The Christopher S. Bond Bridge – An Icon for Kansas City, Missouri

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Summary

The US$232 million kcICON Design-Build Project includes the design and construction of a landmark bridge over the Missouri River and reconstruction of over six kilometers of Interstate-29/35 in Kansas City, Missouri. The new bridge is almost 42 meters wide and approximately 518 meters long including approach spans. The suspended portion of the bridge consists of a composite steel and concrete, asymmetrical cable-stayed system with a main span of 168 meters and a side span of 138 meters. The striking, diamond-shaped pylon rises over 91 meters off the water and creates a natural gateway between the communities of North Kansas City and Kansas City. The aesthetic lighting features a kinetic lighting system with diode panels mounted to the edge girders to allow an infinite number of lighting shows across the length of the bridge, from simple one-color panels to complex color changing events.

Keywords: Cable-stayed; design-build; landmark; bridge aesthetics; aesthetic lighting

1. Introduction

The kcICON Design-Build Project was initiated to address the issues along the project corridor by improving capacity, safety and mobility and either replace or rehabilitate the existing Paseo Bridge to increase its useful service life. The selected design includes the design and construction of a new landmark cable-stayed bridge over the Missouri River and reconstruction of over six kilometers of Interstate-29/35.

Design and construction services were procured using the design-build method where proposers developed their own design and construction approach that maximizes value to the owner for a fixed, non-negotiable price of US$232 million. This fixed price approach ensured that bids did not exceed the available funding.

There were significant challenges associated with developing a design in this constrained urban corridor and balancing competing goals for the project. The owner required a landmark bridge design that produced dramatic day and night views of the bridge. In addition, the bridge must be durable enough to meet a 100 year service life requirement. However, a competing goal was to maximize capacity, mobility and safety improvements throughout the rest of the corridor.

In an effort to meet the goal of engaging stakeholders and the community to successfully deliver the project, MoDOT facilitated the organization of a Community Advisory Group (CAG) to provide input into the design development process. The CAG is comprised of staff and members of local municipalities, business organizations and community organizations. MoDOT's commitment to engaging stakeholders and the community stretched as far as allowing members of the CAG to have confidential meetings with the design-build teams and review their Missouri River bridge design

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and determine the final aesthetic score. This is the first time that the author is aware of third party stakeholders being given 20 percent of the say in selection of the design-build team.

The river bridge consists of a two-span cable-stayed structure with composite steel plate girder approach spans. The cable-stayed main span is 168 meters with a side span of 138 meters. The superstructure is comprised of a composite steel and concrete deck system made of precast concrete deck panels erected on, and made composite with, the floor beams and steel-edge girders. The superstructure is supported by 40 stays that radiate in a semi-fan arrangement from a single reinforced concrete diamond-shaped pylon.

The concrete pylon is composed of hollow box legs connected at the apex of the diamond and framed transversely by a strut below the deck. The strut provides framing action to assist in resisting lateral loads applied to the pylon and to resist the outward force created at the hip of the pylon. The inward inclination of the upper pylon legs and corresponding inward inclination of the stays creates a superstructure system that is very stiff torsionally and provides superior aerodynamic stability. The change in the direction of inclination of the legs at the hip allows the supporting foundation footprint to be minimized resulting in significant foundation and cofferdam cost savings, as well as reduced impact to the river.

Fig. 1: Rendering of the Christopher S. Bond Bridge.

The main pylon foundation will consist of a single rectangular footing, supported by a group of eight 3.4 meter-diameter drilled shafts. The approach bents will include multi-column piers with a single shaft embedded into bedrock under each column. Shaft diameters and embedded lengths into rock will vary according to load demand at each column.

The creation of a "gateway" experience for motorists traveling on this bridge is a fundamental part of creating an icon for the Kansas City community. In addition, the result is a unique experience for the motorist. As you approach the pylon, the cables envelop the roadway. The lines of the cables bring your attention skyward, and the pylon serves as a focal point and gateway through which every motorist enters and exits.

The horizontal line of the bridge across the water is enhanced by a kinetic lighting solution, which is an effect that creates a visual connection between the two sides of the river. The lighting system includes necklace lights consisting of light-emitting diode panels mounted to the outer surface of the edge girder. These color-changing light-emitting diode panels are controlled by a highly flexible and sophisticated lighting control system that allows for the display of infinite numbers of lighting shows across the length of the bridge, from simple one-color panels to complex, color-changing events.

The colors and lighting events can be coordinated with seasonal changes and with special events taking place in the community. This active lighting system will serve as a major element of communication and will involve the bridge in the community at a social level.