



Remember the Red River Valley

BY LARRY A. ERICKSON, P.E.

Part replacement span, part revitalization tool, a new bridge over the Red River of the North connects two Upper Midwest towns in North Dakota and Minnesota.

WHEN MOST PEOPLE HEAR "RED RIVER," THEY LIKELY THINK OF THE BORDER BETWEEN TEXAS AND OKLAHOMA. But there's a second Red River—also serving as a border between two states—further north.

A major crossing of this "other" Red River was recently updated: the Main Avenue Bridge (Trunk Highway 10), which crosses the river between Moorhead, Minn. and Fargo, N.D. A combination of geometric and structural deficiencies, along with flooding issues, led the Minnesota and North Dakota Departments of Transportation to replace the existing bridge, which was constructed in 1936. While the bridge replacement was the project's initial focus, the new structure also became an integral component to the area's riverfront and Moorhead's downtown revitalization efforts.

A pedestrian promenade on the mid-span plaza provides views of the Red River and riverfront parks.



The result is a state-of-the-art, environmentally durable vehicular structure that is able to handle growing traffic volumes and addresses improvements to substructure movement. Developing a steel girder system was key to accommodating the possibility of "adding on" aesthetic enhancements that reflected a sense of connectivity between the two neighboring cities.

With five spans, the new 800-ft-long steel girder bridge incorporates several architectural enhancements, creating a recognizable regional landmark that melds engineering, art, and design. The project consisted of replacing the original bridge, reconstruction of roadway approaches in both cities, and reconstruction of Third Street in Moorhead as a riverfront parkway. The bridge also features a unique mid-span plaza, bridge-head plazas on either end of

The curved mid-span plaza girders sweep over the Red River, bearing only at the pier and framing into the bridge girders.



the structure, and grand stairs that provide a pedestrian connection to the riverfront.

Unstable Conditions

The selection of steel for the superstructure ultimately turned out to be the only possible solution, given the desire to provide an arched mid-span plaza—not to mention the need to hold up to the soil conditions in the Red River Valley. The Fargo-Moorhead area lies in a region of poor soil/construction conditions and is prone to geological instability of the riverbanks. In particular, the channel walls of the Red River and its tributaries are prone to slope failure and soil movement towards the river.

If the piers were to move slightly, steel would be easier to jack and reset the bearings. To offset potential movement of the piers, the bridge designers used larger, high-capacity 16-in. steel sheet piles. These were used at a higher pile spacing than usual to allow for soil movement between the piles. The bridge designer implemented unique design considerations for movement of the abutment and piers, which is not unusual for structures in this area.

Another precaution taken to address soil movement was to design the bearing

assemblies with a PTFE bearing system, the first of its kind used in the two bordering states. The stainless steel-plated sole plate was oversized in the longitudinal direction, allowing for bearing adjustment of the Teflon bearing plate in the event of slope movement.

A Pleasing Plaza

The 50-ft x 250-ft mid-span public plaza was a distinctive attribute to the river crossing. A steel girder system was selected, as it provided the ability to fabricate main girder members to fit the curvilinear outside shape of the plaza. The use of steel allowed the necessary flexibility in the shape, size, and visual appearance of the plaza. The plaza was designed as a curved shape so the girders would sweep over the Red River, bearing only at the piers and efficiently supporting the structure.

Another design feature of the public plaza was the use of stainless steel spires to create a series of vertical elements that augment the design of the public plaza and house vertical fiber-optic lighting. The aesthetic lighting supplements the roadway lighting and continually changes color to tie into seasonal or other themes, such as displaying a stylized “aurora borealis.”

The bridge has received numerous awards for its engineering complexity and thoughtful application of artistic and interpretive amenities. It is an iconic gateway for both cities and offers an enhanced urban environment and usage experience for travelers, while also serving as a gathering place for civic celebrations and community enjoyment. MSC

Larry Erickson of SRF Consulting Group was the lead bridge engineer for this project and has been involved in the design of more than 280 bridges. He has managed several major river crossings during his 30-year career.

Owner

Minnesota Department of Transportation and North Dakota Department of Transportation

Designer

SRF Consulting Group, Inc., Minneapolis

Detailer

Tensor Engineering, Indian Harbor Beach, Fla. (AISC Member)

General Contractor

Industrial Builders, Inc., Fargo, N.D