Alabama Highway 199 Over Uphapee Creek, Macon County

General Description The main bridge at Uphapee Creek is a replacement for a bridge that has suffered from streambed scour resulting from sand and gravel mining downstream. The route carries heavily loaded sand and gravel trucks and logging trucks. On the same project, within 1.6 km (1 mi) of this structure, a flood-relief bridge and a bridge over Bulger Creek are being replaced that will not utilize HPC. The HPC project at Uphapee Creek consists of seven 34.7-m (114-ft) AASHTO Bulb-Tee (BT) pre-stressed concrete girder spans. All spans are simple-span construction on either drilled-shaft or driven-steel-pile foundations. Girders are spaced at 2.67 m (8.75 ft), giving a 12.2-m (40-ft) roadway. The deck thickness is 178 mm (7 in). The Alabama Department of Transportation conducted the project in cooperation with Auburn University.

Outline of HPC Features The HPC project specifications required high 28-day compressive strength, high early-strength, and low permeability. Specified compressive strengths for the HPC elements were:

Element	Compressive Strength
Girders@Transfer	55 MPa (8000 psi)
Girders@28 Days	69 MPa (10,000 psi)
Deck@28 Days	41 MPa (6000 psi)
Cap and Columns @28 Days	41 MPa (6000 psi)

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.

Pretensioned Girders The AASHTO BT-54 girders are 1372 mm (54 in) deep and are pretensioned with forty-two 15.2-mm- (0.6-in-) diameter, low-relaxation, 1862-MPa (270-ksi) strand. Strands are draped to reduce stresses at the ends. The girders were steam-cured to obtain high early-release strength.

Substructure Intermediate bents and the end abutments were constructed using concrete with f'c = 41 MPa (6000 psi). The design was based on a compressive strength of 21 MPa (3000 psi).

Deck The 28-day compressive strength of the deck concrete was 41 MPa (6000 psi). The design was based on 28 MPa (4000 psi). Special curing of the deck concrete required that it be kept moist by fogging until wet curing was begun. Specified entrained air content was between 3 percent and 5 percent.

Concrete Tests The following properties were measured for both the girder and deck concretes:

- Compressive Strength
- Chloride Permeability
- Flexural Strength
- Abrasion Resistance
- Modules of Elasticity
- Creep and Shrinkage
- Splitting Tensile Strength

Instrumentation The girders were instrumented to monitor behavior from placement of concrete through long-term service life under dead, live, and impact

loading. Instrumentation consists of embedded thermocouples to monitor and record temperature gradient across the girder depth, and electrical resistance strain gauges and vibrating wire strain gauges to measure and record strains throughout the girder length and depth. Calibrated live-load tests will be performed in August 2000. External gauges will be utilized to measure and record deflections.

Construction The project was let to contract in March 1998, and Clark Construction Company, Inc. was the contractor. The girders were fabricated in fall 1998 by Sherman Prestressed Concrete. The substructure was constructed during summer 1999. The ready-mix concrete supplier was Blue Circle Williams. The bridge was opened to traffic in April 2000.

Benefits By using HPC in the girders, the bridge design was changed from a 243.8-m (800-ft) bridge made up of eight 30.5-m (100-ft) spans to a bridge made up of seven 34.7-m (114-ft) spans using one fewer girders. The savings is the cost of one pier and the requirement to cast thirty-five 34.7-m (114-ft) girders instead of forty-eight 30.5-m (100-ft) girders.

U.S. Department of Transportation
Federal Highway Administration

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