



Beneficial Use Case Study

I-35W Saint Anthony Falls Bridge

Coal Combustion Product Type:

Fly ash

Project Location:

Minneapolis, Minnesota

Project Participants:

Minnesota Department of Transportation, Cemstone, Flatiron Constructors, Manson Construction, Figg Engineering, TKDA, Ayres Associates, Great River Energy

Project Completion Date:

2008

Project Summary:

On August 1, 2007, the primary spans of the I-35W bridge over the Mississippi River in Minneapolis collapsed into the water below, killing 13 people and injuring 145. Investigators found that the bridge had 16 undersized gusset plates that fractured, causing the bridge deck to give way. Engineers of the replacement bridge had two overarching goals: to build a sturdy, state-of-the-art bridge that would last 100 years and to build it expeditiously so as to minimize the disruption to the surrounding community.

Project Description:

Given the importance of I-35W as a major artery connecting points southwest of Minneapolis with the city's northern suburbs, the Minnesota Department of Transportation set a fast-track schedule for completion of the replacement bridge. Eight days after the bridge collapse, five companies had been approved to bid on the project and, six weeks later, contract awards were announced. Concrete reinforced by rebar was selected for the 10-lane replacement span, which would be fabricated under a design/build contract that allowed for the design and construction to be carried out simultaneously.

Custom concrete mixes were created for the different sections of the bridge, including footings, piers, drilled shafts, and superstructure. Fly ash—from Great River Energy's Coal Creek Station, near Underwood, North Dakota—featured in the mixes of all four of those concrete elements, with the highest percentage incorporated into the superstructure. The concrete superstructure, which carried a strength specification of 6500 psi, incorporated 25% fly ash replacement of cement. Footings, drilled shafts, and piers contained 18%, 18%, and 16% fly ash replacement of cement, respectively. In all, 45 high-performance mix designs were employed.

In addition to the aggressive construction schedule, engineers faced an array of challenges, including cold winter temperatures

during which much of the concrete casting took place and the adjacency of existing infrastructure such as roads, tunnels, and the foundations of the collapsed bridge, which affected where the substructures of the new bridge could be located. Contractor Flatiron-Manson configured a casting yard near the bridge, employing heated prefabricated buildings in which operations could take place. Ultimately, 120 concrete box girder sections were cast onsite, after which they were cured, floated by barge, and hoisted into place at the bridge site by barge-mounted crane.

Construction of the Saint Anthony Falls Bridge, which incorporates 50,000 cubic yards of concrete, was completed in 11 months—three months ahead of schedule—and is designed for a 100-year life. It has earned a number of plaudits, including the Federal Highway Administration's Award of Excellence and an Excellence in Structural Engineering Award from the National Council of Structural Engineers Association.



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