

## **RES 2013-11 Expanding the Informational Catalog of TDOT Low Permeability Bridge Deck Mixtures**

### **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 is currently considering developing a new lower permeability bridge deck concrete specification. In RES 2011-09, three new lower permeability concrete mixtures were developed to address the possible new lower permeability bridge deck concrete specification. The three lower permeability mixtures developed formed the initial portion of an informational catalog to support the possible new specification. However, no mixtures were developed that included Class C fly ash. Further, no mixtures were developed that contained both slag and fly ash. Building on RES 2011-09, additional lower permeability concrete mixtures will be developed that will make access to low permeability concrete for bridge decks easier, more economical, and thus more efficient.

### **Purpose of the Proposed Research**

The proposed project will attempt to develop four new lower permeability bridge deck concrete mixtures to make access to low permeability concrete for bridge decks easier, more economical, and thus more efficient. All materials used in the new lower permeability mixtures will be widely available in Tennessee. The additional example mixture designs would serve as further support for TDOT management implementing a newer lower permeability bridge deck concrete PCC specification.

### **Scope**

The research team will develop four example bridge deck mixture designs with lower chloride permeability. Extensive laboratory supporting data on RCP, compressive strength, and static modulus of elasticity will allow TDOT M&T management to make an informed decision on the wisdom of field testing the new lower RCP mixtures (in a subsequent phase) as a tool to increase bridge deck service life.

### **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. Specifically:

1. Longer service life of bridge decks will lower life cycle cost for bridge decks.
2. Less frequent need for maintenance / rehabilitation / reconstruction incursions into traffic will result in fewer traffic delays.

3. Less frequent need for maintenance / rehabilitation / reconstruction incursions into traffic will result in reduced risks for TDOT and contractor personnel as well as the motoring public.

Further, greater use of supplementary cementing materials (SCMs) will improve TDOT's environmental stewardship.

### **Expected Outcomes**

A PDF format informational catalog containing mixture designs, as well as plastic and hardened properties, will be developed. The catalog will contain the three RES 2011-09 mixtures as well as the four new mixture designs. All mixtures will contain only materials widely available in Tennessee. The catalog will provide critical technical information for TDOT partners, such as municipalities, contractors, concrete producers, etc., attempting to produce mixtures meeting the possible new lower TDOT bridge deck permeability specification. The catalog would smooth the path to a new TDOT Class D-LP PCC (with a specified RCP value) by demonstrating that lower permeability mixtures can be easily and economically produced with materials widely available in Tennessee.

### **Status of the Project**

The project was completed December 4, 2015

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