

Mississippi

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Mississippi is a state built on concrete structures. Of the state's 16,596 bridges, the Mississippi Department of Transportation (MDOT) manages and maintains 5775. Approximately 88% of these bridges are constructed with concrete superstructures.

To widen and replace state-owned bridges, MDOT uses American Association of State Highway and Transportation Officials (AASHTO) prestressed concrete girder shapes along with bulb-tee girders. The locally owned bridge system relies mainly on precast concrete channel-beam bridges for short-span structures.

Mississippi has three precast, prestressed concrete facilities capable of producing voided-slab spans, AASHTO girders, Louisiana girders, Florida girders, Northeast Extreme Tee (NEXT) beams, and prestressed concrete piling. The state has two additional facilities capable of casting reinforced (nonprestressed) concrete channel beams and aesthetic panels.

A robust concrete industry, coupled with the desire to be innovative and create an active working relationship among the departments of transportation (DOTs) of the Gulf South Region, has helped keep a large variety of precast concrete elements cost-effective.

The Gulf South Precast Concrete Association (GSPCA) was founded in 1961 to promote precast, prestressed concrete elements for the transportation systems in Alabama, Louisiana, and Mississippi. In 2016, GSPCA reorganized to form PCI Gulf South, a chapter of the Precast/Prestressed Concrete Institute.

PCI Gulf South expanded its role with DOTs by forming a regional transportation committee composed of members from the Alabama, Louisiana, and Mississippi DOTs, industry, educational institutions, and consultants. Through collaboration with PCI Gulf South, MDOT continues the expansion of concrete technology and standardization today. The relationship has helped MDOT expand the use of concrete elements such as Florida I-beams (FIB),

On February 17, 2016, after a routine inspection indicated significant scour on the southeast corner of the bridge located on Robinson Road in Jackson, Miss., the bridge was closed for nearly a year while plans were developed and funding was acquired. A new bridge was constructed with precast, prestressed concrete Florida I-beams and a cast-in-place deck. It opened to traffic on September 1, 2017. All Photos: Mississippi Department of Transportation.



NEXT beams, and other pre- and post-tensioned precast concrete bridge elements. MDOT has worked with PCI Gulf South to implement use of these elements in a way that is consistent with surrounding states. This standardization has allowed MDOT to purchase these elements at much lower costs.

Long-Span Post-Tensioned Systems

Mississippi has traditionally turned to structural steel for long-span river and railroad crossings, grade separations, and bay bridges. However, because the cost of structural steel is high and the state lacks a strong steel industry with fabrication capabilities, prestressed and post-tensioned concrete systems have become the structures of choice for long spans.

On August 29, 2005, Mississippi was severely affected by one of the most devastating hurricanes to strike the Gulf Coast. Hurricane Katrina destroyed two of the state's large bascule bridges along U.S. Highway 90 in Biloxi Bay and Bay St. Louis. With replacement costs at nearly \$500 million, Mississippi began developing design-build documents to replace the two bridges. This was MDOT's second design-build project after the Mississippi Legislature opened the procurement process in 2004, and the estimated cost was 100 times that of MDOT's first design-build project, the replacement of a low-traffic, rural bridge.

Under a conventional, expedited design-bid-build procurement format, MDOT expected project delivery would take between three and four years. However, design-build provided a project delivery of less than two years.

The Bay St. Louis Bridge was constructed by a joint venture of Granite Construction, Watsonville, Calif., and Archer Western (Walsh Group), Atlanta, Ga., with HNTB, Baton Rouge, La., in charge of the design as well as construction engineering and inspection (CEI) (See *ASPIRE*® Spring 2007). The Biloxi Bay Bridge was constructed by joint venture Kiewit Massman Traylor Constructors, Omaha, Neb., as the contractor and Parsons Transportation Group, Pasadena, Calif., as the designer, with Volkert in Jackson, Miss., conducting the CEI (See *ASPIRE* Winter 2012). Both bridges were completed in record time with prestressed, post-tensioned concrete girders as the superstructure elements.

Each bridge is a fixed-span high-rise structure composed of prestressed concrete bulb-tee girders with a multispan, haunched, post-tensioned main span unit. The decks are cast-in-place (CIP) concrete and contain



After being damaged beyond repair following Hurricane Katrina in August 2005, the new Biloxi Bay Bridge was completed in record time with prestressed concrete girder approach spans and haunched post-tensioned concrete girders for the main spans. The aesthetically designed new bridge features artwork from local artists and pedestrian lanes offering beautiful views of Biloxi, Ocean Springs, and the Biloxi Bay.

pedestrian lanes that are large enough to double as inspection lanes for under-bridge inspection vehicles.

The result is two aesthetically designed, long-lasting, and low-maintenance concrete bridges, which have replaced costly, high-maintenance bascule bridges. The new bridges also feature artwork from local artists. The new pedestrian lanes have become so popular with local residents that MDOT authorized a project to build a new parking area near the Bay St. Louis Bridge to make pedestrian access easier.

The new bridges are higher, wider, and longer than the structures they replaced. The record rebuild has helped reconnect communities, restore mobility, and renew the Gulf Coast infrastructure, economy, and culture. Communities on the Mississippi Gulf Coast are now stronger, and their futures are brighter.

Innovative Solutions for Local System Bridges

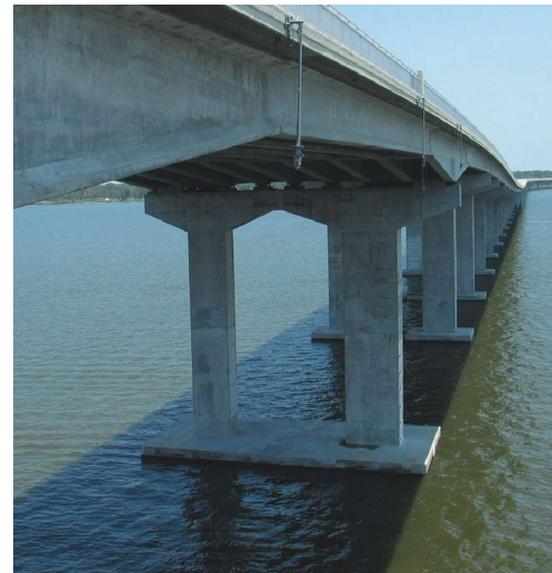
The City of Jackson closed a local bridge, located on Robinson Road between Raymond Road and the McDowell Road Extension, after a routine inspection indicated significant scour on the southeast corner of the bridge. After the closure on February 17, 2016, the scour caused the collapse of the end span on the three-span channel-beam bridge in March 2016.

Mississippi's local system traditionally uses 19-ft- to 31-ft-long reinforced concrete channel beams, but the City of Jackson was forced to search for an alternative solution to replace the bridge when this solution would not meet the following challenges:

- Existing utilities could not be moved.
- The existing roadway grade could not be raised.

The bridge was closed for nearly a year while city officials, the Federal Highway Administration, and MDOT's Local Public Agency (LPA) Division acquired funding and developed plans. Volkert was selected to design the replacement bridge.

With assistance from the local prestressed concrete industry, a design was developed for a bridge comprised of four FIBs that span 95 ft to address the needs of this project. The deck is CIP, and the abutments are CIP caps supported by concrete piles. The cap and piling were specifically designed and located to avoid



The new Bay St. Louis Bridge constructed after Hurricane Katrina is a fixed-span, high-rise bridge comprised of prestressed concrete bulb-tee girders with a multispan, haunched, post-tensioned concrete main span unit. The bridge connects Bay St. Louis with Pass Christian on the heavily traveled U.S. Highway 90 corridor along Mississippi's Gulf Coast.

existing utilities. The new bridge was opened to traffic on September 1, 2017.

This LPA project was the first use of FIBs in Mississippi. Having used this new feature on a small-scale project, MDOT is now planning to use these beams in multiple projects currently under design. MDOT will begin construction of Mississippi's first state-owned project using FIBs in the spring of 2018.

Aesthetic Bridge Solutions

With a robust concrete industry, MDOT is able to add aesthetic elements to bridges at a lower cost than would be possible with other construction materials. The U.S. Highway 61/84 Bridge over Liberty Road in Natchez, Miss., is a prime example of such a structure.

Liberty Road provides access to the starting point of the Natchez Trace Parkway at milepost 0. The Natchez Trace Parkway is part of the U.S. National Park Service and extends 444 miles from Natchez to Nashville, Tenn. It follows the Old Natchez Trace, a historic trail used by Native Americans, settlers, traders, and soldiers.

Also known as the Gateway to the Natchez Trace, the bridge over Liberty Road serves as the entrance to this national landmark. For this reason, its design needed to be signature in nature and invoke the feeling of entering the past. The bridge is a traditional two-span AASHTO Type IV girder bridge with a CIP deck, CIP abutments, and intermediate bents.

Aesthetic precast concrete panels and castings were added to the bridge to provide an attractive

landmark. The castings and panels were cast by Jackson Precast, Jackson, Miss., a member of PCI Gulf South and a facility specializing in aesthetic panels and castings.

Preservation and Accelerated Projects

Concrete elements, both precast and CIP concrete, have provided Mississippi with low-cost, sustainable bridges constructed and maintained to be durable and dependable over the long term. With the flexibility of the federal Moving Ahead for Progress in the 21st Century Act (MAP-21), MDOT spends, on average, \$100 million on bridge replacements, \$3 million on preservation, and \$20 million on rehabilitation annually. Prior to MAP-21, MDOT was only able to spend funds on replacements, leaving bridges to fall into disrepair. However, because of concrete's ability to withstand decay, MDOT's structures have fared well.

MDOT is eliminating joints on CIP decks by the use of link slabs and repairing open joints with modular and preformed joints.

In the past 15 years, MDOT has started to experience concrete deck deterioration in portions of north Mississippi bridges. Some of this deterioration has been linked to high chloride concentrations in concrete decks. In response to this problem and as part of the rehabilitation program, MDOT has developed a hydro-demolition and concrete-overlay process to repair these damaged bridge decks.

Since 1987, Mississippi's transportation funding has remained flat, while construction

and maintenance costs have risen by more than 300%. MDOT has recently shifted its primary focus to system preservation, but it is still unable to keep up with infrastructure needs at the current funding level.

Accelerated bridge construction projects are becoming commonplace in MDOT's priority and project development. In the past, bridge replacement projects have required either new bridge construction to take place along a new alignment or for temporary detour roads and bridges to be constructed. The right-of-way and utility issues associated with these options make them both costly and time-consuming.

Moving forward, MDOT will perform more in-place bridge replacements, which will require road closures. Precast concrete systems allow for fast construction, reduce right-of-way and utility costs, and significantly reduce closure times and the impact on the traveling public.

In 2016, MDOT celebrated its centennial year by looking back at the great advancements and investments in the state's transportation network. Looking ahead, in the midst of funding challenges, MDOT will continue finding innovative solutions to sustain Mississippi's transportation infrastructure and future economic growth throughout the state. **A**

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The U.S. Highway 61/84 Bridge over Liberty Road in Natchez, Miss., presents examples of precast concrete aesthetic panels and castings that the Mississippi Department of Transportation is able to add to bridges at a lower cost with a robust concrete industry in Mississippi.