High Performance Concrete Bridges- Alabama
Alabama Highway 199 Over Uphaupee And Bulger Creek, Macon County

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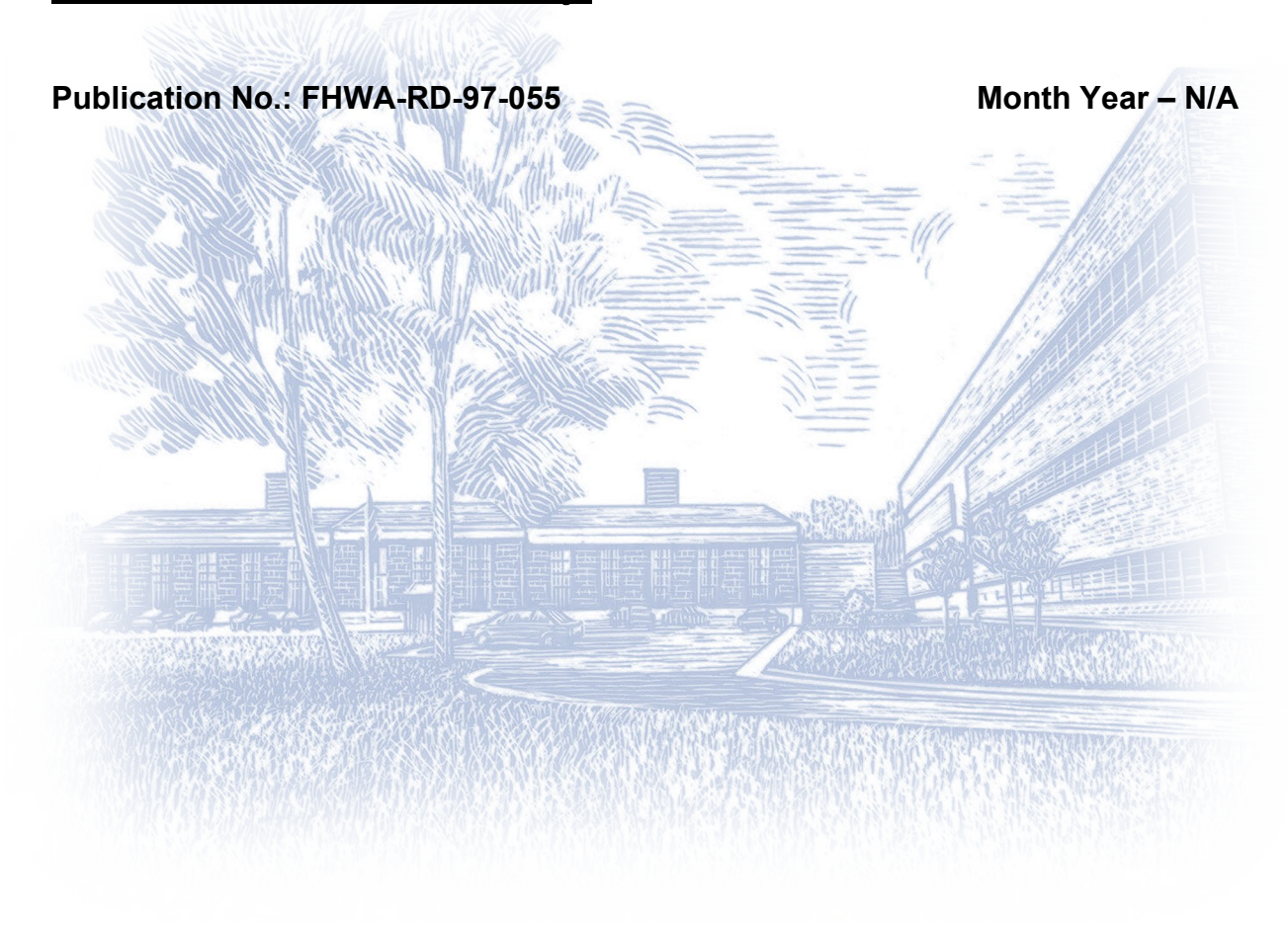

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Federal Highway Administration

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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

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 prestressed 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 is conducting the project in cooperation with Auburn University.

Outline of HPC Features

The HPC project specifications require high 28-day compressive strength, high early-strength, and low permeability. Specified compressive strengths for the HPC elements are:

Element	Compressive Strength
Girders @ transfer	62 MPa (9,000 psi)
Girders @ 28 days	69 MPa (10,000 psi)
Deck@ 28 days	41 MPa (6,000 psi)
Cap and columns @ 28 days	41 MPa (6,000 psi)

Pretensioned Girders

The AASHTO BT-54 girders are 1372 mm (54 in) deep and are pretensioned with fifty 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 will be steam-cured to obtain high early-release strength.

Substructure

Intermediate bents and the end abutments will be constructed using concrete with f'_c = 41 MPa (6,000 psi). The design will be based on a compressive strength of 21 MPa (3,000 psi).

Deck

The 28-day compressive strength of the deck concrete is 41 MPa (6,000 psi). The design will be based on 28 MPa (4,000 psi). Special curing of the deck concrete is required. After finishing, the deck concrete will be kept moist by mist spray nozzles for at least 72 hours. Entrained air content will be between 3 percent and 5 percent. Chloride permeability will be less than 1800 coulombs at 56 days.

Concrete Tests

The following properties will be measured for both the girder and deck concrete:

- Compressive strength
- Chloride permeability
- Flexural strength
- Abrasion resistance
- Modulus of elasticity

- Creep and shrinkage
- Splitting tensile strength

Instrumentation

The girders will be instrumented to monitor behavior from placement of concrete through long-term service life under dead, live, and impact loading. Instrumentation will consist 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. External gauges will be utilized to measure and record deflections. Calibrated live-load tests will be performed.

Construction

The project is currently scheduled for letting to contract in January 1998. The girders would be fabricated in April 1998, and the deck cast in the fall of 1998.

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 the same number of girder lines. The savings is the cost of one pier and the requirement to cast thirty-five 34.7-m (114-ft) girders instead of forty 30.5-m (100-ft) girders.

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

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