

PROJECT

Zumbrota Veterans Memorial Bridge

by Todd R. Stevens, Minnesota Department of Transportation



View of Veterans Memorial Bridge showing bench provided for a future trail. Photo: MnDOT.

Ample new access provided for pedestrians, snowmobiles, cars, and the Zumbro River

Zumbrota, Minn., is the quintessential quiet little town, tucked into the southeastern corner of the state between Minneapolis/St. Paul and Rochester. While it may be small, the town relies on its transportation infrastructure as much as any large metropolitan area. And a major component of Zumbrota's transportation system is the bridge that carries Minnesota Trunk Highway 58 (T.H. 58) over the North Fork of the Zumbro River. With a 23-mile detour to the nearest alternative trunk highway river crossing, a closure of the

T.H. 58 bridge would affect a variety of transportation users including residents going about their daily business, school buses, farm-to-market truckers, and commuters to the town's larger neighbors. Along with its functional importance, the crossing also has historical and social significance to the local community.

The T.H. 58 crossing was closed, however, in 2010 while the Minnesota Department of Transportation (MnDOT) had a replacement bridge built. The new bridge, Bridge 25025, was necessary for the usual reasons. Its predecessor, Bridge 5188, was both functionally obsolete and structurally deficient. The steel beams and concrete deck had suffered significant deterioration, its sufficiency rating had dropped to 18.4 (on a 100-point scale), and its inventory rating was only HS-11 (for comparison, new bridges in Minnesota are designed for approximately HS-25). This was not a routine bridge replacement project, however. Several challenges had to be

overcome, and a variety of design and community issues had to be addressed by the project team.

Local Meaning of Bridge

The existing bridge, Bridge 5188, did not have an official historic designation. However, the bridge site had major historic significance because of the predecessor to Bridge 5188. When it was built in 1932, Bridge 5188 replaced a covered bridge that had been built in 1869. Instead of being demolished, the covered bridge was removed intact and stored for many years. It was refurbished in the 1990s, and in 1997 it was once again erected over the Zumbro River at a trail crossing approximately 300 ft upstream. The Zumbrota Covered Bridge is the only historic covered bridge in Minnesota and is a source of great pride for the Zumbrota community.

The Covered Bridge's replacement also had special meaning for the community, especially the area's military veterans. Bridge 5188 had a plaque on its

profile

VETERANS MEMORIAL BRIDGE (BRIDGE NO. 25025) / ZUMBROTA, MINNESOTA

BRIDGE DESIGN ENGINEER: Minnesota Department of Transportation, Oakdale, Minn.

ROADWAY AND PRELIMINARY BRIDGE DESIGN ENGINEER: Yaggy-Colby Associates, Rochester, Minn.

PRIME CONTRACTOR: Minnowa Construction, Harmony, Minn.

PRECASTER: Cretex Concrete Products, Maple Grove, Minn., a PCI-certified producer

AWARDS: 2011 PCI Bridge Design Awards, Best Bridge with Main Spans up to 75 ft

southwest corner post dedicated to the area's fallen military veterans. The bridge served as an unofficial veteran's memorial, a distinction made more special by the local VFW Post located just off the bridge's southeast corner. Project plans and special provisions called for the plaque to be salvaged during bridge removal, and reset into the southwest corner post of the new bridge. The new bridge was fittingly renamed the Veterans Memorial Bridge by proclamation of the mayor at the project's ribbon cutting. Other features from Bridge 5188 were also replicated in the new bridge, including the ornamental metal railing and concrete rail posts, which were stylistic representations of the Covered Bridge.

While not officially historic, Bridge 5188 turned out to have more historical significance than people realized. During demolition, a time capsule was discovered within the concrete behind the veterans plaque. The time capsule contained many fascinating artifacts from the time of the 1932 construction, including a page from the local newspaper, an American Legion roster, and a listing of local soldiers who had fought in conflicts dating back as far as the Civil War. All items were given to the Zumbrota Area Historical Society. A new time capsule, containing similar items, was placed in the same location in Bridge 25025. Much of the time capsule information was in current



The original Zumbrota Covered Bridge was built in 1869, removed in 1932, refurbished, and returned to service as a trail bridge in 1997. Photo: MnDOT.

electronic formats, along with written instructions to guide a future generation on how to access the information.

Hydraulics and New Structure

Because of funding realities, MnDOT's hydraulic design guidelines, and the limitations inherent to the site, it was determined that hydraulic improvements were not possible. Consequently, the hydraulic focus shifted to alternatives that would avoid negative upstream impacts, particularly to the Covered Bridge. The final recommendation was a two-span bridge utilizing the Minnesota 27M beam, a 27-in.-deep precast, prestressed concrete bulb tee. It was the most practical combination of beam spacing and span length. The resulting 144-ft-long bridge is 34 ft longer than the bridge it replaced and provides nearly 25% more waterway opening for the 100-year flow. It moves the pier from the middle of the stream to the edge of the low-flow channel.

The pier columns are 4 by 8 ft with 1-in. chamfers on the corners. The pier cap is 4 ft 4 in. wide and 5 ft deep over the columns tapering to 4 ft deep between each column. The bridge's two equal, simple-span lengths are 72 ft. The concrete deck is continuous over the joint but there is no continuity diaphragm around the beams. This is standard practice with precast, prestressed concrete beams in Minnesota. The beams are spaced at 6 ft 5 in. for a total width of 68 ft 6 in. The bridge provides two 12-ft-wide travel lanes, two 14-ft-wide shoulders, and 6-ft- and 8-ft-wide sidewalks.

The specified compressive strength of the beam concrete was 8000 psi. Additional durability features include epoxy-coated reinforcement and the addition of a low-slump concrete wearing course over the 7-in.-thick cast-in-place structural deck.

The erection of beams in one span was accomplished by a single crane positioned on the earthen bench near midspan that will become a future trail. A launching beam was used for the erection of the beams in the span over the river, allowing the contractor to use two smaller cranes. With the launching beam, one end of the beam was lifted



The Zumbro River shown at flood stage on September 23, 2010, toward the conclusion of construction. Photo: City of Zumbrota.

TWO-SPAN, PRECAST, PRESTRESSED CONCRETE BEAM BRIDGE WITH SEMI-INTEGRAL ABUTMENTS, CAST-IN-PLACE CONCRETE COMPOSITE DECK, AND CAST-IN-PLACE CONCRETE ABUTMENTS AND PIERS / MINNESOTA DEPARTMENT OF TRANSPORTATION, OWNER

BRIDGE DESCRIPTION: 144-ft-long, 68.5-ft-wide, two-span precast, prestressed concrete beam bridge providing sidewalk and trail over a river

STRUCTURAL COMPONENTS: 27-in.-deep precast, prestressed concrete bulb tees, cast-in-place composite concrete deck, drilled shaft piers, cast-in-place concrete piers, and semi-integral abutments

BRIDGE CONSTRUCTION COST: \$111/ft²



Looking upstream at the river pier. Photo: MnDOT.

from the transport truck and placed on a roller support on the near end of the launching beam. That end of the beam is pushed across the span, with the other end supported by a crane. Once across, the girder was set into its final position with cranes at both ends. This operation was simplified on this bridge by the presence of the earthen bench under the north span. The use of launching beams is fairly common in Minnesota.

Foundations

Like the existing bridge, the south abutment is founded on a spread footing on rock at an elevation approximately 3 ft below streambed. The abutment is tall, with the southeast wingwall carved into the existing rock face. The north abutment, located within the roadway embankment, is approximately 60 ft from the low-flow channel, where the top of bedrock had dropped to roughly 30 ft below streambed. Consequently, the recommendation for the north abutment was a short stub abutment

on steel H-piles. Both abutments utilized MnDOT's semi-integral details, eliminating the need for expansion joints in the superstructure.

At the pier, hydraulic modeling indicated 23 ft of potential scour and drilled shafts were used for the foundations, with a 48-in.-diameter rock socket approximately 15 ft into the dolostone bedrock and a 54-in.-diameter shaft from the top of the rock socket up to streambed. Since three shafts could provide the necessary support, a single shaft was positioned beneath each of the three pier columns.

Schedule

The contract limited roadway closure to a 14-week period beginning the second week of June and ending before the Labor Day weekend in September. In the end, the contractor was not able to meet the Labor Day completion date, and completion was further delayed by unusually wet weather and historic flooding during September. The center travel lanes of the bridge were opened

The first beam has been placed in the Veterans Memorial Bridge in Zumbrota, Minn. The launching beam is seen in the background and is used to slide the concrete beams across the river where they could be lifted by a crane located there. Photo: MnDOT.



Northwest corner showing aesthetics, including railing post and insets replicating the covered bridge. Photo: MnDOT.

to traffic at a ribbon cutting ceremony on September 17, minimizing the inconvenience to local travelers. Minor work continued on the sidewalks and railings with all work completed by the end of September 2010.

The Final Product

The construction of Bridge 25025 was a success in many ways. It replaced a severely deteriorated bridge with a cost-effective and durable concrete structure. The 27-in.-deep Minnesota 27M bulb tee allowed for the hydraulic opening to be optimized. Additional width provided by the new bridge cross section will accommodate all modes of transportation, including snowmobiles in the winter. The lengthened bridge provides space on the river bank under the north span for a trail underpass, which will be connected to the regional trail system in the future. And, the new bridge was designed and built in a manner that emphasized the local community's focus on the site's bridge history, as well as the sacrifices made by the area's military veterans.

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