

RAPID RISE FROM THE ASHES

GDOT's team rebuilds I-85 segment in 44 days using precast concrete bulb tees after devastating fire destroys three spans in both northbound and southbound directions

by Bill DuVall, Georgia Department of Transportation

I will long remember March 30, 2017. I was driving into town that evening with my son to have burgers when the radio announced there was an intense fire under the Interstate 85 (I-85) viaduct near Piedmont Road in Atlanta, Ga. I called the state bridge inspection engineer for an update, turned the car around, and headed to the office.

My son was so excited he didn't even mind going to my office. That worked well, as he could read and answer texts (he's good at it) and make calls for me as we went. I contacted my assistants, the construction office, management, and the Federal Highway Administration (FHWA). At 6 p.m., as we drove, we

heard that a span had collapsed. I have experienced numerous incidents with bridges damaged by collision or fire, but none had ever brought down a span until that night.

Georgia State Patrol was first on the scene and closed I-85. Other first responders included Georgia Department of Transportation's (GDOT's) highway emergency response operators and local police and firefighters. Due to their coordinated and immediate response, no one was injured by the collapse. That left it to our team to determine the extent of the damage and the best and most expedient way to return the bridge to service immediately.

243,000 Vehicles per Day

I-85 splits from Interstate 75 in downtown Atlanta, and heads north towards South Carolina. The viaduct crosses Piedmont Road in a section that carries 243,000 vehicles per day. Due to its key location and the extent of the damage, Governor Nathan Deal declared a state of emergency, which allowed FHWA to authorize emergency funding and allowed GDOT to negotiate the contract for repair. The governor also asked GDOT Commissioner Russell McMurry to fund incentives for early completion. Road-user costs were used to set the appropriate level of incentive.

McMurry immediately contacted C.W. Matthews (CWM) Contracting Co., which had responded quickly to a bridge fire on Interstate 285 in 2001. CWM's representatives were at the I-85 site that night placing light towers and evaluating the damage and reconstruction options.

The heat of the fire caused enough damage to the concrete and prestressing strands that the bridge collapsed. It also caused significant damage to the intermediate bents supporting that span and those spans directly north and south. The concrete bents experienced loss of concrete cover, buckling of column reinforcement, and significant cap damage. GDOT bridge inspectors later found extensive delamination and



Evaluations found that three spans in each direction needed to be replaced as well as four bents, with round columns and inverted-tee bent caps. Demolition of the spans began immediately. All Photos: Georgia Department of Transportation.

profile

INTERSTATE 85 BRIDGE OVER PIEDMONT ROAD / ATLANTA, GEORGIA

ENGINEER: Georgia Department of Transportation, Atlanta, Ga.

PRIME CONTRACTOR: C. W. Matthews Contracting Co., Marietta, Ga.

DEMOLITION CONTRACTOR: D. H. Griffin Construction, Greensboro, N.C.

PRECASTER: Standard Concrete Products, Atlanta and Savannah, Ga.—a PCI-certified producer

cracking of the bottom flanges of the inverted-tee bent caps. Ultimately, it was determined that three spans in each direction needed to be replaced: spans 29, 30, and 31 northbound (ranging from 76 to 92 ft) and spans 28, 29, and 30 southbound (ranging from 80 to 120 ft). Four bents also had to be replaced. They were similar in type, with round columns and inverted-tee bent caps, but the cap lengths varied due to the skew and number of beams supported.



Similar to Design-Build

The project proceeded similarly to a design-build project, with GDOT working closely with CWM on issues related to the reconstruction. GDOT provided the contractor with initial structural details so they could immediately contact suppliers.

The GDOT team coordinated efforts through the Transportation Management Center and conducted progress updates every few hours. The first goal by department designers was to provide construction plans to the contractor and estimators by late Sunday so work could begin Monday morning. That goal was achieved through a tremendous team effort by the GDOT bridge engineering staff.

The reconstruction contract was designated for completion on June 15, 2017, with a \$1.5-million incentive if completed by May 25 (before Memorial Day) and \$2 million if completed by May 21. GDOT allowed \$200,000 for every day prior to that, up to \$3.1 million.

The existing spans were demolished in tight quarters, crushed, and cleared from the site. Crews used small pneumatic hammers to expose the concrete column cores and footings on all columns. The original columns were 3.5 or 4 ft in diameter and many of them could be salvaged, with new concrete placed

The damaged portion of the bridge contained complex layouts, including a slight curve with the typical bent laid out radially, a 50-degree skew where the viaduct crossed Piedmont Road, and two trapezoidal spans

around the cores. Existing pile footings were reused, and the contractor cleaned the adjacent bents and superstructure to expose their condition. Bridge inspectors worked throughout the demolition, identifying the damage and ensuring the remaining structure was sound.

As demolition transitioned to reconstruction, GDOT installed a webcam. In retrospect, it should have been installed at the beginning of the project so that citizens could watch the entire process. It's inexpensive and offers a great asset to share with the public. As an engineer, it was fascinating to watch CWM complete the project in record time.

The communications team also provided regular updates to the news media and social media websites. Interviews were conducted and placed on YouTube as well. Traffic information and construction updates were widely shared by partner agencies and officials. The GDOT communications team really came through, and the public appreciated the efforts to inform them along the way.

Beams on Critical Path

Early on it was evident that casting new beams would be on the critical path. The night of the fire, Standard

Concrete Products (SCP), which had cast the original beams, was contacted. SCP found forms for the original AASHTO Type V prestressed concrete girders at various plants, but they were not available in sufficient numbers. So the 61 beams to be replaced were redesigned using 63-in.-deep bulb tees. Due to the varying span configurations, this required a huge effort.

The damaged portion of the bridge featured complex layouts, including a slight curve with the typical bent laid out radially and a 50-degree skew where the viaduct crossed Piedmont Road. In the six spans needing replacement, one (over Piedmont Road) had skewed bents at each end, two spans were trapezoidal, and three had radial bents.

The southbound span over Piedmont Road had 12 lines of girders, while the other two southbound spans each had 11 girder lines. The northbound bridge had nine lines of girders in each span. Six girder designs were created and detailed to replace the 61 girders. GDOT began checking shop drawings from the precaster on Sunday night and provided approved beam details to the contractor and fabricator before completion of the entire set of construction drawings at midnight on Sunday.

GEORGIA DEPARTMENT OF TRANSPORTATION, OWNER

OTHER MATERIAL SUPPLIERS: Live-feed webcam: OxBlue, Atlanta, Ga.; Steel diaphragms: Augusta Iron & Steel, Augusta, Ga.; Bearing pads: Highway Materials, Forest Park, Ga.; Metal deck forms: Topikal, Atlanta, Ga.

BRIDGE DESCRIPTION: Replacement of three spans both northbound and southbound (six in all) of the 4150-ft viaduct of Interstate 85 over Piedmont Road following fire

STRUCTURAL COMPONENTS: 61 prestressed, precast concrete bulb tees, 63 in. deep, ranging from 43 to 115 ft long; 4 concrete intermediate bents with inverted-tee caps; 5090 yd² of concrete bridge deck

BRIDGE CONSTRUCTION COST: \$16.7 million (including \$1.6 million for demolition and \$3.1 million in incentives)



Many of the original columns, 3.5 or 4 ft in diameter, were salvaged, with new concrete placed around the cores. Existing pile footings also were reused.

Two Plants Cast Beams

Forty-nine of the prestressed concrete beams were produced at SCP's Atlanta plant and 12 were produced across the state at their Savannah plant and trucked to the site. The contractor began work on the spans with the most conventional beams and then progressed to the trapezoidal spans. In some places, cranes had to reach 120 ft to set the beams. GDOT worked closely with the contractor to inspect the beams before they left the plant, and permitting restrictions were adjusted to create greater flexibility for deliveries.

SCP was able to manufacture the girders within days of receiving the plans. By April 18, two spans of girders were erected and crews were able to start cast-in-place deck construction.

Crews also had to work around overhead transmission lines in some locations. CWM coordinated directly with Georgia Power and did not interrupt service during the construction.

One of the most complicated portions of the project was the inverted-tee caps. There were concerns early on with trying to redesign the caps, but the original design was kept. The caps contain a tremendous amount of reinforcement with tight clearances. The design team worked closely with the field to make necessary adjustments and keep the project on schedule.

GDOT prefers to use concrete diaphragms in all of its bridge projects. However, steel diaphragms are allowed in certain situations. In this case steel diaphragms were provided in the design in order to accelerate construction.

GDOT required the contractor to wet-cure the decks for a minimum of three

Timeline	
The timeline for the reconstruction of the viaduct on Interstate 85 in 44 days:	
MARCH 30 (THURSDAY):	Fire event damages six spans. GDOT contacts C.W. Matthews and Standard Concrete Products about girder options.
APRIL 1:	Progress updates begin being shared every few hours through GDOT's Operations Center.
APRIL 2:	GDOT provides intermediate structural details to CWM so it can work with suppliers.
APRIL 3 (Monday):	Plans for replacement prestressed concrete beams are sent to CWM and estimators at 12:01 a.m. Work begins to expose concrete cores on columns and footings.
APRIL 4:	Press conference announces timeline and plan. Governor asks GDOT Commission to incentivize project.
APRIL 6:	Columns at Bent 29 southbound are formed and placed. On-site webcam is installed and provides live feed.
APRIL 10:	Most columns are completed and caps are formed.
APRIL 17:	First prestressed concrete beams are set.
APRIL 25:	Final girder is placed on southbound span over Piedmont Road.
MAY 3:	All spans are placed and grinding begins on northbound bridge deck.
MAY 12:	Northbound lanes are opened.
MAY 13:	Southbound lanes are opened and the full incentive payment is achieved.

days using curing blankets and soaker hoses. Uncoated reinforcement also was used to save time, as the new deck would provide sufficient durability compared to the 30-year-old decks on subsequent spans. The new decks will be sealed in the near future to provide additional protection. In fact, the decks turned out better than expected and it is anticipated that due to the use of Type III cement the final concrete strength will be much higher than the 3.5-ksi requirement.

GDOT also used 24-hour accelerated-strength concrete to construct the substructure, with fiber additives to minimize cracking. The mixture design included Type III cement, but no. 89 stone was added due to the congestion of the reinforcement and to improve workability.

Incentives Realized

Work moved so smoothly and efficiently that CWM opened the northbound lanes on May 12 and the southbound lanes on May 13. That fast work generated the full \$3.1 million in incentives and it was definitely worth it. In addition to finishing so quickly, no injuries were reported during construction. CWM did a great job with this project.

A formal report on the cause of the fire has not been completed; GDOT continues its support of and participation in an investigation of this event by the National Transportation Safety Board and appropriate local agencies. Armed with findings and recommendations, GDOT will develop additional practices to ensure the safety and integrity of its infrastructure.

That fast work generated the full \$3.1 million in incentives and it was definitely worth it.

I am humbled by the work of the GDOT bridge office to return this critical bridge to service so rapidly. It required a huge team effort, and I was especially proud that so many of our junior engineers rose to the challenge. At this point, there is only one remaining task left on my list related to this event: I still owe my son a burger. 🍔

Bill DuVall is the state bridge engineer in the Office of Bridges and Structures with the Georgia Department of Transportation in Atlanta, Ga.