



# FACT SHEET

## Development of High Early-Strength Concrete for Accelerated Bridge Construction Closure Pour Connections

### RESEARCH PROJECT TITLE

*Development of High Early-Strength Concrete for Accelerated Bridge Construction Closure Pour Connections*

### STUDYTIMELINE

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### PRINCIPAL INVESTIGATOR

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### MORE INFORMATION

The New England Transportation Consortium, a cooperative effort of the transportation agencies of the six New England States, funded this research. Through the Consortium, the states pool professional, academic and financial resources for transportation research leading to the development of improved methods for dealing with common problems associated with the administration, planning, design, construction, rehabilitation, reconstruction, operation and maintenance of the region's transportation system.

The NETC is hosted by the University of Vermont Transportation Research Center



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### Introduction

Accelerated bridge construction (ABC) has become a popular alternative to using traditional construction techniques in new bridge construction and existing bridge deck replacement because of the reduction of time spent in field activities. A key feature of bridges built using ABC techniques is the extensive use of prefabricated components. Prefabricated components are joined in the field using small volume closure pours involving high performance materials (steel and concrete) to ensure adequate transfer of forces between components. To date the materials developed for closure pours have been based on proprietary components, so a need has arisen for development of mixes that use generic components. In this project, a methodology to design a non-proprietary concrete mixture was developed to achieve the high early-strength needed in ABC construction (4000 psi in 12 hrs. using standard curing conditions).

### Methodology

The following activities were conducted to develop the high-early strength concrete mix:

- Conduct a technical literature review and a survey of state DOTs and precasting plants to obtain typical high-strength concrete mixtures.
- Develop mixture performance specification. Strength gain rate was the key performance parameter used to initially assess adequacy of the mixture.
- Develop trial mixes to achieve performance targets of strength and workability
- Test mixture following applicable ASTM and AASHTO specifications for set time, air content, slump (spread), compressive strength, bar pullout, confined shrinkage test, alkali-silica reactivity.
- Test mixture in a realistic closure pour condition similar to those used to connect precast components. Test the joined specimen to failure in the structures laboratory.



### Conclusions

The project was successful in developing a methodology that can be used to design high early-strength concrete mixtures for ABC. The concrete mixture developed in this project used non-proprietary materials with the exception of high-range superplasticizers that can be obtained from several construction chemical companies. The mixture satisfied the performance objectives of rapid strength development (4000 psi @ 12 hrs), and exhibited other performance properties similar to a typical concrete mixes (workability, shrinkage cracking time, ASR resistance).

### What are potential impacts?

New England State DOTs may be able to use the findings of this project to develop non-proprietary concrete mixtures for use in accelerated bridge construction projects. The need to sole source proprietary materials for specific projects is therefore eliminated.