NORTH/WEST PASSAGE

October 2024

Purchasing Data from Vendors of Connected Vehicle (CV) Data

Project 18.4 – FINAL

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Table of Contents

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1. INTRODUCTION

The North/West Passage (NWP) pooled fund study program focuses on developing effective methods for sharing, coordinating, and integrating traveler information, operational activities, and emerging technologies across state and provincial borders. Membership includes the states of Washington, Idaho, Montana, Wyoming, North Dakota, South Dakota, and Minnesota, as illustrated in Figure 1.

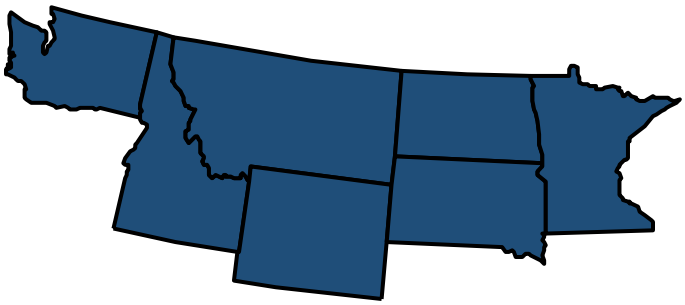

Figure 1: North/West Passage Members

In recent years, NWP members have increasingly explored connected vehicles within their agencies, and this has been a topic discussed among NWP members. One aspect of connected vehicles (CV) is public transportation agencies purchasing vendor-provided CV data. The data provided could be individual vehicle data or aggregated data depending on the need of the agency. The CV data provided can be beneficial to transportation operations, for example, by providing speed data, for planning activities to provide origin and destination data, and for maintenance performance measures by providing friction data or speed data.

Project Purpose

Share NWP member experiences procuring CV/probe data and explore the potential for corridor-wide procurement of CV/probe data.

The NWP member states have varying levels of experience procuring data from vendors. The purpose of this project was to share experiences procuring CV data from vendors and/or aggregation services and to explore the potential for corridor-wide procurement of CV data.

Based on the experiences shared, there were common challenges using CV/probe data that were noted by the NWP members. The member states are rural and there are many holes, dead zones, and gaps with third-party data that result in a lack of coverage due to low penetration of vehicles reporting data. A similar concern was the difficulty retrieving data in many rural areas. With these challenges, the NWP member states discussed and agreed at this time to not pursue purchasing data jointly as a corridor, but they may consider this again if the factors mentioned above are resolved or improved.

This report provides an overview of connected vehicle data and documents NWP member use, interests, and challenges with CV/probe data. In addition, procurement approaches and examples used by other agencies outside the NWP are described as well as next steps for NWP to consider procuring CV/probe data.

The sections of this report include:

- 2. CV Data, Communications, Uses, Procurement, and Data Analytics Programs – Provides an overview of connected vehicle data, communication approaches, uses, procurement, and data analytics programs.
- 3. CV Data Analytics Program Presentation – A summary of information provided from a demonstration of the University of Maryland's Regional Integrated Transportation System (RITIS), an analytics program, is also provided.

- 4. North/West Passage Members CV/Probe Uses, Interests, and Challenges – Documents connected vehicles uses, interest, and challenges with connected vehicle data.
- 5. Summary and Next Steps – Provides and overall summary of the project and suggested next steps for NWP members to consider.

2. CV DATA, COMMUNICATIONS, USES, PROCUREMENT, AND DATA ANALYTICS PROGRAMS

This section provides an overview of connected vehicle data, communication approaches, uses, procurement, and data analytics programs.

Connected Vehicle Data

Connected vehicle data may include aggregated data or individual vehicle data. Aggregated data may include average speeds, traffic volumes, segment travel times, start and end of queues, and trip trajectories. Individual vehicle data may include vehicle speeds, vehicle heading, vehicle acceleration, harsh braking occurrences, and vehicle brake system status.

Connected Vehicle Data Communication Approaches

The Connected Vehicle Pooled Fund Study (CV PFS) completed a document, Model CV Data Architecture (March 2023), to create a resource for Infrastructure Owner Operators (IOOs) to use as they make decisions about the CV data they produce and share, and the CV data they receive and use.

Following are examples from the Model CV Data Architecture Document on connected vehicle data communications approaches.

- ***Vehicle to IOO Data Path #1: Direct*** - Includes vehicles equipped with on-board units (OBUs) broadcasting data using the 5.9 GHz spectrum that is received by IOO deployed RSUs. There is no 'handshaking' or confirmation of data communications; these are broadcasts of data that may be received by any device within range of the broadcast. From the CV perspective, the in-vehicle radios that broadcast data are connected to the in-vehicle application(s) that generate data into messages. From the IOO perspective, the RSUs that receive data may either communicate the data (as received) through backhaul communications to a central location or implement some form of mobile edge computing (MEC) to either process and integrate the data into systems at the roadside or communicate the processed data to a central location through backhaul communications. *Source: Model CV Data Architecture (March 2023)*
- ***Vehicle to IOO Data Path #2: Private Vendors and Aggregation Portals*** - Involves private vendors and aggregation portals communicating over network cellular. The most common example is network cellular communication of vehicle data to a central server operated by an original equipment manufacturer (OEM) or a private vendor. From the IOO perspective, IOOs receive CV data by the private vendor applications or aggregation portals through internet communications. *Source: Model CV Data Architecture (March 2023)*
- ***Vehicle to IOO Data Path #3: IOO Internal Application*** - Includes situations when IOO vehicles communicate directly to IOO operated applications. The communications may use network cellular or an agency operated radio communications. In current systems, a combination of voice and data are communicated, depending upon on-board applications. The data communicated through this data path typically have very specific purposes or roles to support the agency (e.g., monitoring snowplow progress and chemical treatment rates) and therefore is different from

receiving data from general vehicles traveling on the roads. *Source: Model CV Data Architecture (March 2023)*

Connected Vehicle Data Uses

Examples of data uses from the CV PFS Model CV Data Architecture (2023) include:

- The Kentucky Transportation Cabinet uses crowdsourced data to identify road weather hazards and monitor work zone performance.
- Maricopa County DOT in Arizona uses CV data to perform signal timings, reducing the need for floating car surveys.
- City of Montreal uses incident, speed, and travel time data in near real-time.
- Maryland DOT and Georgia DOT access CV data through an aggregation portal (RITIS) to support post-event analyses and planning for managing future events. This eliminates their need for local storage or data processing/display.
- Many agencies ingest vendor data to provide speed data on traveler information maps.

Connected Vehicle Data Procurement

There are different approaches to procuring CV/probe data as described in the examples below.

- ***State DOT Request for Proposals (RFP) Process:*** Many State DOTs purchase CV/probe data through an RFP process. This may include providing background on the data needs and the objectives of the project. The scope of work will be defined as well as the contracting approach with the selected data providers. The data ownership and licensing may be noted as well as the timeframe and schedule. Vendors will submit a proposal and the State DOT will select a vendor based on an evaluation of the proposal. State DOTs may purchase individual or aggregated CV data, or they may purchase a data analytics platform and integrate current data into the platform.
- ***Prequalified Vendor List for Multiple Transportation Agencies:*** The Eastern Transportation Coalition (TETC) is a partnership of 19 states and the District of Columbia (D.C.) and is focused on connecting public agencies across modes of travel to increase safety and efficiency. *Source: The Eastern Transportation Coalition Website.* A Transportation Data Marketplace (TDM) provides TETC members with the opportunity to select from pre-qualified vendors to provide data in the following six categories:
    - Real-time travel time and speed data
    - Volume data
    - Conflation – traffic data
    - Waypoint data
    - Origin-destination data
    - Freight data

  A TDM Request for Proposals (RFP) in 2021 was issued to engage one or more contractors for the prequalified list. In 2008 one vendor was selected, in 2014 there were 3 vendors selected, and most recently in 2022 there were 11 vendors selected. TETC members complete a data use

agreement, and they are provided access to a data analytics platform that provides real-time visualizations of public data, third-party probe data and tools, and trip analysis.

- ***CV PFS Model CV Data Architecture:*** The CV Pooled Fund Study Model CV Data Architecture (March 2023) document identifies a series of recommendations that transportation agencies may want to consider when procuring CV data.
    - Procurement agreements shall clearly allow sharing and access for other groups in the agency and partner agencies.
    - If relying on storage by vendor or aggregation service, IOO's procurement agreements shall define minimum storage and availability periods, including survivability of contract end dates.

Connected Vehicle Analytic Platforms

With CV data there is a large amount of data produced. Many transportation agencies do not have staff resources to analyze the data provided by the CV data vendors. To assist agencies, there are data analytics programs. These programs can provide many different and, in some cases, customizable options and dashboards to view CV data in more concise formats for agencies. Examples of what data analytics programs can do include:

- Continuously calculate travel times and provide information to a state's Advanced Traffic Management System (ATMS).
- Provide alerts when traffic volumes differ from historical averages, encouraging operations personnel to explore if there is an incident or event.
- Store and provide access to CV data, reducing or eliminating the agency's need to provide storage.
- Provide interfaces that enable IOOs to review data or computed analytics to understand conditions in the field, potentially reducing the need to perform field visits.
- Operated support to compare data (e.g., past travel times in work zones, improvement after a project is complete).
- Monitor roadway conditions, either in real-time or near real-time.

3. CV DATA ANALYTICS PROGRAM PRESENTATION

As part of this project, the NWP members were interested in a demonstration of a CV data analytics program. The University of Maryland's Regional Integrated Transportation System (RITIS) is a platform for transportation data analysis, monitoring, and visualization. Michael Pack from the University of Maryland Center for Advanced Transportation Technology (CATT) Laboratory provided a demonstration of RITIS on May 23, 2024.

- RITIS consumes private sector CV data and location-based services data (LBS).
    - LBS is data provided by cell phones and tracking of mobile devices.
    - CV data is everything else provided by a vehicle and its sensors (e.g., speeds, estimated volumes, safety events such as incidents occurring in area, traction control engaged, slamming on brakes, speeding, airbags deployed, live video).
- The RITIS platform has been developed over the past 18 years at the University of Maryland.
- There is a cost to utilize the RITIS platform. Agencies can purchase data from vendors and have RITIS ingest the data or the data can be purchased through the University of Maryland on behalf of an agency. The cost is based on the amount of data that is being consumed and managed. If an agency purchases the RITIS platform, anyone in the state can use it (e.g., MPOs, universities, consultants on behalf of the DOT).
- There are 50 different analytics tools embedded in the RITIS platform.
- Real-time situational awareness is provided by consuming data directly from state and local transportation agencies, plus local police, fire department, local municipalities as well as third-party providers and CV data suppliers that share data with RITIS. RITIS also ingests tens of thousands of CCTV feeds (e.g., roadways, dash cams) including CCTV feeds from DOTs.
- RITIS can ingest a variety of data. The following are examples:
    - First responder communication and computer aided dispatch. Users can click on a certain area to listen to the radio.
    - Real time weather data based on precipitation type and intensity is mapped to the roadway. The weather data is from the National Weather Service (NWS), Road Weather Information Systems (RWIS) and off CV.
    - Live locations of maritime vessels, transit vehicles, and flight data (e.g., planes and helicopters).
    - Weigh in motion data.
    - ITS sensor data.
    - Incident management plans.
- Safety analytics in RITIS can provide an agency with the ability to view crash data, ATMS event data, and CV data streams to produce heat maps which can identify unsafe locations and be used for performance measures such as clearance times.
- There is a user group within RITIS that provides reporting templates and tutorials for agencies to use (e.g., daily work zone performance report, predicting holiday travel, after action reports, work zone impact) to develop reports.

- RITIS also provides historic analytics to use to analyze bottle necks, identify congestion, compare one data to another data, identify causes of congestion, user delay costs, etc.
- One data provider for RITIS includes cell phone handling data. From the data you can determine if a person is picking up the phone while driving, rapid acceleration or deceleration to use to analyze a safety profile of a highway.
- Trip analytics is also a feature provided by RITIS. A user can view normal conditions and then view when an incident occurs or what routes motorists drove.
- CV high frequency data streams (location every 5 to 15 seconds) are used for signal performance measures. Maryland also uses these data streams in rural areas to identify issues to avoid sending out technicians.
- There are different ways an agency can assess data accuracy. Probe speed data can be assessed by installing temporary bluetooth readers and spot checking. However, probe speed data will have issues in extremely low volume locations. If there is not any traffic, speed reading cannot be provided, but many third parties then supplement with historic data. It is challenging to validate origin and destination data. Some agencies compare different data products.
- The methodology used by RITIS is provided with details stepping a user through algorithms. RITIS works with DOTs to validate the algorithms.
- There are variety of RITIS Resources that provide additional information: RITIS Report Templates page, RITIS Tool Catalog, RITIS Tutorials, and RITIS Support.

NWP members found the presentation beneficial and were especially interested in understanding all of the data sources ingested by RITIS, methodology used, accuracy of the data, and understanding the cost to use the RITIS platform.

4. NORTH/WEST PASSAGE MEMBERS CV/PROBE USES, INTERESTS, AND CHALLENGES

Phone interviews were conducted with NWP member states to gather information on historical and real-time CV/probe uses in each state. Interests as well as challenges with probe data were also discussed.

Connected Vehicle Uses

NWP member states use historical travel pattern data provided by vendors that typically include volumes and origin-destination tables for multiple uses in planning. For example, Minnesota analyzed volume data provided by a vendor to understand when increased volumes were occurring at a specific intersection. Historical speed data provided by vendors is also used by members, for example in Minnesota the data was reviewed for post-analyses of work zones.

Real-time time data (e.g., speed) is used by Washington, Idaho, and Minnesota to provide travel times. Real-time fleet data is also used by member states for example for snowplow AVL tracking, a leader-follower truck system in North Dakota, and providing alerts of maintenance/snowplow vehicles to drivers nearby.

Connected Vehicle Interests

There is interest in using quality aggregated CV/probe data by the NWP member states for a variety of uses including variable speed limits, ramp metering, enhancing detector data locations, winter maintenance, identifying when a roadway recovers after a winter event, and freight movements. Individual vehicle data is also of interest for harsh braking midway through a work zone effort to make revisions.

Connected Vehicle Challenges

However, there was one common challenge with the use of CV/probe data noted by the NWP members. The member states are rural and there are many holes, dead zones, and gaps with third-party data that result in a lack of coverage due to low penetration of probes. It is also difficult to retrieve data in many rural areas.

There may be opportunities to combine probe data with other data collection. In North Dakota automated traffic recorders (ATR) and radar-based environmental sensor stations (ESS) are used for performance measures and for speed recovery to determine at what point a roadway returns to normal. The data provided is what is needed in North Dakota at these sites for performance measures. This data may be enough for North Dakota's need, but other situations may benefit from combining current data collection methods with quality rural probe data.

5. SUMMARY AND NEXT STEPS

This project provided NWP members with the opportunity to share experiences procuring CV data from vendors and/or aggregation services and to explore the potential for corridor-wide procurement of CV data. In addition, different procurement options were identified to assist states considering procuring data.

There was one common challenge with the use of CV/probe data noted by the NWP members. The member states are rural and there are many holes, dead zones, and gaps with third-party data that result in a lack of coverage due to low penetration of probes. It is also difficult to retrieve data in many rural areas. With this challenge, the NWP member states discussed and agreed at this time to not pursue purchasing data jointly as a corridor.

However, there were a number of suggested ideas that members could consider as a future opportunity for re-evaluating CV/probe data Including:

- Annually during an Operations Task Force meeting, provide an opportunity for each member state to share new experiences with CV data and discuss interest in purchasing data jointly as a corridor.
- As new research is made available on the accuracy and increased penetration of CV/probe data, request presentations to share results to the NWP members.
- As members are made aware of contracting by other agencies to procure data as a group, share the details with the NWP members.

Overall, the research conducted for this project provided NWP member agencies with details on CV data, CV data procurement options, and members' experiences with CV data. This information assisted members to conclude at this time to not purchase CV data. However, as CV data continues to improve in rural areas, the NWP member states will continue to consider purchasing data jointly as a corridor.