OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF STRUCTURAL ENGINEERING
RESEARCH IMPLEMENTATION PLAN

Title: Use of HPC for an Adjacent Box Beam Bridge Guernsey County, Ohio, Bridge #GUE-22-0657

State Job Number: 14615
PID Number:
Research Agency: University of Cincinnati
Researcher(s): Richard Miller
Technical Liaison(s): Tim Keller
Research Manager: Omar Abu-Hajar
Sponsor(s): Tony Vogel
Study Start Date: 6/17/1996
Study Completion Date: 10/29/1999
Study Duration: 40 Months
Study Cost: $352,926.00
Study Funding Type: 100% Federal form FHWA

STATEMENT OF NEED:
As part of FHWA’s multi-state SHRP High Performance Concrete (HPC) Implementation Program, a highway bridge in Ohio originally designed using normal concrete as a three-span adjacent box girder structure was able to be redesigned as a single-span HPC adjacent box girder bridge.

RESEARCH OBJECTIVES:
To document the steps taken to design two HPC mixes required for the project:

- 10,000 psi concrete mix for the prestressed concrete box girders.
- 8,000 psi concrete mix for the cast-in-place parts of the bridge such as the abutments.

RESEARCH TASKS:
- Design an HPC mix for the precast girders. A second HPC mix was to be designed for the bridge abutment.
- Instrument and perform destructive and non-destructive testing on two prototype beams to assure that AASHTO requirements being met.
- Monitor and record the construction of the bridge and document the success and failure in using the HPC for precast/prestressed bridges.
- Conduct non-destructive testing on the final structures.

RESEARCH DELIVERABLES:
- The final report describes research findings, conclusions, and recommendations.

RESEARCH RECOMMENDATIONS:
This project was to demonstrate that a precast/prestressed concrete bridge could be improved through the use of High Performance Concrete (HPC). A non-composite adjacent box girder bridge was chosen for this research project; this bridge is GUE-22-6.57. It was possible to redesign this bridge as a single span 115 ft. long by using HPC with ODOT 42B48. HPC was demonstrated to be durable since it has low rapid chloride permeability (<400 coulombs), and it is excellent resistance to freeze thaw cycles. One problem with the adjacent box girder bridges is that the shear keys between the adjacent girders crack and leak. This bridge was designed with an experimental mid-depth shear key which would resist cracking and leakage.
**PROJECT PANEL COMMENTS:**
This research has proven that using HPC in prestressed precast box girders was successful; and high strength concrete can aid in increasing beam spans. The added structural benefits are however limited due to the small increase in allowable tensile stresses, live load deflections will remain virtually the same, and the limited space to place prestressing strands. High durability and low rapid chloride permeability of HPC are now being assured in the current CMS dated January 1, 2005 in Section 515.15. The biggest problem in prestressed concrete non-composite girders is joint-cracking between girders; thus allowing salt water to leak causing reinforcement corrosion. HPC does not solve joint cracking problem. The added benefits from using HPC in prestressed concrete box girders will not offset the added costs.

**IMPLEMENTATION STEPS & TIME FRAME:**
No implementation steps are anticipated to be taken.

**EXPECTED BENEFITS:**
N/A

**EXPECTED RISKS, OBSTACLES, & STRATEGIES TO OVERCOME THEM:**
N/A

**OTHER ODOT OFFICES AFFECTED BY THE CHANGE:**
None

**PROGRESS REPORTING & TIME FRAME:**
N/A

**TECHNOLOGY TRANSFER METHODS TO BE USED:**
The final report has been posted on the ODOT Office of Research & Development website and the hard copy of this report was distributed to other national libraries.

**IMPLEMENTATION COST & SOURCE OF FUNDING:**
N/A

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**Approved By:** (attached additional sheets if necessary)

**Office Administrator:**

Signature: ___________ Time Keller ___________ Office: OSE ___________ Date: 12/9/2005 ___________

**Division Deputy Director:**

Signature: ___________ Tony Vogel ___________ Division: DHO ___________ Date: 12/9/2005 ___________