadway system that serves the Maynard H. Jackson Jr. International Terminal of the Hartsfield-Jackson Atlanta International Airport incorporates a mile-long, multi-level, prestressed concrete beam bridge that features 14 horizontal curves and 12 grade changes. All photos: Max Anton Birnkammer.

profile

MAYNARD H. JACKSON JR. INTERNATIONAL TERMINAL ELEVATED ROADWAY SYSTEM / ATLANTA, GA.

BRIDGE DESIGN ENGINEER: Atkins, Atlanta, Ga., an Ascend Joint Venture partner

GENERAL CONTRACTOR: Holder, Manhattan, Moody, Hunt, a Joint Venture, Hapeville, Ga.

BRIDGE CONTRACTOR: Matthews/Thrasher, a Joint Venture, College Park, Ga.

CONCRETE SUPPLIER: Argos USA, Alpharetta, Ga.

PRECASTER: Gulf Coast Pre-Stress Inc., Jonesboro, Ga., a PCI-certified producer

ERECTOR: Thrasher Contracting, Atlanta, Ga.

OTHER SUB-CONSULTANTS: Prime Engineering Inc., Atlanta, Ga., Delon Hampton & Associates Inc., Atlanta, Ga., and Street Smarts Inc., Duluth, Ga., all Ascend Joint Venture partners; and Brindley Pieters & Associates Inc., Atlanta, Ga.

To enhance the durability and appearance of the elevated roadway, a protective coating was applied to all exposed vertical faces of the bridge superstructure, the exterior faces of the beams and parapets, and the pier caps and columns.

Constructed from 100,000 yd^3 of precast, prestressed concrete, the 70-span, elevated roadway system incorporates a multi-level beam bridge with 14 horizontal curves and 12 grade changes. The structure supports large, protective passenger canopies; provides multiple access points for vehicles and pedestrians; and is designed to enable future expansion with minimal traffic disruption.

Overcoming "Foundational" Challenges

The busy airport couldn't stop operating while a new terminal was being built, which meant that constructing the elevated roadway system required complex coordination. One of the biggest challenges was that the construction site for the elevated roadway was the former airport access road that served the Delta Airlines Technical Operations Center, a Gate Gourmet food-service facility, and the airport's control tower.

The need to preserve and protect existing utilities created unique challenges—especially when designing the foundations of the elevated roadway. For example, the headwaters of the 344-mile-long Flint River flow beneath the airport runways—and the construction site—through an 18-ft-diameter concrete culvert. To avoid culvert damage and possible river pollution, a set of cantilevered pier caps and dual-level piers were used.

The bridge footings also had to span the airport's 42-in.-diameter main sanitary sewer. This was achieved with a footing that straddles the sewer line, which helped reduce costs and enabled the airport to maintain restroom service throughout construction.

Another challenge engineers had to overcome was Delta Airlines' use of vibration-sensitive equipment in the adjacent aircraft maintenance facility. An investigation revealed that vibration from a normal pile-driving operation would force Delta technicians to continuously and laboriously recalibrate highly sensitive equipment—which would have meant significant aircraft maintenance slowdowns and potential flight delays. Instead, auger-cast concrete piles—which had never been used on a bridge of this size in Georgia—were used. The auger-cast piles were an outstanding success, enabling aircraft maintenance to proceed unhindered and saving Delta millions of dollars in equipment-calibration and work-delay costs.

The complex geometry of the bridge presented an entirely different set of design challenges. The precast concrete beam manufacturer was able to produce prestressed concrete beams with beveled ends—often varying within a single span—to match the many different bends and skews required by the complicated bridge geometry. The manufacturer also incorporated multiple sleeves into the precast concrete beams to serve as conduits for lighting, security, and communication systems.

Drainage was also an issue. With three roadway levels (service on the bottom, passenger arrival in the middle, and passenger departure on top), draining the structure with conventional scuppers was not possible. In addition, the roadway's varying geometry—including long stretches of bridge with 0% profile grade—rendered a typical deck-drain system unworkable and impractical. The solution was to install trench drains along the gutter line at the departure and arrival levels—another first in Georgia for a bridge of this scale.

CITY OF ATLANTA, DEPARTMENT OF AVIATION, OWNER

BRIDGE DESCRIPTION: Bridge features 14 horizontal curves (radii from 115 to 382 ft), 12 grade changes (up to 6%), deck widths between 27 and 115 ft, and span lengths ranging from 40 to 90 ft.

STRUCTURAL COMPONENTS: 578 AASHTO Type III I-beams and 36 prestressed concrete box beams with an 8-in.-thick, cast-in-place concrete deck and single- and dual-level concrete piers with spread footings and auger-cast concrete piles

BRIDGE CONSTRUCTION COST: \$35,100,000 (\$117/ft^2)

AWARDS: Precast/Prestressed Concrete Institute (PCI): *2012 Design Award* (Best Bridge with Spans 76 to 150 Feet); American Concrete Institute (ACI) Georgia Chapter: *2012 First Place Award* (Public Works Other than Buildings); American Council of Engineering Companies (ACEC) of Georgia: *2013 Grand Award for Engineering Excellence*; ACEC of Georgia: *2013 People's Choice Award* (combination of elevated roadway structure and I-75 access roadway)

A forest of cast-in-place, reinforced concrete piers rises from the former site of a key Atlanta airport service road. Each pier is supported by spread footings and auger-cast concrete piles.

All three levels of the roadway are visible in this view. The ground level is for service access, the second level is for arrivals, and the top level is for departures.

Improving Efficiency, Boosting Productivity

Using concrete for both substructure and superstructure enabled the contractor to meet an aggressive project completion schedule. By slightly increasing the concrete strength and using multiple early-break cylinders, the contractor was able to remove formwork and place construction loads on concrete members earlier in the schedule, which helped reduce overall construction time.

Because the pier caps for both levels could support construction loads, prestressed concrete beams could be placed on either or both levels, which enabled multiple decking crews to work simultaneously.

The girder erector was able to further accelerate the construction at the widest sections of the bridge by using a gantry system to install girders on the bridge's upper level. Using the gantry enabled the lower level deck to be constructed with a single concrete placement and eliminated a longitudinal construction joint. The bridge is comprised of 614 girders; during their most productive week, crews were able to erect 200 of them.

Increasing Durability, Reducing Maintenance

Materials and construction methods were selected to not only satisfy the project's requirements in a cost-conscious manner, but also with longer-term needs in mind—such as durability and maintenance. In addition to the artful installation of trench drains, the bridge incorporates a number of other maintenance-reducing features, including:

- Minimizing permeability by paying careful attention to the concrete
- Using as few expansion joints as possible—some as far as 500 ft apart
- Protecting and enhancing the appearance of the concrete by applying a highly durable water-based coating to all exposed vertical faces of the bridge superstructure, the exterior faces of the beams and parapets, and the pier caps and columns

"We certainly encountered a wide range of engineering challenges in this project," said Atkins project manager Stephen Kahle; "not the least of which was designing a multi-level roadway in a tightly confined area—while at the same time maintaining public access and utility service to numerous mission-critical, pre-existing businesses and facilities. I'm pleased to say that our structural engineering team was able to employ a number of innovative, 'first-in-Georgia' design and construction techniques that helped minimize costs and keep the project on schedule."

The 8-in.-thick, cast-in-place, reinforced concrete deck is supported by prestressed concrete box beams that sit on cast-in-place concrete piers and spread footings with auger-cast concrete piles.

New Gateway to the World

With 80% of U.S. residents within two hours' flying time from Atlanta, Hartsfield-Jackson Atlanta International Airport is a vital part of North America's transportation infrastructure. Now international travelers are using the elevated roadway system to gain convenient access to both the arrival and departure levels of the international terminal.

The new elevated roadway structure enables the Maynard H. Jackson Jr. International Terminal to serve as an efficient and attractive gateway to world travel.

Barry L. Brown is an assistant vice president and senior transportation group manager for Atkins in Atlanta, Ga.

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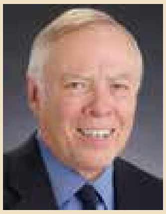
AESTHETICS COMMENTARY
by Frederick Gottemoeller



Airport-terminal roadways are hybrids; they are not quite buildings, but they are not quite bridges either. Design speeds for these structures are low, permitted curvatures are sharp, and long spans are not required to cross ramps below. The pier spacing for these structures mimics the bay sizes of the terminal itself. In fact, for reasons of architectural or functional harmony, it may well be necessary for the two dimensions to match.

Like a building, the terminal roadway is seen close-up by pedestrians. For those on the lower arrival level, the space below the terminal roadway becomes an extension of the arrivals hall, which is often filled with people. The terminal roadway defines the boundaries and creates the ceiling of this huge outdoor space. If done well, the roadway structure can make the arrival experience more welcoming.

This is an immense challenge. The curves of the roadway and the need to clear undercrossing ramps necessitates multiple pier configurations and straddle bents. The key to success in this situation is to use simple, attractive details, which are consistently repeated.

The Maynard H. Jackson Jr. International Terminal Elevated Roadway System does this very well. The piers always use "inverted T" pier caps supported by simple square columns. The pier caps always end with rectangular blocks, terminating the cap and at the same time disguising the "T" cross section. At the straddle bents, the rectangular end blocks are always simple extensions of the columns. The differing planes of the webs and flanges of the precast concrete I-girders create panels of shade and shadow that add to the visual interest. With a highway bridge, these characteristics are seen from such a distance and at such high speed that they are barely noticed. Here, they become valuable contributors to the overall impression.

The fact that there are no decorative architectural features adds to the effect of simplicity and calm. Adding such features would have added only visual distraction and complication.

The simplicity and calm extends to the roadway lighting and the way it is supported by the structure. Finally, the light-colored coating evens out the color and texture of the concrete elements and makes it possible to appreciate the piers as simple shapes. It also reflects light within this huge arrival hall, making it brighter in daylight and easier to light at night.

For any airport terminal seen from the landside, the terminal roadway structure is more important in determining the architectural impression of the terminal than the terminal building itself. Many airports miss this fact, spending much time and energy on the architecture of the building and not enough on the appearance of the terminal roadway. By constructing a terminal roadway of this high visual quality, Atlanta has avoided this trap.