Photo Source: USDOT

CONNECTED VEHICLE APPLICATIONS:
ROAD WEATHER MANAGEMENT

LIMIT 35 SAFETY   **MOBILITY**   **ENVIRONMENT**

Connected vehicle applications related to road weather management and enabling systems are being designed to collect and take advantage of connected vehicle data and information transmissions to increase situational awareness, improve roadway levels of service, and optimize use of resources and materials. The use of these applications and systems are intended to inform decisions as well as increase the ability to respond quickly and appropriately to adverse weather and roadway surface conditions in order to reduce or eliminate weather-related crashes and delays. Applications will support advisories, warnings, and vehicle and/or infrastructure controls. This document includes a brief description of the connected vehicle road weather management applications and enabling systems in development or in practice. In addition, the Connected Vehicle Reference Implementation Architecture website (http://www.iteris.com/cvria/html/applications/applications.html) provides more information about these and other applications. Some applications and enabling systems (e.g., the Vehicle Data Translator) are available via the Open Source Application Development Portal (http://www.itsforge.net).
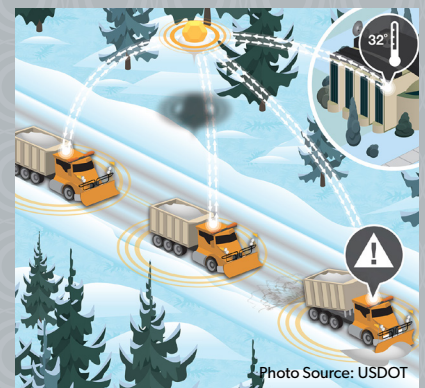

Photo Source: USDOT

Connected Vehicle Applications

- **Enhanced Maintenance Decision Support System (EMDSS):** Generates improved plans and recommendations to maintenance personnel, providing expanded data acquisition from fixed and remote sensors as well as from mobile sources (i.e., agency fleet vehicles, and general public vehicles). It allows an enhanced ability to assess the nature and magnitude of storms, determine staffing needs, plan road treatment strategies and timing, and activate pre/post-treatment systems.

- **Motorist Advisories and Warnings (MAW):** Develops accurate segment-specific warnings or advisories for motorists in order to help optimize travel plans by time and route based on forecasted and current road weather conditions. Through web-based and mobile application interfaces, it allows users to plan trips based on forecasted road weather conditions and time of travel, and allows users to respond to deteriorating conditions in real time, prior to entering a problem segment along their current route.

- **Variable Speed Limits for Weather-Responsive Traffic Management (WRTM):** Determines the appropriate current safe speed for a roadway/corridor based on road weather and traffic conditions. It provides real-time information on appropriate speeds for current conditions and warns drivers of upcoming road conditions.

- **Signalized Intersection for WRTM:** Determines appropriate traffic signal timings at intersections based on road weather and traffic conditions. It is used to adjust signal phase and timing in a signal cycle or to select special signal timing plans most appropriate for the prevailing conditions.

Road Weather Connected Vehicle Applications
Issues alerts and advisories of unsafe road weather conditions

Photo Source: USDOT

U.S. Department of Transportation

- **Road Weather Information (RWINFO) for Maintenance and Fleet Management Systems:** Monitors the status of maintenance operations as well as the location and status of maintenance vehicles; while tracking the type and amounts of material used. It utilizes data collected from vehicles and equipment used year-round and especially during winter maintenance periods, and, when available, is used as an input to the EMDSS application to refine and optimize the recommended weather response plans and treatment strategies.

- **Road Weather Information (RWINFO) for Freight Carriers:** Develops accurate segment-specific warnings or advisories for commercial vehicle drivers and commercial vehicle dispatchers to help optimize travel plans by time and route based on forecasted and current road weather conditions, and to respond to deteriorating road conditions in real time. This application takes into account additional freight-specific factors, such as highway and bridge restrictions, hours-of-service limitations, parking availability, delivery schedules, and vehicle permits.

- **Road Weather Information (RWINFO) and Routing Support for Emergency Responders:** Develops accurate segment-specific warnings or advisories for emergency response vehicle drivers and dispatchers to help optimize response travel plans and route efficiency by time and route based on forecasted and current road weather conditions, and to respond to deteriorating road conditions in real time. This application takes into account additional factors, such as location and routing to surrounding emergency response resources, and may influence decisions to hand off emergency calls from one responder to another in a different location.

- **Road Weather Performance Management:** Highlights the potential for connected vehicle data to enhance and transform road weather performance measurement and management processes in traffic management and maintenance operations. While inputs may vary based on type and severity of weather events as well as the priorities and constraints unique to each State, outputs from this tool help transportation agencies evaluate their performance and identify areas for improvement.

Enabling Systems

- **Vehicle Data Translator (VDT):** Ingests and processes mobile data from connected vehicles and integrates them with ancillary weather data sources to provide quality-checked, near real time and forecasted road weather and atmospheric condition information for specific roadway segments. Recent updates include improved quality check algorithms, including the development of new confidence value flags, as well as algorithms for deriving enhanced weather and road conditions from available data; for example by using windshield wiper status to infer precipitation or by using anti-lock braking system (ABS) and tire data to infer road friction.

- **Weather Data Environment (WxDE):** Assimilates, quality checks, and provides access to road weather data from networks of fixed and mobile stations across the country, providing data on an interoperable platform to meet weather-related research needs focused towards Intelligent Transportation Systems (ITS). The WxDE incorporates functionality from the VDT, and has the ability to be integrated with the Research Data Exchange (RDE), allowing weather-related data to be readily accessible for the research and development of connected vehicle applications. The WxDE can be found at: https://wxde.fhwa.dot.gov.

- **Integrated Modeling for Road Weather Condition Prediction:** A sophisticated ensemble of traffic and weather models that will leverage the imminent deployment of connected vehicle systems and will allow users to proactively react to weather and conditions; the model considers trends in road conditions (e.g., road maintenance, incidents, road and weather data) and combines this information with real time road and weather data to create predictive information.

- **Citizen Reporting (CR) of Weather and Road Conditions:** Creates timelier, more concentrated data through a form of crowdsourcing in which citizens (non-DOT personnel) are recruited and trained to use specific applications built and managed by DOTs to report weather and road conditions as they travel. The objective of CR programs is to increase weather and road condition data granularity beyond traditional forms of condition reporting (usually maintenance field crews). Connected vehicle road weather applications use those data to increase the accuracy and efficiency of their outputs.

Road Weather Module for Automated Vehicle Application

- **Automated Vehicle in Adverse Weather Decision Support System (AVAW-DSS):** Incorporates weather data into the decision logic of automated vehicle applications in order to improve safety when automated vehicles operate in adverse weather.