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Identifying Concrete Plant Mixing Procedures for Electrically Conductive Concrete for the Iowa City Bus Stop Enhancement Project

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Abstract

Electrically conductive concrete (ECON) heated pavement system (HPS) is a promising alternative to the traditional ice management techniques to remove the accumulated ice due to snowstorms and keeping the roadways and sidewalks free from ice. Carbon fiber (CF) modified ECON can produce heat when electrical energy is applied to it, and the generated thermal energy can melt the ice on the roadways and sidewalks. Full-scale field implementations of ECON HPS both in Des Moines International Airport (DSM) and Iowa Department of Transportation (DOT) central offices reveal that the electrical resistivity of ECON produced in the ready-mix concrete plant is much higher than the laboratory-prepared ECON. Higher ECON electrical resistivity decreases the ECON thermal performance and increases the time for melting ice. As a part of the ongoing Iowa DOT project TR-789: Implementing a Self-Heating, Electrically Conductive Concrete Heated Pavement System for the Bus Stop Enhancement Project in the City of Iowa City, the objective of this study is to do a thorough investigation to identify the reasoning behind the discrepancy between laboratory-produced and ready-mix concrete plant-produced ECON resistivity. This study shows that the higher mixing energy of the truck mixer degrades the CF and increases the electrical resistivity. Therefore, suitable mixing procedures for concrete plant are suggested and discussed in this study, which can produce ECON of comparable quality to the laboratory ones.