

Louetta Road Overpass, State Highway 249, Houston

General Description Texas State Highway 249 was upgraded from a four-lane, at-grade road to a limited-access freeway. Consequently, two overpass structures have been built at Louetta Road to carry three lanes in each direction, plus shoulders and ramp transitions. The bridges are three spans each, nominally 40 m (130 ft) per span. Beams are pretensioned and are U-shaped. At the interior bents, each beam is supported by a single post-tensioned pier. All beams and piers were designed and fabricated using high-performance/high-strength concrete. The composite decks are precast concrete subdeck panels with cast-in-place concrete topping. For comparison purposes, the southbound main-lane bridge has a high-performance/high-strength cast-in-place concrete deck, whereas the northbound main-lane bridge has a high-performance/normal-strength cast-in-place concrete deck. 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 elements varies 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. Strengths 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
U-Beams @ Transfer	48-61 MPa (6900-8800 psi)
U-Beams @ 56 Days	69-90 MPa (10,000-13,000 psi)
Piers	69 MPa (10,000 psi)
Deck (Southbound)	55 MPa (8000 psi)
Deck (Northbound)	28 MPa (4000 psi)
Prestressed Concrete Subdeck Panels	55 MPa (8000 psi)

Due to the large number of closely spaced prestressing strands, placement of the concrete in the U-shaped beams required superior workability and the use of a set retarder and high-range water-reducing admixture. No accelerated curing was used. Cement was partially replaced with fly ash in all mixes.

Pretensioned Beams The pretensioned beams were fabricated using a newly developed cross-section. The TxDOT U54 beams are trapezoidal in cross-section, but open at the top with flanged stems. The width of the beam across the top of the stems is 2.4 m (8 ft); the beams are 1372 mm (54 in) deep. The beam stems are 126 mm (5 in) thick and the thickness of the bottom flange can accommodate three rows of strands. Except for the interior beams of the shortest span where a 12.7-mm- (0.5-in-) diameter strand was used, 15.2-mm- (0.6-in-) diameter strand spacing at 50

mm (2 in) on center was used for pretensioning. Transfer- and development-length tests were conducted in this project to obtain FHWA approval for the use of 15.2-mm- (0.6-in-) diameter pretensioned strands at 50-mm (2-in) spacing.

Piers The piers are hollow 991-mm (3.25-ft) square segments with chamfered corners. Two walls are 190.5 mm (7.5 in) thick to accommodate three 34.93-mm- (1.38-in-) diameter post-tensioning bars. The other two walls are 102 mm (4 in) thick. The use of this pier system allowed speedy construction in the field to provide beam supports and the effective utilization of high-performance concrete in the substructure.

Deck The deck is composite, cast-in-place, reinforced concrete with

precast, prestressed concrete sub-deck 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.

Construction Construction of the Louetta Road Overpass began in February 1994. The contractor was Williams Brothers, Inc. of Houston. The U-beams were fabricated by Texas Concrete Company of Victoria, Texas. Cast-in-place concrete was provided by Lopez-Gloria Construction Services, Inc. of Houston. The bridge was opened to traffic in May 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 of the HPC 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 simple-span construction for this overpass. Otherwise, a more complicated and costly superstructure and/or substructure design would have been required due to the underneath-roadway constraints. Aesthetics were considered, and the U-beams with a single pier per widely spaced beam offer an attractive alternative to typical designs. ■



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