High-Performance Concrete Bridges- New Hampshire Route 104 Bridge Over The Newfound River, Bristol

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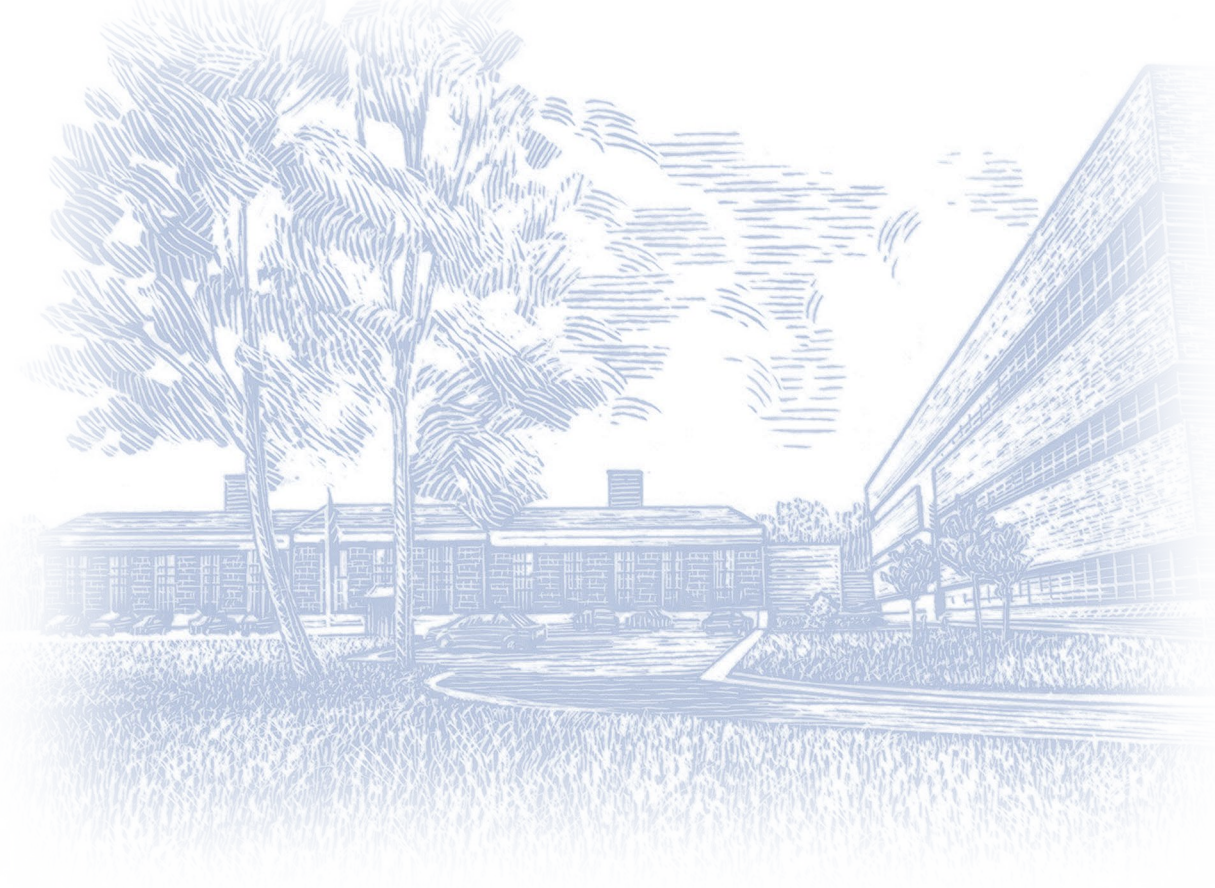

U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
Turner-Fairbank Highway Research Center
6300 Georgetown Pike, McLean, VA 22101

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 HPC bridge is of simple-span construction nominally 20 m (65 ft) long. The bridge consists of two through traffic lanes, a shoulder, a left-turn lane and a sidewalk. Width of the deck is 18 m (58 ft) and thickness of the deck is 229 mm (9 in). Load carrying elements consist of five Type III AASHTO prestressed concrete I-girders. The Route 104 HPC bridge was completed in 1996.

Outline of HPC Features

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

Element	Compressive Strength
Beams @ Transfer	45 MPa (6,500 psi)
Beams @ 28 days	55 MPa (8,000 psi)
Deck @ 28 days	41 MPa (6,000 psi)

All mixes included a set retarder and high-range water-reducing admixture. Silica fume was used as the mineral admixture.

Preliminary Deck HPC Evaluation

Three bridge deck concrete mixes were selected from laboratory tests 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 epoxy-coated reinforcement and one with uncoated reinforcement. These slabs were exposed to truck traffic over the winter of 1995-1996 at a waste management site. After a winter's exposure, 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 HPC evaluation and in the HPC bridge:

- Slump
- Scaling
- Air Content
- Rapid Chloride Permeability
- Water Content
- Strength
- Chloride Intrusion
- Freeze/Thaw Durability
- Abrasion Resistance

In addition, the maturity relationship is being developed using temperature measurements and compressive strength tests. Deflection of the slabs in the preliminary HPC deck evaluation and in the HPC bridge under dead and live loads is being measured to determine creep and shrinkage effects and stiffness under the applied loads. HPC mix and slab evaluations were conducted during the last 6 months of 1995.

Construction

The HPC bridge contract was awarded in 1995. The bridge was constructed in 1996 and evaluation of the structure is ongoing.

Benefits

In 1998, the New Hampshire Department of Transportation will construct a second HPC bridge. This second bridge will be located upstream from the first and will carry traffic on Route 3A over the Newfound River.

Throughout the construction and early life of both bridges, the materials, constructability, and performance will be carefully monitored. 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:

FHWA Headquarters Contact:Terry Halkyard, 202/366-6765 (FAX 202/366-7909)
FHWA Region 1 Contact: Dan Byer, 518/431-4224 (FAX 518/431-4208)
FHWA New Hampshire Division Contact: Dave Hall, 603/225-1631 (FAX 603-225-1602)
NHDOT Contact: Chris Waszczuk, 603/271-2731 (FAX 603/271-7025)