San Angelo Bridge, U.S. Route 67, San Angelo

General Description The San Angelo Bridge, more formally known as the North Concho River, U.S. 87, and South Orient Railroad Overpass, consists of eastbound and westbound U.S. Route 67 main-lane bridges. The eastbound main-lane bridge is HPC. The westbound main lanes use conventional concrete mixes, except for a high-performance/normal-strength concrete deck in five of the nine spans. The geometry of the crossing is such that the eastbound HPC beam spans vary from 19.4 m (63.8 ft) to 47.9 m (157 ft). The simple-span AASHTO Type IV prestressed concrete I-beams are used in seven spans, and Texas Type B prestressed concrete I-beams are used in the short eighth span. The Texas Department of Transportation (TxDOT) conducted the project in cooperation with the University of Texas at Austin.

Outline of HPC Features The concrete strength of the bridge beams varied from 40 MPa (5800 psi) to 102 MPa (14,800 psi) according to the demand of the particular application. The design strengths were specified at 28 days for the deck and piers. The design strength for the beams was specified at 56 days to account for the strength gain with time that is typical of many higher strength concretes. The strengths of the eastbound bridge were:

HIGH-PERFORMANCE CONCRETE

Concrete with enhanced durability and strength characteristics. Under the Strategic Highway Research Program (SHRP), more than 40 concrete and structural products were developed. To implement the new technology of using High-Performance Concrete (HPC), the Federal Highway Administration (FHWA) has a program underway to showcase bridges constructed with HPC. The objective is to advance the use of HPC to achieve economy of construction and long-term performance.

Element	Compressive Strength
Beams@Transfer	61-74 MPa (8900-10,800 psi)
Beams@56 Days	40-101 MPa (5800-14,700 psi)
Piers	41 MPa (6000 psi)
Pier Cap	55 MPa (8000 psi)
Deck	41 MPa (6000 psi)
Prestressed Concrete Subdeck Panels	41 MPa (6000 psi)

To facilitate placement of the concrete in the I-beams, set retarder and high-range water-reducing admixtures were used. Accelerated curing was not used. Cement was partially replaced with fly ash in all mixes.

Prestressed Beams The AASHTO Type IV prestressed concrete I-beams were 1372 mm (54 in) deep and were designed with straight pretensioned strands and draped post-tensioned strands. All strands are 15.2 mm (0.6 in) in diameter. The pretensioned strands are spaced at 51 mm (2 in), and two ducts carry the draped post-tensioned strands. Transfer- and development-length tests were conducted in this project to obtain FHWA approval for use of the 15.2-mm-(0.6-in-) diameter pretensioned strands at 51-mm (2-in) spacing.

Piers The substructure consists of a cast-in-place reinforced concrete single column with tapered cap. A window in each column complements openings in the superstructure's traffic railing.

Deck The deck is composite, cast-in-place, reinforced concrete with precast, prestressed concrete subdeck panels. One task in this project was to accumulate field experience with the use of high-strength versus normal-strength high-performance concrete in cast-in-place concrete deck construction. A reinforcing bar with a new pattern of deformation was also used. This bar was developed by the University of Kansas to provide improved bond characteristics, and it replaced the standard reinforcement in the cast-in-place concrete decks of two spans.

Construction Construction of this bridge began in June 1995. The contractors were Jascon, Inc., Uvalde, Texas, and Reece Albert, Inc., San Angelo, Texas. The cast-in-place concrete was provided by Concho Concrete Company, San Angelo, Texas. The prestressed concrete I-beams were fabricated by Texas Concrete Company, Victoria, Texas, while the prestressed concrete subdeck panels were fabricated by Bexar Concrete Works, San Antonio, Texas. The project was completed and opened to traffic in January 1998.

Long-Term Performance TxDOT, in cooperation with the University of Texas at Austin, has a long-term monitoring project underway to continue reading the extensive instrumentation installed in the bridge, as well as to make visual observations and comparisons between the HPC elements and normal concrete elements. The interpretation of the results from the extended data acquisition will document actual performance and should lead to improved design guides for HPC use and better construction specifications.

Benefits The use of the high-strength characteristic of high-performance concrete in the beam design allowed a significant reduction in the number of beams and the reduction of one span. It is anticipated that the improved durability will result in reduced long-term maintenance costs and longer service life.■

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