

# Outstanding Shotcrete Project Award Winner

## 2005 Outstanding Infrastructure Project

# Scottsdale Arch at Indian Bend Wash



*Finished Scottsdale Con-Arch*

by Bill Noland

**T**he Scottsdale Road project consisted of a road widening from two to four lanes with center turn lanes. Its original design required a conventional six-span bridge to be constructed with AASHTO-type box girders over the Indian Bend Wash. Hunter Contracting Co. selected its Con-Arch division to provide a design-build arch structure that would replace the bridge through a value engineering proposal. The arch would serve as a floodway crossing for Scottsdale Road and offer a more enhanced and pleasing backdrop for the McCormick Ranch Resort to the east and the town of Paradise Valley to the west.

Con-Arch, through The Highway Innovative Technology Evaluation Center (HITEC), CERF Report No. 40723, developed a modern way to engineer and construct arch structures in the 1990s. The technology of both engineering and constructing an arch was lost back in the early 1900s due to rising labor and form material costs and the lack of an economical way to place the concrete around the arch shape. With the use of computer-aided drafting and modern design software, Con-Arch is able to design the arch to take advantage of its shape, thus eliminating any inefficiency of having thicker shotcrete or concrete sections and large quantities of reinforcement.

The most challenging aspects of the design were placing the arch in the same envelope as the conventional bridge and maintaining the water flow area that would handle the 100 year floods. The new design consisted of a six cell 42 ft (12.8 m) span arch with a 10 ft 4 in. (3.15 m) rise and a length of 139 ft (42.4 m). It was designed with an extra headwall and the use of a lag and beam shoring system at the end of the first phase of construction to allow encroachment as close as possible to the existing roadway and to eliminate the need for a third phase in construction. Construction challenges were maintaining flood water during the foundation and the superstructure work. The



*Crossing prior to construction*

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Indian Bend Wash is a major greenbelt floodway for the city of Scottsdale that was built by the U.S. Army Corps of Engineers to protect the city from flood water. Even though the wash only flows during rainfall periods, it takes a very small amount of rain to make it flow. The original design required removal and replacement of the main sanitary sewer line from the city of Scottsdale to make room for the bridge foundations, which were large reinforced concrete shafts. The sanitary sewer line replacement was no longer necessary after the arch was designed due to the use of a raft slab and scour walls for the foundation. Numerous utilities crossed the wash, and the conflicts between the utility locations and the conventional bridge were paramount, to say the least. These conflicts were almost all eliminated due to the redesign of the arch. Construction

time savings amounted to over 8 weeks total due to the new design.

Structural shotcrete plays a very significant roll in the constructibility of the arch. The use of single-sided forms and shotcrete has paved the way for this modern arch technology. We can easily place shotcrete on any vertical or horizontal surface thus eliminating the need for an outside containment form. The quality of today's shotcrete mixture designs, with added accelerators and water-reducing agents, modern placement equipment, and the precise placement of the shotcrete with ACI-certified nozzle men, ensures a quality structural component. Shotcrete placed with a low water-cement ratio, if protected with an approved curing method, gains early strength and allows early form removal thus saving form cycle time.



*Concrete invert poured ready for form placement*



*Setting skewed 42 ft Con-Arch steel form*



*Setting Con-Arch reusable steel forms*



*Placing shotcrete on Con-Arch steel forms*

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*Shotcrete used in construction of headwalls, wing walls, arch, and cutoff wall*



*Shotcrete collar pipe penetration*

One of the most significant aspects of this project was the use of value engineering. Value engineering is nothing new to the industry but plays an important roll today due to the rise in material and labor costs. The primary purpose of value engineering is to reduce the costs of construction without impairing the value of the project. In this instance, the value added by the enhancements pleased the city of Scottsdale's Design Review Committee very much. Compared with the conventional design, the arch design saved the city more than \$564,000 and allowed enhancements to be added to the project, such as the trumpet features on the headwalls, form liners for aesthetics, integral color to the shotcrete, and street lighting.

Several adjacent retaining walls were also placed with the shotcrete method, most of which were over 16 ft (4.9 m) in height and had a form liner in the face for architectural features.

The team players were Hunter Contracting Co., the City of Scottsdale, Larson Associates Architect, Sacra Engineering, CMG Drainage Engineering, Cemex, and CLG Steel.

Con-Arch is a division of Hunter Contracting Co., a highway and industrial contractor, located in Gilbert and Tucson, AZ. Hunter Contracting Co. has served the construction industry since 1964. Visit: [www.con-arch.com](http://www.con-arch.com).

## Outstanding Infrastructure Project

### *Project Name*

Scottsdale Road—Indian Bend to McCormick Parkway Improvements

### *Project Location*

Scottsdale, AZ

### *Shotcrete & General Contractor*

Hunter Contracting Co.

### *Project Owner*

City of Scottsdale

### *Architect*

Larson Associates

### *Engineer*

Sacra Engineering

### *Material Supplier*

Cemex



*Bill Noland is the Con-Arch manager for Hunter Contracting Company with 18 years of experience in arch construction and 35 years in the concrete industry. He is a member of the American Shotcrete Association, has served on the Board of Directors for the American Road and Transportation Builders Association from 2002-2003, and currently serves on the Board of Directors for the Tucson Utility Contractors Association. Noland is also Chair of the Pinal County Joint Co-op Committee for the Association of General Contractors in Arizona.*