

NORTH CAROLINA

The state's department of transportation uses weighting factors, bundling to gain most bang from legislature's extra funding in next 2 years

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The new Herbert C. Bonner Bridge in Dare County, N.C., which begins construction this spring, features a 2.8-mile-long structure composed of precast concrete segmental box girders and prestressed girder spans. The new bridge will parallel the existing one, the only access to Hatteras Island. Photo: HDR Inc.

North Carolina's backlog of structurally deficient bridges has been targeted by the state's legislature for both fiscal years 2016 and 2017. With \$150 million added to the budget over the two-year period, the North Carolina Department of Transportation (NCDOT) is using a variety of techniques, including bridge prioritization, design-build delivery methods, and bundling of projects to maximize the effectiveness of this mandate.

The addition of an extra \$50 million in 2016 and \$100 million in 2017 to address deficient bridges was provided with the directive to address the state's core needs by using objective criteria rather than reacting to political pressures. This funding will significantly reduce the 2167 structurally deficient bridges (out of 13,400) in the state. NCDOT is fortunate to have legislators in North Carolina who see the growing problem and understand the need to act now.

As with many states, North Carolina saw a boom in post-war highway construction, and many of those bridges have reached the end of their useful lives. Over the years, that total continues to grow and requires replacements that provide few disruptions to the traveling public.

To determine how best to optimize the funding, NCDOT has ranked the bridges using its Priority Replacement Index

(PRI). This index assigns values to a number of bridge measures (for example, average daily traffic, load rating, structure condition rating, and detour length) and determines replacement priorities. In addition to that approach, NCDOT initiated a low-impact bridge replacement program, which focuses on replacing rural, low-volume bridges in kind rather than providing substantial upgrades. This ensures projects can be completed as quickly as possible and spreads the money to more bridges needing replacement.

Design-Build Method Growing

NCDOT also makes use of the design-build delivery method to encourage innovation and custom efficiencies by each bidder. Design-build has become an important tool as it speeds up the construction process by allowing site work to begin as designs are completed.

One of the state's first successes with design-build projects was the US Route 17 Washington Bypass project in Beaufort County. The precast concrete bridge consists of 140 spans (116 spans plus two parallel structures of 12 spans) that are each about 121 ft long. Bidders were scored on their creativity and estimated cost. Adjustments were made to the proposal to lower costs based on feedback.

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Larger projects often use the design-build process, such as the ongoing replacement of the Herbert C. Bonner Bridge, an existing 2.5-mile-long structure in Dare County on the Outer Banks that serves as the only road access from the mainland to Hatteras Island. The 2.8-mile-long replacement structure, which will parallel the existing bridge, will use a segmental box-girder design for the major spans and precast concrete girders for the approach structures. Construction will begin this spring. This represents a major milestone, as the bridge has needed replacement for years but was held up due to legal actions.

The work also includes an interim bridge on NC 12 near Pea Island that replaces the existing temporary bridge that was constructed over an inlet created during Hurricane Irene in 2011. The interim bridge will be constructed with enough durability to last until a permanent solution is determined that is compatible with stakeholder interests. It will feature 47 spans of 50-ft-long cored-slab units, with virtually the entire bridge composed of precast concrete elements. This construction, let under a separate design-build project, has begun.



One of the first projects completed using the design-build delivery method in the state was the US Route 17 Washington Bypass bridge in Beaufort County, N.C. It was completed using a gantry system that drove piles, set precast concrete bents, and erected beams from above to minimize impact to the wetlands below. Photo: Flatiron.

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The use of design-build techniques also has led to the bundling of several bridge projects through NCDOT's design-build delivery method. Initially, NCDOT bundled seven to twelve bridge replacements in a division into a bid. Recent feedback from contracting partners showed that bidders preferred bundles of five to seven projects of a similar bridge type in a smaller area. That approach reduces risk and optimizes use of cranes and crews.

Three Types of Concrete Bridges

In general, NCDOT designs three types of concrete bridges.

1. Approximately 50% of the bridges built each year are cored-slabs: precast, prestressed, and post-tensioned concrete voided slabs with an asphalt or concrete overlay. This bridge type is cost-effective and long lasting, and contractors are familiar with it. It is the workhorse design for our shorter-span bridges.
2. Longer bridges with low truck traffic are typically designed with precast, prestressed

concrete box beams.

3. Longer bridges and those with more truck traffic are designed with prestressed girders. Unique designs are used for projects with unusual or challenging constraints.

One such project is the Yadkin River Veterans Memorial Bridges, a dual-highway bridge that improved safety and accessibility on Interstate 85 (I-85) between Charlotte and Greensboro. The 2900-ft-long, 21-span structures used 77-in.-deep precast concrete for economical fabrication (PCEF) bulb-tee prestressed concrete girders up to 140 ft long made continuous for live load. The design features a single, super-elevated horizontal curve with a 17,000-ft radius that eliminated the series of tangents and curves in the previous structure.

More Stakeholder Input

The Yadkin River project, as well as the new Bonner Bridge, point to the trend toward negotiating with more stakeholders on projects. Large projects receive a great deal of feedback, with more organizations interested in every aspect as they realize how significant the bridges' impact can be on its community. The goal is to find the best balance of all factors, as in ranking the projects, to maximize the benefits to all interests.

Certainly, environmental concerns have grown in importance as more is understood about the environment's impact on the bridge and vice versa. NCDOT has worked hard to streamline the environmental-permitting process to ensure timely

construction schedules while addressing issues that partners and environmental agencies raise. The process is smoother today than it has in the past despite becoming more stringent.

NCDOT remains optimistic that its inventory of deficient bridges will be reduced even as work on more ambitious projects continues. Currently, NCDOT is beginning environmental studies on the \$440-million Mid-Currituck Bridge, a two-lane, 7-mile-long toll-road bridge that will alleviate congestion on the only crossing of the Currituck Sound along the coast.

With such projects as the Bonner, Pea Island, and Mid-Currituck projects moving forward, along with an expanded program to eliminate structurally deficient bridges, NCDOT expects a busy and productive year. The department is extremely fortunate that the state's legislative leaders have taken a great interest in replacing deficient bridges and expanding access to isolated areas. **A**

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EDITOR'S NOTE

Project articles on the Washington Bypass and the Yadkin River Bridge appeared in the Fall 2008 and Winter 2014 issues of ASPIRE,™ respectively.