

Making HEADWAY

BY ROBERT BRENDEL AND ANOUSONE AROUNPRADITH, P.E.



Catherine Morrison

With no option to raise the roadway, two Interstate replacement bridges find a way to span an expanded railroad thoroughfare and provide enough headroom for trains to pass underneath.

SAFE AND SOUND is the name of the game for Missouri bridges—and not just figuratively.

In one of the most ambitious statewide bridge improvement programs in the country, the Missouri Department of Transportation's (MoDOT) Safe and Sound Bridge Improvement Program has improved 802 bridges in three-and-a-half years: 554 replacements through a single design-build contract and 248 rehabilitation projects managed through its more conventional monthly lettings.

As part of the program, two Interstate 55 bridges, northbound and southbound traveling over the BNSF railroad and 5th Street in Festus, Mo., were identified to be re-decked. These bridges, built in 1967, had six spans each ranging from 37 ft to 60 ft long for a total length of 300 ft. In the center, over the railroad tracks, was a 60-ft span.

However, this stretch of I-55, which lies about 35 miles south of downtown St. Louis, is experiencing rapid growth and carries increasingly higher traffic volumes as commuters from Jefferson County's bedroom communities travel to work in St. Louis. Consequently, there was a desire to widen the bridges for an eventual third lane in each direction. This could not be accommodated if the bridges were to merely be re-decked. Plus,

the Safe and Sound budget had only \$1.5 million to allocate to the project—not enough to replace the structures.

Luckily, MoDOT's St. Louis District chipped in \$3 million, which enabled MoDOT's Bridge Division to search for the design solution to economically build two new bridges that would accommodate the additional lanes while also fitting within multiple on-site constraints.

Snug Space

MoDOT's first goal was to have a jointless deck to ensure longevity for the new bridges—which effectively meant the old six-span configuration was out of the question. But fewer spans also translated into deeper girders—and could those fit within the other site limitations?

The most significant of these was the railroad. BNSF wanted the new bridge to accommodate space for a second track and also required 23 ft of vertical clearance—a snug proposition in both directions. In addition, utilities in the area that could not be disturbed, plus maintaining the flow of 5th Street and a private driveway, limited the options for locating the bents. Because there was no possibility of raising the highway above or lowering the railroad track below, vertical clearance parameters were



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- ◀ The notched-out section of the center span provides the necessary 23 ft of clearance for trains below.
- ▲ MoDOT's Safe and Sound Bridge Improvement Program has improved 802 bridges in three-and-a-half years, including the two I-55 bridges.
- ▼ A notched-out section in Stupp's fabrication facility.

unyielding and any new design would have to stay within them.

There were other concerns as well. First, if mechanically stabilized earth (MSE) walls were used for the abutments, geologists were concerned they could settle as much as 3 ft. If concrete girders were chosen, there were very real concerns about their weight as well as the size of crane that would be needed to lift them into position during staged construction.

Ultimately, a three-span continuous composite plate girder design was chosen for the bridges, with spans of 100 ft, 64 ft and 114 ft. The lighter-weight steel superstructure also helped address seismic concerns, as the bridges are within the New Madrid Seismic Zone.

While it's atypical to have the shortest span in the middle of a bridge—typically they're on the ends—the arrangement worked. Positioning the 64-ft span in the middle not only allowed enough room for the railroad and its future second track but also allowed for placing bents that would not disturb utilities or the track bed embankment.

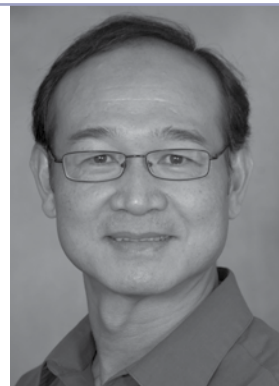
However, the vertical clearance issue remained. Achieving the three-span continuous girder design required a girder depth of 60 in. The only way to get the needed 23 ft of clearance over the railroad was to notch-out a section of the center span girders. The

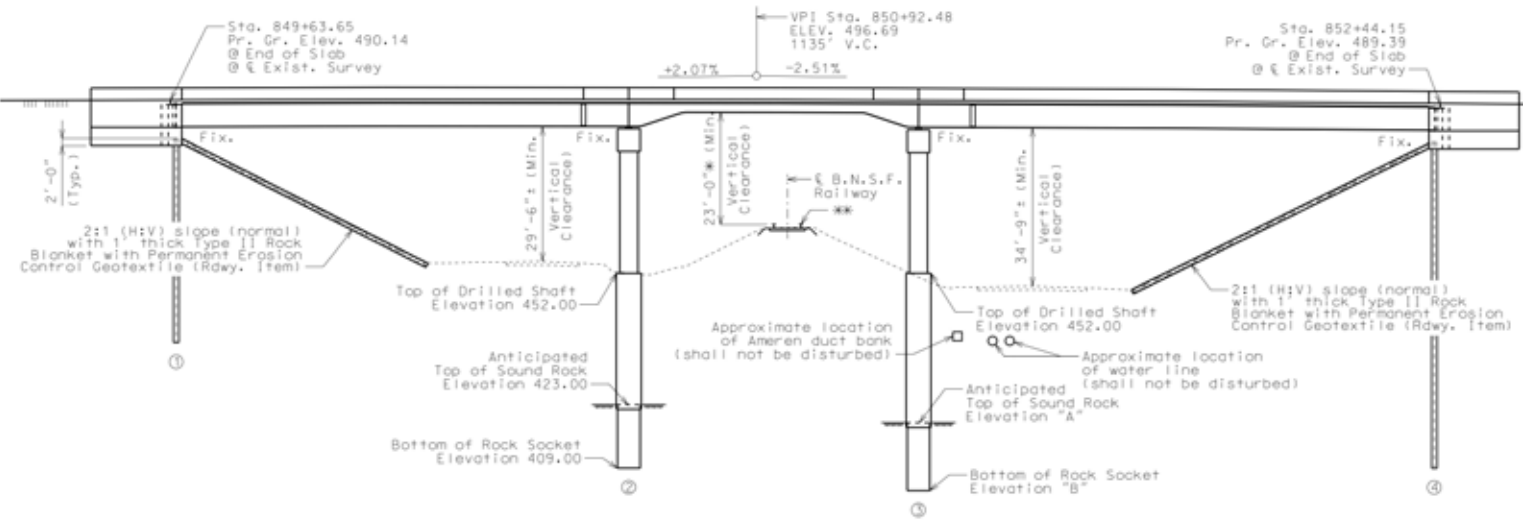


Stupp Bridge

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- ▲ An elevation drawing of the bridges.
- ◀ The center girder “notches” up to a 22-in. x 3/16-in. web plate with 15-in. x 1 1/8-in. flanges.

end span girders were 60-in. x 3/16-in. web plates with 15-in. x 3/4-in. top flanges and 15-in. x 1 1/8-in. bottom flanges, and the center girder “notches” up to a 22-in. x 3/16-in. web plate with 15-in. x 1 1/8-in. flanges. As such, the steel was fabricated to gradually taper the depth of the girder from 60 in. at the ends to 22 in. over the centermost 40 ft of the span—which not only solved the vertical issue but also saved on material weight and provided a unique look to the bridges. Weathering steel was used for the spans, with the exterior girders painted to ensure a consistent appearance that fit in with the aesthetics of the bridges’ surroundings.



Because of the site complexities, general contractor Gershenson Construction Company was given a long window to complete the project over two construction seasons. The northbound bridge was completed within a year of the start of construction and the southbound bridge was finished six months after that; the bridges use 375 tons of steel in all. ■

Owner and Structural Engineer
Missouri Department of Transportation

General Contractor
Gershenson Construction Company, Eurkea, Mo.

Steel Fabricator and Detailer
Stupp Bridge Company, Bowling Green, Ky. (AISC Member/NSBA Member/AISC Certified)

- ◀ The two new bridges use 375 tons of steel in all.