NRRA National Road Research Alliance

Benefits of Veta Web for MDMS

The Need for a Web Platform to Implement MDMS

Many States have been piloting the Material Delivery Management System (MDMS) (an expanded form of E-Ticketing) since 2015. The increased use of this technology has been accelerating due to the impact of COVID-19 since 2020. A draft AASHTO provisional practice has been established to assist with the standardization of data block naming conventions, data elements, data exports, addressing centralized suppliers' needs, and more. There are currently more than 15 vendors providing varying level of solutions for the MDMS technology. As with ride quality (smoothness), intelligent compaction (IC), paver mounted thermal profiling (PMTP), a standardized platform is needed to view the MDMS data regardless of the MDMS vendors used on the contracts. There could potentially be multiple MDMS platforms that an inspector is required to navigate on a given contract depending upon which MDMS each subcontractor elects to utilize (e.g., a different MDMS for asphalt, concrete, aggregate, milling, etc.).

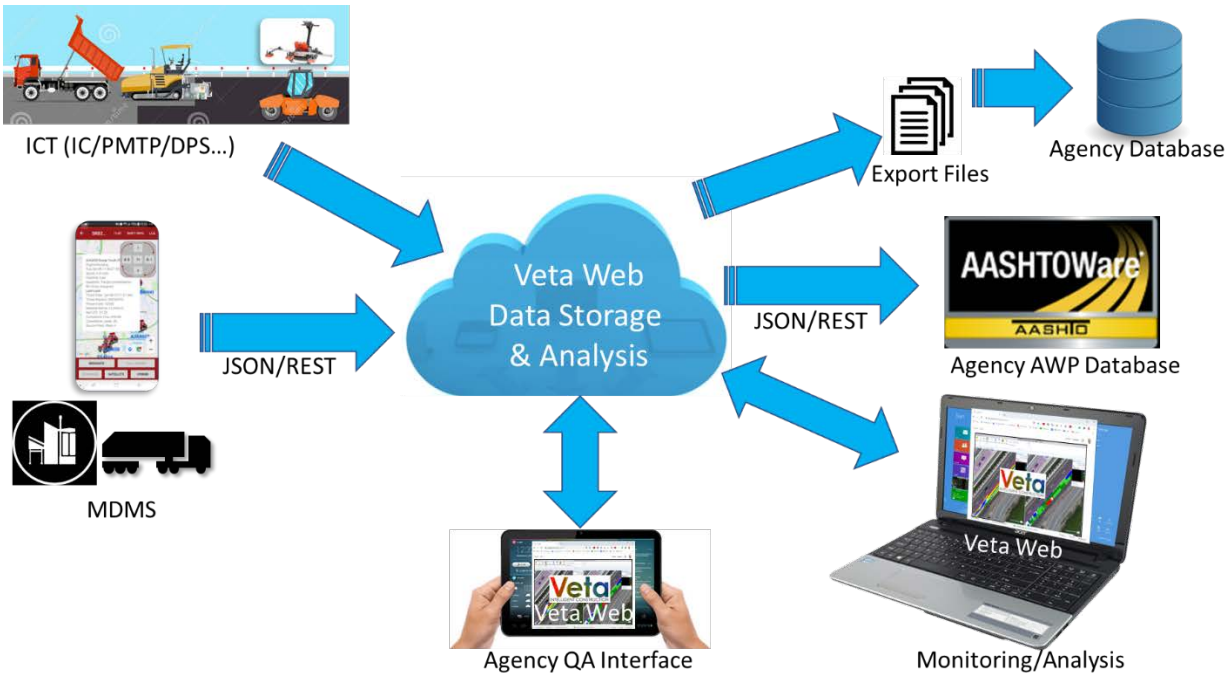
Additionally, an agency interface is needed (independent from the Contractor's MDMS) to allow for data entry of split load, rejected loads, and other information. Also, MDMS data and analysis results will need to be transferred into AASHTOWare® Project and other state database systems. However, this will not address the standardization of the geospatial needs that the MDMS currently provides.

The potential solution to overcome the above challenges is a public-domain, standardized web-based geospatial software system. Sponsored by the FHWA and TPF, the Veta desktop software has been a proven model for integrating and mapping data from various intelligent construction technologies (ICT) with great success since 2012. Therefore, it is recommended to develop a Veta Web that can be a standardized web platform to integrate all MDMS-related data in a standardized format (e.g., JSON).

Proposed Veta Web Platform

The proposed Veta Web platform consists of a web-based server application for MDMS data storage and computation for analysis. Being web-based, Veta Web can be run from any mobile device, laptop/desktop computers, etc., as long as the internet connection is available. The conceptual architecture of Veta Web is illustrated below.

- MDMS data can be pushed from transaction points and fleets to the Veta Web cloud database using a standard method (i.e., JSON and REST API).
- Agency inspectors can perform quality assurance (QA) and upload the data to the Veta Web cloud storage using the Veta Web agency interface. Also, agency inspectors can monitor the fleet information and paving progress using the same interface.
- Other intelligent construction technologies (ICT) (including IC, PMTP, Dielectric constant profiles methods – Dielectric Profile System [DPS], etc.) can also push their data to the same cloud storage.
- Agency and contractor office staff can monitor and perform mapping and analysis using the Veta Web.
- The MDMS data and analysis results can be transferred from the Veta Web cloud to agencies' AASHTOWare Project® database using a standard file method (i.e., JSON and REST API).
- For agencies not using AASHTOWare Project®, they can export the MDMS data and analysis results from the Veta Web cloud to local data files and upload them to the agencies' own database.



The MDMS data will be stored on the server with data security and integrity. Veta Web will be used for managing users, data-access permissions, and MDMS projects. While Veta Web will interact with the server, the time-intensive calculations will be performed on the server. This includes filtering, analyzing, reporting, and map creation similar to those in the current Veta desktop version. Specifically, the following features:

- Recreating current Veta desktop mapping GUI for the Veta Web.
- New MDMS analysis projects can be created, stored, and managed as stored in *.vetaweb files.
- MDMS data can also be downloaded by users to local computing devices on a routine basis as redundancy. In the event of data loss or corruption on the server, the user can re-upload the data, or if the data is still available from the vendor's systems, the server can re-download the data.

Anticipated Benefits of Veta Web to MDMS

The anticipated benefits of using Veta Web to the implementation of MDMS include the following:

Facilitation of Data Management

- Push MDMS data in a standardized format to the cloud server from any transaction points (at the source, construction sites) and beacon devices (GPS/cellular trackers on trucks) using the single Veta Web GUI via the internet.
- Eliminate the complexities of nested geofences within the vendor's MDMS, as the Agency's static geofences needed for reconciling quantities with respect to projects and funding categories can now be created within Veta and recorded with respect to the dump location.
- Create an agency interface where agency data does not require data entry within the contractor's MDMS.
- Push MDMS data to AASHTOWare® Project or other Agency databases through a standardized method (e.g., REST APIs, JSON).
- Export of MDMS data as an ASCII, CSV, XLSX, or text format. Agencies can then upload these files to their own database.

Near Real-Time Monitoring with Powerful Mapping Visualization

- Map the numbers of trucks at the source, transit, construction site, and return to the source.
- Show map features to allow the user to click on any given truck symbol to view the associated E-Ticket.
- Overlay material dump locations on ICT data maps, including DPS, IC, and PMTP data for Agencies collecting dump latitude and longitude coordinates.
- Identify mix changes with respect to dump placement locations.

Near Real-Time Data Analysis

- Tabularize the ticket status summary (e.g., ticket number, loaded, in transit, dumped).
- Estimate the arrival time to the dump location and on-site wait-time of trucks before dumping.
- Calculate flow/feed rates and display of these results on maps.

MDMS Data Integration with ICT Data and QA Data

- Tie QA sample identifications and test results for a given load of material to the dump locations.
- Determine an appropriate calibration curve (as related to mix design changes) to associate with the DPS measurements.
- Generate as-built asphalt heat loss curves for troubleshooting workmanship issues using MDMS temperatures collected at the source and Jobsite, PMTP measurements behind the paver screed, and IC temperature measurements during compaction.
- Identify remove-and-replace limits based on dump locations collected by the MDMS, DPS, IC, PMTP, and spot test data.
- Contractor and Agency user interface to allow for data entry of split loads, rejected loads, and other quality assurance (QA) information.

Here is a mark-up for one of the many Veta Web features described above to tie each E-Ticket with stationing on the PMTP temperature map. Comparing the PMTP temperature and IC pass count maps, a QA core data location can be tied to the asphalt truck, stationing of the dump, sublot, temperature segregation, and pass count information. Therefore, the causes of any QA noncompliance can be identified.