

## ABC Innovative Projects

<b>Riverdale Road Bridge over I-84</b>					
<b>Location</b>	Riverdale Road over I-84 in the city of Riverdale in Weber County				
<b>State</b>	Utah				
<b>Owner</b>	State				
<b>Year ABC Built</b>	2008				
<b>State ID #</b>	SP0026(4)0-B				
<b>NBI #</b>	0C-966				
<b>Coordinates</b>	<b>Latitude:</b>	41.174896	<b>Longitude:</b>	-112.009925	
<b>Contact Person</b>	Carmen Swanwick, P.E. Chief Structural Engineer Utah Department of Transportation Phone: 801-965-4981 Email: cswanwick@utah.gov				
<b>Mobility Impact Time</b>	<b>ABC:</b>	no reduction in number of lanes during construction	<b>Conventional:</b>	estimated 8 months (4 months per phase), plus winter weather delays	
<b>Impact Category</b>	<b>Tier 1</b>	<b>Tier 2</b>	<b>Tier 3</b>	<b>Tier 4</b>	<b>Tier 5</b>
	X				
<b>Primary Driver(s)</b>	<ul style="list-style-type: none"> <li>reduced traffic impacts – reduced traffic impact time</li> <li>reduced onsite construction time – reduced impacts to local businesses during important retail period (Thanksgiving to Christmas)</li> <li>improved work-zone safety (through reduced time on construction site)</li> </ul>				
<b>Description</b>	<ul style="list-style-type: none"> <li>155.5-ft-long and 170.83-ft-wide two-span steel plate-girder bridge (76.5 ft – 76.5 ft); 5° skew</li> <li>Urban location</li> <li>Average Daily Traffic count: 31,475 on Riverdale Road (2010); 14,900 on I-84 (2010)</li> <li>Traffic management alternative, if constructed conventionally: extended use of reduced lane and shoulder widths and lane shifts</li> </ul> <p><b>Existing Bridge:</b> The existing two-span reinforced concrete beam bridge was 203-ft long and 76-ft wide with concrete substructure founded on piles. It had four 12-ft-wide traffic lanes, a 10-ft-wide left-turn lane, a 4-ft-wide central median, and two 3-ft-wide shoulders. Built in 1967, the bridge was deteriorated and required replacement.</p> <p><b>Replacement Bridge:</b> The replacement bridge accommodates a Single Point Urban Interchange (SPUI). It has six 12-ft-wide traffic lanes, two 12-ft-wide turning lanes, two 4-ft-wide minimum shoulders, and two 6-ft-wide sidewalks. The cross-section consists of twenty 3-ft-deep steel plate girders spaced at 8.67-ft with an 8.25-inch-thick non-composite full-depth precast deck. The precast abutments are founded on steel HP 14x102 piles. The interior pier consists of four separate precast caps, each supported on two precast columns, also founded on steel HP piles. Other prefabricated elements include precast end diaphragms and precast approach slabs.</p> <p>Mechanically-stabilized earth (MSE) wall abutments were used for the bridge. The MSE walls used lightweight fill to minimize settlement and avoid surcharging. This reduction</p>				

in settlement accommodated the phased construction better and significantly reduced the project schedule by eliminating surcharge time.

**Construction Methods:**

The new bridge was designed much larger than the existing structure to limit impacts. Part of the minimize-impact strategy was to make an oversized square SPUI instead of an hour-glass SPUI bridge to accommodate the phased construction and traffic with minimal impacts.

The contractor match-cast the prefabricated elements at an onsite casting yard.

The bridge remained open throughout construction, which consisted of two phases. In Phase I, two 42.21-ft-wide bridges were constructed on either side of the existing bridge while traffic was maintained on the existing bridge. In Phase 2, traffic was shifted to the new bridges, the existing bridge was demolished, and the middle half of the new bridge was built and connected to the Phase I bridges.


In Phase 1, piles were driven. Post-tensioning bars and ducts, dead anchor accessories, and anchorage zone reinforcement were placed in the footing forms. The footing reinforcement was placed, and the footings were cast. After footing strength was achieved, the abutment stems were erected over the embedded post-tensioning bars in the footings. Adjoining faces were epoxy coated prior to erection. After the top segment was erected and the epoxy reached strength, the vertical post-tensioning strands were stressed and duct connections were grouted.

The precast columns were erected onto the cast-in-place footings and similarly connected to the footings. The precast caps were erected and post-tensioned to the columns, and the steel plate-girders were erected on the caps. The non-composite precast deck panels were erected onto neoprene foam strips on the edges of the top flanges of the girders; there were no shear studs connecting the panels to the girders. The longitudinal post-tensioning ducts, spaced at 2.5 ft across the deck width, were coupled and tendons were threaded through the ducts. The transverse deck joints were grouted. The longitudinal post-tensioning tendons were stressed and ducts were grouted. Haunches over the girder flanges were grouted. The precast end diaphragms were then bolted onto the backs of the girders. The precast approach slabs were placed, and a closure joint was cast to connect the deck, end diaphragm, and approach slabs. Bridge parapets and sidewalks were cast.

In Phase 2, traffic was then switched to the two new outside bridges, the existing bridge was demolished, and the middle half of the bridge was constructed, tying the two outside bridges together and forming the final cross-section. The abutment closure joints and the longitudinal closure joints were cast. A polymer concrete overlay was applied and the bridge was opened to traffic.

The Construction Manager General Contractor (CMGC) project delivery method was used for this project.

The contract required completion by Thanksgiving and included a \$60,000 disincentive if the bridge was not completed by then. The contractor missed the deadline due to roadway and wall schedules behind the bridge. However, the outside segments were completed by Thanksgiving, and this allowed construction activities to stop and the interchange to act as a normal interchange during the shopping season. The contractor paid the disincentive penalty rather than bring in additional workers to finish the roadway, wall, and interior bridge by Thanksgiving. The break after Thanksgiving then allowed time to complete fabrication of the remaining precast elements in the yard.

	<p>[Before Thanksgiving the construction schedule had been so tight that the precast elements were being taken directly from the precast beds in the yard and erected on the bridge.] When construction resumed in January, the contractor was able to quickly finish the interior section of the bridge.</p> <p><b>Stakeholder Feedback:</b>  Lessons learned:</p> <ul style="list-style-type: none"> <li>• Keep an eye on the overall project schedule (roadway and walls), not just the bridge.</li> <li>• CMGC was very important and helpful in the development of the precast details and assembly methods. The contractor and designer worked together extensively during the design process.</li> <li>• An efficiency gained was that no shop drawings were required. The contractor was able to construct the prefabricated elements in the onsite casting yard using the design plans.</li> <li>• The business community was very pleased with the minimal impacts they dealt with.</li> </ul>			
<b>High Performance Materials</b>	<ul style="list-style-type: none"> <li>•</li> </ul>			
<b>Photos</b>				
<a href="#">Additional photos</a>				
<b>Project Planning</b>	<b>Decision-Making Tools</b>	<i>Site Procurement</i>	<b>Procurement</b>	<b>Contracting</b>
	<ul style="list-style-type: none"> <li>• State process</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• CMGC</li> </ul>	<ul style="list-style-type: none"> <li>• Full lane closure</li> <li>• Incentive / disincentive clauses</li> </ul>
<b>Geotechnical Solutions</b>	<i>Foundations &amp; Walls</i>		<b>Rapid Embankment</b>	
	<ul style="list-style-type: none"> <li>•</li> </ul>		<ul style="list-style-type: none"> <li>• Lightweight fill</li> </ul>	
<b>Structural Solutions</b>	<b>Prefabricated Bridge Elements &amp; Systems</b>			<i>Construction</i>
	<b>Elements</b>	<i>Systems</i>	<b>Miscellaneous</b>	<ul style="list-style-type: none"> <li>•</li> </ul>
	<ul style="list-style-type: none"> <li>• Full-depth precast deck panels w/ PT</li> <li>• Precast caps and columns</li> <li>• Precast abutment stems</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• CIP reinforced concrete closure joints</li> <li>• Grouted keys</li> <li>• PT ducts, grouted</li> <li>• Match casting</li> <li>• Epoxy joints</li> <li>• Polymer concrete overlay</li> <li>• Precast approach slabs</li> <li>• Precast diaphragms</li> </ul>	
<b>Costs</b>	<p>The low bid was \$3.8 million. The cost per square foot of bridge was \$143.</p> <p>The non-composite deck detail reduced onsite bridge construction time by several months, equating to a \$2 million road user cost savings.</p>			
<b>Funding</b>	<i>Federal only</i>	<b>State only</b>	<i>Federal and State</i>	<i>Other</i>
		X		

<b>Incentive Program (\$)</b>	<i>Highways for LIFE</i>	<i>IBRD</i>	<i>SHRP2</i>	<i>Other</i>
<b>Contract Plans</b>	<b>Complete Set:</b>	<a href="#">Contract Plans</a> (link to pdf)	<b>ABC *:</b>	
<b>Specifications</b>	<b>Complete Set:</b>		<b>ABC *:</b>	<a href="#">SP 03413S: Precast Stay-in-Place Form</a> (link to doc) <a href="#">SP 03413S: Precast Substructures</a> (link to doc) <a href="#">SP 03485S: Precast Approach Slabs and Deck Panels</a> (link to doc)
<b>Bid Tabs</b>	Not available.			
<b>Schedule</b>	<b>Engineer's:</b>	Not available.	<b>Actual:</b>	
<b>Other Related Information</b>	<a href="#">Utah ABC Process</a> (link to pdf) <a href="http://www.udot.utah.gov">UDOT ABC website</a> [http://www.udot.utah.gov (Inside UDOT / Project Development / Structures Design and Bridge Operations / ABC)]			
<b>Photo Credits</b>	Utah Department of Transportation			

\* Specific to the ABC used in the project.