



BUILDING IT BACK IN RECORD TIME:

THE I35W ST. ANTHONY FALLS BRIDGE IN MINNESOTA

By Rachel Langston

On September 18, 2008, the first vehicles rolled across the new I35W St. Anthony Falls Bridge in Minneapolis. Only 340 days earlier, the original bridge collapsed, killing 13 people and injuring 145 more. Prior to the collapse, approximately 140,000 vehicles traveled the bridge daily, and the absence of this route caused traffic problems throughout the city. The collapse meant a new bridge had to be erected as soon as possible.

Before the new bridge could be built, the old one had to be removed. Carl Bolander & Sons, a St. Paul contractor, received the emergency demolition and debris removal contract for the collapsed bridge, which included three deck truss spans, eight continuous steel beam spans, three concrete slab spans, and multiple piers. Because the collapse occurred during rush hour, the removal of approximately 100 vehicles was also necessary. Five days after the collapse, Bolander moved equipment to the site to begin clearing debris. They positioned a crane on each side of the river, a third crane on a barge in the river, and a fourth crane at an unloading site.

The fact that the bridge was already broken made it different from other demolition projects. An ongoing investigation into the cause of the bridge failure meant that demolition and debris removal had to be conducted in an unusual manner. Blasting in a structured, coordinated way wasn't necessary to destroy the bridge. The National Transportation Safety Board (NTSB), the Federal Highway Administration (FHWA), and the State of Minnesota Department of Transportation (MnDOT) oversaw the demolition and debris removal closely, resulting in a slower, more tedious pace. At the deepest point of the channel, the river is approximately 20 feet deep. In addition to construction personnel, structural engineers and safety officers for each agency were heavily involved in each phase of the project.

Portions of the bridge that remained intact (the north and south approaches) did require demolition by blasting before they could be

removed. Bolander had to get written approval before any material from collapsed portions could be disturbed. Once approval was granted, pieces were mapped and labeled by one of the overseeing agencies. Finally, Bolander personnel lifted the pieces away from the river and unloaded them at designated sites. Depending on their role in the investigation, materials were taken to a designated drop site, a secure site, and/or recycling facilities. Metal from the site was salvaged, and concrete was recycled into Class 5 aggregate.

During peak work time, Bolander had approximately 65 workers on-site. Two and a half months later—over a month earlier than projected—more than 30,000 tons of debris had been cleared. The demolition project, including lead paint removal, produced over 30,000 hours of work without a lost-time accident.



A NEW BRIDGE RISING

New construction included two parallel bridges—one northbound and one southbound. Each bridge is 115 feet above the river, 189 feet wide, and 1,216 feet long, with a main span of 504 feet over the river. The construction features cantilever assembly of precast and cast-in-place segments. The finished bridge includes more than 48,000 cubic yards of concrete;

1,000-plus miles of high-strength, post-tensioning strands; and over 21 million pounds of steel.

The bridges contain side-by-side, post-tensioned concrete box girders of varying depths, from 11 feet (at midspan) to 25 feet (at the piers). The concrete piers are supported by 7-foot-diameter footings created by attaching drilling shafts to cranes and boring 100 feet into rock.

Drilling could not take place during weather below -20°F, so the Minnesota winter was a factor. Before drilling 109 permanent shafts, crews created test shafts and prestressed them with hydraulic jacks simulating weights greater than the actual weight of the bridge. Test shafts were capped and permanently sealed. For

ABOUT the AUTHOR



Rachel Langston is a contributing editor for Modern Contractor Solutions and the owner of RPL Communications (www.rplcommunications.com), a freelance writing and desktop publishing company.

With a sales volume of \$752 million in 2007, Flatiron Construction Corp. is one of the leading providers of transportation construction and civil engineering in North America. For more information, please contact Christie DeLuca, marketing & communications manager, at 720.494.8034 or visit www.flatironcorp.com.

reinforcement, cranes lowered rebar cages into permanent shafts before concrete was poured.

MAKING IT WORK WITH A DESIGN/BUILD APPROACH

This was a design/build project, so design work was finalized as groundbreaking and initial site prep began. The contract specified that designers, construction company personnel, and MnDOT employees would share office space. Close proximity to other partners allowed for faster decisions during the process.

CASTING FOR PERFECT PERFORMANCE

Utilizing two separate casting sites for simultaneous casting made the concrete work go faster. To aid the process, 15 precast segments each were poured on eight casting beds at the custom-built casting yard. Temporary steel structures known as falsework were erected to support the large molds. Molds, including keys to ensure quick, correct alignment of the segments, were then built. Segments measuring 50 feet wide, 16 feet long, and up to 25 feet deep, and varying in weight from 150 to 200 tons, were cast in the shape of the box girder.

Having the bottom and top of the bridge created in a single process further reduced construction time. While in use, casting beds were covered by specially designed, heated sheds on rollers. Each shed covered the concrete during extreme outside temperatures so that it could cure correctly. When segments were finished, the shed was rolled over the next bed.

Insulation blankets and hot air were used on completed casts to allow for outdoor storage until the time of installation. For installation, a 300-ton shuttle lift moved segments from the casting

yard to the staging area. Then segments were loaded onto barges and moved to the bridge site before being lifted into place with a 600-ton-capacity ringer crane installed on two anchored barges. Installation of the precast segments took 46 days and involved precise surveying and use of hydraulic jacks. The final segment, approximately 7 feet wide, was sealed with a cast-in-place "closure pour" directly above the river.

A STATE-OF-THE-ART SUCCESS

Perhaps the most important achievement of the project was the smart technology built into the bridge. For example:

- Each bridge has a separate foundation.
- The box girders provide for multiple areas of weight distribution of bridge traffic and are reinforced with high-strength steel embedded in the concrete.
- Foundations are multiple drilled shafts socketed into bedrock.
- Columns under the box girders create a direct load path to foundations.
- High-performance concrete was used for maximum durability, cost-effectiveness, and attractiveness.
- The bridge contains a "smart" monitoring system with 323 embedded sensors and cameras to check elements of the bridge.

At 5 a.m. on Thursday, September 18, 2008, state troopers led the first vehicles across the new bridge. As some motorists waved flags in celebration, the project, completed 3 months early and approximately \$15 million under budget, reconnected the City of Minneapolis and was pronounced a resounding success. ♦

NEW
How to Locate Video
Available Online

FIND IT ALL
UNDERGROUND

PHONE/POWER LINES, GAS LINES, WATER/SEWER

800-999-8280
www.schonstedt.com

SCHONSTEDT 
INSTRUMENT COMPANY
Making Locating Easier Since 1953