High Performance Concrete Bridges- Texas
Louetta Road Overpass State Highway 249, Houston

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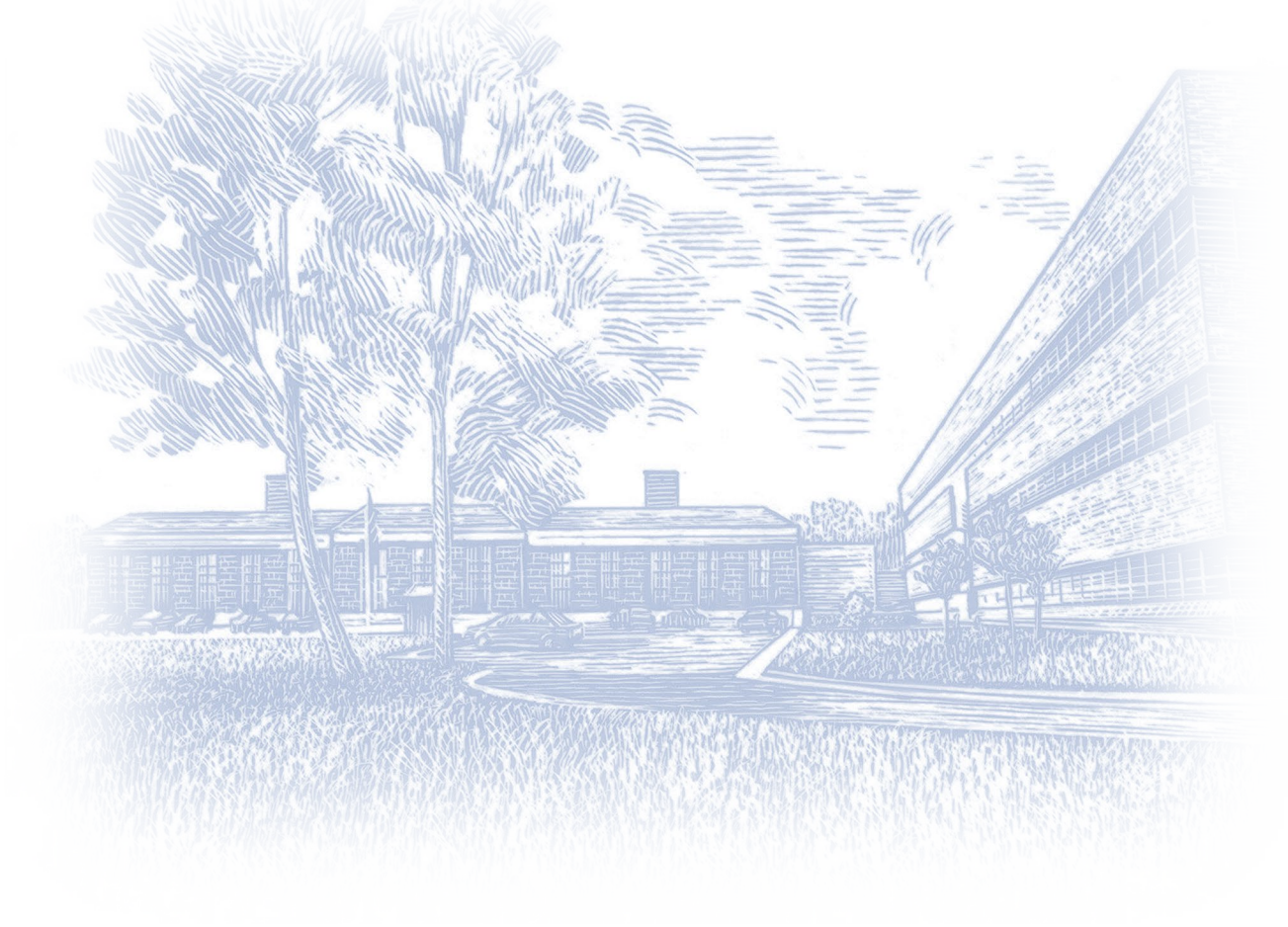

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Foreword

High-Performance Concrete - Concrete with enhanced durability and strength characteristics. Under the Strategic Highway Research Program (SHRP), more than 40 concrete and structure 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

General Description

Texas State Highway 249 is being 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 span 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) is conducting the project in cooperation with the University of Texas at Austin.

Outline of HPC Features

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:

Element	Compressive Strength
U-Beams @ Transfer	48-61 MPa (6,900-8,800 psi)
U-Beams @ 56 Days	69-90 MPa (10,000-13,000 psi)
Piers	69 MPa (10,000 psi)
Deck - Southbound	55 MPa (8,000 psi)
Deck - Northbound	28 MPa (4,000 psi)
Subdeck Panels	55 MPa (8,000 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 are fabricated using a newly developed cross-section. The TxDOT U54 beams are trapezoidal in cross-section, but open at the top with flanged stems. Width of the beam across the top of the stems is 2.4 mm (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 be varied to accommodate either two or three rows of strands. Except for the interior beams of the shortest span where 12.7 mm (0.5 in) diameter strand was used, 15.2 mm (0.6 in) diameter strand spaced 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 for 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 subdeck panels. One task in this project is to accumulate field experience on 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 overpass will be completed by late summer 1997 and will be open to area traffic by November 1997.

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 a consideration, and the U-beams with a single pier per widely-spaced beam offer an attractive alternative to typical designs.

For further information on High-Performance Concrete or this project, contact:

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