High-Performance Concrete Bridges- North Carolina U.S. 401 Over The Neuse River, Wake County

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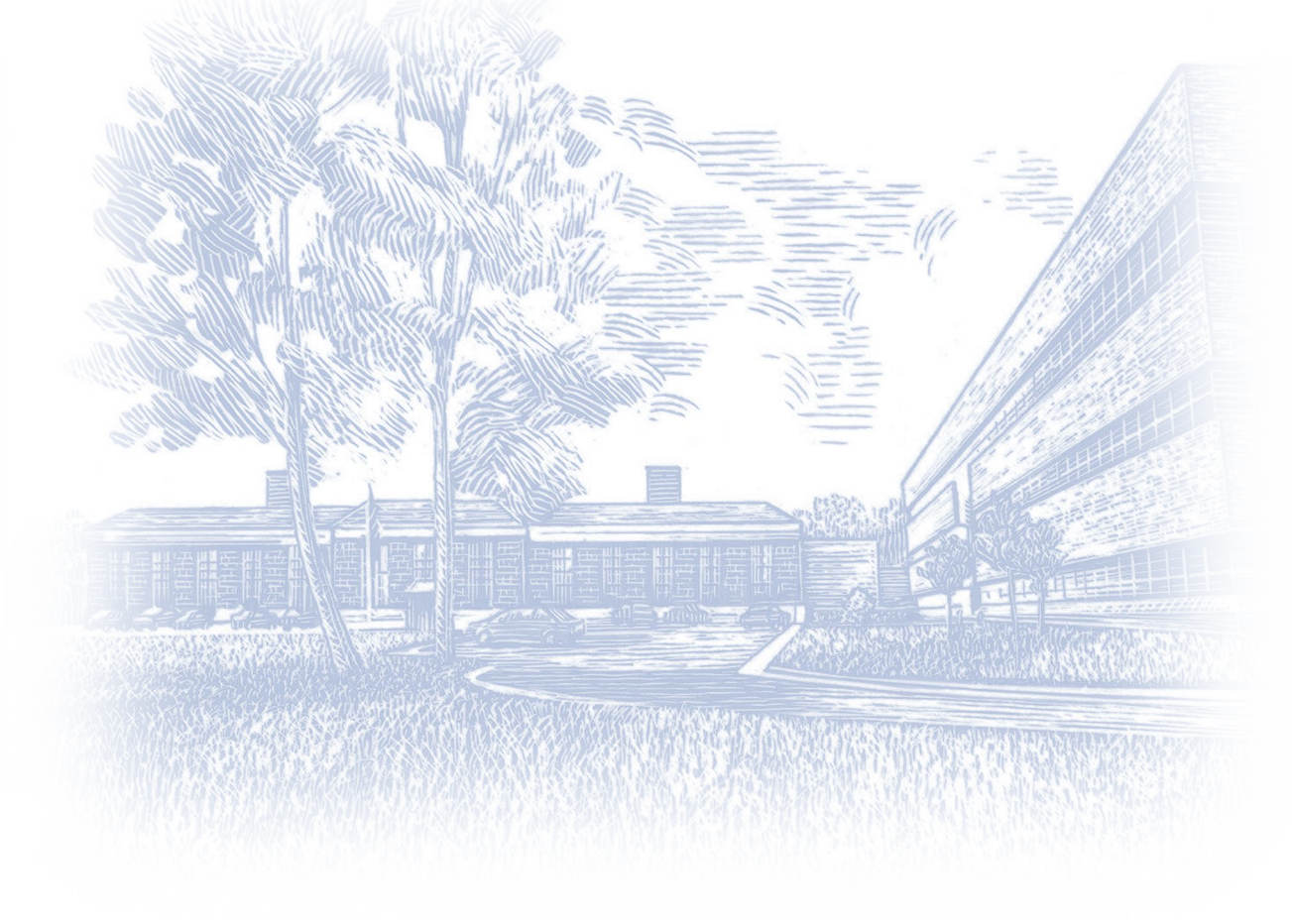

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Federal Highway Administration

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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 dual HPC bridges consist of two spans of 28.0 m (91.9 ft) and two spans of 17.5 m (57.4 ft) each. Each bridge is 14.4 m (47.1 ft) wide, and carries a 12.0 m (39.4 ft) roadway section and a 1.9 m (6.2 ft) sidewalk. The bridges will utilize AASHTO Type IV simple-span prestressed I-girders made continuous for live load. Girder spacing is 31.2 m (10.24 ft) on center and the deck thickness is 215.9 mm (8.5 in).

Outline of HPC Features

The HPC will have the following strength requirements:

Element	Compressive Strength
Deck @ 28 days	41 MPa (6,000 psi)
Girder @ transfer	48 MPa (7,000 psi)
Girder @ 28 days	69 MPa (10,000 psi)

In addition to the strength requirements, the HPC mix will be formulated to provide several performance characteristics, such as freeze-thaw durability, resistance to chloride ion intrusion, scaling and abrasion resistance, and resistance to internal chemical attack.

Pretensioned Beams

The AASHTO Type IV prestressed concrete I-girders are 1372 mm (54 in) deep. The girders are pretensioned with 15.2-mm (0.6 in) diameter straight and draped strands. They are simple-span girders made continuous for live load.

Substructure

The interior bent and end bent caps are to be constructed of concrete with f'_c=21 MPa (3,000 psi). The interior bent caps are supported by 1,372 mm (54 in) drilled piers constructed of concrete with f'_c equal to 31 MPa (4,500 psi).

Concrete Evaluation

The following properties will be measured by North Carolina State University researchers for both the girder and deck concrete:

- Compressive Strength
- Freeze-Thaw Durability
- Modulus of Elasticity
- Chloride Permeability
- Shrinkage
- Scaling Resistance
- Creep
- Abrasion Resistance
- Resistance to Internal Chemical Attack

Instrumentation

Internal and external instrumentation will be installed on four girders. Temperature will be monitored through critical stages and at critical locations on the four girders. Structural behaviors, such as camber and deflections, will also be monitored. Measurements will be taken to determine strand transfer length at both ends of at least two girders. Monitoring will be initiated at the fabrication plant and will continue for a period of 3 years after completion of construction of the project.

Construction

The bridge contract is scheduled to be let in July 1998. The girders will be produced in the fall of 1998 and the deck will be cast in the spring of 1999.

Benefits

Benefits are anticipated in both initial costs (by utilizing fewer girders and piers) and maintenance costs (due to improved durability). There are many nearby structures with similar span arrangements to offer performance comparisons.

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

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