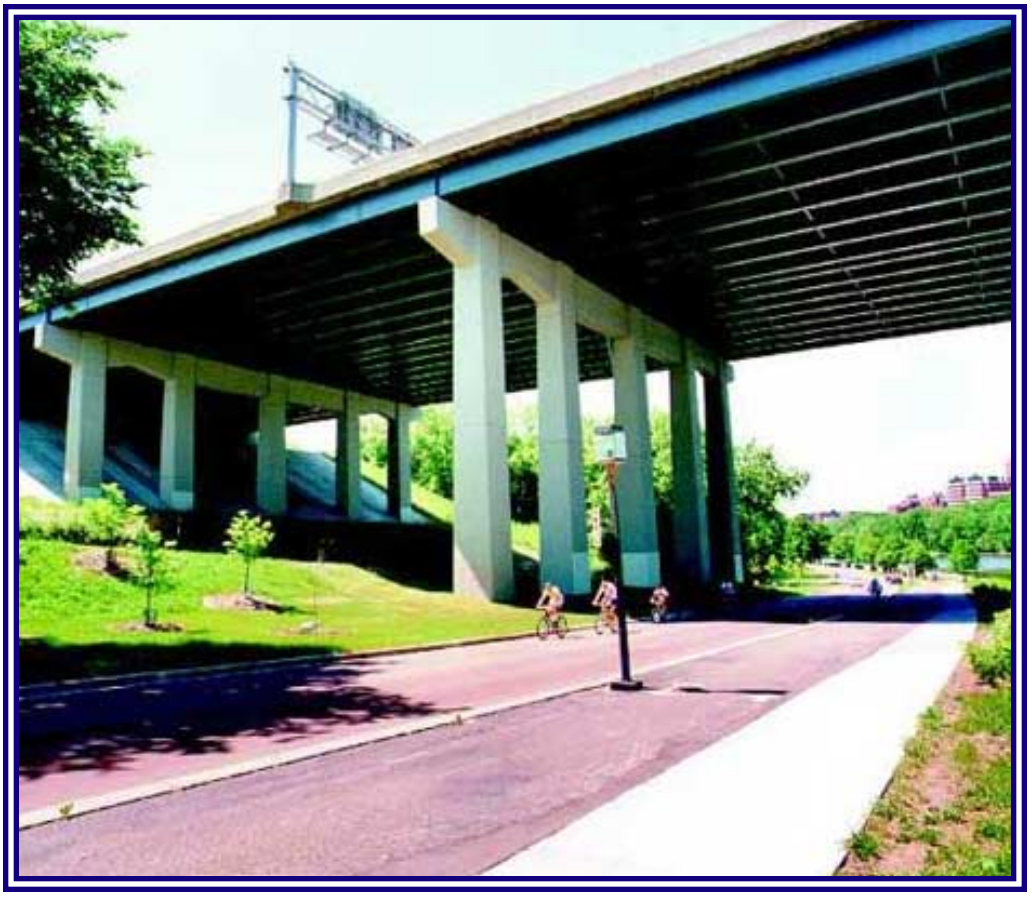
Prize Bridge Award: Reconstructed

DARTMOUTH BRIDGE



The 1001'-long Dartmouth Bridge, carrying Interstate 94 over the Mississippi River in Minneapolis, was recently rehabilitated and widened from four to six lanes to increase traffic capacity, improve safety, and extend the service life of the structure. The rehabilitation involved the removal and replacement of the entire steel superstructure. Engineers optimized the flexibility of multi-girder steel construction to adapt beams to conform to difficult geometry and to develop a construction-staging scheme that enabled the total rehabilitation in less than two years while the bridge remained open to traffic.

The main spans of the existing bridge contained non-redundant members, several fatigue-prone details that didn't meet current design codes, and steel that was beginning to crack in high stress areas. The approach spans did not have the capacity to carry additional loads from added lanes.

The new deck is 141'-4" wide fifty feet wider than the original deck providing one additional traffic lane in each direction and wider shoulders for improved bridge safety. The approach spans are welded plate composite girders. The main spans consist of ten haunched welded plate girders that are composite with the concrete deck.

Some of the unique aspects of this project were: significant widening of a heavily traveled bridge under traffic; use of steel multi-girder construction for the new superstructure to adapt to

DARTMOUTH BRIDGE
(I-94 OVER THE MISSISSIPPI RIVER IN MINNESOTA)

Owner:
Minnesota Department of Transportation

Designer:
Parsons Brinkerhoff Quade & Douglas, Minneapolis (NSBA Affiliate Member)

General Contractor:
Lunda Construction Co., Black River Falls, MN

Detailer:
Tensor Engineering Co., Indian Harbour Beach, FL (NSBA Affiliate Member)

Fabricator:
PDM Bridge, Eau Claire, WI (NSBA Member)

Erector:
Hi-Boom Inc., Black River Falls, WI

difficult geometry and complex construction staging requirements; expansion of the two main piers in the water — without additional columns — by new post-tensioned pier caps cantilevered 3939' to each side.

To increase the service life of the structure and to increase the load capacity, the entire existing steel superstructure was replaced. Multi-girder composite construction reduced the steel weight per square foot from 55.8 psf before rehabilitation to 45.4 psf after rehabilitation, a 19% reduction in structural steel weight.

Engineers designed the main-span steel girders to be haunched at the piers. This provided an economical structure as well as aesthetically pleasing lines in the beautiful, urban river setting.

The Minnesota Department of Transportation required that all rehabilitation work on the bridge be performed under traffic within a two-year construction period. Engineers developed a staging scheme that provided

enough space for four through-lanes of traffic as well as space for construction. Initial work to construct the pier cantilevers was performed with minimal impact on traffic. The new girders were first erected on the pier cantilevers so that traffic could be switched from the old to the new portions of the bridge, allowing work to proceed on the removal of the remaining original girders and completion of the superstructure. All of the removed steel was recycled.

An exit ramp at the southeast corner of the bridge required the fascia girder to follow a 6-degree alignment. This curve required a 24' extension of the abutment. The existing rock ledge foundation at the abutment receded into the bluff. The bluff's steep slopes made it nearly impossible to access the area to determine the extent of competent foundation rock for the abutment. To assure adequate support, the alignment of the abutment was kinked back between girders 8 and 9 so that the abutment could follow the receding rock ledge.

Considering the heavy bridge traffic (the 1994 average daily traffic (ADT) count was 141,000 and the 20-year projected ADT is 170,000) the complete removal and replacement of the superstructure under traffic was a great accomplishment. Structural steel provided the economy and flexibility required for this complex project.