High Performance Concrete Bridges- Virginia
Route 40 Over The Falling River, Lynchburg District

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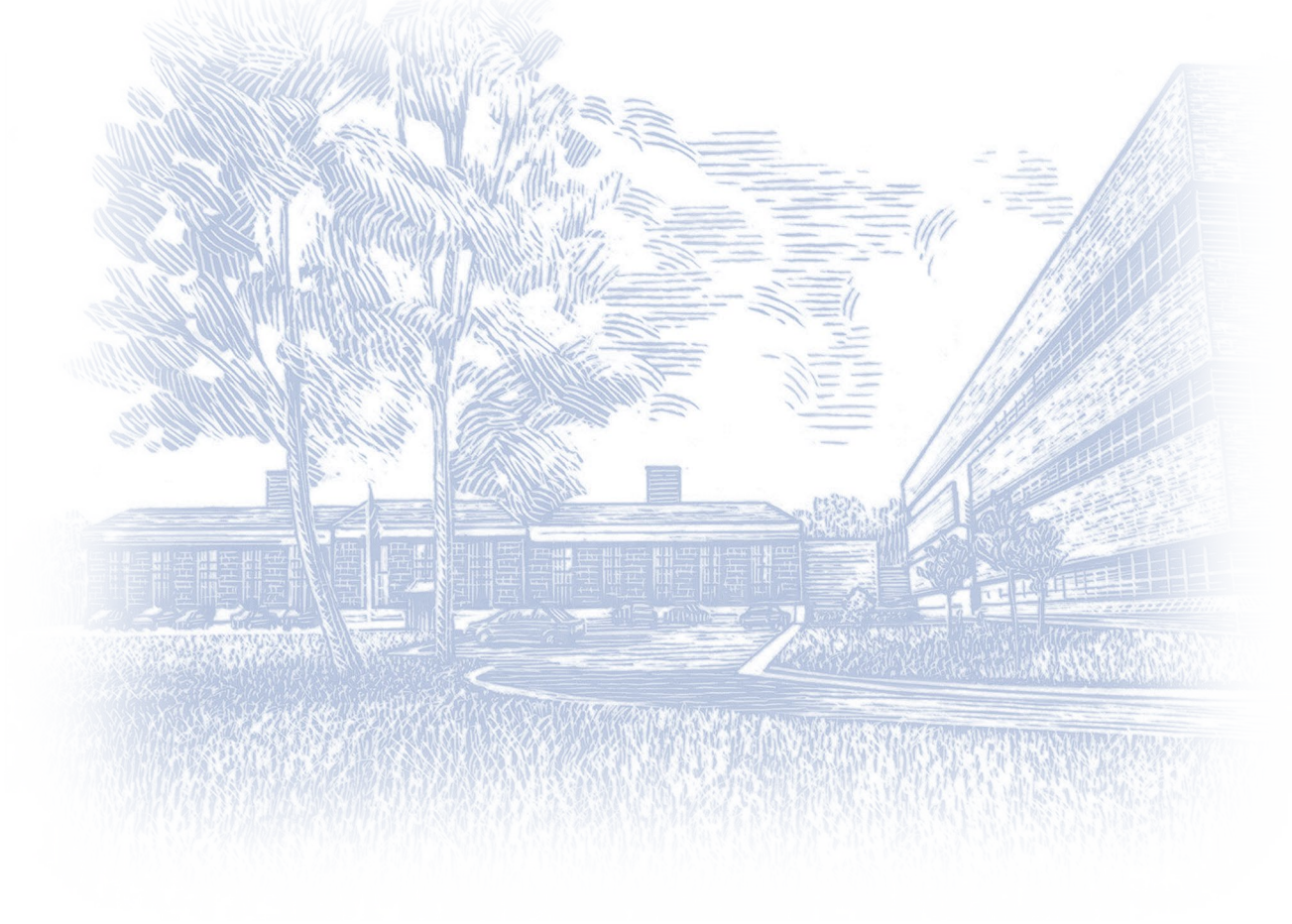

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Foreword

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 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 bridge is a two-lane, 13.4 m (44 ft) wide structure made up of four equal spans 24.4 m (80 ft) long. Each of the simple spans consists of 5 AASHTO Type IV pretensioned concrete I-beams. The beams are spaced at 3.1 m (10.3 ft) on center. The project is being conducted by the Virginia Department of Transportation in cooperation with the Virginia Transportation Research Council.

Outline of HPC Features

The HPC elements have both compressive strength requirements and chloride permeability requirements according to the application in the structure. The requirements for all elements measured at 28 days are:

Element	Compressive Strength		Chloride Permeability	
	FHWA HPC Performance Grade	MPa (psi)	FHWA HPC Performance Grade	Coulombs
Beams @ transfer		41 (6,000)		
Beams	2	55 (8,000)	2	less than or equal to 1,500
Deck		28 (4,000)	1	less than or equal to 2,500
Substructure		21 (3,000)		less than or equal to 3,500

Pretensioned Beams

The AASHTO Type IV prestressed concrete I-beams were pretensioned with 15.2 mm (0.6 in) diameter strands at 51 mm (2 in) on center. The concrete contained silica fume and had a water-to -cementious material ratio of 0.32. The HPC bridge contained five beams, compared to seven beams needed if the bridge had been designed as a conventional concrete bridge.

Substructure

Although the compressive strength of the substructure HPC is what is typically specified for substructure concrete in Virginia, there is a permeability requirement added to the performance characteristics.

Deck

The deck is 216 mm (8.5 in) thick, which is 13 mm (0.5 in) thicker than conventional concrete design because of the wider beam spacing. The cementitious portion of the concrete was made with equal parts of portland cement and slag. For the actual bridge, the measured deck concrete compressvie strength exceeded 55 MPa (8,000 psi).

Construction

The contract was awarded in 1994 and construction was started in early 1995. The bridge is now open to traffic.

Benefits

The bid bridge construction cost was $527/m^2 ($49/ft^2). This may be compared to the 1994 average cost of $624/m^2 ($58/ft^2) for 34 bridges in the Federal-aid Highway system in Virginia. The initial savings over the normal bridge material and construction was estimated to be 4%.

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

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