Using friction data in combination with data from other weather sources can inform winter operations decision-making and maintenance strategies.

RESEARCH SOLUTIONS

Using connected vehicle data to enhance winter safety

Friction levels between a vehicle's tires and the road are a primary indicator of road safety and accessibility. Connected vehicles provide continuous information about road conditions, which can be valuable in winter maintenance decision-making. This project evaluated the effectiveness of using real-time friction data from connected vehicles to help transportation agencies make traffic management decisions and provide a better understanding of the effects of different weather scenarios on road performance.

THE NEED

Transportation agencies need reliable, real-time friction data to monitor road conditions and inform winter maintenance operations decision-making. Connected vehicles, which continuously measure road friction, allow agencies to access this valuable information and use it in combination with other weather information and indicators to better inform decisions such as activating or deactivating variable speed limits or requiring snow chains in applicable locations.

Real-time friction data collected from a fleet of connected vehicles allowed researchers to examine the use and value of this data. Connected vehicle software processes sensor data to measure the maximum available friction between the road surface and a vehicle's tires. This project assessed the value of connected vehicle friction measurement data for winter maintenance operations to determine if continued access to the data was cost-effective.

RESEARCH APPROACH

Using connected vehicle friction data from the 2023–2024 winter season,

(continued)

"The friction data demonstrated its potential value, but it won't be a viable option in Iowa until connected vehicle coverage has increased."

— TINA GREENFIELD,
Iowa DOT Winter Operations Team

investigators evaluated the added value of friction data in case studies conducted in three states: Colorado, Pennsylvania, and Utah.

The first use case evaluated how friction data could assist variable speed limit decisions by comparing friction data to historical speed restriction data and assessing how the friction data would have impacted past variable speed limit decisions.

Similar to the variable speed limit comparison, the second case study compared friction data to historical chain notices to assess how the friction data would have impacted past decisions to require chains.

The final use case evaluated three methods for using friction data to assess winter maintenance operations. Two methods used friction data and transportation agency maintenance data to calculate key performance indicators (KPIs) based on the time when the roads were unsafe due to low friction measurements to the time when the roads returned to an acceptable state. The third method determined the effectiveness of winter maintenance during different snowfall intensities for a complete road network.

WHAT IOWA LEARNED

In the first use case, the friction data demonstrated its ability to identify and measure slipperiness and its value as a parameter in making decisions regarding variable speed limits. Its effectiveness, however, was limited when the number of connected vehicles providing data was low.

The second use case again demonstrated the reliability of the friction data to provide slipperiness measurements to use as a parameter for chain law decisions. Because the friction data alone does not distinguish between snowy and icy roads, agencies should use it in combination with existing weather data if chain laws are only applicable during snowfall.

The third use case demonstrated effective options to employ the friction data to improve winter maintenance operations. These options include:

- Using friction data to create a KPI for road segments, and analyzing the KPI results and trends to assess maintenance performance.
- Conducting a detailed study of specific road segments to analyze how maintenance work mitigated low friction levels.
- Using the KPI throughout the winter weather season to effectively reallocate resources to meet KPI standards.

PUTTING IT TO WORK

The friction data demonstrated its value to assist with winter maintenance operations. Transportation agencies that have sufficient connected vehicle coverage in their jurisdictions may want to add friction data to their winter maintenance analyses. However, in areas without sufficient coverage, using friction data may not be cost-effective.

ABOUT THIS PROJECT

PROJECT NAME: Assessment of Connected Vehicle Friction Measurement Data on DOT Winter Maintenance Use Cases

Final Report | Technical Brief

PROJECT FUNDING PROGRAM: Aurora, a 19-state collaborative research effort

PROJECT NUMBER: TPF-5(435)

REPORT DATE: August 2024

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