THE US 69 MISSOURI RIVER BRIDGE

FRANK BLAKEMORE, PE

BIOGRAPHY

Frank Blakemore is a Senior Project Manager with Garver, and has 20 years of bridge experience. He was the Design Manager for the US 69 Missouri River Bridge design/build project. He has worked on a several design/build projects and a variety of bridge projects including arch, cable stay, and segmental bridges.

SUMMARY

The new US 69 Missouri River Bridge replaces two aging steel truss bridges with a steel plate girder structure for the main unit. This new bridge has an overall length of approximately 2,155 feet, including a 420 foot main navigation span. As lead designer for this design-build project, Garver's design provides an overall bridge width of 75'-8", and provides two lanes northbound, two lanes southbound, and a shared use path for bicycle/pedestrian traffic. Part of the innovation for a successful score and bid in the design-build competition was to keep the new alignment near the existing southbound bridge and to shorten the bridge as much as possible. This included closing a road on the Kansas side and interaction with the levee on the Missouri side of the River.

Steel played an essential role in providing a competitive design and cost proposal. With a 320-foot span over the railroad tracks, a 420-foot navigation span, and the desire to minimize the number of piers in the river, the steel plate girder superstructure was a logical choice.

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ABSTRACT

The new US 69 Missouri River Bridge replaces two aging steel truss bridges with a steel plate girder structure. This new bridge has an overall length of approximately 2,155 feet, including a 420 foot main navigation span. As lead designer for this design-build project, Garver's fast track design provides an overall bridge length of 2,155 feet and 75'-8" bridge width with two lanes northbound, two lanes southbound, and a shared use path for bicycle/pedestrian traffic. Part of the innovation for a successful score and bid in the design-build competition was to keep the new alignment near the existing southbound bridge and to shorten the bridge as much as possible. This included closing a road on the Kansas side and interaction with the levee on the Missouri side of the River. Another opportunity the design-build team took advantage of was a unique realignment of Argosy Casino Parkway (utilizing the side span of an existing bridge), tied to the existing roadway and the access ramp from northbound US 69 with a roundabout.

INTRODUCTION

The states of Missouri and Kansas are constructing a replacement bridge for U.S. 69, crossing the Missouri River from Riverside, Missouri to Kansas City, Kansas. The location of the new structure parallels the existing Fairfax and Platte Purchase bridges. The American Bridge/Garver Team was the successful proposer to replace the existing US 69 Missouri River crossing in Kansas City, which consists of the southbound Fairfax Bridge and the northbound Platte Purchase Bridge. As lead designer for this design-build project, Garver's design includes two lanes northbound, two lanes southbound, and a shared use path for bicycle/pedestrian traffic. The overall bridge length is 2,155 feet and the bridge width is 75'-8". See Figure 1 for a rendering of the completed structure.

Figure 1: Rendering of completed US 69 Bridge over the Missouri River

HISTORY

The construction of the existing Fairfax Bridge was completed in 1938 and the Platte Purchase Bridge was completed in 1955. Both bridges carry U.S. 69 traffic over the Missouri River and connects Kansas City, Kansas, to Riverside, Missouri. These bridges are primarily through-truss spans across the Missouri River, providing a navigation span of 415 feet, and are shown in Figure 2. Both structures have been rehabilitated several times and are deemed structurally deficient. This replacement project is a jointly funded by the Missouri Department of Transportation (MoDOT) and the Kansas Department of Transportation (KDOT), with procurement led by MoDOT.

Figure 2: Existing Platte Purchase Bridge (left) and Fairfax Bridge (right)

During procurement, five design/build teams were shortlisted. The preaward portion of the project consisted of confidential meetings between MoDOT and each of the teams, submission of a technical proposal, and submission of a cost proposal. The scoring criteria were Cost, Method of Handling Traffic, Missouri River Bridge, and Safety. Following review of the technical proposal and cost proposal, the American Bridge/Garver team was selected as providing the best value.

MISSOURI RIVER BRIDGE

Steel played an essential role in providing a competitive design and cost proposal. With a 320-foot span over the railroad tracks, a 420-foot navigation span, and the desire to minimize the number of piers in the river, the steel plate girder superstructure was a logical choice. Structural steel also made sense when looking at the limited crane placement locations and the girder segment weights to provide an efficient construction sequence.

The bridge consists of two units, a 1,351 foot plate girder unit and an 804-foot prestressed beam unit. At Unit 1, to provide the necessary navigation span, minimize impacts to the levee, and span across the railroad tracks, a steel plate girder superstructure was utilized. The plate girder has a maximum depth of 12 feet at the 420-foot long navigation span and then haunches down to 10 feet in the adjacent spans, including a 320-foot end span across the railroad tracks. The girder webs are Grade 50W while the flanges utilized Grade 70W steel. The girders are spaced at 11'-4", with an 8 1/2" cast-in-place deck utilizing steel stay-in-place deck forms. See Figure 3 for an overview of the bridge and Figure 4 for the Unit 1 Typical Section.

Unit 2 spans from the north river bank to just beyond the crest of the levee. The typical span length is 165-feet, with the maximum span of 168-foot occurring over the levee itself. The superstructure consists of prestressed NU-78 beams spaced 9'-9" apart with an 8 ½" deck.

The substructure design used a two-column bent in all locations, with varying foundation types. The river piers utilized a 10'-6" drilled shaft integral to each column, along with a 10-foot by 10-foot tie beam at water level to accommodate the vessel collision loading. For the bents in the north overbank area and the end bents, the columns were 6'-6" diameter and footings with steel H-piles were utilized. Bent 9 in the north overbank area, however, utilizes 9'-0" diameter drilled shafts to maintain the

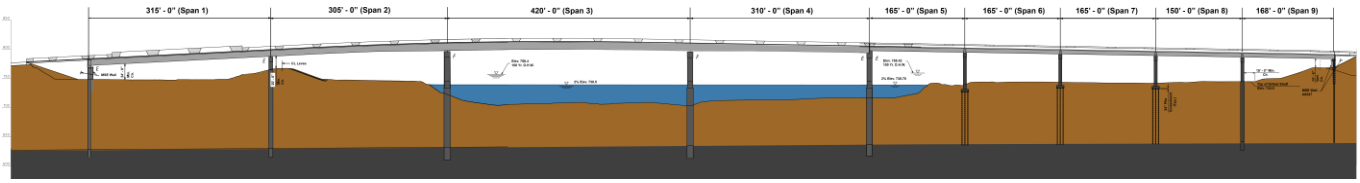

Figure 3: Bridge Layout

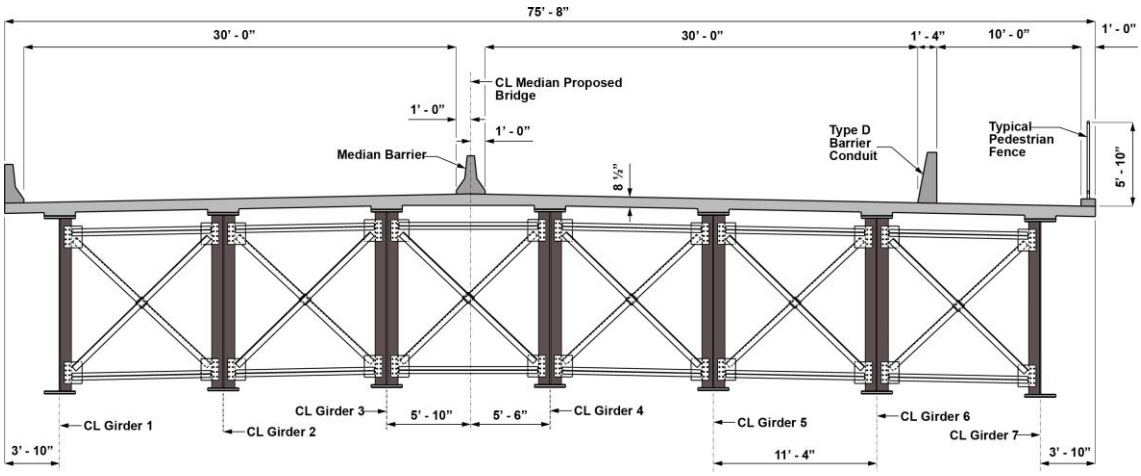

Figure 4: Unit 1 Typical Section

required 15-feet clearance from the levee. Both end bents were built behind MSE walls with corrugated metal pipe pile spacers placed around the piles to minimize interaction with the wall.

LEVEE INTERACTION

A significant risk the design-build team took in the pursuit phase was to shorten the bridge as much as possible on the north end. This required significant interaction with the Riverside Quindaro Bend levee district and the USACE, as the abutment was placed just landward of the crown of the levee. This design allowed the bridge to be shortened approximately 270 feet.

Construction of the End Bent 10 abutment foundation consists of driven h-piles encased with concrete collars to prevent any potential seepage paths during flood events. (See Figure 5) The span length provided in this last span was 168', which is also the maximum length that can be utilized for a BT-78 prestressed beam.

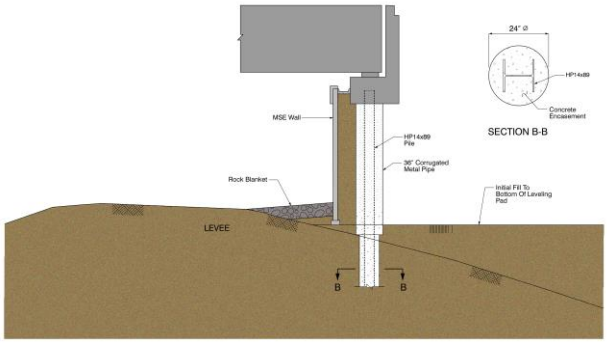

Figure 5: End Bent 10 Section

On the south end of the bridge, Bent 2 was required to be placed through the levee of the Fairfax Drainage District. Bent 2 also utilized drilled shaft foundations to minimize impacts to the levee. (See Figure 6.)

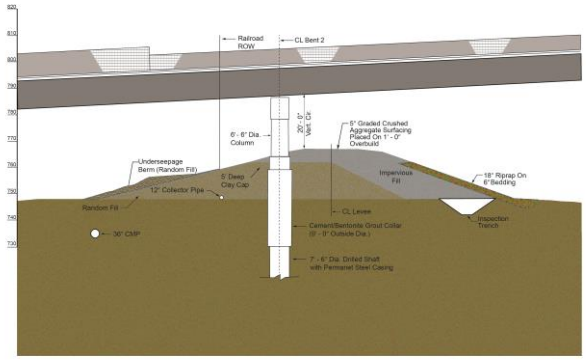

Figure 6: Bent 2 Section

ROADWAY

Construction sequencing and maintaining one lane of traffic in each direction was a key factor in selection of the proposed design during the proposal phase. The existing Platte Purchase Bridge was utilized for head to head traffic while the new US 69 bridge was built upstream with less than 10 feet horizontal clearance. Two temporary crossovers were utilized. One crossover shifted traffic from existing southbound US 69 to the existing Platte Purchase Bridge. Once the new northbound US 69 ramp bridge over relocated Argosy Casino Parkway was completed, a second temporary crossover was used to shift northbound traffic from the existing Platte Purchase Bridge to the new northbound US 69 ramp to I-635. A significant elevation difference coupled with a narrow median between the existing northbound and southbound lanes made the design of the crossovers challenging.

Another opportunity the design-build team took advantage of was a unique realignment of Argosy Casino Parkway (utilizing the side span of an existing bridge), tied to the existing roadway and the access ramp from northbound US 69 with a roundabout. The apparent solution to tie Argosy Casino Parkway together in a straight alignment would have required two new bridges, both constructed under tall fills below the US 69 mainline.

With the innovation of utilizing the existing end span of the US 69 Bridge over I-635, the new bridge for northbound US 69 was able to be built separately without any effect on traffic. The existing abutment of the bridge had a spill slope that was replaced with a soil nail wall several feet in front of the abutment piling. This innovation freed up enough space to allow the two-lane Argosy Casino

Figure 7. Roundabout Intersection for Argosy Parkway

parkway to pass through and tie into the new roundabout on the east side of US 69. See Figure 7 for the roundabout intersection under construction.

The Missouri approach posed several challenges from a roadway perspective including a narrow right of way corridor and the need to minimize traffic closures during construction. To keep the proposed footprint within the existing right of way, 2:1 slopes were used for several hundred feet on the levee approach. With the fill height reaching nearly 40 feet, a special geogrid reinforced zone was designed. As part of the project requirements, uninterrupted ramp access had to be provided to Argosy Casino throughout the project except for a 60 day window to construct the new access ramp from northbound US 69. During this timeframe, nearly 6,500 cubic yards of fill, longitudinal barrier, several drainage structures, and a connection to the proposed roundabout are placed. The design build team worked together to minimize the amount of construction during the 60 day window by utilizing a significant amount of temporary retaining walls and intricate traffic control plans. The design team also assisted in coordinating over a dozen utilities to facilitate successful and acceptable relocations occurring in a timely manner.

CONSTRUCTION AND ERECTION

The construction of the new bridge is on schedule, with the opening of the new Fairfax Bridge scheduled for August 2016. The following pictures illustrate the current status of steel erection and overall construction.

Figure 8. Steel Erection over the Railroad Tracks

Figure 9. River Bent Construction

CONCLUSION

The American Bridge/Garver Team was the successful proposer to replace the existing US 69 Missouri River crossing in Kansas City, which consists of the southbound Fairfax Bridge and the northbound Platte Purchase Bridge. As lead designer for this design-build project, Garver's fast track design provides an overall bridge length of 2,155 feet and 75'-8" bridge width with two lanes northbound, two lanes southbound, and a shared use path for bicycle/pedestrian traffic. Part of the innovation for a successful score and bid in the design-build competition was to keep the new alignment near the existing southbound bridge and to shorten the bridge as much as possible. This included closing a road on the Kansas side and interaction with the levee on the Missouri side of the River. The new US 69 Missouri River crossing will result in a safe and low maintenance bridge designed for a 100-year service life expectancy.