

Innovations in Buchanan County, Iowa

by Brian Keierleber, Buchanan County, Iowa



Ultra-high-performance concrete was used in the Pi-shaped girders of the center span of the Jakway Park Bridge. Photo: Iowa Department of Transportation.

Like much of the nation, Buchanan County, Iowa, has many old bridges. For some perspective, Buchanan County has replaced bridges built in 1870, 1872, and 1875. As a reminder, General Custer fought in the Battle of Little Bighorn June 25, 1876. Buchanan County has been aggressively replacing these older bridges, yet it still has pin-connected truss bridges from the late 1800s or early 1900s.

In rural Buchanan County, economics drive replacement methods. Economics consider life-cycle costs, so greater first costs are acceptable in exchange for long-term performance. Most of the county's 257 bridges are less than 60-ft-long, so simple spans are preferred. Currently, precast concrete slabs seem the most economical for spans less than 50 ft. This system is popular in the region.

Buchanan County is the location of the Jakway Park Bridge—one the first bridges in the United States to use ultra-high-performance concrete (UHPC). The UHPC is used in the Pi-shaped girders of the 51-ft 4-in.-long center span of this three-span bridge. (See *ASPIRE* Winter 2010)

Recently, a cast-on-site slab bridge was constructed on geosynthetic reinforced soil (GRS) abutments. The goal was to construct the bridge without a crane. The plan was to construct the concrete slabs on site and pull them into place with a wrecker. This was an

aggressive concept because the slabs were 6 ft wide, 2 ft thick, and 52 ft long. Placing the slabs with the wrecker led to safety concerns. In an effort to expedite the opening of the bridge, a large crane was brought in to place the slabs.

The county incorporated a number of new technologies on this project, such as internal curing of the concrete using prewetted lightweight aggregate. Test results showed that the concrete's 28-day compressive strength was increased by 19%, flexural strength was increased by 9%, shrinkage was reduced, and charge-passing coulombs (per rapid chloride permeability test [ASTM C1202]) was reduced by 13.7%. This information correlated very closely with an article in the January/February 2013 issue of *Concrete Bridge Views*.

In addition to the internally cured concrete and cast-on-site concrete slabs, this project also incorporated GRS abutments, designed and constructed with layers of backfill wrapped in fabric, and stacked on a one-to-one slope and faced with a roller-compacted concrete. Slopes of 2:1 were used parallel to the road. Placement and compaction was accomplished utilizing a vibratory compactor on a hydraulic excavator.



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Cast-on-site concrete slabs. Photo: Buchanan County.



Compacted concrete on geosynthetic reinforced soil abutments on Jakway Park Bridge. Photo: Buchanan County.

EDITOR'S NOTE

More information about internal curing of concrete using lightweight aggregate is available in a new American Concrete Institute publication titled "Report on Internally Cured Concrete using Prewetted Absorptive Lightweight Aggregate," ACI (308-213)R-13.

More information about GRS is available on the FHWA website: www.fhwa.dot.gov/everydaycounts/technology/grs_ibsl.