

**NEW ENGLAND TRANSPORTATION CONSORTIUM
QUARTERLY PROJECT PROGRESS REPORT**

A. PROJECT NUMBER AND TITLE:

NETC 13-1: Development of High Early-Strength Concrete for Accelerated Bridge Construction Closure Pour Connections

B. PRINCIPAL INVESTIGATOR(s) & UNIVERSITY(s):

Sergio F. Breña (PI) – University of Massachusetts Amherst
Scott A. Civjan (Co-PI) – University of Massachusetts Amherst

C. WEB SITE ADDRESS (If one exists):

D. START DATE (Per NETC Agreement): September 01, 2014

E. END DATE (Per NETC Agreement): April 02, 2016; August 31, 2016 (amended)

F. ANTICIPATED COMPLETION DATE: January 14, 2017

A no-cost extension was requested to January 14, 2017. This extension was requested to allow conducting project activities that were delayed because of the time shrinkage tests were taking. Without knowing if the shrinkage performance of the selected mixes was acceptable, the project team could not make progress on other testing activities.

G. PROJECT OBJECTIVES:

To develop and validate concrete mixtures capable of developing high early strength without detrimentally affecting their long-term durability. The mixtures are for use in projects using accelerated bridge construction methods.

H. REPORT PERIOD: October 1, 2016 – December 31, 2016

I. ACCOMPLISHMENTS THIS PERIOD:

Task 1: Literature Search

- Completed the literature review and summarized findings.

Task 2: Develop Mixture Design Specification

- Created a mixture design specification based on the development procedure used in this research project

Task 3: Develop Mix Design

- No further development was required of the mixture design. The two selected concrete mixtures were used for final testing.

Task 4: Test Mixture

- Completed the shrinkage testing (AASHTO PP 34-99). A minimum of three tests were performed on each of the final selected concrete mixtures.
- Completed the design and fabrication for the bar pullout test setup, including strength analysis of members within the setup (ASTM A944)
- Design and fabrication of steel reinforcement used within each bar pullout test concrete specimen completed
- Completed fabrication of formwork used for the bar pullout test concrete specimens for No.4 and No.6 test bars, including tying of steel reinforcement within each specimen

- Performed bar pullout test on two selected concrete mixtures developed through trial batches on No. 4 and No. 6 epoxy coated test bars
- Gradation of aggregates used for the selected mixes was modified as required to conduct alkali-silica reactivity test (ASTM C1567) using fine aggregates and a crushed coarse aggregates
- Mixed the sodium hydroxide solution required for the alkali-silica reactivity testing
- Performed alkali-silica reactivity aggregate tests on two mortar mix designs compatible with the selected concrete mixtures, one using coarse aggregates and the other using fine aggregates

J. PROBLEMS ENCOUNTERED (If any):

- Variability occurred within the trial batch mixture designs; therefore, more tests were required per mixture design to ensure accuracy of results
- Mixing procedures were altered to reduce variability in the small-scale mixtures
- The time until cracking of shrinkage ring tests according to AASHTO P 34-99 was longer than anticipated causing delay of other activities in the project. Due to limits on availability of equipment in our laboratory, data could only be simultaneously recorded for two tests at any given time; in order to perform sufficient shrinkage ring tests for the two mixes selected, it took longer to perform the full number of tests required.
- The project was extended at no cost for 6 months from August 2016 to December 2016. Approval for this extension was granted officially in early 2017.
- Funding for the graduate student working in the project expired in August 2016; a teaching assistantship was used to keep funding the graduate student (Stephanie Castine) while she continued working on the project from August-December 2016 in order to try to finish project activities. There are still a few activities that were proposed to conduct in the proposal (freeze-thaw testing, chloride penetration, large-scale component testing) that will not be able to be concluded by January 14, 2017, the current expiration date of the project. The PI will communicate with the Chair of the Technical Advisory Committee to discuss the appropriate action to take.

K. TECHNOLOGY TRANSFER ACTIVITIES:

No technology transfer activities were performed.

L. STATUS BY TASK:

Task 1: Literature Search – 100% complete

Task 2: Develop Mixture Design Specification – 100% complete

Task 3: Develop Mix Design – Trial batches have been developed; may need slight adjustments –100%

Task 4: Test Mixture – Experimental test setups are being designed and prepared (75%)

M. PERCENT COMPLETION OF TOTAL PROJECT: 90%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

Task 4: Test Mixture

- Fabricate and test freeze-thaw specimens (ASTM C666)
- Fabricate and test specimens for chloride permeability (ASTM 1543 & ASTM C672)
- Full-scale test, including design and fabrication of test setup, fabrication of test specimen and testing

O. FINANCIAL STATUS:

As of: September 30, 2016

Total Project Budget: \$ 174,923

Total Expenditures: \$ 155,825

Note: This report should not require more than 2-3 pages & should be e-mailed to the NETC Coordinator so as to arrive no later than three (3) working days after the end of each calendar quarter.