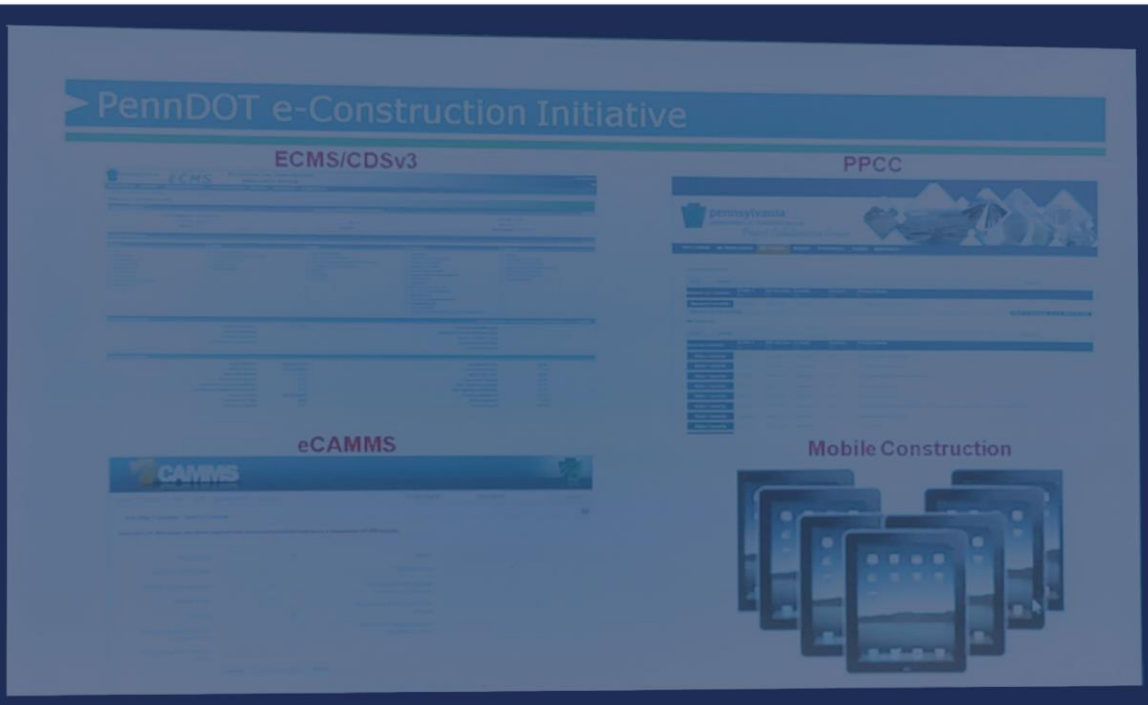
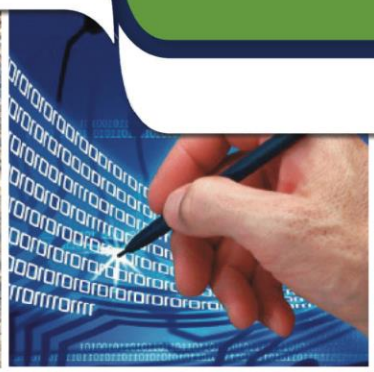
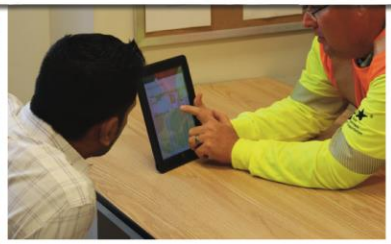



# e-Construction
## PEER-TO-PEER EXCHANGE
## Summary Report



All Photos: FHWA

Michigan DOT and
Washington DOT

January 30-31, 2018
Lansing, MI

U.S.Department of Transportation
**Federal Highway Administration**

# Table of Contents

# 1. Background

The Michigan Department of Transportation (MDOT) hosted an e-Construction peer exchange with the Washington Department of Transportation (WSDOT) in Lansing, Michigan on January 30 and 31, 2018. e-Construction is defined as a paperless construction administration delivery processes that includes electronic submission of construction documentation by stakeholders, electronic document routing and approvals (with digital/electronic signatures), and digital management of all construction documentation in a secure environment that allows access to authorized project stakeholders. The event was sponsored by the Federal Highway Administration (FHWA) and representatives from FHWA Headquarters and Michigan's FHWA Division Office also participated in the event. MDOT provided details on its use of AASHTOWare Project Construction Materials as well as FieldManager and FieldBook for collection of construction data on the jobsite. MDOT also described its use of ProjectWise for document storage and project workflows. WSDOT provided background and a presentation on its legacy systems, including internally developed programs.

The morning sessions on the first day (see Appendix A for the full agenda) served as a preface to the peer exchange and allowed for personal introductions along with background information on each State's construction program and e-Construction activities. MDOT outlined the process for using ProjectWise and provided a software demonstration. Both agencies also discussed the use of ProjectWise software, mainly for design applications but also with consideration for how this tool can be used during construction. The group also discussed practices for application of digital signatures and electronic approvals, such as through CoSign.

The morning of the second day consisted of additional discussion sessions on e-Construction field devices with a focus on the use of iPads for project inspection documentation. Additionally, participants discussed materials management including the acceptance of contractor quality control data for project records. Participants also discussed next steps, action items, and follow-up activities for how to maintain the momentum from the exchange and continue the dialogue.

The Peer Exchange was the fifteenth and final event for EDC-3; FHWA continues to offer peer exchange opportunities through EDC-4 on e-Construction and Construction Partnering. This report includes a summary of key findings from the event, links to relevant documents, and the full notes from the peer exchange discussions.

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## 2. e-Construction Implementation – Key Peer Exchange Findings

The peer exchange produced several relevant and practical findings identified through group roundtable discussions. The following sections outline the items that were highlighted by the group as next steps, implementation ideas, document exchanges, or focus areas—all of which are designed to assist with future implementation within the States' e-Construction programs. Where available, website links are provided for some of the practices currently in use by the agencies. MDOT and WSDOT also shared some documents, presentations, and information by email that are not publicly available on the internet.

MDOT and WSDOT shared detailed information on **legacy systems, requirements, development, and plans for software upgrades** during implementation of e-Construction applications such as AASHTOWare. MDOT is using FieldManager for project inspection documentation and is upgrading to the AASHTOWare Project Preconstruction, Construction, and Materials modules, as well as utilizing Bentley Systems' ProjectWise for document storage and workflows. WSDOT is mainly using internally developed legacy systems for most of its e-Construction systems; it also uses InfoPath and SharePoint for mobile data entry and Business to Government Now (B2GNOW) software for managing civil rights and labor requirements.

Link to MDOT e-Construction wiki page:
http://mdotwiki.state.mi.us/construction/index.php/E-Construction

Link to MDOT YouTube video of the e-Construction process:
https://www.youtube.com/watch?v=HAbYgqgnyB8

Link to MDOT ProjectWise information page:
http://www.michigan.gov/mdot/0,4616,7-151-9625_21540_36037-321341--,00.html

Avenza Maps is being tested for geolocations and map data.
https://www.avenza.com/avenza-maps/

Implementation ideas from the discussions are summarized below.

**Data vs. Documents**

MDOT is embracing the move from storage and management of documents to the storage and management of data. Scanning and uploading a PDF turns that file into e-paper, which may or may not provide access to the needed data in the file. Adjusting users' approach to understanding that they are collecting, storing, and managing the data that are part of those files becomes a major influence on how the data are collected.

**Business Processes and Roadmap Development**

WSDOT plans to review its construction business processes and determine whether some processes should be adjusted, eliminated, or remain unmodified.

WSDOT plans to take small steps: identify and define pilot projects, address and rectify firewall issues, and maximize use of ProjectWise and all its legacy systems. WSDOT will maintain management buy-in and support by presenting return on investment (ROI) information. MDOT did some very rough savings calculations and determined ROI at $12 million per year across the construction organization. The DOT and

contractors both find that a primary benefit of e-Construction tools is that they help process payments accurately in a shorter timeframe.

**Staffing**
Both DOTs have a full- time equivalent (FTE) caps; MDOT utilizes consultants, students, and co-ops to meet its needs without jeopardizing the FTE caps.

**Customization and Standardization**
MDOT purchased and maintains a highly customized and configured version of AASHTOWare. As customizations increase so does the need for resources (both internal and external) to support and maintain the software. MDOT must support activities, provide maintenance, and troubleshoot at a very high level with MDOT resources.

Both MDOT and WSDOT agree that standardization is important. Acceptance and utilization of file/folder naming conventions and providing access to standard specifications and documents is one of the simpler but most critical components of an e-Construction system.

**Partnership**
Partnership is critical between design, construction, industry, management, consultants, and FHWA. e-Construction affects and benefits more than just the DOT end users. Getting buy-in from and working in partnership with industry stakeholders, specifically the contractors and contractor associations, allows for a very smooth transition where all users are working toward the same goals.

**Maximizing Current Tools**
WSDOT has access to SharePoint, ProjectWise, and other tools that have proven beneficial to DOT e-Construction approaches nationwide. WSDOT representatives do not feel they have maximized its use of all of these systems. MDOT, for instance, was initially using ProjectWise in its design process. Since MDOT already had licenses and access to ProjectWise, it was able to quickly and efficiently incorporate construction business workflows to be applied to construction management.

**Grants are available for implementation of e-Construction**, and DOTs have received Grants to support digital data collection on projects as well as provide for efficiencies and cost savings in administering construction contracts and procuring devices.

Links to Grant and State Transportation Innovation Council funding sources:
http://www.fhwa.dot.gov/accelerating/grants/index.cfm
http://www.fhwa.dot.gov/stic/

Link to FHWA e-Construction Web site:
https://www.fhwa.dot.gov/construction/econstruction/

# 3. Peer Exchange Discussion Notes

This section provides additional notes following the organization of the agenda. Question and Answer sessions followed some presentations and demonstrations, which are labeled "Q" and "A" in the notes. As noted above, the full agenda for the peer exchange is included as an appendix to this document, along with a roster of participants.

Matt DiGiovanni with FHWA's Resource Center provided an e-Construction overview from the Federal perspective. He noted that e-Construction is an initiative through FHWA's Every Day Counts program to promote systems to move toward paperless administration of construction projects. It also moves toward a more efficient and transparent delivery of construction projects, including allowing project staff to focus efforts on construction inspection and management activities.

## 3.1 Washington DOT Overview

WSDOT is divided into six operating regions. The population base is mostly on the west side of the State. The Cascade Mountains divide the State; there are two general climate zones as a result, which require different approaches to construction. WSDOT has programmed approximately $6.7 billion in construction over the next four years. WSDOT has some unique transportation issues, including the most extensive ferry system in the United States, three floating bridges, and one of the world's largest ongoing tunneling projects. Legislation in Washington allows for WSDOT to use various contract delivery methods, including design-build and design-bid-build. WSDOT utilizes both in-house and consultant inspection resources.

WSDOT IT is centralized within the DOT; the State currently has a 75-year record retention policy, which presents some unique challenges for document and file storage.

WSDOT's current e-Construction systems are a combination of internally developed and off the shelf systems:

- Construction Contract Information System (CCIS) – designed to manage change orders, but also manages most construction administration tools.
- Bid Express (AASHTOWare), with the DOT at approximately 60 to 70 percent utilization.
- Materials Tracking Program (MTP) – used to enter and store materials certifications, manufacturer's information, and materials data.
- InfoPath and SharePoint – custom developed systems used for field data collection. Reviews and approvals can be performed online. Much of the data is self-populated. Within the next five years, InfoPath will be replaced.
- Microsoft Internet Explorer 11 – used for field note records and inspector daily reports, which will also be upgraded.
- Field Note Record – information is populated automatically.
- Business to Government Now (B2GNow) – a diversity management and compliance system (http://b2gnow.com/).
- ProjectWise – limited use for larger projects; has not yet maximized use of ProjectWise.
- As-built drawings – WSDOT staff manage the process by printing plans, marking them up, and scanning to the project file.

All WSDOT systems are standalone; some were developed back in the 1980s through mainframe computers. There is a great deal of maintenance required. WSDOT has many systems that were designed and/or customized internally or through various contracts.

Inspectors are using standard PCs, laptops, and tablets. All connectivity requires virtual private network (VPN) access. There is State legislation to allow for data storage in the cloud. There are certain locations throughout Washington that experience connectivity issues. On the west side of the Cascades, there are almost no connectivity issues, whereas there are significant connectivity issues on the east side.

Design-Build contractors are required to provide a document management system. WSDOT provides specifications that the contractors must meet, but they do not specify which software, programs, or systems the contractors must use. Contractors are using various versions of some customized and commercial-off-the-shelf systems.

**Digital Signatures**

There is an executive order for digital signatures with parameters for use from the Washington Secretary of Transportation. CoSign is a tool WSDOT uses that provides third-party verification for digital signatures. WSDOT does not accept digitally signed documents from contractors on anything where its business process currently requires an ink signature.

**Pavia Headlight Pilot**

WSDOT piloted a software tool by Pavia Systems named HeadLight, which is a mobile inspection software tool for data collection and documentation. The pilot involved developing the program as well as implementing it. The DOT provided approximately 100 iPads to inspectors to participate in the pilot and provide user feedback.

Pavia's iPad software version allowed for easier access to photography and access to data. The InfoPath system WSDOT uses through SharePoint does not manage data – it provides form entries, whereas the Pavia system stores information in a database. HeadLight on iOS allows data to be collected off-line with synchronization later once connected.

**Contract Administration Tools for Management of RFIs and Submittals**

WSDOT is using an Electronic Content Management Portal agency-wide for electronic contract final records. Each project office decides whether to manage the project as paperless or with paper for some elements.

WSDOT has utilized Primavera Contract Management to manage requests for information (RFI) and submittals on larger projects. The downside was that contractors did not have access to this system, so they were still using email. Oracle Unifier will be used for contract management, Inspector Daily Reports (IDR), and field note records. Project managers (PM) or regions will determine whether a project will utilize these systems on projects. WSDOT is in the process of migrating data from Contract Management to Primavera Unifier. Use is not specified in bid documents, and is left to the discretion of the WSDOT PMs.

## 3.2 Michigan DOT e-Construction Overview

MDOT began significantly advancing its e-Construction effort in 2012. At that time, MDOT already had in place electronic plans and proposals, contract administration software (FieldManager), and electronic bidding (Bid Express).

MDOT recognized several areas that required processes to move toward a paperless system:

- Digital Signatures
- Mobile Devices
- Document Management & Outside Access (including electronic plans & proposals, contract administration software, and electronic bidding)
- e-Publications & Online Manuals
- Mandatory Contract Requirements (specifying electronic documentation as mandatory for contracts, including deadlines for implementation)

MDOT noted that having subject matter experts who understand the processes in construction and the business process was critical to developing a successful system. MDOT found that the software development part was easy, but its developers needed access and commitment from the business practice experts who could provide reference for the elements. MDOT is working with the IT agency to investigate the use of external cloud storage for documents.

**Digital Signatures**
MDOT has implemented CoSign as its approved digital signature provider. MDOT provides access to the CoSign process to contractors, consultants and local agencies. The system provides validation of all signatures. MDOT does not currently allow ink signatures on any documentation for projects that are implemented electronically. MDOT received approval for use of digital signatures through the Michigan Attorney General.

MDOT still requires contractors to manually sign bonding information, which is then stored electronically in ProjectWise.

**Document Management**
MDOT uses ProjectWise for document management, which has a central storage on MDOT servers – it is not in the cloud – and has back-ups in case of emergency or damage to existing servers. The key to the whole process is the "single source of truth" element, which ensures that all parties are looking at the same version of a piece of data, which is stored only once. ProjectWise is accessible to users 24/7 through the client server log-in. Users only have access into the secure areas where they have been granted access. MDOT provides access to contractors through MDOT's ProjectWise license.

**Mobile Devices**
MDOT implemented mobile devices in 2012 and provided 600 iPads to its staff. All devices are cellular-enabled, although there are connectivity challenges in certain areas of the state.

MDOT inspectors who use iPads still require laptops for other job functions such as timecards. In areas with poor cellular coverage, MDOT has identified "truck modems" that can be used to improve signal access to

multiple inspectors on a rural project. This application was a result of collaboration with the state IT division, who works with both the DOT and the Michigan State Police.

Every individual is provided an Apple ID, which has no payment method attached so users are not able to purchase apps. State-issued device users are only allowed to access certain apps.

**As-Builts**
MDOT has an initiative to look at culvert assets as a first step. The agency is looking at ways to apply as-builts into an asset management system, and would like to replace the process of scanning 2D as-built files with electronic mark-ups.

The contractor is responsible for providing as-builts for a project. MDOT observes that the quality of as-builts varies widely from contractor to contractor. Generally, the contractor is printing the plan files, marking them up, then scanning back to ProjectWise. There are some contractors who perform this activity in Bluebeam or other software. The files are reviewed for general quality assurance (QA)/quality control (QC), marked as complete, and stored in the applicable ProjectWise folder.

## 3.3 MDOT IT

Michigan has a centralized IT division; IT staff are State employees and are assigned to various departments. Michigan implemented AASHTOWare prior to 2000 and is now looking to migrate to the web-based version, AASHTOWare Project. Michigan will implement one contract with AASHTOWare Project for risk mitigation to allow for observation and prevention of payment delays to contractors. Michigan is deliberately using a slow implementation approach to ensure adequate observation time and to maximize implementation of system elements.

MDOT IT has approximately 12 staff total who support FieldManager, Contract Administration System, AASHTOWare Project, and user acceptance testing. Many members of this team participate on AASHTOWare user groups. Users spend a considerable amount of time understanding exactly how and why the processes work and how to use the tools effectively. Some IT staff are writing the code, and as upgrades are pushed from AASHTOWare, MDOT must maintain all the customizations they have designed. MDOT has developed many custom reports. There are also two MDOT IT staff who support the IT side of ProjectWise (server configuration/setup, firewall connections, etc.).

MDOT IT does testing, support, development, and some project work. MDOT and MDOT IT utilizes student interns and co-ops for part-time yearly and summer work.

## 3.4 MDOT and AASHTOWare

MDOT shared a demonstration with the group. MDOT developed FieldManager in collaboration with InfoTech and have joint ownership of the system. Michigan initially assisted in the development of FieldManager and its system pre-dates SiteManager.

Contractors are provided access through FieldManager Contractor, where they have controlled, role-based access to various functions. In addition, MDOT can provide performance evaluation information on contractors through FieldManager, which is also tied to the contractors' prequalification data.

Some functionality of FieldManager includes:

- Entry of IDRs & Daily Work Reports
- Upload of those reports electronically
- Creation of PDF reports for manager signature
- Upload of data to Central Office for contractor payment

MDOT's Quality Assurance Manual is the materials handbook – it describes all processes and standards and is updated annually. Contractors are mandated to provide the Material Source List (MSL) Form 0501 at the beginning of the project and must continually update it. MDOT contractors do their own QC and submit their QC plan for approval from MDOT. Materials acceptance requirement forms and payment authorizations are performed through FieldManager with resource and support documentation coming from ProjectWise.

MDOT has a single sign-on where users provide credentials and are directed through AASHTOWare and other programs. Users are assigned roles and can have multiple roles and are granted access to various roles through an administrator.

MDOT shared AASHTOWare Project Construction Materials demonstration with the group. AASHTOWare Project Construction Materials is the web-based updated version of AASHTOWare SiteManager/FieldManager and includes a Construction module and a Materials module. MDOT is migrating its FieldManager system to Construction Materials. MDOT is implementing Construction Materials by phases because it is a major undertaking.

When a user submits a workflow item, the next-level approver will receive an email with a link to the submittal or that approver can view the items requiring his or her attention.

One major advantage of AASHTOWare Project is that it is "data" driven as opposed to "PDF" or "document" driven, as PDFs and document files are e-paper. The data can be analyzed and reviewed in various modes as opposed to data being downloaded onto PDFs and stored or transmitted as e-paper or electronic files.

MDOT noted that the Materials module requires a lot more development and configuration than the Construction module. MDOT's FieldManager and Construction Materials modules work with the AASHTOWare Project Preconstruction module.

One challenge is maintaining materials sources data; for example, system admins can add suppliers and make them obsolete. Obsolete suppliers are not deleted from permanent project records, but cannot be used as suppliers on new project records. This is necessary as there are so many company buy-outs and company name changes and allows the records to represent a single data source for individual suppliers even though a different display name may be included.

MDOT noted that the Materials module is highly customizable, both from the IT perspective and from the user perspective. Both IT and admin users can configure fields and business processes based on the level of customization/configuration required.

AASHTOWare stores documents, links (data) that are uploaded to it on MDOT's AASHTOWare database on MDOT servers.

All MDOT Office Technicians must be trained and certified as AASHTOWare users. They have yearly classroom training sessions and are planning to implement a web-based training program in the future. MDOT currently has multi-tier help desk support available, which includes a support level that provides access to InfoTech support specialists.

## 3.5 Michigan Infrastructure and Transportation Association (MITA) Perspective on e-Construction

MITA began to introduce InfoTech FieldManager Contractor to its contractor members as MDOT implemented FieldManager. MITA worked with InfoTech to identify three key challenge areas that the contractors were dealing with:

1. Accuracy of data
2. Efficiency of processing data
3. Timeliness of payment processing

Stakeholders also noted that the biggest key to success for implementation would be an electronic filing cabinet. Use of e-Construction has also encouraged more competitive bidding. Prior to 2005, MITA received calls from contractors complaining about a lost piece of paperwork was holding up their payments.

Lessons learned:

- **Be solution-oriented**: Michigan has committed to partner with MITA and be solution-oriented
- **Consistency is key**: Lack of consistency between projects with different naming conventions, filing locations, etc. caused significant challenges for contractors.
- **Champions are necessary**: Someone needs to serve as the primary point of contact and obtain buy-in across an agency and external to the agency.

On the initial pilot project, MDOT replaced 26 miles of highway/interchange within a single construction season (four to five months) and processed payments of $1 million per week. e-Construction was specified in the contract documents and communicated in a mandatory pre-bid meeting. The contractor community worked to implement MDOT's e-Construction technology and tools and to collaborate with MDOT.

There were some challenges, such as some of the smaller contractors required more time to familiarize themselves with the technology. But the contractors involved were so pleased with the payment processing that they all said they never wanted to go back to the standard paper system.

MITA recommends having an internal champion to move things along internally and be the voice and sales person internally to get buy-in from all levels. e-Construction has created a more collaborative process and adjusted claims processing by eliminating at least one step.

It has also encouraged construction parties to resolve disputes at the project level instead of pushing through a claims process. It has also fostered a more transparent process to allow for checking of a "paper trail" and more simplified and accurate ways to audit the process and check for accountability on processing.

Contractors also need access to electronic systems for submittals. MDOT's shop drawing review process:

- Contractor uploads shop drawing to ProjectWise
- An email is generated to the office technician that the shop drawing has been uploaded
- The office technician adjusts the status of the pdf file in ProjectWise
- The office technician sends an email to the required reviewing parties
- Reviewing parties provide comments, and applicable notification is sent to the contractor

A special provision in project contract documents states the final legal project files are those housed in ProjectWise.

Q: What is the future of e-Construction?
A: Participants shared their perspectives:

- Automated Machine Guidance technology: MITA is seeing a lot of contractors have access to GPS guided machinery to allow for stakeless grading.
- Building Information Modeling (BIM): Using a 3D model to confirm inspection details, perform clash detection, and provide for instant access and transmittal of approvals and reports provides for greater efficiencies.
- Augmented Reality: There are challenges working outside with a virtual reality headset, things as simple as the lighting and ability to see the images on the lens.

Q: Is safety an issue?
A: Participants shared their perspectives:

- There have been improvements since there are not as many opportunities for individual injuries for survey staking, etc. based on the need to be on site.
- Less driving between work sites, offices, etc. have decreased potential for driving accidents.

## 3.6 MDOT's Use of FieldManager, FieldBook, and Mobile Inspector

FieldBook is the program available for offline use on laptops; however, it does not work on iPads. MDOT is pushing out Mobile Inspector, which works with the AASHTOWare Project suite for IDR Report. Mobile Inspector app is free, but you pay for the sync service through AASHTOWare. Mobile Inspector is device neutral and can be used on mobile devices and laptops.

MDOT shared a Mobile Inspector (laptop version) demonstration with the group, with the following highlights:

- Weather information and data comes from pre-approved sources and preloaded weather condition information.

- Pay items are auto-populated.
- If inspectors need to add an item on the fly, they can quickly contact the system admins who can add immediately and it will be available back to the inspector within a few minutes.
- If a new subcontractor shows up, that information can be added, similar to adding items.
- Inspectors can work all-day offline in areas with no connectivity. Once they reach a connected area, the information will automatically upload and any system updates will automatically download.
- Photos can be uploaded using the device camera.
- Mobile Inspector was designed to be used as a simple IDR data collector.
- Most inspectors reconcile quantities daily on the jobsite.
- The only data not generally made available to the contractors is the contractor performance evaluation data.
- New estimate data is live, the contractors do not have to wait two weeks for the estimates.

Typical MDOT project staff includes:

- Construction/Resident Engineer (responsible charge, and signs off on it)
- Project Engineer (formal or cursory review)
- Office Tech (responsible for managing the inspector daily reports and AASHTOWare)
- Inspector

FieldManager is designed around pay items. Project correspondence is collected and stored in ProjectWise. There are multiple saved reports that are stored and available through FieldManager. AASHTO controls the release of AASHTOWare. Info Tech is the consultant hired by AASHTO to manage and develop the suite of products. For help and support, MDOT manages most help support for general functionality and a certain level of programming; help and support for more robust programming and software issues is managed through Info Tech.

## 3.7 MDOT's Use of Other Apps

Some MDOT construction offices have found useful apps and share that information with other offices. There is no set list. The offices have had issues with some apps where an iOS update had been pushed and the apps they are using were not yet compatible with the latest version of iOS.

MDOT is investigating Bluebeam; the agency has approximately 50 licenses, for both the design division and construction division. Designers started a Bluebeam pilot for milestone reviews. MDOT is also moving toward a single-plan PDF as opposed to single-plan sheet PDFs.

MDOT field staffers are only using paper for materials/delivery tickets. They are reviewing e-ticketing options.

FHWA hosted a virtual webinar on Iowa DOT's e-Ticketing process:
https://www.fhwa.dot.gov/construction/econstruction/peer_exchange/archive.cfm

## 3.8 WSDOT Site Cameras

WSDOT uses OxBlue for time-lapse photography of construction sites for various projects as appropriate. https://oxblue.com/

WSDOT owns some cameras and pays monthly fees for various services. WSDOT manages the use of the cameras themselves as opposed to specifying the contractors to do so. In other instances, WSDOT may include providing and operating cameras in construction contracts.

## 3.9 MDOT's Use of ProjectWise

File structure for projects on ProjectWise is standardized for all projects statewide and set up at project inception, including design files. Very few people at MDOT have permissions to edit folders, structure, etc.; it is an extremely secure system. When folders are set up, permissions are automatically assigned to internal and external users. The FHWA has access to certain levels of files through ProjectWise to review or sign files.

MDOT uses single sign-on for internal ProjectWise users (connects to State of Michigan's active directory) and creates accounts and passwords for external users, including contractors.

Standardization of files and naming conventions is an extremely important benefit of e-Construction. MDOT has created an Internal Files Only folder that is not available to external users. All users can add files to folders to which they have access. When added, no one is notified that the files have been added until the user selects "Change State" on the file menu, which then automatically populates an email to the pre-determined parties with notification. (If they do not select Change State, the next level reviewers are not notified.) Once the parties are notified via email, they can click on the link in the email to go to the file location in ProjectWise.

Use of ProjectWise has created a very strong audit trail to show who has access to what documents and at what time; who has been notified; who has read, opened, or modified the file; etc. MDOT keeps its backups for 30 days. The audit trail can also be used to recover copies of files that were deleted or modified by mistake. Auditors can be granted permissions to view and access only the files to which they need access.

ProjectWise does not eliminate the need for person-to-person communication. However, by contract documents Special Provision, use of ProjectWise is specified as MDOT's document management system. Consultants, design and construction, are also granted access to ProjectWise, which includes detailed design data and information in addition to the contractor-related project files. MDOT has approximately 6,000 ProjectWise users; however, the DOT only pays for the number of users who are accessing the system. ProjectWise data is stored at the State of Michigan's server farm and locally at individual office servers; all servers are protected MDOT-owned servers, behind the firewall. External users must enter the system through three firewalls.

Keys to success for ProjectWise:

- Standardized file naming conventions are critical
- Contractors must understand the process and what they have agreed to in the Special Provision, including that the electronic files stored in ProjectWise are the official project document record

- The audit trail is beneficial for both official and non-official auditing functions, including file back-ups and recovery
- Internal and external users must understand that ProjectWise is the official document storage location and project record
- MDOT had already purchased ProjectWise under an enterprise-wide license agreement under its Design section, and making use of existing tools where applicable can be efficient, though the existing tools should not be forced into the process if something else works better.

Michigan uses ProjectWise as its back-end storage.

MDOT's ProjectWise support external site: https://mdotjboss.state.mi.us/SpecProv/projectwisesupport.htm

## 3.10 MDOT's Project Plan PDF Pilot

Milestone reviews can be completed through Bluebeam on a single plan view. MDOT is piloting these on multiple projects and can be accessed here: https://mdotjboss.state.mi.us/SpecProv/trainingmaterials.htm (go to All-Pilots then under Project PDF).

MDOT has also created a layering system accessible through Adobe where users can view the single plan sheet and turn layers/levels on and off for various views, which is now a contractual requirement for design. MDOT is realizing significant file size reductions based on this new method, which can also realize a file storage cost savings.

## 3.11 FHWA Device Pilot Program

As part of the FHWA Device Pilot Program, Rob Fijol, FHWA Michigan Division, was provided an iPad to use for applications such as contract modification approvals. The pilot program ended over a year ago, but Rob is still using his iPad and apps are still being used and refreshed. Users experienced some initial challenges with using a personal identity verification (PIV) card on the Apple devices due to lack of a DOT configuration for a card reader.

PIV card use is now enabled and the tablets provide benefits to daily work activities, especially in the field. Users have realized considerable time savings based on use of e-signatures alone. Rob approached office processes to eliminate paper, including contract modifications and general e-signatures.

As excerpted below in Table 1 from the FHWA Division Office e-Construction Pilot Final Project Report, the FHWA Michigan Division Office has realized the following savings:

**Table 1. Performance Measures Reported by Michigan Division Office (Combined Totals).**

| Performance Measure | Measured Values from 1/1/16 through 11/30/16 |
|---|---|
| Number of paper plan sets eliminated through access to electronic versions via tablet | 74,600 pieces of paper (based on 200 pages per plan set) |
| Change order approval time savings (estimated hours) | 44 hours saved |
| Number of times electronic files are accessed from the field due to increased availability of data (data plan use) | 1449 times files accessed |
| Number of hours of tablet use | 1873.5 hours of use |
| Number of documentation photos taken using tablet | 35 photos taken |

## 3.12 Transportation Asset Management Systems

**Michigan Asset Management System**
MDOT is using Vueworks, a commercial-off-the-shelf product from Data Transfer Solutions, LLC.

MDOT has a service request portal that can be used through tablet and other devices to request maintenance or repair of a damaged asset. MDOT has pre-populated most of the work order items, which can also be used for reporting and cost estimating purposes.

MDOT encourages its staffers to enter the asset data into the system while on site, when the information is fresh in their minds and easily accessible. Condition analysis is especially useful for data analysis and reporting purposes. MDOT may look at using LiDAR for asset collection and management.

MDOT uses a Road Analyzer SLD (Straight Line Diagram) program is tied to Google Maps updated street view imagery.

MDOT is still working to overcome the fear of technology for maintenance applications. The e-Construction approach has helped push this embracing of technology throughout MDOT.

**WSDOT Asset Management**
WSDOT uses Highway Assets Tracking System (HATS), an internally developed system that is integrated with ESRI. HATS has been up and running for three to four years. WSDOT has designated individuals within each region to act as trainers and SMEs. WSDOT IT has two developers who manage the programming, maintenance, assist with training and upgrades, etc. WSDOT just purchased 900 iPads for maintenance, inspection, inventory purposes. Maintenance staff has embraced the iPads and has been using them for multiple purposes outside of maintenance and inventory.

# 4. Conclusion

The peer exchange concluded with a roundtable discussion on how each participant anticipated using the information shared in the future. WSDOT and MDOT plan to follow up in the future to share insights, lessons learned, and other information as future applications such as maximizing use of ProjectWise.

## Appendix A – e-Construction Peer Exchange Agenda

**Michigan DOT and Washington DOT**
**e-Construction Peer Exchange**

**Aeronautics Building**
**Executive Conference Room**
**2700 Port Lansing Road**
**Capital City Airport**
**Lansing, Michigan 48906**
**517-335-9283**

| Day 1 – January 30, 2018 | | |
|---|---|---|
| Time | Topic | Presenters / Facilitators |
| 8:00am – 8:30am | Welcoming Remarks and Introductions<br>Peer Exchange Background and Overview<br>Goals and Objectives | Matt DiGiovanni – FHWA<br>Heather VerHage – Michigan DOT<br>Dan Burns – Michigan DOT<br>Neal Uhlmeyer – Washington DOT<br>Tom Zagorski – Michael Baker Int'l |
| 8:30am – 9:15am | Background on Washington DOT's e-Construction Systems – Document Management, Digital Signatures, Field Data Collection | Neal Uhlmeyer – WSDOT |
| 9:15am – 10:15am | Michigan e-Construction Overview<br>• Evolution to Paperless<br>• e-Construction Architecture | Stu Laakso, MDOT |
| 10:15am – 10:30am | Break | |
| 10:30am – 11:30am | Field Systems Implementation / Training / Support / Maintenance Round Table | Deb Mosher, Diane Jadzinski, and Dan Burns, MDOT |
| 11:30am – 12:45pm | Lunch (on our own) | |
| 12:45pm – 2:30pm | Materials Management – Data Collection and e-Construction Integration<br>• AASHTOWare Construction and Materials Phase I & II | Matt Bellgowan, Marty Foster, & Dan Burns, MDOT |
| 2:30pm – 2:45pm | Break | |
| 2:45pm – 4:00pm | Contractor Perspectives on e-Construction<br>• How MDOT Obtained Industry Buy-In<br>• How e-Construction Has Benefitted Private Industry<br>• Contractor Ideas for Future e-Construction Implementation | Dan Burns, MDOT<br>Glenn Bukoski – VP of Engineering Services & Rachelle VanDeventer – VP of Industry Relations, Michigan Infrastructure and Transportation Association |
| 4:00pm | Adjourn | |
| Dinner on our own | | |

| Day 2 – January 31, 2018 | | |
|---|---|---|
| Time | Topic | Presenters / Facilitators |
| 8:00am – 10:00am | Review of e-Construction Mobile Devices (iPad)<br>• Inspection Documentation and Daily Work Reports<br>• Apps in Use in the Field<br>• Typical Inspection Data Processes | Jordan Wirth & Dan Burns, MDOT |
| 10:00am – 10:15am | Break | |
| 10:15am – 11:00am | Data Collection and Storage Using Collaborative Project Sites (ProjectWise)<br>• File Structure and Naming Conventions<br>• User Access & Contractor/ Consultant/FHWA Input<br>• Workflow Examples and Demonstration<br>• Forms and Signatures<br>• Document Retention Policies/Solutions | Stu Laakso, MDOT |
| 11:00am – 1130am | Discussion on FHWA Division Office Pilot Program for Tablets | FHWA/All |
| 11:30am – 12:45pm | Lunch (on our own) | |
| 1245pm – 1:45pm | Information Technology Security Discussion<br>• Enterprise Architecture – How Was the Solution Implemented?<br>• PMO, Project Delivery, Document Mgmt. Software<br>• Use of Cloud-Based Services for Storage and Data Security<br>• End User Experience, Feedback, and Continuous Improvement | Heather VerHage & Andy Esch, MDOT |
| 1:45pm – 2:30pm | Enterprise Wide Asset Management at Michigan DOT | Justin Droste, MDOT |
| 2:30pm – 2:45pm | Discussion on Takeaways for Implementation | Tom Zagorski, Michael Baker International |
| 2:45pm – 3:00pm | Closing Remarks, Feedback on Peer Exchange, and Next Steps | All |
| 3:00pm | Adjourn | |


U.S. Department of Transportation
Federal Highway Administration

## Appendix B – e-Construction Peer Exchange Roster

| Name | Agency |
|---|---|
| Jacob Armour | Michigan DOT |
| Matt Bellgowan | Michigan DOT |
| Glenn Bukoski | Michigan Infrastructure and Transportation Association |
| Dan Burns | Michigan DOT |
| Matt DiGiovanni | FHWA Resource Center |
| Justin Droste | Michigan DOT |
| Andy Esch | Michigan DOT |
| Rob Fijol | FHWA Michigan Division |
| Marty Foster | Michigan DOT |
| Larry Gruginski | Washington DOT |
| Michele Horak | Michael Baker International |
| Diane Jadzinski | Michigan DOT |
| Stu Laakso | Michigan DOT |
| Rob Molohon | Washington DOT |
| Deb Mosher | Michigan DOT |
| Steve Solak | Michigan DOT |
| Chris Tams | Washington DOT |
| Neal Uhlmeyer | Washington DOT |
| Rachelle VanDeventer | Michigan Infrastructure and Transportation Association |
| Heather VerHage | Michigan DOT |
| John Wilkerson | Michigan DOT |
| Jordan Wirth | Michigan DOT |
| Tom Zagorski | Michael Baker International |