Pavement Temperature Sensors

project summary

Aurora

working to advance road weather information systems technology

RESEARCH PROJECT TITLE
Laboratory and Field Studies of Pavement Temperature Sensors–Aurora Project 2001-04

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ABOUT AURORA
Aurora is an international partnership of public agencies performing joint research, evaluation, and deployment initiatives related to road weather information systems (RWIS).

www.aurora-program.org

Objectives

The objective of this project was to conduct both laboratory and field studies to evaluate the pavement surface temperature reporting performance of various models of in-pavement (contact) and mobile (noncontact) pavement temperature sensors in varying environmental conditions.

Problem Statement

Many agencies use various models of in-ground and mobile sensors to measure pavement temperature. However, little documentation exists on the accuracy of the various sensors, and there is no standard methodology for sensor testing.

Technology Description

Six in-pavement sensors were tested in this study and two mobile sensors were tested in this study. All of the sensors were evaluated by comparing their reported temperature readings, at any given time, to the readings of closely located, highly accurate baseline thermistors that were affixed to the pavement surface.

Concrete sensor installation

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Test Plan 1: Controlled Climate Tests	
Objective 1-1	Fixed temperature
1-2	Varying temperature
1-3	Mobile sensor acclimation time
1-4	Varied mobile sensor height
1-5	Cold day with and without direct solar impact
1-6	Warm pavement with snowfall
1-7	Cold pavement with rainfall
1-8	Iced pavement with rainfall
1-9	Compacted snow (melting)
1-10	Frost depositing
1-11	Mobile sensor performance in varying ambient temperature
Test Plan 2: De-icing Chemical Tests	
Objective 2-1	Cold day with and without direct solar impact
2-2	Warm pavement with snowfall
2-3	Cold pavement with rainfall
2-4	Iced pavement with rainfall
Test Plan 3: Field Tests	
Objective 3-1	Cold day with and without direct solar impact
3-2	Cold night with and without strong radiational cooling
3-3	Warm pavement with snowfall
3-4	Cold pavement with rainfall
3-5	Iced pavement with rainfall
3-6	Mobile sensor field evaluation

Key Findings

Throughout the variety of environmental conditions tested, on average, the sensors reported surface temperatures within 0.8°C (1.4°F) of the actual pavement surface temperature. The application of sodium chloride to the sensors had an insignificant impact on sensor temperature reporting performance. Solar impact was difficult to reproduce in the laboratory environment because non-uniform spatial distribution of the simulated solar light caused different surfaces and locations of the pavement to heat differently.

Laboratory test chamber

Implementation Benefits

The study results offer detailed understanding of the range of accuracy that can be expected with pavement temperature sensors. The data and conclusions drawn from this study are published so that Aurora members and others will have additional information to assist in their implementation and procurement decisions. Additionally, results from this study will be used by the NCHRP to develop testing and calibration standards for pavement sensors.

Implementation Recommendations

Development of an acceptable range of accuracy could be achieved with the data obtained in this study. The greater RWIS community may want to explore the creation of an acceptable range of accuracy, possibly through other RWIS projects such as the Clarus initiative.