

NHDOT SPR2 PROGRAM RESEARCH PROGRESS REPORT

Project# 42372M		Report Period Year 2023 <input type="checkbox"/> Q1 (Jan-Mar) <input type="checkbox"/> Q2 (Apr-Jun) <input checked="" type="checkbox"/> Q3 (Jul-Sep) <input type="checkbox"/> Q4 (Oct-Dec)	
Project Title: Reduce Concrete Cracking through Mix Design			
Project Investigator: Eshan Dave, University of New Hampshire Phone: 603-862-5268 E-mail: eshan.dave@unh.edu			
Project Start Date: 4/12/2023	Project End Date: 12/31/2025	Project schedule status: <input checked="" type="checkbox"/> On schedule <input type="checkbox"/> Ahead of schedule <input type="checkbox"/> Behind schedule	

Brief Project Description:

Concrete cracking affects the long-term condition and performance of both bridge and culvert structures. Shrinkage cracking is perceived to be a deterrent to placing exposed decks/slabs during bridge and culvert rehabilitation and replacement projects. Concrete cracking during bridge construction allows oxygen, moisture and salts into the structure accelerating corrosion and deterioration. Understanding methods to avoid cracking at the mix design level will allow exposed decks to be more often considered as a viable option. This is especially critical as more rapid bridge projects are proposed.

Different construction and specification methods have been previously explored to reduce concrete cracking at bridge curb locations. This research will explore alternates to current mix design practice including lightweight concrete, changes to PCC and pozzolan content, etc., to reduce concrete cracking. Stand alone, off structure concrete placement like sidewalks, concrete slabs, etc., could be used as test areas for observation. The Bureau of Bridge Maintenance will work with the researchers at those locations as well as considering placement in bureau projects.

Progress this Quarter (include meetings, installations, equipment purchases, significant progress, etc.):

During the reporting quarter, the research team focused their efforts on gathering literature relevant to the study objectives. This includes recent papers and reports related to various concrete mix design alterations as well as construction practice changes that have helped lower the propensity for cracking in bridge cubs and decks. A brief summary of some of the recently published literature on reduction of early age concrete cracking in bridges is shown below in Table 1.

Table 1. Sample of Literature Sources

Title (Publication Year)
Evaluating the Effect of Incorporating Slag Cement with Pre-wetted Lightweight Aggregate on Reducing Cracking of Concrete Bridge Decks (2023)
Determination of Concrete Shrinkage Initiation in Internally Cured and Conventional Concrete Decks (2022)
Investigation of the Causes of Transverse Bridge Deck Cracking (2022)
Bridge Deck Cracking Evaluation (2021)
Construction of Low-Cracking High-Performance Bridge Decks Incorporating New Technology (2020)
Internal Curing of Bridge Decks and Concrete Pavement to Reduce Cracking (2022)

NHDOT SPR2 PROGRAM

RESEARCH PROGRESS REPORT

The research team also met with the project TAG and the NHDOT research engineer on 15th September 2023 at the New Hampshire Department of Transportation in Concord NH for a project kick-off meeting. At this meeting, the research team presented the project workplan as well as a summary of findings from a previous related study. The meeting also allowed research team and project TAG to discuss plan for subsequent meetings.

Items needed from NHDOT (i.e., Concurrence, Sub-contract, Assignments, Samples, Testing, etc...):

During project kick-off meeting, the research team has requested following information from the project TAG:

- List of potential bridge maintenance construction projects for Fall and Winter for 2023 as well as Spring and Summer of 2024.
- List of bridge curb and deck replacement projects undertaken by bureau of bridge maintenance from last three years.
- Laboratory testing data (QC as well as mix design approval data) for NHDOT class A and AA concrete used on recent bridge maintenance curb and decks.
- Mix batching slips from bridge curb and deck replacement projects from last three years (when available).

Anticipated research next three (3) months:

During the upcoming quarter, research team anticipates to complete majority of literature review on the topic and to propose to TAG a laboratory experiment for evaluating various PCC mixes that can help lower cracking potential in bridge curbs and decks. Simultaneously, research team will work with the NHDOT bridge maintenance unit to identify various existing bridge study sites that can be used to evaluating the amount and severity of cracking in bridge curbs and decks. PCC batching reports from these sites will be used to compare the mix composition with the cracking performances. This information will be used in design of the laboratory experiment for the project.

Circumstances affecting project:

There a slight delay in the Task 1 of the project. Majority of it is associated with delay in arrival of the graduate student that was recruited to work on this effort. The graduate student is now expected to arrive in Spring 2024 semester. No long term delays are expected to the overall project timeline.

Tasks (from Work Plan)	Planned % Complete	Actual % Complete
Task 1 Literature and Current Practice Review	95	50
Task 2 Mix Design and Lab Evaluation	0	0
Task 3 Survey of Study Sites for Cracking Performance	0	0
Task 4 Analysis of Results and Recommendation Development	0	0
Task-5 Final Report and Poster	0	0

Barriers or constraints to implementing research results

Nothing to report.