Florida Department of Transportation Research

Factors That Influence the Variability of Concrete Surface Resistivity of Field Cast Samples

March 2026

Project Number
BED05

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Current Situation

The Florida Department of Transportation (FDOT) uses American Association of State Highway and Transportation Officials (AASHTO) T 358, a standard test for surface resistivity, to evaluate the concrete's ability to resist chloride ion penetration. However, there are notable differences in resistivity readings between field-fabricated and laboratory-fabricated concrete samples. These discrepancies can affect the accuracy of the test when applied to quality control programs in the field. Several factors such as moisture, temperature, curing methods, and equipment differences contribute to this variability, but the extent of their impact has not been fully quantified.

A concrete sample surface resistivity is measured according to AASHTO T 358. In this method, the probe is placed on the sample surface at 0 degrees to measure the concrete surface resistivity then rotated with the probe being placed on the line 90 degrees to the initial line.

To implement resistivity testing in field applications, it is crucial to understand and mitigate these differences.

Research Objectives

The main objective of this research was to identify and quantify the factors that influence resistivity measurements in concrete samples, comparing field- and laboratory-fabricated specimens (per AASHTO T 358 and AASHTO TP 119).

Project Activities

The University of Florida research team conducted a literature review to identify variables that could affect the concrete resistivity measurements of samples made in the laboratory and field. The identified factors were electrical resistivity measurement frequency, temperature control during curing, time between sample fabrication and demolding, limewater curing method, sample moisture state during testing, and sample production.

The University of Florida research team used these factors to develop an experimental matrix and conduct a ruggedness study to test the concrete's reliability and consistency under various conditions. The research included both laboratory-controlled tests and field trials.

Project Conclusions and Benefits

The study found limewater curing and moisture state to be significant factors influencing resistivity readings. Temperature control and frequency used had minor effects, and time of demolding was found to be significant for more mixtures with surface resistivity than bulk resistivity.

Based on these findings, the study recommends strict adherence to AASHTO and American Society for Testing and Materials (ASTM) standards regarding moisture control, curing conditions, and equipment calibration to ensure reliable field measurements. These recommendations will enhance the accuracy of resistivity testing, making it a more viable tool for field-based concrete quality control.

For more information, please see fdot.gov/research.