

**May 2022 ABC-UTC Monthly Webinar: Experimentation with ABC Technology in South Carolina:  
S-770 Bridge over Hanging Rock Creek – Lancaster County**

#	Questions	Responses
	<b>Design</b>	
1	Besides "performance" comparisons between the superstructure types, were cost and design life also considered in this project?	This project was primarily done for performance comparisons. So, cost was not heavily considered. It was expected that the new technology would be more expensive. While SCDOT expects bridges to achieve a 75-year design life, there were no formal studies to determine design life. Cored slabs are only used on lower volume routes in order to get more design life. The NEXT-D beams were expected to get a design life similar to I-beams supporting cast-in-place decks or cast-in-place flat slabs.
2	Can you discuss joint installations, bearings, section camber, bridge-to-roadway transitions, and connections to parapet walls?	This bridge consists of simple-span construction. Joints are relatively simple to construction. They consist of foam backer rods and cold applied sealant. Calculated final cambers are as follows: 40-ft NEXT-D Beams - 1.125 inches, 70-ft Cored Slabs - 2 inches, 40-ft Modified Solid Slabs - 0.5625 inches. The roadway transition was handled by 20-ft long cast-in-place approach slabs with asphalt overlays. Connections between parapet walls and superstructure units were accomplished by embedding rebar in exterior prestressed units during the fabrication process.
3	Is an overlay necessary? If not, how is the roadway crown achieved? What is a practical maximum span length with the dimensions chosen?	For this project, the asphalt overlay was necessary due to the use of the cored and solid slabs. However, the NEXT-D beam span could be used without an overlay. In this case, the superstructure was placed flat and the asphalt overlay was thickened as needed to form the crown. The scope of this project did not provide a lot of useful information on the maximum span lengths for NEXT-D beams. However, Research Report No. 3 noted that up to 60-ft spans were possible with NEXT-D beams.

4	Was high-strength epoxy grout considered as an alternative to UHPC for the closure pours? If not, why?	The researchers of this project developed connections for the NEXT-D beams based on UHPC. Some of the direction of this project was based on technology and information available at the time. Other materials could have been used, but research would have to be performed on those materials to verify their capabilities.
5	Why is the SCDOT approved cross section different from the standard NEXT Beam cross section?	The initial objective of the research was to develop a quick-to-build section that has a low profile similar to a flat slab bridge (30-ft and 40-ft spans). Consequently, a thinner section was developed. The widths were impacted by the roadway width needed for the project. The widths were also impacted by the fact that the overall width of the NEXT-D beam span needed to match that of the cored slab spans (42 ft out to out).
<b>Construction</b>		
6	Can you discuss the ABC elements at precast plants and the concrete mix designs?	For the NEXT-D beams, a 6500 psi mix was needed. There were no special mixes needed beyond our standard mixes for prestressed concrete.
7	It appears that placing formwork under the joints between girders could be challenging. How was this done?	For the NEXT-D beams, strips of plywood were attached to the underside of the decks between the closure pours. Expandable spray foam sealer was added to make them watertight. For the cored slabs, backer rod material and spray foam sealant was used.
8	Can you discuss lessons learned for this project?	UHPC was and still is expensive because of the lack of options for mixes. Watertight joints are essential due to the fluidity of UHPC or complete filling of closure pours will not be achieved before curing. Due to the fluidity of the mix, placing on vertical grades can be a challenge and must be thought out. Because of the nature of the materials, safety precautions must be employed when mixing and placing UHPC. Larger openings in closure pours are easier for placing UHPC. Providing good specifications for mixing, handling, and placing UHPC is essential for a good product.

9	Did the NEXT-D beams exhibit cracking in the underside of the beam-to-flange corners?	No cracking in the undersides of the NEXT-D beam-to-flange corners was observed.
<b>Questions during Webinar</b>		
10	How is the work on FIB (Florida I-Beams) beams for South Carolina (SC) coming? When can we expect the SC standards for their design and construction and implementation?	We are currently allowing the use of FIBs on both Design-Build and Design-Bid-Build projects. We are seeking to initiate a consultant contract to develop standard FIB drawings, but that has been currently delayed due to funding issues.
11	It seems like Hanging Rock Creek is the only bridge that has been built with NEXT-D beams. Are there plans to go with NEXT beams for any other bridges? If so, are there any plans to create standard drawings and designs for these beams?	There are currently no active plans for another NEXT-D beam project at this time. There are currently no plans to create standards for NEXT-D beams at present. We have found since the Hanging Rock Creek project that longer spans are being required for most projects now due to hydraulic and environmental reasons, restricting the number of locations where NEXT-D beams could be used.
12	What are the limiting span lengths for cored slabs and solid slabs in South Carolina?	The maximum span lengths for cored and solid slab spans are 70 ft.
13	What kind of connection is used between the precast girder superstructure and the substructure to resist the seismic forces?	In South Carolina, anchor bolts are the typical connection for prestressed concrete superstructures to substructures, regardless of the seismic hazard. Shear keys are required in moderate to high seismic areas to provide restraint in the transverse direction. Minimum substructure seat widths are required to help prevent superstructure collapse if the anchor bolts fail.
14	Why did you use the narrower width for the NEXT-D beams? These are seen as 6.08 ft and 7 ft on this bridge. Is it shipping and handling or anything else? The typical NEXT beams are 10 ft to 12 ft.	The widths of the NEXT-D beams were established to provide a common bridge deck width with the cored slabs and solid slab units. Smaller width units were decided upon to allow for lighter sections for handling.
15	Because this bridge is experimental, are these spans instrumented permanently? Can we see any comparative long-term behavior between cored slabs and NEXT beams in deterioration progress?	The spans were only instrumented for two years after construction was complete as part of the agreement associated with the IBRD research requirements. There have been no follow-up studies that I am aware of since the last load tests were performed.

16	Was any special surface preparation used along the faces of the shear keys in the precast beams?	The shear keys in the precast beams were form cast, and no additional surface treatment was required.
17	What is the typical diameter size, spacing, and tension force in the tie rods?	The rods are 1 1/4-inches in diameter. The spacing was every 10 ft on 40-ft solid slabs and 16 ft on 70-ft cored slabs. The tie rods were torqued to 625 ft-lbs.
18	Did you have flow challenges with placing UHPC into the smaller pockets for the slab options?	It was harder to get the material placed through the smaller openings, but I'm not aware of any flow issues once placed.
19	What is the compressive strength of the UHPC mix that was used in the pockets?	The UHPC had a compressive strength (f'c) of 21,000 psi.
20	How did the girder distribution factor (DF) for bending and shear compare with that of standard bridge beams?	Shear compared to a Type I structure in AASHTO, and Moment compared to a Typed K structure.
21	Would the Lawson's Fork Creek I-85 bridge replacement (Spartanburg County, circa 1995) be considered ABC?	Based on what I found in our Plans Library, I would not consider Lawson's Fork bridge to be ABC construction. The only ABC elements that I see are steel H-piles supporting the end bents.
22	What volume of bridges in South Carolina are cored slabs or adjacent slab beam bridges? Also, what percentage of these bridges are showing longitudinal cracking along the shear keys?	SCDOT does not keep statistical records such as these. For the shear key problems, I can answer that anecdotally based on conversations with one of our construction engineers. In most cases of new cored slabs, efflorescence is usually noted running out of joints from beneath the bridge not long after construction has occurred. This indicates that there are cracks in the shear keys or no bond between the shear keys and cored slabs, allowing water to leach through the joint.
23	Why did the contractor decide to use a proprietary UHPC mix when they were provided the ability to use local materials to produce UHPC?	Since there was a prequalification specification for the UHPC mix, the contractor opted to use the proprietary mix to reduce his risk on cost and time delays in getting a mix approved.