



# Mike O'Callaghan-Pat Tillman Memorial Bridge

Clark County, Nevada, USA and Mohave County, Arizona, USA

By David Goodyear, P.E., S.E., P.Eng

*T. Y. Lin International was an Outstanding Award winner for the Mike O'Callaghan-Pat Tillman Memorial Bridge project in the 2011 NCSEA Annual Excellence in Structural Engineering Awards Program (Category – New Bridge and Transportation Structures).*

**S**oaring 900 feet above the Colorado River, the Mike O'Callaghan-Pat Tillman Memorial Bridge frames one of the foremost engineering wonders of the world – the Hoover Dam. The 1,900 foot long Colorado River crossing is the centerpiece of the \$240 million, four-lane Hoover Dam Bypass Project. The lead Agency for the project was the Central Federal Lands Division of the US Federal Highway Administration, led by Dave Zanetell as Program Manager (PM).

The Bypass design team consisted of HDR, Jacobs and TY Lin International (TYLI). HDR managed the consultant team and led design of the Nevada roadway, Jacobs led design of the Arizona roadway, and TYLI led the design of the landmark Colorado River span.

With a main span of 1,060 feet, this bridge is the fourth-longest, single-span concrete arch bridge in the world. In addition to the NCSEA Outstanding Project Award, this project was also awarded the ASCE OPAL and ACEC Grand Conceptor Awards for design.

Like most Agency let projects, the bridge design effort began with a bridge type study. However, the new crossing had been studied since 1968, and the PM saw an opportunity to use past work to screen bridge type candidates and move directly into final design. Stakeholders all agreed that a deck arch bridge was preferred, and the design team moved forward to assess the options within that bridge type.

The type study focused on concrete and steel arch structures at two different span lengths – one at 1,060 feet and the second at 1,325 feet to span a rock fault zone being studied in parallel with the type study. Once the geologists confirmed that the rock formations would allow the shorter span, the economical choices came down to the concrete arch with composite deck and a Glen Canyon-type trussed steel arch. .

A defining moment for the project came prior to a stakeholder meeting to discuss the draft type study. Dave Zanetell reviewed the draft type study report authored by David Goodyear. He confided in David his concern that the type selection needed to reflect the special character



*Photo courtesy of Jamey Stillings Photography.*

of the Hoover site. The cost estimates showed a small preference for the concrete alternative, but Dave's perspective was clearly broader than first cost. While a repeat of a Glen Canyon-type steel design might be easier to administer, he believed it would not be the right solution for the Hoover site and the generations of visitors to the Dam. This foresight was an example of the talent that would result in a signature project that realized budgetary and contextual design results. As designers we can dream, but without visionary clients, dreams are rarely realized.

The ensuing meeting with the Design Advisory Panel affirmed the type selection recommendation, and the Executive Committee of Agency leads unanimously selected the design you now see framing the view of Hoover Dam.

The character and form of the bridge is classical, but the bridge design is unique. Every innovation was vetted by CFL and the Structural Management Group convened to review design, from the choice to use high strength concrete for stiffness of the long span arch to the unique composite connection between the steel tub girders and post-tensioned integral concrete caps. The framing system and sections that were defined at the end of the type study withstood the scrutiny of final design and review, with the only change in structural section being a 6-inch deepening of the integral concrete caps.

Building this form was anything but simple. Reaching over 1,000 feet across a hard rock canyon in 120-degree heat is a challenge not for the faint of heart.

The construction contract was awarded in September of 2004 to Obayashi-PSM, JV. The Bridge was built using a variety of limited access techniques similar to those assumed for design. The arch ribs were supported with temporary stay cables hanging from temporary

towers. The towers in turn were supported over the skewback piers, which had been designed for this erection method. The concrete segments for the arch were poured using four headings of self-advancing form travelers. Most of the arch segments were placed at night to avoid the triple-digit desert temperatures.

The construction project was beset with a major accident at the beginning of arch construction. Winds resulted in the loss of the high-line crane needed to service work over the canyon. Instead of crippling the project, this event produced a more organized and determined construction team that would go on to achieve impressive results in completing the 52 cast-in-place arch sections on an accelerated schedule, closing within 3/4-inch over the midpoint of the canyon!

## Conclusion

The Mike O'Callaghan-Pat Tillman Memorial Bridge now frames the view of the Black Canyon from Hoover Dam for the coming generations of tourists, and is the cornerstone in a new, efficient highway system funnelling commercial traffic between the states of Nevada and Arizona. The project reflects the skill and determination of the people who built it, all of whom take pride in their accomplishment. ■

*David Goodyear, P.E., S.E., P.Eng is the Chief Bridge Engineer for T.Y. Lin International, and led the design for the new Colorado River Bridge at Hoover Dam as the Engineer of Record. David has served as Chairman of the PTI Committee on Cable-Stayed Bridges and was a member of the NCHRP team that authored the initial Concrete Segmental Guide Specifications with PTI.*