Mobile Weather Data Collection Guidelines (on DOT Fleet Vehicles)

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BACKGROUND

In the 2009 Aurora Program Peer Exchange, guidelines for mobile weather data collection were identified as a high priority by the states that participated. The problem statement was assigned to the Aurora Pooled Fund given their expertise includes the collection and dissemination of road and weather data.

PROBLEM STATEMENT

With the addition of integrated telecommunications and information technology or telematics to maintenance fleet vehicles, we gain the ability to collect data that may aid in identifying current road and weather conditions. However, care must be taken to assure these data reflect actual conditions and not a microclimate created by the vehicle.

KEY FINDINGS

When a heavy-duty truck is plowing snow, the amount of contaminants introduced into the nearby environment have enough negative impacts on precipitation, wind, visibility, humidity, barometric pressure, and pavement condition information to make this information invalid for most purposes. While information from light-duty vehicles has the potential to be higher quality, it still has inherent problems that can lessen the value to agencies significantly.

Surface temperature information is one of the most widely desired parameters by state transportation agencies or departments of transportation (DOTs) with several different brands and/or types of sensors currently available to collect this information. Although some of these sensors are capable of collecting accurate surface temperature information, any sensor collecting data in this fashion will only be capable of identifying the surface temperature, which can be different than true pavement temperature.

The truck-mounted sensor will only take readings for the uppermost layer, which could be pavement, snow, ice, water, or again slush. Even though this method has shortcomings, it still provides valuable information for chemical selection and application rates.

Proper sensor placement and mounting on the vehicle also play a role in determining the accuracy of this information. Along with surface temperature information, ambient air temperature is usually collected by this type of sensor. This information is generally accurate, depending on proper placement of the sensor on the vehicle.

In past studies, both surface and air temperature readings have been shown to be affected by the vehicle entering and exiting a heated storage facility. Time (up to 30 minutes in some cases) required for each sensor to acclimate to a new temperature range and provide accurate readings varies considerably by manufacturer and model, so care is required when selecting the sensor to ensure it will meet the practices and needs of the agency. Alternatively, automatic data filters may be needed to remove readings that might be impacted by temperature acclimation.

A plow vehicle is a poor platform from which to collect other weather parameters such as relative humidity, wind, and precipitation. The microclimate (snow cloud) created by the plow vehicle would render the readings of these parameters virtually useless. For instance, a precipitation sensor mounted on a plow vehicle would almost always indicate snowfall during an event, even if no snow was actually falling, because snow often blows over the top of the plow blade and circulates in the airflow around the truck. Relative humidity readings would almost always be higher than the surrounding actual environment.

Maintenance vehicles also spend a significant amount of time parked for routine work duties such as chemical reloads, shift changes, traffic control, or vehicle inspections. Engine heat from a parked vehicle can accumulate around the sensor environment and lead to unusually high temperature readings. The vehicles are often also parked on the shoulder, not the road. Even while in motion, maintenance vehicles often operate away from the actual road surface while maintaining shoulders or hauling material out of ditches or work sites, for example.

We recognize that air and pavement temperature sensors have been used successfully by maintenance professionals for some time. Maintenance vehicle drivers have an advantage in interpreting the information from their trucks because they know if they are parked, on the shoulder, driving a very snowy road, or otherwise in an environment that is not representative, and can choose to ignore the readings.

CONCLUSIONS

Remote users who receive only the temperature and general truck location are at a distinct disadvantage in being able to decide if readings are reasonable. The erratic behavior of maintenance vehicles necessitates some type of filtering be performed to reduce or eliminate misleading readings.

Salinity measures and friction values have the potential to identify surface conditions and provide information to improve safety for the traveling public. DOTs have expressed a recurring interest in collecting this information before, during, and after an event. Although the ability to collect such information would provide great value to a DOT, sensor technology and environmental issues caused during snow and ice operations make a snowplow a very unlikely candidate to collect accurate data on this parameter.

The purpose of a snowplow is to remove contaminants, apply chemicals, and alter the road surface condition. Keeping this in mind, salinity and friction values collected during this process are transient and applicable only for a very short time.

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