

RES 2013-41 Determining Concrete Chloride Permeability Rapidly and Effectively

Introduction

A key step for increasing bridge deck service life is to develop lower rapid chloride permeability (RCP) concrete mixtures. In RES2010-07 Optimum Air Content Range (Plastic and Hardened) for TDOT Class D PCC, a typical Class D PCC mixture was found to have an RCP value of about 1,540 coulombs (independent of air content) at 56-days based on 100 samples tested. TDOT Materials & Tests (M & T) Division began to consider developing a new lower permeability bridge deck concrete specification. Unfortunately, the current AASHTO procedure for determining RCP is slow and expensive. A more rapid procedure would benefit both TDOT and its partners.

Purpose of the Proposed Research

Bridge deck mixture design development, mixture design submittals, quality control, and quality assurance testing could all be streamlined if concrete chloride permeability could be determined more rapidly. However, accuracy should not be sacrificed for speed. Fortunately, a Virginia DOT researcher developed a curing regime that has shown promise in determining the results of rapid chloride permeability tests (RCPT) faster. In addition, a new surface resistivity method has gained favor with the Florida DOT. However, there has been some ambiguity as to whether the accelerated curing correlates best with 56 or 91 day chloride permeability. The research will address this ambiguity as well as attempt to determine a rapid, efficient, and reliable means for determining concrete chloride permeability.

Scope

The research team will evaluate the ability of RCPT and surface resistivity tests conducted at various ages to predict the 56-day RCP value of bridge deck concrete mixtures. Further, a literature review will be used to augment the evaluation.

Significance (Benefits to TDOT)

Delaying chlorides from reaching the critical reinforcement in bridge decks will extend bridge deck service life and reduce cost to TDOT. Less frequent need for maintenance / rehabilitation / reconstruction incursions into traffic will result in fewer traffic delays, increased safety, and greater efficiency through lower life cycle costs for Tennessee bridge decks. Having critical RCP information sooner would allow TDOT decision makers more latitude in achieving TDOT goals of safety, efficiency, and collaboration with local partners.

Expected Outcomes

The proposed project will result in a more efficient testing procedure for chloride permeability. The procedure will streamline mixture design development, mixture design submittals, quality control, and quality assurance testing for the proposed new TDOT lower permeability bridge deck concrete specification. The testing procedure will also benefit TDOT partners, such as municipalities, contractors, concrete producers, etc. attempting to produce concrete mixtures meeting the proposed new TDOT lower permeability bridge deck concrete specification.

Status of the Project

The project is currently about 75% completed. The project is scheduled to be completed July 31, 2018.

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