NRRA – Veta Phase II Activities

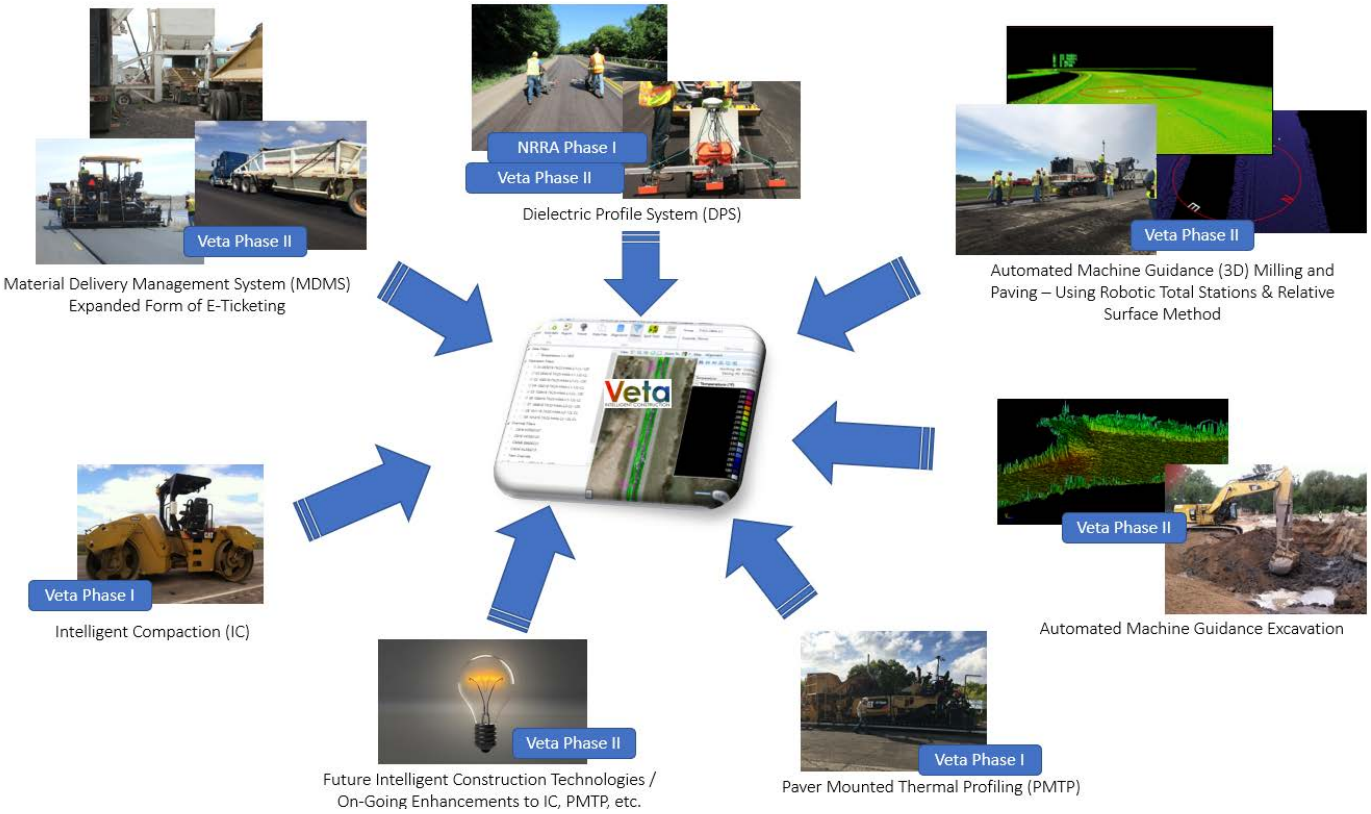
National Road Research Alliance (NRRA)

Due to the overlapping initiatives between NRRA and the Veta Phase I pooled fund TPF-5 (334), it was decided to incorporate phase II of the Veta pooled fund under phase II of NRRA (TPF-5 (466), https://www.pooledfund.org/Details/Study/693). States can become full members of NRRA (which also includes Veta Phase II) or solely join the intelligent construction team (ICT) and Veta Phase II.

Additional information regarding NRRA can be found at: http://www.dot.state.mn.us/mnroad/nrra/index.html.

Veta Phase II

As part of the NRRA Phase II mission of sustainability and intelligent construction, Phase II of the Veta pooled fund will include enhancements for the following ICTs (that were considered high priority items) depending upon funding availability. See the image below illustrating potential Veta Phase II activities.



Dielectric Profile System (DPS)

Dielectric Profiling System (DPS) is the focus of TPF-5 (443), "Continuous Asphalt Mixture Compaction Assessment Using Dielectric Profiling System."Veta will be the national, standardized platform for viewing DPS data. However, TPF-5 (443) does not include funding to support the needed enhancements in Veta to allow for import, viewing, and analyses of DPS. Consequently, as part of NRRA Phase I, funding was procured to create an importer to bring DPS data into Veta and allow for mapping and analysis of DPS data. Additional enhancements will be required within Veta to support the DPS analysis (e.g., generation of calibration curves, core density to dielectric measurement comparisons, system calibration verifications, etc.). These needed enhancements are proposed for completion under Veta Phase II.

Material Delivery Management System (MDMS)

Material Delivery Management System (MDMS) is an expanded form of E-Ticketing, an EDC-6 Initiative.Many States have been piloting the MDMS 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), 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.).

Veta will be the national, standardized platform for viewing MDMS data. Consequently, the following enhancements are proposed for completion under Veta Phase II:

- Mapping of the numbers of trucks at the source, transit, construction site, and return to the source.
- Map features to allow the user to click on any given truck symbol to view the associated E-Ticket.
- Overlaying of material dump locations on ICT data maps, including DPS, IC, and PMTP data for Agencies collecting dump latitude and longitude coordinates.
- Identification of mix changes with respect to dump placement locations.
- Tabularization of the ticket status summary (e.g., ticket number, loaded, in transit, dumped).
- Estimate of the arrival time to the dump location and on-site wait-time of trucks before dumping.
- Calculation of flow/feed rates and display of these results on maps.
- Tying of QA sample identifications and test results for a given load of material to the dump locations.
- Determination of an appropriate calibration curve (related to mix design changes) to associate with the DPS measurements.
- Generation of 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.
- Identification of remove-and-replace limits based on dump locations collected by the MDMS and DPS/IC/PMTP/spot test data.
- Contractor and Agency user interface to allow for data entry of split loads, rejected loads, and other quality assurance (QA) information.

Veta Web

Converting Veta from a desktop platform into a web-based system would allow the realization of the following essential items.

- Viewing ICT data (e.g., IC, PMTP, MDMS, DPS, AMG, etc.) near-real-time, using a standardized web-based viewing and analyses platform.
- Allow real-time entry of needed agency data for auto-creation of Veta projects by contractors, including:
- Start and end station limits of production areas
- Production dates
- Centerline offsets for use in automation of location filters
- Exclusion limits
- DPS Calibration Equations
- MDMS agency data (e.g., split load quantities/pay items, sample IDs, air and source temperature measurements at source and in the field, etc.).
- Spot tests (QC/QA test results) – for use in overlaying on top of other ICT data.
- And other emerging technologies and data.

- Improved Submittal Timeline – Currently, with the IC and PMTP technologies, states have not been able to get Veta project submittals daily. Typically, the Veta projects are not submitted until after completion of the work. This is not an option with the DPS. The web-based platform will help support daily submittals' ability by making the software live (i.e., allowing real-time, automated import of vendor data into Veta vs. manual, real-time entry of agency data, live viewing of data, etc.).
- Allow ICT to be used in near real-time as a construction monitoring tool instead of as post-processed data.

Consequently, conversion of Veta from a desktop platform to a web-based application is proposed for completion under Veta Phase II.

Automated Machine Guidance (AMG) Milling and Paving Operations

Independent verification measurements are collected during AMG milling and paving operations. However, the density of measurements is limited by the number of resources available and technical abilities. These measurements often require surveyor experience. Therefore, often a minimal number of QA measurements are typically collected each day. Consequently, in addition to these measurements, it is recommended that a denser and more frequent verification process is also completed using the as-built measurements recorded by the AMG equipment. The digital terrain model (DTM) generated for the as-built surface is then compared to that for the Model of Record (i.e., milling depth and/or pavement thickness design models). The density of measurements significantly impacts the percent of measurements that are considered within tolerance. Therefore, the daily production should also be reviewed per sublot and at a set node frequency. Most survey software cannot automatically split the data per sublot, easily remove excluded areas, and provide ease in dealing with shifting centerline offsets and tapers. Additionally, inspectors often do not have the expertise to use survey software to complete these operations. Consequently, the following enhancements are proposed for completion under Veta Phase II:

- Overlaying of the as-built and model of record surfaces for calculation of volumes of cut and fill.
- Calculation of the delta (differences) milling/paving depths between the as-built and model of record surfaces.
- Calculation of the percent of DTM nodes exceeding required tolerances.
- Filtering of data by date, location, offsets from milling head (e.g., 1-ft inside the left and right edge of the milling operation), etc.
- Creation of sublots for better understanding of areas of concerns.

Automated Machine Guidance (AMG) Excavation Operations

Currently, there are multiple vendors that provide solutions for AMG excavation activities. This makes it difficult for construction staff to use different software to view excavation activities out on the jobsite. Consequently, the following is proposed for completion under Veta Phase II:

- Import of AMG excavation coordinates (X, Y, Z)
- Mapping of excavation elevations.
- Ability to filter by lowest elevation, date, locations.
- Calculation of excavation volumes by overlapping surface model with bottom of excavation model.

Future Intelligent Construction Technologies

During this technology era, it is anticipated that additional technologies may rapidly arise that warrant inclusion within the Veta software, such as what recently occurred with the MDMS. Consequently, a placeholder exists to allow these technologies to be incorporated into the Veta software should the pooled fund participants address the given technology needs.

On-Going Veta Enhancements

Additional enhancements may be warranted for inclusion with respect to the technologies incorporated into Veta during Phase I. Consequently, a placeholder exists to allow pooled fund participants to address the given enhancement needs.