NATIONAL AWARD

MAJOR SPAN

Burro Creek Canyon Bridge

U.S. Highway 93 between Phoenix and Las Vegas

Owner/Designer
Arizona Department of Transportation, Phoenix

Consultant
URS, Phoenix

Fabricator
PDM Bridge, Eau Claire, Wisc. (AISC Member)

Detailer
Tensor Engineering Co., Indian Harbour Beach, Fla. (AISC Member)

Erector
Traylor Brothers, Irvine, Calif.

General Contractor
R.E. Monks, Fountain Hills, Ariz.

Arizona U.S. Highway 93 runs north to south through central Arizona and is the primary transportation corridor between Phoenix and Las Vegas. Transportation growth through this corridor and related safety concerns have necessitated an expansion of the corridor—and a second Burro Creek Bridge.

The existing Burro Creek Bridge, which carried two-way auto traffic, is a truss arch structure with spandrel columns supporting the roadway deck and plate girder approach spans. The final design for the new bridge design was also a truss arch, but using weathering steel for future maintenance reasons. The existing Burro Creek Bridge will be painted in the future to blend aesthetically with its new sister.

The location is environmentally sensitive, part of a wilderness recreation and campground area, and owned by U.S. Bureau of Land Management (BLM). This federal agency, as steward and custodian of the unique canyon area, had set a higher level of environmental restraints for this new bridge crossing over the canyon. Major constraints included: minimal damage and disturbance to the canyon, preservation of the natural settings and compatibility, no construction access to the canyon base, and maintaining a scenic view from the nearby campground. The Arizona Department of Transportation (ADOT) developed a partnering relationship with BLM early in the planning and design process, and BLM concerns and priorities were included in the layout and bridge type selection.

Learning from Lessons Past

The existing Burro Creek Bridge offered insight as to how to deal with the challenge of erecting a structure—that would not be internally stable until it was complete—over a significant opening. A cable high line was used with the first bridge to deliver material and erect the structural steel. A cable-stay tower was also used for temporary erection support, as the truss arch stretched out from the abutments and ultimately closed at center span. The spandrel columns and decking were then erected with the high line once the main arch truss was complete.

This erection method was suggested by ADOT

in the original project bid documents for the new bridge. However, the erector concluded that this method was slow and not competitive. Experience within the estimating team was drawn upon and lessons learned from previous projects were brought to the table. One such bridge project, in Washington state, was erected "over the top" with a light crawler crane. A bogie cart system was used to ferry materials to the erection crane as it walked forward to erect the truss bridge until the cantilevered halves closed at center span. But the New Burro Creek Bridge design, by itself, was not capable of self-support, nor was it capable of supporting an erection crane.

Another previous bridge project, in Michigan, was also considered. This through-arch structure, which was also erected with a crane over the top, used a temporary support tower with cable stays to support the arch erection and crane loads until the arch was completed. This erection method appeared to be adaptable to the New Burro Creek Bridge, and the tower components used for this bridge still existed and were available. As such, this was the chosen method for the new Burro Creek Bridge.

Laying the Groundwork

Extensive geotechnical investigation and iterative bridge foundation studies were performed to optimize the location of the bridge. A computer-based visual simulation study presented the impact and compatibility of the various feasible bridge structure types on the scenic view of the canyon.

Three-dimensional simulation models were developed to make comparative evaluation of alternative bridge types over the canyon setting and to aid in selection of bridge structure type. Innovative connection designs were developed to improve fabrication and erection methods and enhance construction safety. High-strength weathering steel was used to protect the environment and blend with the natural setting and rock types of the canyon. Special types of wind bracing and anchoring details at skewbacks were developed to streamline steel erection. In addition, special provisions and dynamic control parameters were specified in design to control rock-blasting effects.

The Right Fit

A steel truss arch bridge layout was selected as the best fit for the canyon. Arch skewback foundation layout and excavation limits were refined in order to reduce rock excavation and rock fall in the canyon.

Constructability issues of the steel arch over the canyon, with minimal disturbance and in close proximity of the existing Burro Creek Canyon Bridge with heavy traffic, were major criteria in the design development process. Several innovative and optimized design features were included to achieve these goals. Skewback piers were designed to provide support and anchorage for the cantilever launch of the steel arch over the canyon. Flexible connection details were provided for ease of fabrication, transport, and field erection.

Erection productivity and worker safety were addressed using an access platform system. The contract specifications originally called for the use of safety nets, but the access platform system prompted the elimination of this requirement and afforded a heightened level of worker safety. This in turn resulted in improved erection productivity. A bottom platform extended across the lower chord joints, from which the lower arch truss members could be erected and bolted. The platforms were moved forward with the erection in a trapeze fashion. Upper erection platforms were smaller and specific to a single joint, and also served to provide erection access and later, a secure means to complete the joint bolting process. MSC