

Surface Resistivity as an Alternative for Rapid Chloride Permeability Test of Hardened Concrete

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Introduction

Kansas experiences harsh winters that require frequent use of de-icing salts, making it critical to the long-term durability of concrete structures that the permeability is kept under control. Under current KDOT specification, the Rapid Chloride Permeability (RCP) test, as described in ASTM Standard C1202 (2012), or the Volume of Permeable Voids method, described in ASTM Standard C642 (2013), more commonly known as the boil test, must be performed to evaluate concrete permeability. Surface resistivity testing was investigated as an alternative to these tests.

Project Description

Testing for surface resistivity was set up to evaluate the correlation of surface resistivity with RCP and boil tests, the effect of loss of saturation on the sample, and the repeatability of surface resistivity testing. Results indicate a strong relationship (R-squared value of 0.84) between 28-day surface resistivity and 56-day C1202 RCP testing. Results also correlate well to a mathematical relationship derived through Ohm's Law. Surface resistivity did not have a strong relationship (R-squared value of 0.37) with C642 boil testing.

Cylinders were cast to evaluate the effect of saturation levels and differential sample drying. Cylinders were allowed to dry for varying lengths of time at different ages. Results indicated that allowing the samples to dry, regardless of the length of drying time and the age at which the samples were drying, increased the surface resistivity results by an average of 15%.

Through the course of this study, including all samples tested, the standard deviation and coefficient of variation on any given set of cylinders is 1.4 and 4.9%, respectively. If only samples used for the correlation of 28-day surface resistivity to 56-day RCP are used, the coefficient of variation is 4.2%.

A cost-benefit analysis was performed to evaluate the monetary savings resulting from this research. A triennial analysis indicates a total cost savings by KDOT and contractors of approximately \$980,000 and a cost-benefit ratio of 9.2.

Project Results

As a result of this research, recommended specification limits have been developed for surface resistivity testing. As of January 2014, surface resistivity testing has been added to KDOT Standard Specifications as an alternate test method for concrete permeability.

Project Information

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