

# Design-build expedites replacement of Memorial Bridge

Innovative design will save inspection, maintenance costs over lifetime of span, which is slated to open one year earlier at no additional cost.

Before the New Hampshire and Maine departments of transportation officially closed the Memorial Bridge in July 2011, the span carried 12,000 vehicles per day and executed more than 4,000 vertical lifts per year to accommodate river traffic into Portsmouth Harbor and along the Piscataqua River between the city of Portsmouth, N.H., and the town of Kittery, Maine.

The 1923 bistate bridge was, and still is, a critical link between the communities, enhancing trade and commerce, tourism, community life and the region's historic and aesthetic characters. The hardship and economic impact caused by the emergency bridge closure were two major reasons why joint owners, the New Hampshire Department of Transportation and Maine Department of Transportation, elected to deliver the replacement bridge as one of NHDOT's first design-build procurements.

Like its predecessor, the replacement bridge will be a 50 percent-50 percent joint responsibility between the two DOTs, with each state funding half of the \$81.42 million cost. NHDOT is the lead agency for the project, with the MaineDOT and the Federal Highway Administration as our partners.

## Using design-build to accelerate delivery

Within New Hampshire, there are 3,828 bridges of which 2,143 are state-maintained structures. Of those, there are 140 "Red List" bridges, including the Memorial Bridge. The department created the term "Red List" some 40 years ago to identify those bridges having structural deficiencies and to show that the state's needs were greater than the available funding and resources. By department practice, these bridges require more frequent inspections due to known structural deficiencies, poor structural conditions, weight restrictions or construction type (e.g. covered bridges).

Approximately 64 of the 140 "Red List" bridges are scheduled to be replaced or rehabilitated under the department's 10-year capital plan (2013-2022). Approximately \$30 million of the \$140 million NHDOT receives annually in federal funds is allocated to addressing overall bridge needs. For the state to fiscally constrain the 10-year plan, the department has had to delay or defer many projects, including those for "Red List" bridges, due to insufficient funds.

The goal, of course, is to remove from the list more bridges than are added during any calendar year. During the past 15 years, we have eliminated from the list an average of 18 bridges annually, while we have added an average of 16 bridges annually. Although this implies that progress is being made, it now takes approximately eight years to address a "Red List" bridge, whereas previously it took five years. The Memorial Bridge has been on the department's "Red List" for more than 10 years. Neither the citizens nor the economies of Portsmouth and Kittery could wait any longer.

## Noting the benefits of design-build

In 2005, New Hampshire authorized the use of design-build procurement on state projects not exceeding \$5 million. Four years later, the state revised the law to allow design-build for projects up to \$25 million. For projects exceeding \$25 million, a public hearing must be held. Documentation, outlining the costs, details, public input and reasons for using design-build for the specific project, are submitted to the State Legislature.

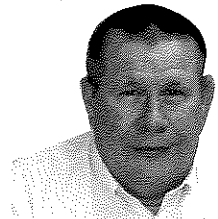
Currently, we have three "Red List" bridges under design-build procurement. Two are awarded and under construction, including the Memorial Bridge, and we are hoping to award the third contract this summer.



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Demolition of the Memorial Bridge began in January 2012 and is well under way. Removal of the previous bridge spans was completed by April 2012, and construction of the new Memorial Bridge has begun. It is scheduled to open to vehicles, bicyclists and pedestrians in July 2013.

Although none of the design-build contracts are complete, our department already can report two major benefits:

- 1. Time and cost savings.** We allocated \$90 million for the Portsmouth Memorial Bridge project. Because of the highly competitive construction environment, the total design-build cost will be slightly less than that at \$81.4 million. Plus, we anticipate the new bridge will be

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delivered one year faster than with the design-bid-build process. This ran counter to our perception that design-build often costs more. Although the successful design-build team's price proposal was the highest, delivery of the project nearly a year earlier than the schedule estimated by the department (and four months sooner than the schedules submitted by the other design-build teams) resulted in this proposal being the best value.

## **2. Innovative, cost-effective design.**

The design-build process fosters collaboration between designer and contractor and has produced an innovative, cost-effective design. The lift span machinery will be below deck, thereby protecting it from exposure to the weather and making it more easily accessible for maintenance activities than when located at the top of the truss towers. The pedestrian walkways will be inside truss planes, which provide a solid deck for the entire bridge surface and eliminates the situation where debris and salt-laden snow and ice would collect at the truss gusset plates between the sidewalk and roadway. Finally, the gusset plates will be eliminated. Typically, gusset plates are where moisture and road salt collect

and corrosion begins. In place of gusset plates, the Memorial Bridge design-build team is using a single-plate connection for the panel points on the truss, with truss members joined beyond the truss panel point and plate. Thus, design-build is not only delivering innovation, but it likely will reduce inspection and maintenance costs over the new bridge's lifetime.

Due to the bridge site's historic setting, any new alignments — either for a new bridge or a temporary bridge — would have caused significant impact to the area, as well as increased the project's costs. Another factor in staying on alignment is the reuse of the existing lift span piers, which are located within the fast moving tides of the Piscataqua River and extend more than 60 feet to bedrock at the river bottom. In response, the department chose to use the existing structure's current alignment and existing pier foundations, which were found to be in acceptable condition, and the use of mini-pile drilled shafts proposed by the design-build team were deemed to be reusable for all new AASHTO loadings, including vessel collision. Those site constraints also prohibited us from building a temporary bridge, which also has saved time and expense.

## **Identifying early best practices**

As expected, executing the first few design-build projects is a learning process. Because our department strives for continual improvement, we already have begun noting how we might build on the success of the Memorial Bridge replacement in future design-build projects:

- 1. Tight technical documents.** Perhaps our biggest takeaway is the pivotal role technical documents play in design-build. Having solid, well-written but flexible technical documents that specify the technical proposal requirements can foster innovation among the design-build team. In addition, having solid documentation requirements increased our comfort level in giving up some control of the overall design, which is required under design-build procurement.
- 2. Dedicated project staff.** The accelerated pace and overlapping phases of design-build were counterintuitive to our department's standard

business model and required us to make some adjustments. First, we learned to have confidence in the design-build team just as we would under a design-bid-build job. Second, we assigned specific, experienced staff to the project to enhance continuity and communication, and we dedicated their efforts almost exclusively to this project.

- 3. Innovation.** The design-build process fosters innovation among the contracting team, allowing them to develop and deliver a bridge that ultimately will be faster to construct and less costly to operate and maintain.

Replacing the Memorial Bridge is a large, complex project and a good candidate for design-build delivery. However, design-build is not a good fit for every project. Small projects, such as deck replacements or single-span bridge replacements, for example, typically would not be suitable for design-build procurement because they often lack the opportunity for innovation. For DOTs to realize the full benefits of design-build, there must be an opportunity for innovation and the need for schedule acceleration. To that end, the majority of Red List bridge projects still are anticipated to be delivered via the design-bid-build procurement method. But, for large projects, such as the Memorial Bridge, where quality of life and the local communities and their economies are impacted across state lines, design-build procurement is proving to be a worthwhile alternative. ■

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#### ABOUT THE AUTHORS

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