Project Capsule

26-2C

September 2025

Evaluation of the Effect of Integral Waterproofing Agents (Admixtures) on Surface Resistivity Measurements

PROBLEM

Electrical resistivity is a material property that refers to concrete's resistance to the transmission of electric charges. Concrete is considered a porous material; this porosity corresponds to a system of nano and microscopic pores, interconnected at different degrees. Electrical resistivity is proportional to the resistivity of the pore solution and inversely proportional to the connectivity and volume of the pores. A test method to measure the overall resistivity of the concrete specimens is surface resistivity, which corresponds to a practical, non-destructive indicator for concrete durability. Moreover, surface resistivity correlates well with other durability properties, such as chloride permeability and corrosion rate. Further, previous research projects have found that surface resistivity is related to other concrete mechanical properties, such as compressive strength and split tensile strength.

Concrete waterproofing admixtures correspond to additives that are incorporated with the goal of turning concrete itself into a water barrier. The effect of waterproofing admixtures has been studied in various concrete parameters such as fresh properties, compressive strength, flexural strength, tensile strength, drying shrinkage, plastic shrinkage, and creep. In terms of concrete's durability, the addition of these admixtures has been found to reduce water absorption rate and permeability. Additionally, waterproofing admixtures are known to delay chloride ion penetration, which can lead to an extension of the concrete's surface life. Although the effect of waterproofing admixtures has been thoroughly studied, their specific effects on surface resistivity warrants further study. Considering that supplementary cementitious materials (SCMs) are becoming less available, waterproofing admixtures need to be further studied to quantifiably determine if, as well as how, these admixtures will have a negative or positive effect on the surface resistivity of concrete.

OBJECTIVE

The objectives of this study are to:

1. Determine the effect of incorporating waterproofing admixtures on the surface resistivity of concrete; and
2. Determine if the different admixture dosages can be optimized.

Start Date
August 27, 2025

Duration
24 months

Funding
SPR: TT-Fed/TT-Reg - 6

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METHODOLOGY

The methodology will be structured around the five (5) key tasks listed below:

- Task 1: Literature Review—extensive review on different types of waterproofing admixtures and their effects on different concrete properties, as well as a deeper literature review on surface resistivity and its implications for concrete performance.
- Task 2: Collection of chemical admixtures—10 different waterproofing admixtures will be collected and implemented in order to be used in concrete admixtures.
- Task 3: Comparative testing
- Task 4: Analysis—after testing is complete, an ANOVA test, followed by a Tukey's Honestly Significant Difference (HSD) test, will be performed to determine the statistical difference between the surface resistivity values associated with the different waterproofing admixtures placed on the concrete. The same process will be performed with the compressive, water absorption, and sorptivity tests.
- Task 5: Final Report and Technical Summary

IMPLEMENTATION POTENTIAL

The results from this research can be used by DOTD and other state highway agencies (SHAs) to qualify concrete mixtures based on surface resistivity measurements. Further, as SCMs become less available, waterproofing admixtures can become a potential option for replacement. This research will provide valuable information that will shorten the uncertainties in the application and performance of these products. This action will reduce the risks of its implementation, therefore lowering the costs associated with improper performance.