PROJECT PROFILE

# Fort Madison Toll Bridge

Electrical and Mechanical Inspection and Design | Fort Madison, IA

**CLIENT**

BNSF Railway

**BACKGROUND**

Completed in 1927, Fort Madison Toll Bridge—also known as the Santa Fe Swing Span Bridge—is a double-decker swing-span bridge over the Mississippi River that connects Fort Madison, Iowa, with Niota, Illinois. Privately owned by BNSF Railway, the swinging truss bridge has a two-lane highway on the upper deck and a two-track freight railroad on the lower deck. The bridge machinery and electrical operating systems are located on the moving structure and consist of bridge drive motors and brakes, two rail lock motors, and two end lift motors. The bridge is provided with two sources of power—one from the local electric utility and a second from an on-site standby generator.

WJE performed an in-depth inspection and condition assessment of the electrical systems, concluding that the electric power and control installation as well as both duplicate electric service feeders were in poor condition and potentially on the verge of failure. Based on these findings, BNSF Railway contracted WJE to design a replacement power and control system for the bridge. Due to the criticality of the operation of the bridge, BNSF Railway elected to perform the proposed replacement work in stages.

**SOLUTION**

The initial stage included designing a new aerial and submarine cable system between the bridge's fixed and moving structures, ensuring that the designed aerial and submarine cable would be unaffected by the rotation of the swing span when transitioning between the fixed and moving structures during bridge operation. The completion of the new electric service feeder system provided the bridge with reliable sources of electric service feeder. The second stage of electric power and control replacement design consisted of the replacement and upgrade of the bridge drive motors, brakes, and bridge control system.

The drive system replacements included replacing the motors and drives with modern induction motors and variable frequency drives. Replacing the existing braking system with electromechanical brakes with modern thrustor brakes and the addition of drive initiated dynamic braking enables the operating bridge braking to be achieved using the new motors and drives and utilizing the electro-mechanical brakes as holding brakes.

The existing bridge control system consisted of a combination of PLC and relay logic but had not been configured as a redundant system. The replacement system, which consists of both PLC land relay logic, is configured so that the PLC is the primary form of bridge control, with the relay logic acting as backup.