High-Performance Concrete Bridges- New Hampshire Route 3A Bridge Over The Newfound River, Bristol

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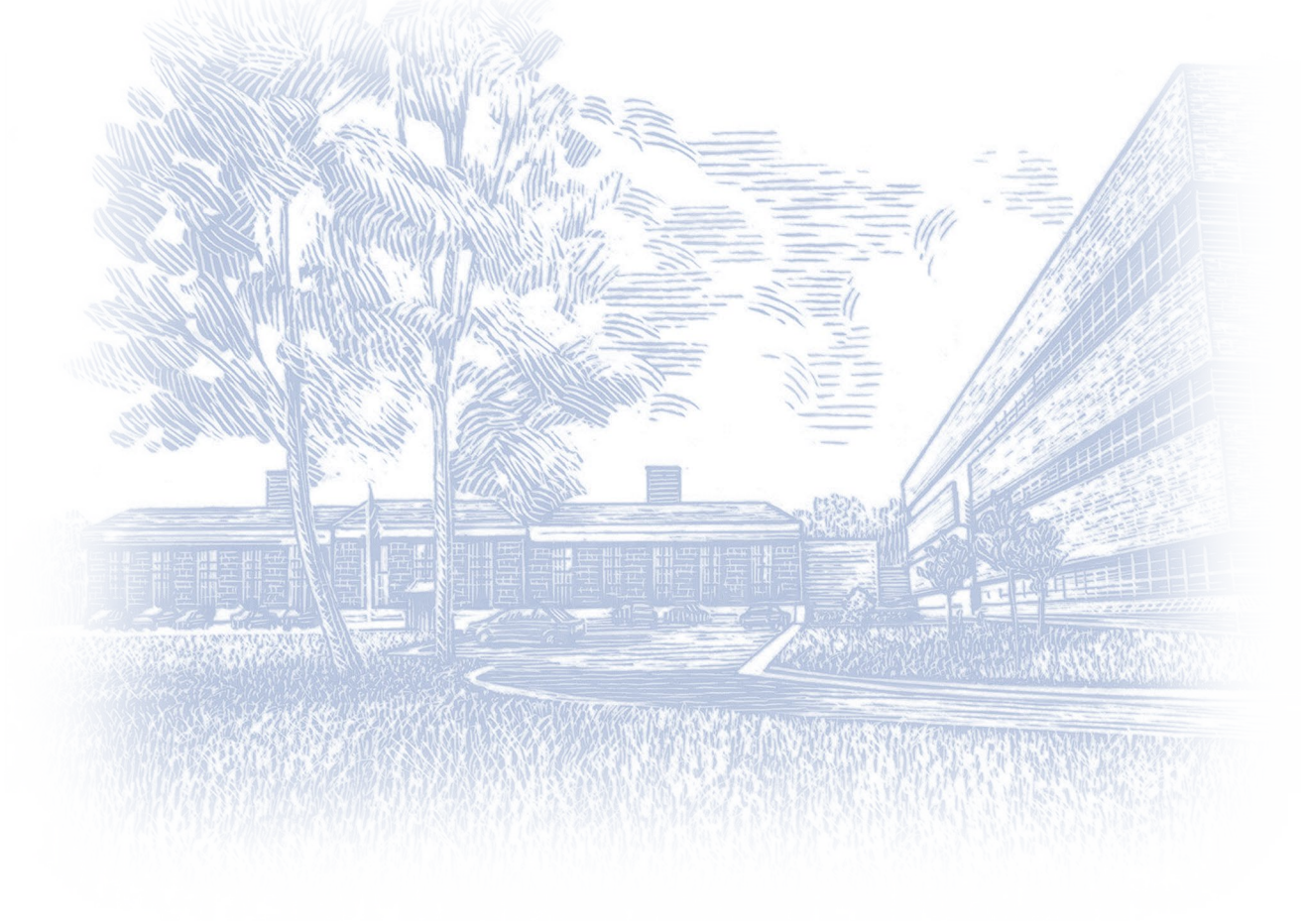

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Foreword

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 under way 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 HPC bridge will be a simple-span structure, 18.3 m (60 ft) long. The bridge will consist of two travel lanes, shoulders, and one sidewalk. The bridge superstructure will be 12.0 m (39.5 ft) wide and will consist of four New England (NE) Bulb-Tee girders spaced 3.5 m (11.5 ft) on center with a 229-mm (9-in) thick deck. The NE Bulb-Tee girder section, which was recently developed for the region as a new economical section, will incorporate the use of 15-mm (0.6-in) diameter low-relaxation strands. The bridge deck will consist of 89-mm (3.5-in) thick precast prestressed deck panels overlaid with 140 mm (5.5 in) of cast-in-place concrete. Conventional concrete, 28 MPa (4,000 psi), will be used in the at-grade approach slabs for comparison purposes. The bridge is scheduled to be completed in the fall of 1999.

Outline of HPC Features

Concrete mixes for the bridge elements will be varied according to the demands of the particular application. Concrete strength, durability properties, and other characteristics will be selected for the bridge elements and will be specified in the project documents. The design strength requirements will be:

Element	Compressive Strength
Beams @ Transfer	38 MPa (5,500 psi)
Beams @ 28 Days	55 MPa (8,000 psi)
Deck @ 28 Days	41 MPa (6,000 psi)

The permeability requirements will be:

Element	Permeability
Beams @ 56 Days	less than 1000 coulombs
Deck @ 56 Days	less than 1000 coulombs

Preliminary HPC Deck Evaluation

Three HPC bridge deck mixes were selected for field trials. For each mix, two slabs 2.4 m (8 ft) thick by 1.2 m (4 ft) wide by 4.9 m (16 ft) long were constructed, one with an epoxy-coated reinforcement and one with an uncoated reinforcement. These slabs were exposed to truck traffic over one winter. The slabs were qualitatively checked for cracking and condition of reinforcement from cores. Research was conducted by the University of New Hampshire.

Concrete Evaluation

The following concrete properties were measured in the preliminary deck evaluation and will be measured in the actual HPC bridge:

- Slump
- Scaling
- Air Content
- Rapid Chloride Permeability
- Water Content
- Strength
- Chloride Intrusion

- Freeze-Thaw Durability
- Abrasion Resistance

In addition, the following information was documented on the preliminary deck slabs and will be compiled for the HPC bridge: (1) strength maturity relationship using temperature measurements and compression cylinders; (2) deflection due to dead loads to evaluate creep and shrinkage effects, and deflection due to live loads to evaluate stiffness.

Instrumentation

Two of the girders will be instrumented with vibrating wire strain gauges located within the bottom flanges and thermistors (temperature measurement devices) located throughout the girder depth. Girder strain measurements will be taken at release of the prestressing strands prior to transportation to the site, after erection, and periodically after deck placement. Thermistors will also be placed in the deck to measure temperature differentials within the concrete and to correlate ambient freeze-thaw cycles with those within the deck concrete.

Construction

HPC mix and slab evaluations were conducted during the last 6 months of 1995. The HPC bridge is currently scheduled to be let to bid in July 1998. Due to traffic control issues, construction of the bridge will occur in two phases. The girders will be cast in the spring of 1999 and the deck pour will be completed in early fall of 1999. Completion of the bridge should occur in the fall of 1999.

Benefits

By using HPC in the girders, the project is expected to reflect a cost savings by using shallower girder members while allowing wider girder spacing. Furthermore, greater durability with reduced long-term maintenance will be derived by using HPC in both the deck and girders.

Materials, constructibility, and performance will be carefully monitored throughout the construction and early life of the structure. The resulting experience should provide a strong field basis to evaluate the benefits of using high-performance concrete in a harsh northern climate.

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

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