



Regional Rollout of the Super Air Meter (SAM) and Surface Resistivity (SR) for Performance Engineered Mixture Initiative

What Was The Research Need?

Performance Engineered Mixture (PEM) initiatives have been the primary focus of concrete research for some time. To date, PEM has targeted projects that further the use of concrete pavements, which does not have a direct impact on the Tennessee Department of Transportation's (TDOT) concrete program. TDOT has partnered with multiple Tennessee universities over the years to build our knowledge on the emerging PEM testing requirements. Two projects concluded over the years that support similar acceptance program changes nationwide - *Enhancing Freeze-Thaw Resistance of Tennessee Concrete Mixes through Improved Air Void Testing (RES2020-09)*^{[1][2]} conducted by the University of Tennessee - Knoxville (UTK) and *Determining Concrete Chloride Permeability Rapidly and Effectively (RES2013-41)*^[3] conducted by Tennessee Technological University (TTU).

RES2020-09 researched the use of the Super Air Meter (SAM) test (AASHTO T 395)^[4] on Tennessee concrete mixes. This research project was a good start to our understanding of the use of the SAM unit on our mixtures. One of the challenges that this project faced included a limited dataset versus the initial proposed target. Focus from this project skewed attention to eastern Regions of Tennessee. To remedy this shortcoming, TDOT needs to focus our own efforts into data collection statewide.

RES2013-41 researched hardened concrete permeability. Rapid Chloride Permeability (RCP) Testing (ASTM C1202)^[5] is an accepted method for determining permeability susceptibility. However, it is costly and highly variable upon repeat attempts. During this study, the Surface Resistivity (SR) Test (AASHTO T 358)^[6] was determined to have similar results to the RCP test for a fraction of the cost. This test allows TDOT to quickly test the resistance as a means of determining permeability. More data is necessary to see where our concrete mixtures stand statewide and whether the observed values compare to the recommended SR values in RES2013-41.

Attention to facilitating the growth of Tennessee-specific data set and analyzing the dataset is a critical component in rolling these units out for acceptance testing purposes.

PROJECT NUMBER:
RES2023-27

PRINCIPAL INVESTIGATOR:
C.W. Hampton & Tyler Lacy
(TDOT)

TDOT LEAD STAFF:
Jason Mellons
Materials & Tests

PROJECT SCHEDULE:
January 2023 to December
2024

Research Objectives

1. Develop/Provide training for all Regional IA personnel
2. Collect dataset and evaluate SAM number on concrete mixtures statewide
3. Develop an acceptance program for PEM mix designs
4. Develop TDOT specifications and procedures to incorporate into concrete program

Tasks	3	6	9	12	15	18	21	24
1 Equipment acquisition								
2 Develop training material and forms								
3 Data collection								
3 a Data collection (amended)								
4 Analyze data								
5 Develop verification/acceptance program								
6 Develop specifications and procedures								
7 Final report and presentation								

The estimated data collection window will shift slightly from the original proposal to better align with summer projects in 2024. This will have no impact on the schedule data analysis and final report. The official data collection window will be June 1st, 2023, through June 30th, 2024.

What was the Research Approach?

The data provided by SAM and SR testing is integral to the improvement of concrete durability as a part of the Department’s Performance Engineered Mixture (PEM) initiatives. The SAM number has been shown to be an indicator of the freeze-thaw durability. The SR value correlates well with the permeability of concrete, an indicator of how susceptible a structure is to degrading elements such as road salt. This project will expand the Department’s experience and institutional knowledge. The goal is to provide data on local materials to support the development and implementation of a measurable specification for acceptance.

Potential Implementation and Expected Benefits

This project details the procedure and requirements for the implementation of the Super Air Meter (SAM) and Surface Resistivity (SR) equipment and associated test methods within the Department’s Quality Assurance (QA) program.