

TDOT Fast Fix 8 Project

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Placing precast concrete end wall on existing pier to make the new abutment. All Photos: Gresham, Smith & Partners.



Precast concrete deck panels with longitudinal joints over box beams and splice bar connections between panels.

The construction manager/general contractor (CM/GC) project delivery method is being piloted in three projects in Tennessee with a total aggregate of \$200 million in construction costs. The pilot program sunsets after 5 years and is effective July 1, 2014 to July 1, 2019. CM/GC is a project delivery method that allows the Tennessee Department of Transportation (TDOT) to engage a construction manager during the design process of a project to provide constructability input through a competitive qualification-based selection process. Following the design process, TDOT and the construction manager negotiate a guaranteed maximum price for the construction of the project based on the defined scope and schedule.

The I-40 project, also called the Fast Fix 8 project, had an average daily traffic of 130,000, and the project site limits were in downtown Nashville. Therefore, time was very valuable for the roadway users and stakeholders. Per the innovative CM/GC process, which shortens delivery time and reduces design errors, TDOT decided to close I-40 for 10 weekends for safety and efficiency, and kept all lanes operational during the work week.

The Fast Fix 8 project was the first CM/GC project by TDOT. It was a good fit for this method due to the opportunity to explore innovation and technology, and because it could deviate from standard materials and design features with value engineering and constructability reviews throughout the preconstruction and construction phase.

Concrete Solutions

In order to complete the project on the tight timeline established by TDOT, precast

concrete bridge elements were used on many of the bridges. Those elements include precast, prestressed concrete box beams; full-depth prestressed concrete deck panels; precast concrete end walls; and precast concrete approach slabs. All of these concrete elements were fabricated off site at a precasting facility in Lexington, Ky.

The most complex elements to fabricate were the precast concrete end walls. The design of the project eliminated the end spans on the existing bridges and modifications to the existing bents allowed them to function as abutments. The individual pieces were custom fabricated to fit around the existing riser blocks on the bent cap and to wrap around the new box beams. These elements were pinned to the caps and were joined by a shear key filled with a specialty concrete mix.

The full-depth precast concrete deck panels were prestressed transversely for the bottom mat of reinforcement and used nonprestressed reinforcing steel for the top-mat reinforcement. Each panel spanned over three or four bays of beams. The panels had open joints over the box beam to provide a positive connection for composite action. The connection between panels used a contact lap-splice bar in a socket.

The joints and sockets were filled with high-strength concrete. The special mixture (designated as TDOT Class X) was capable of reaching 4 ksi in 4 hours and could be batched and delivered in a ready-mixed concrete truck. The pot life for the concrete was 1 hour, which allowed enough time for a truck to unload up to 4 yd³ before the material began to lose its workability.

The mixture was developed by the contractor, the ready-mix supplier, the admixture supplier,

and the Concrete Institute at Middle Tennessee State University. It had exceptional resistance to chloride penetration, bond strength, and shrinkage. In contrast, if the high-strength material had been small-batch mixed with a bagged material, it would have taken over 36,000 bags for this project. This class “X” material was instrumental in the success of this project.

Conclusion

CM/GC with accelerated bridge construction was the best approach because it provided TDOT the flexibility to respond to uncertainty with the Fast Fix 8 project in real time. Also, it shortened the delivery time by more than 2 years and created a strong team work environment. In addition, the contractor was able to meet with the public early and become committed to the public's needs, the project goals, and the design. The contractor was able to adjust the construction approach because it was not restricted to a hard bid price.

The use of precast concrete bridge elements was key in achieving an early project completion date. The ability to quickly fabricate the various elements from readily available materials meant that the bridge components could be delivered on an accelerated schedule. Also, because components were manufactured in a precasting facility, the project team knew that a superior-quality product with excellent performance would be provided. ▲

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