On the Fast TRACK

BY BEN NEAL

How to plan and prepare for what-ifs when constructing a rapid-replacement rail bridge.

All photos: The Ruhlin Company

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NORFOLK SOUTHERN'S RAIL LINE THROUGH Monroe, Mich., is an important, if perhaps unknown, contributor to the U.S. auto industry.

Carrying trains between Toldeo and Detroit, it is a direct conduit for supplying commodities and freight to automakers. But a major component of the line, an existing steel bridge over the Raisin River in Monroe, had reached the end of its useful life. Built in 1894, the three-span ballasted deck through-truss (Baltimore configuration) had deteriorated to the point where replacement was the only solution to keeping this important rout open.

The $10.9 million project posed numerous challenges, including constructing a new steel superstructure and three new piers,

▲ Picking the new span up from the lay-down yard.

◄ Removing an existing span.

▲ Placing an old span on an island downstream to make way for the new spans.

using the same alignment and grade as the existing structure while minimizing impact to railroad traffic. Through proactive problem-solving and teamwork, the construction team preassembled the new spans in a staging area just south of the site while simultaneous construction of the new piers was taking place beneath the existing bridge.

Minimizing Delays

The new bridge is a four-span through-plate girder superstructure. With the new structure continuing along the same alignment and grade as the existing bridge, a traditional construction approach would have required a four-month disruption in train service. With the emphasis on minimizing train delays, Norfolk Southern granted a five-day (120 hours) outage to complete the replacement of the structure. With a tight work schedule and a complicated span erection sequence, safety was a critical factor. Coordination was made more complex by random train movements, which came from both directions throughout the day. Constant communication between work crews and the on-site Norfolk Southern representative ensured that everyone was clear prior to trains coming through the site.

In preparation for on-site construction, the team created a lay-down yard on the southeast corner of the structure while a temporary causeway was constructed across the river. The causeway was constructed using 15,000 tons of stone, 120 tons of temporary steel beams and 160 crane mats. The temporary beams and crane mats were used to create bridges to maintain the flow of the river and allowed for quick removal in times of high water to eliminate the potential for flooding upriver. These temporary bridges had to be designed to withstand the weight of the cranes carrying the new bridge sections as well as maintain the ability to be removed quickly, if the need arose. While the new piers were being constructed beneath the existing bridge—they were constructed to within 1 in. of the existing structure—the project team constructed four new steel spans in the lay-down yard. Each span consisted of approximately 385 pieces of structural steel and 7,500 field bolts, and each incorporates a ¾-in. steel deck that was welded together during assembly to create a solid floor plate 115 ft long. Steel for the entire bridge totalled 780 tons. Using a steel deck also expedited construction by allowing the deck to be installed ahead of time, as other types of deck would likely have had to be installed during the outage. Waterproofing was applied over the entire deck prior to the outage in order to make efficient use of the available work time.

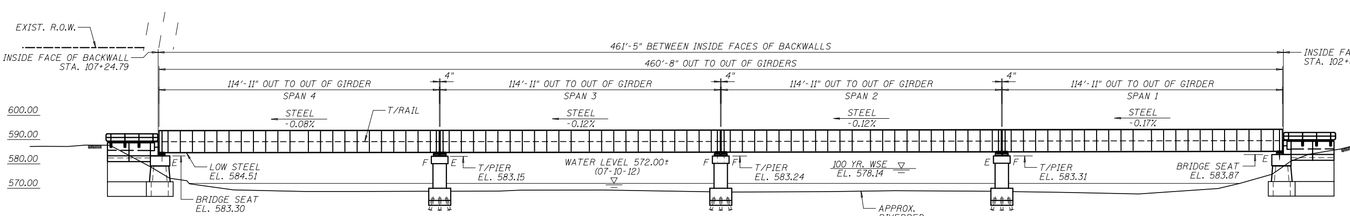
The Importance of Preplanning

Extensive planning was required prior to the owner granting an extended outage. Several team meetings were held to coordinate not only the work to replace the structure, but also the work required to maintain the signals and remove and replace the tracks themselves. An outage schedule, broken down into half-hour increments, was required by the owner prior to the beginning of the work outage window. When all of the pieces were in place, the outage was scheduled for late winter. However, four days prior to the scheduled outage, the area received 3 in. of rain that caused ice in the river to break and flow downriver. The temporary bridges were removed to prevent potential flooding, and the outage was delayed. Luckily, preplanning during the design phase anticipated the potential for

▲ Unloading steel in the lay-down yard.

▲ A view, from the deck, of two new spans set onto new piers.

▼ An elevation view of the new bridge.



flooding, and a contingency plan was built into the project to address possible delays. Further project discussions led to the outage being rescheduled for July 2015. Activities were rearranged so that work that was scheduled to take place after the outage could be performed prior to the outage in order to keep the crews productive. The decision to postpone until July was made to avoid the area's historically wet spring season and the potential for even more flooding. As such, the existing structure would continue to carry train traffic for a few additional months.

During the outage, the existing bridge was dismantled, via torch-cutting, enough to lighten each span for removal. The three existing spans were then picked and placed on temporary stone islands downriver to make way for the new spans. Two existing sandstone and concrete piers and the top 4 ft to 5 ft of the existing bridge abutments were also removed during demolition. The removed spans produced 750 tons of steel to be recycled.

Once demolition was completed, bearings were placed on the newly built piers and precast concrete abutment pieces were placed to allow for span erection. The new spans were then rigged and walked into place with a tandem pick by 300-ton Manitowoc 2250 crawler cranes. Each pick was approximately 200 tons and carefully choreographed so that weight remained balanced and the operators of each crane stayed in sync throughout the movement. The spans were carried approximately 1,000 ft across the lay-down area and through the river before being swung into their final positions on the newly installed bearings. Once the four new bridge spans were placed, expansion joints were installed and waterproofing was applied over the joints.

Up and Running

This bridge replacement demonstrates the importance of coordination, planning and execution of complex projects. The challenge was to balance replacing the bridge quickly and avoid an extended outage while also factoring in potential weather- and flood-related delays inherent to the area. Starting with design, the project team rose to that challenge and was able to work together to meet a critical time frame while keeping quality a priority and maintaining the project budget. Crews worked in two 12-hour shifts so that construction continued around the clock for 120 continuous hours, and the project was completed on time, resulting in minimal disruption to the trains and the industry that they serve. ■

Owner
Norfolk Southern, Norfolk, Va.

General Contractor
The Ruhlin Company, Akron, Ohio

Structural Engineer
Alfred Benesch and Company, Chicago

Steel Fabricator
Industrial Steel Construction, Inc., Gary, Ind.