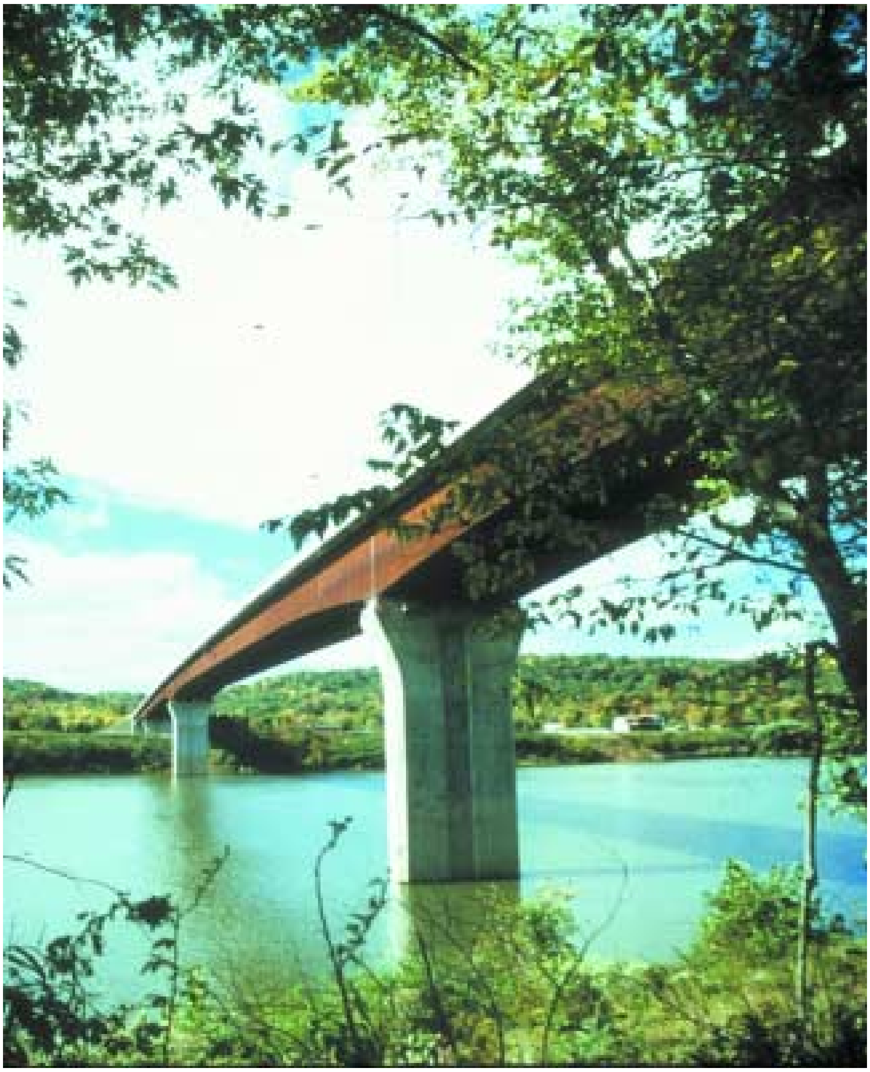
Merit Award: Long Span

Lower Buffalo Bridge

Buffalo, West Virginia



This $21.8 million project connects US 35 to WV62 over the Kanawha River near Buffalo, West Virginia. The bridge site is in the Kanawha Valley of Putnam County, West Virginia, halfway between Charleston, the state's capital and largest city, and Huntington, the second largest city in the state. The broad Kanawha Valley is surrounded by rolling hills and dotted with farming communities and newer suburban areas.

Although Putnam County is one of the fastest growing counties in the state of West Virginia, there was no bridge crossing the Kanawha River within miles of Buffalo. The new Lower Buffalo Bridge opens up some of the best land in the state to economic development and provides a direct connection to a new US 35 upgrade under construction and I- 64.

The bridge had to be completed and open to traffic by mid-1998 to allow for the new Toyota manufacturing facility in Buffalo to ship state-of-the-art engines. The bridge also had to span the navigable Kanawha River with minimal falsework and span over areas on both banks with known archeological deposits.

Environmental Concerns

The flood plain area at the Lower Buffalo Bridge site is an established archeological dig site with numerous Native American campsites and artifacts. An environmental consultant for the West Virginia Department of Transportation (WVDOT) performed both phase one and phase two archeological surveys at the proposed bridge site and identified archeologically sensitive areas on both riverbanks. Construction activity for a new bridge over these sensitive areas was limited to the depth of cultivation (about 30"). Excavation and foundation work could not begin until after an extensive phase three survey was completed.

Rather than perform the lengthy phase three survey work, the WVDOT decided to design and build a five span structure with the piers and abutments located outside of the archeologically sensitive areas. The Lower Buffalo Bridge, with and overall length of 1,850' and spans of 269', 394', 525', 394', and 269', easily clears the sensitive areas. The use of a steel girder superstructure allowed great flexibility in locating piers and abutments.

Features of the Structure

The Lower Buffalo Bridge is on a tangent alignment. The approach roadway on the west bank of the Kanawha River has a 330' radius curve with a spiral. The roadway grade is 3% on the west side and 5% on the east side on a 790' vertical curve. The profile grade provides a 68' vertical clearance from normal river pool elevation to the bottom of the steel girders, and the two river piers provide a 500' wide navigation channel.

The bridge section has two 12' traffic lanes, two 6' shoulders and concrete parapets. Right-of-way was purchased adjacent to the bridge for a future dual structure. A constant deck cross slope of .02%, and the use of a box girder superstructure, allows for a future structure to be easily built with a widened four lane roadway.

The bridge superstructure consists of twin haunched composite steel box girders on 20' centers supporting a reinforced concrete deck with parapets. The box girder webs are plumb and on 10' centers with 4'-4" deck overhangs. The steel box girder profile haunches over the piers and smoothes out into parallel flange boxes at midspan. The two steel box girders are supported on curved columns.

Details of the structure include a clean and uncluttered box girder underside, interior box lighting, complete inspection access and the use of Grade 50W steel throughout. Additionally, identical box girders with a symmetric span arrangement permit significant duplication in fabrication. Constant 36" wide top flanges simplified the installation of stay-in-place forms.

The structure is fully continuous from abutment to abutment. Expansion and contraction is accommodated by the use of steel finger joints with neoprene troughs at the abutments and guided steel pot bearings at the two approach piers and abutments. The two river piers have pot bearings fixed against temperature movement. Full depth box girder interior stiffeners permit the vertical reaction over the piers to remain aligned with the supporting column throughout the range of temperature movement.

None of the 3,200 tons of Grade 50W structural steel used to fabricate the bridge was fracture critical. To provide redundancy, permanent cross-frames throughout the length of the bridge were designed to transfer the weight and live loading from one box to the other in the event that a girder section was cracked and became unserviceable.

Another example of the structure's technical originality was the use of large, torsionally rigid box girder field sections to reduce the number of individual field pieces and field bolted connections. The designers located field sections to limit shipping pieces to 100 tons or less. Actual shipped pieces ranged in size from up to 92 tons and 113' long. By choosing a twin box girder superstructure the designers were able to minimize the number of field bolted cross-frames connections between girder lines. A shop installed top lateral bracing system, which was designed to support the box girder sections on their side, provided excellent torsional rigidity during shipping and erection.

The use of unpainted weathering steel for the bridge provided corrosion resistance, reduced shop fabrication time, eliminated the need for future maintenance painting and enhanced the overall appearance of the structure. The burnt sienna color of the unpainted weathering steel complements the rural landscape. The color of the steel girders contrasts with and delineates the lighter gray and dark shadows of the piers and deck fascia. The overall appearance is that of a structure that truly belongs in a valley landscape.

The bridge design provides an attractive, proportional and balanced structure. Although the box girder sections are 10 to 13' deep at midspan and haunch to 18' over the piers, the long spans give the impression of a slender ribbon stretched from bank to bank.

Conclusion

Steel fabrication began in March 1997 and proceeded concurrently with the bridge substructure construction. The steel erection was complete in August 1998, and the concrete deck, parapets, and overlay were cast in the fall in time for traffic to cross the bridge in October 1998.

Project Team

Owner
West Virginia Department of Transportation

Designer
BRW/Hazelet & Erdal

Steel Fabricator
Stupp Bridge Company

Steel Detailer
Stupp Bridge Company

Steel Erector
Tri-State Steel Construction

General Contractor
National Engineering