Prize Bridge Award: Medium Span

MUD FORK BRIDGE

The Mud Fork Bridge carries U.S. 119 over the Mud Fork River valley in Logan County, WV. Owned by the West Virginia Department of Transportation, the structure is a 1,530' long, six-span (250', 290', 290', 270', 230', 200') continuous composite steel plate girder bridge supported on single shaft piers up to 200' in height. The roadway alignment lies mostly on tangent with the northern end on a spiral curve. The 76'-4"-wide roadway is carried by four girders spaced at 22'-6" center to center with cross frames and substringers. The girders are a constant 12' deep and utilize longitudinal web stiffeners with a minimum number of transverse The challenge presented in designing the Mud Fork Bridge was to create an economicl structure that minimized the visual intrusion on the rural mountainous landscape. During the preliminary design phase, numerous span arrangements and cross sections were studied in order to optimize the design. A six-span and an eight-span arrangement were studied along with a four-girder (with substringers), seven-girder and an eight-girder cross section. The four-girder cross-section and eight-span arrangement was found to be the lowest cost solution. The six-span arrangement, which was found to be 6 percent more costly, was chosen for final design since it provided improved aesthetics and less impact to the valley floor.

SUMMARY OF SPECIAL DESIGN FEATURES

The selection of the six-span arrangement with spans up to 290' provides an extremely aesthetic solution that optimizes the span-to-valley height ratio. The

long spans and constant depth superstructure produce an open and elegant solution for this setting. Also, the use of weathering steel adds to the rustic appearance of the bridge, to reflect the rustic rural quality of the surrounding countryside at this site.

Among the features that afforded a cost-effective construction are the wide girder spacing minimized the steel quantity, fabrication and erection, thus producing an extremely cost-effective design. The 12' deep girders, utilizing both longitudinal and transverse stiffeners, produced an optimized balance between fabrication and material costs. The use of a continuous surface (1,530' long) with expansion joints only at the abutments minimizes maintenance cost and provides an exceptionally smooth ride. The use of single shaft hollow section piers with post-tensioned hammerheads achieved an economical substructure and minimal impact to the valley crossing.

Specific Elements of Superstructure Design

The cross section consisted of four 12' constant depth girders spaced at 22'-6" center to center with cross frames and substringers. Grade 50 weathering steel was used in this project. The web sizes varied from 9/16" and 5/8" thick with longitudinal stiffeners and transverse stiffeners. The flanges had a maximum thickness of 3½" and maximum width of 38". There were fixed pot bearings at three center piers and expansion pot bearings at abutments and the adjacent piers. Two field splices per span were used except for the two 290' spans where three filed splices were used to facilitate shipping and erection. Also, a 8½" thick composite concrete slab with steel girders was used.

Specific Elements of Substructure Design

The pier was made up of five single shaft concrete piers with the maximum height of more

than 200'. The cross sections of pier shafts are rectangular tubes, with a wall thickness of 2', and a constant width of 22' in the transverse direction and a various width in the longitudinal direction. Post-tensioned hammerhead pier caps, with an 8' width, a 74' length and 26' cantilevers, were used. The foundation consisted of spread footings, with 3' diameter drilled shafts at pier 1 and abutments due to the soil condition.

MUD FORK BRIDGE

Owner::
West Virginia Department of Transportation

Designer:
HNTB Corporation,
Scott Depot, WV

General Contractor:
Edward Kraemer & Sons, Inc.,
Plain, WI

Fabricator:
PDM Bridge Division, Eau Clair, WI (NSBA Member)

Erector:
Traylor Brothers
Evansville, IN