2021 Initial Idea Development

2021-2022 NRRA Research and MnROAD Construction Development
(Form – February 2, 2021)

Initial Proposal is for NRRA Executive Team to Approve for further development (keep to two pages)

Short Implementation Title:	Convert Desktop Version of Veta to a Web-Based Application and Standardized Material Delivery Management System Platform (Top Priorities 1-2-3)
NRRA Team(s):	Intelligent Construction Technologies (would provide construction benefits to Flexible, Rigid, Geotechnical, Preventative Maintenance Teams)
Research/Synthesis:	Implementation
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Phase I Cost:	$400,000 (Hybrid Veta Desktop – Web Version, Priority #1)
Phase II Cost:	$400,000 (Standardized MDMS, Priority #2)
Phase III Cost:	$400,000 (Full Veta Web Implementation, Priority #1)
Years Expected:	Phase I: years 1-2, Phase II: years 2-3, Phase III: years 3-4 (Phase II can be completed at the same time as Phase I).
Partnerships:	Possibly FHWA SHRPII Funding ($125,000) for Phase I. 80:20 Match Required

Implementation Objectives:

What is the purpose and need along with the basic steps to a successfully research effort?

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 levels of solutions for the MDMS technology. As with ride quality (smoothness), intelligent compaction (IC), paver mounted thermal profiling (PMTP), dielectric profile system (DPS), 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 TPFs, 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. Additionally, a web platform will also provide a near-real-time platform for viewing the IC, PMTP, and DPS data to identify workmanship issues. Currently, this information can only be viewed post-processed with the desktop version of Veta.

NRRA Sustainability/Resiliency and or Intelligent Construction:

How will this project focus on these objectives which are the cornerstone of our NRRA Phase-II efforts?

The following summarizes the anticipated benefits:

- Facilitation of data management and standardization for e-construction initiatives.
- Near real-time monitoring of construction activities 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.
  - Maps of compaction, thermal segregation and dielectric measurements.
- 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 these results on maps. Information can be used to assist with the mitigation of thermal segregation as measured with the PMTP method.
- MDMS data integration with ICT and quality assurance data.
  - Tie agencies' QA sample identifications and test results for a given load of material to the dump locations.
  - Determine an appropriate calibration curve (related to mix design/production 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 interfaces to allow for data entry of split loads, rejected loads, and other quality assurance (QA) information.
- Allow for real-time data entry of needed agency data for auto-creation of IC, PMTP, and DPS Veta projects by contractors.
- Allow ICT to be used in near real-time as a construction monitoring tool instead of as post-processed data.

Implementation Plan:

How is this going to be used by its members?

Construction

Smart application and web-based tool for use during construction for the following:

- Monitoring of E-Tickets and other associated MDMS data.
- Entering of Field Data Associated with ICT technology
- Monitoring of compaction (IC), thermal segregation (PMTP), and dielectric profile/air voids (DPS) data during construction efforts.
- Identification of remove-and-replace limits.
- Analyses of ICT data for monetary adjustments.
- Acceptance tool
- Push data to AASHTOWare Project to reconcile quantities and review equipment-use hours with billable hours (e.g., rollers, pavers, etc.).

Civil Rights / Labor Compliance

MDMS data will be used to assist with reviewing prevailing wages, small businesses, Davis Bacon Law, and other auditing activities.

Asset Management / Scoping – Materials and Soils Engineers / Maintenance / Pavement Performance

Integrating intelligent construction data for the creation of a virtual roadway. This information can be pushed to other platforms for archiving as a construction as-built asset. Additionally, information can be used to help troubleshoot causes of pavement performance issues, determining locations for future testing during scoping activities, etc.