PRESS RELEASE

HOLLINS ROAD BRIDGE OVER TINKER CREEK IN ROANOKE, VIRGINIA

2008 ACEC/MD ENGINEERING EXCELLENCE HONOR AWARD

This project was designed by ***Alvi Associates*** and involved replacement of an existing two-lane bridge with a new five-lane bridge. A significant design challenge was that the bridge crosses a river where the subsurface material consists of karst terrain – a pinnacled limestone with the depth to rock varying from as little as 5 feet to more than 60 feet! The solution is an innovative bridge consisting of a three-span concrete rigid frame. The foundations consist of steel piles to accommodate the varying depths to bedrock.

This design solution provides a wide variety of benefits, as described below.

Original or Innovative Application of New or Existing Techniques

This bridge design is innovative, but in a unique way – it revives a design approach more common about a century ago. During that earlier era, bridges often used framed construction to save material, but such bridges eventually became less common as designers sought to simplify the design process. Modern software now enables us to return to designing more efficient framed structures, yet without the past burden of lengthy hand calculations. This bridge capitalizes on that opportunity, and is one of just a few such modern framed concrete bridges in the Mid-Atlantic region.

Complexity

On one hand, this bridge is quite simple, and deliberately so, because it eliminates all deck joints, bearings, and beams – elements common in a conventional bridge. On the other hand, this simplified

construction actually makes the bridge structural analysis considerably more complex. This is because, when the members of a bridge are framed together, the various bridge members can't be designed independently, one at a time. Instead, the entire bridge must be analyzed as an integral system through an iterative process. Moreover, a framed structure can develop significant thermal and concrete shrinkage forces not found in a conventional bridge. These forces were accounted for, and a special construction sequence was developed to successfully minimize them. Additional complications were use of staged construction, and the need to design foundations which accommodate the karst terrain.

Social, Economic, and Sustainable Design Considerations

Compared to a conventional design, the framed design developed for this bridge provides substantial benefits with respect to *all* key design considerations:

- A thin deck was used, without beams. This maximizes the waterway opening, allowing floods to pass more easily, in turn shortening the bridge and providing major cost savings.
- The efficiency of the framed construction reduces material needs and construction cost. It also provides a structurally redundant and safer design, which is a particular advantage in a river environment where flooding and scour are inevitable.
- The all-concrete construction, with no exposed structural steel, eliminates the maintenance costs and environmental impacts associated with future repainting of steel – always an issue when crossing a river.
- Elimination of all deck joints, bearings, and beams further reduces maintenance requirements, and also accelerates construction.
- The visual cleanliness and simplicity of the bridge offers an elegant appearance.

Exceeding Client/Owner Needs

The client originally developed a conventional design, involving a beam bridge, based on hydraulic studies. On our own initiative, we reviewed these studies in depth and ended up proposing the alternate "value engineered" design described herein, which was readily accepted by the client because of all the benefits noted above. The client has been very pleased with the outcome.

Future Value to the Engineering Profession

This bridge serves as an example of how thinking out of the box, and applying modern computing power, can enable revival of a bridge type from a past era – a type of design which is now largely forgotten, yet can provide many benefits for today's projects. We plan to present this project in papers and conferences to widen exposure to this design approach. We hope that this exposure will gradually result in broad adoption of this bridge type for the many projects where it makes sense, thereby providing considerable value to both the profession and society.