Evaluation of Vaisala Spectro Pavement Sensor

project summary

Aurora

working to advance road weather information systems technology

RESEARCH PROJECT TITLE
Evaluation of Vaisala Spectro Pavement Sensor

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PROJECT CHAMPION
Ministry of Transportation of Ontario

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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).

Objective

The purpose of this project was to study the accuracy and usefulness of the Vaisala Spectro/Cyclo (DST111 and DSC111) pavement condition and temperature sensor suite under real-world conditions. The goal was to compare data collected from the Vaisala sensor suite with data gathered from in situ sensors to determine if the data were accurate.

Problem Statement

Monitoring road surface conditions during and after winter storms is critical to determine what winter road maintenance should be performed. Many different sensors (traditionally in situ) exist that can take readings so that less of the agency's staff time needs to be devoted to monitoring winter conditions at remote locations. The Vaisala Spectro/Cyclo suite has two new remote optical sensors. The suite uses an active near-infrared band remote sensor to determine surface state, such as dry, moist, wet, ice, snow/frost, or slush. The sensor also measures the grip level, which is intended to represent the level of friction of the road surface. Temperature is measured using a sensor based on infrared technology. The Ministry of Transportation of Ontario (MTO) and the University of North Dakota Surface Transportation Weather Research Center (UND STWRC) conducted tests to determine the suite's accuracy and usefulness.

Vaisala Spectro/Cyclo sensor suite: DSC111 (left) and DST111 (right)

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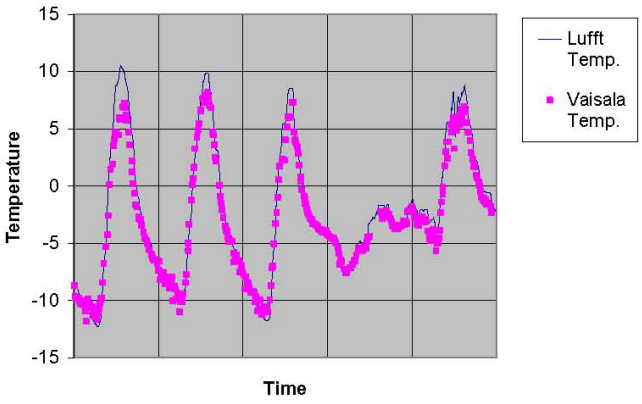
Ontario

Technology Description

MTO installed the sensor suite on a four-lane highway east of Ottawa. Four major snowstorms in the winters of 2007 (Feb.14 and Mar. 2) and 2008 (Feb.1–2 and Feb.6–7) were monitored closely for this study. Pavement temperature and state data were compared with data from an existing in situ Lufft IRS-20 sensor previously installed in the pavement. Grip readings were compared to those obtained from a Traction Watcher One (TWO).

Key Findings

- The DST111 sensor gave higher temperature readings under lower temperatures and lower readings under higher temperatures compared to the Lufft sensor.
- Surface states reported by the DSC111 sensor were accurate, with a matching rate of over 85%.
- Correlation between the grip levels from the DSC11 sensor and the frictions from TWO device was very weak under conditions of low friction.



Comparison of temperature from Vaisala and Lufft in situ sensors

Implementation Benefits

- The Vaisala sensor suite could be another sensor used to monitor road conditions in remote locations.
- The Spectro/Cyclo suite should also prove useful as both an observational input and validation data source toward efforts to improve the Federal prototype and Pooled-Fund Maintenance Decision Support System software.

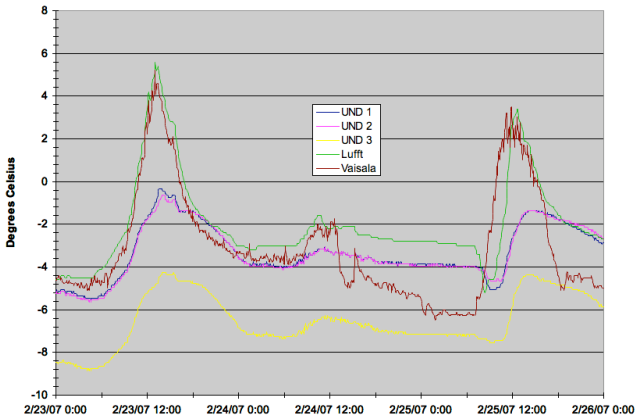
UND

Technology Description

The UND STWRC installed the Vaisala sensor suite in its existing Road Weather Research Facility in a decommissioned rest area adjacent to Interstate 29 south of Grand Forks. Data were predominantly collected from January 1, 2007 to March 31, 2007. Pavement temperature and state readings were compared to locally-developed sensors as well as a Lufft sensor. Friction measurements were compared to those produced by the Halliday RT3.

Key Findings

- The Vaisala sensor suite produced results, with respect to pavement temperature, that were comparable to current in situ technologies.
- Vaisala sensor temperatures do not track more closely with the 10 cm subsurface temperatures, which was the expected result.
- Fog could impact the Vaisala sensor temperature readings, but snow cover seems to insulate in situ sensors, impacting temperature readings.



Pavement surface temperature time series for UND 1–3, Lufft, and Vaisala sensors for February 23–25, 2007

Implementation Readiness

More field testing should be conducted to further prove that the data from the suite are accurate and to answer questions that were beyond the scope of this project.