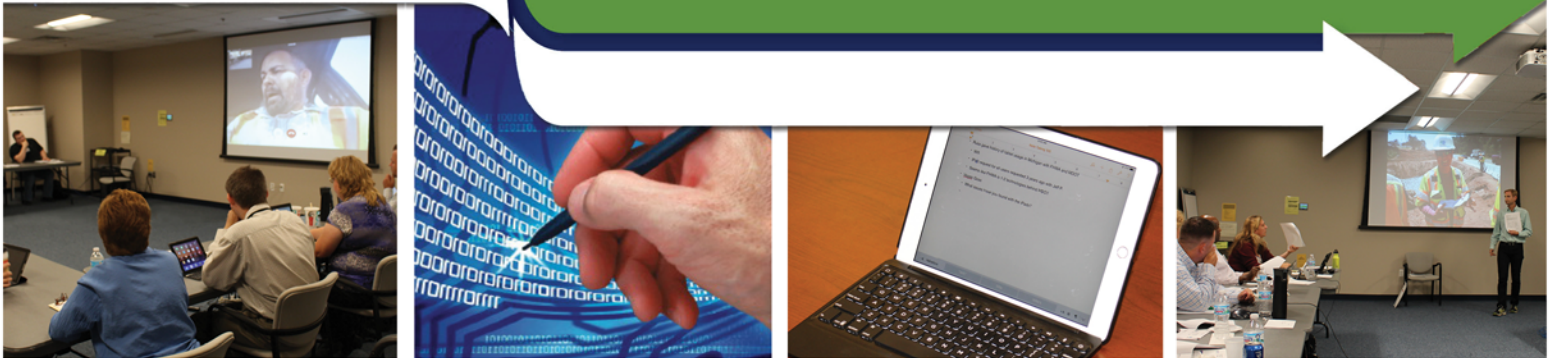# e-Construction
PEER-TO-PEER EXCHANGE

Summary Report

Michigan Department of Transportation and
California Department of Transportation

June 27-30, 2016
Lansing, MI

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1. Background

The Michigan Department of Transportation (MDOT) hosted a peer exchange with the California Department of Transportation (Caltrans) in Lansing, Michigan, on June 27–29, 2016. The peer exchange focused on e-Construction, which is defined as paperless construction administration delivery processes that include electronic submission of construction documentation by stakeholders, electronic document routing and approvals (e-signatures and digital signatures), and digital management of construction documentation in a secure environment that allows distribution to authorized project stakeholders through mobile devices. The Federal Highway Administration (FHWA) sponsored the event, and representatives from FHWA Headquarters, Resource Center, and each participating State's Division Office participated in the event.

The agenda was designed to follow a logical construction project delivery process (see Appendix A for the full agenda), beginning with the need for e-Construction technologies and associated training requirements and maintenance of tools and technologies. MDOT provided a thorough presentation on AASHTOWare software tools, including the current implementation of AASHTOWare Project Construction and Materials module. The second day included demonstrations for project collaboration sites (SharePoint and ProjectWise), discussion on tools for labor compliance management (LCPTracker and AASHTOWare Project Civil Rights and Labor), materials management, mobile devices (iPads and Windows-based tablets), and contractor perspectives on e-Construction from the Michigan Infrastructure and Transportation Association (MITA). Participants discussed information technology (IT) security, enterprise-wide asset management, and e-Ticketing concepts on the third day, and the peer exchange concluded with discussion on key concepts for implementation and the future direction of e-Construction in Michigan and California.

The event also included a presentation and discussion session on a current FHWA pilot project to deploy mobile devices in 10 FHWA Division Offices in Iowa, Florida, Michigan, Missouri, North Carolina, Pennsylvania, Texas, Utah, Virginia, and West Virginia. The purpose of the pilot project is to assist FHWA engineers and inspectors by enhancing e-Construction efficiencies and increasing access to real-time data in the field. In addition, this pilot project ensures that Division Offices are able to also apply e-Construction in conjunction with the evolving business practices of their State DOT partners. FHWA users are piloting the iPad Air 2 (Florida, Iowa, and Michigan) and the Surface Pro 3 (all other offices) .

This peer exchange was the seventh in a series designed to assist States with implementation while enabling peers to network and share information across State departments of transportation in a relatively small group setting. The list of attendees (representing construction and IT personnel), along with contact information for each, is provided as an appendix to this document to promote further networking among participants.

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, 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 Caltrans also shared presentations given at the peer exchange.

MDOT and Caltrans shared links to policies, manuals, and specifications for construction that include application of e-Construction and requirements for electronic submittals, documentation, and pilot and final specifications. Documentation provided includes application of electronic bidding; construction inspection form creation, management, and storage; application of digital signatures; and mobile device policies and procedures.

> Link to MDOT's e-Construction Wiki site:
> http://mdotwiki.state.mi.us/construction/index.php/E-Construction
>
> Link to MDOT's pre-Construction ProjectWise Submittal Processes:
> http://mdotwiki.state.mi.us/design/index.php/Design_Submittal_Requirements
>
> Link to Caltrans Standard Specifications for Construction:
> http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2015_StdSpecs/2015_StdSpecs.pdf (Section 2 includes electronic bidding specifications, Section 7 includes specifications for electronic payroll submittals)

For contract change orders, **Caltrans developed a policy that requires electronic submission of extra work bills electronically** to the resident engineer. Validating and verifying electronic extra work bills for correctness before sending them allows bills to be processed more efficiently than previous paper-based processes. This electronic system has also eliminated delays associated with mailing paper documents.

> Link to Caltrans Extra Work Bills (iEWB) system
> webpage: http://www.dot.ca.gov/hq/construc/iewb/

MDOT developed a pilot version and production version of an e-Construction Special Provision. The special provision restricts the use of paper submittals and addresses digitally encrypted signatures and contractor access to and use of ProjectWise.

> Link to MDOT Special Provision for Construction Document Management:
> http://mdotcf.state.mi.us/public/dessssp/spss_source/12SP-104E-01-w13.pdf

MDOT uses a software package called LCPTracker for **managing certified payrolls and other labor compliance–related documents, including Davis-Bacon Act wages**. Participants also discussed the potential for use of the **AASHTOWare Project Civil Rights and Labor module**. MDOT and other

agencies can utilize LCP Tracker to verify submissions and complete first level audits for compliance with Davis-Bacon and related Acts. Contractors can use these software tools to document and submit certified payroll information to the owner agency.

> Link to information on LCPTracker software application:
> http://www.lcptracker.com/

> Link to AASHTOWare Project Civil Rights and Labor Module:
> http://www.aashtoware.org/Project/Pages/Civil%20Rights.aspx?PID=8

MDOT provided a presentation on the structure of AASHTOWare software development and associated costs, including how States purchase service units for consulting support on software and for customization. MDOT assisted AASHTO early on with development of FieldManager and has used the software since inception. Other States have implemented SiteManager in parallel, while MDOT customized FieldManager for application in Michigan.

> Link to AASHTOWare Project FieldManager Software:
> http://www.aashtoware.org/Project/Pages/FieldManager.aspx?PID=13

MDOT developed several e-Construction videos and posted them on YouTube for use by stakeholders and to foster industry buy-in on the concepts.

> Link to video on construction on the 96 Fix project:
> https://www.youtube.com/watch?v=ScB1b3fqjQo

> Link to video on the e-Construction Process at MDOT:
> http://youtu.be/HAbYgqgnyB8

> Link to video on mobile devices in the field:
> http://youtu.be/y_9XCy2IQ2w

Caltrans noted that a local company "PlanGrid" produces **an application that allows users to view and organize construction plans on the iPad and Android and Windows tablet devices**. The app allows users to annotate plan sheets on mobile devices, with synchronization across multiple team members on details that are linked directly to the plans.

> Link to PlanGrid website (software is available in the app stores):
> https://www.plangrid.com

> Link to *Wall Street Journal* article with references to application of the iPad to highway construction:
> http://www.wsj.com/articles/apples-ipad-pro-hopes-to-win-over-pc-users-1459137661

State agencies are using Cloud service providers to store data, and the Federal Government provides guidance on how to participate in and understand the Federal Risk and Authorization Management Program (FedRAMP).

> Link to FedRAMP Information and List of Compliant Cloud Systems:
> https://www.fedramp.gov/marketplace/compliant-systems/

3. Peer Exchange Discussion Notes

This section provides additional notes following the organization of the agenda. Question and answer sessions followed each presentation and demonstration (labeled "Q" and "A" in the notes). As noted in Section 1, the full agenda for the peer exchange is included as an appendix to this document, along with a roster of participants with contact information for each attendee.

Cliff Farr kicked off the peer exchange by facilitating group introductions and also provided an introduction to Michigan DOT and some of the topics to be explored during the peer exchange. MDOT IT personnel are housed within the State's overall IT organization, while Caltrans has IT personnel dedicated solely to the DOT. Caltrans representatives noted that they started an innovation office during the 1990s and developed some of the systems in use today. Caltrans also implemented a survey of States to gather information on e-Construction practices, namely mobile device use and programs in use for document management. Kat Weisner introduced the Every Day Counts (EDC) Program and e-Construction's application to EDC-3 and EDC-4 and noted some synergies with Partnering as related to use of e-Construction technologies.

Jason Gutting, Construction Field Services Division Administrator with MDOT, provided opening remarks on the construction program in Michigan. Several employees are new to their roles at MDOT and the atmosphere is one of excitement for future activities, specifically implementation of technologies. Michigan has 9,700 route miles and 4,800 structures across the State, and is divided into seven regions. Reconstruction costs are two to three times higher than rehabilitation costs as average per lane mile for 2016. Michigan and Caltrans both manage a large number of local agency projects, and in California, the local agencies will administer projects on the State highway system. MDOT administers funding, oversight, and implementation of all local agency projects. Local agencies have the option to use e-Construction systems and industry, as well as MDOT staff engineers, which is a primary catalyst for local agency use of technologies and the move toward paperless construction. MDOT's focus is on innovation and technology application to maximize efficiencies in construction program implementation using existing staffing resources.

Kat Weisner with FHWA outlined the EDC process for nationwide implementation of paperless construction. The focus for EDC-4 is on capturing data, electronic submission of forms including the Inspector Daily Report (IDR) entry and digital signatures. FHWA is interested in ideas for EDC-4 e-Construction implementation; one linkage is to local agency projects. In Michigan, an issue is how to get local agencies to use MDOT prequalified consultants, which requires investment. Local agencies are also becoming direct recipients of federal funds.

3.1 Exploring State Presentation – Caltrans e-Construction Status and Plans

Caltrans has about 18,000 employees split between project delivery and maintenance. The chief engineer is responsible for the majority of project delivery, which includes design, engineering services, environmental analysis, project management, and right-of-way. This organizational structure is similar to MDOT with a larger organization. Caltrans is currently administering over 800 construction projects valued at $8.7 billion. Caltrans is also piloting innovative procurement processes such as design-build. We are currently administering nine design-build contracts. In addition to these projects, there are projects on the State highway system where Caltrans provides oversight, including large projects at the Port of Long Beach, in Riverside County, and the recently completed widening of the 405 freeway in Los Angeles. These design-build oversight projects are valued at over $1 billion each. Support costs to develop, design, and administer are approximately 33% of the total project cost, with construction accounting for approximately 15% of total project cost. Caltrans is working to reduce support costs and looking at innovations such as tablet devices to help reduce support costs by having plans, cross-sections, and other documentation on the tablet device.

Caltrans has a uniform construction filing system with 63 categories that allow for consistent project administration. This helps with future reference to documents and audits as needed. Caltrans has engineers in the field making field observations and daily reports, while technicians handle most testing. The resident engineer will have assistants on a project, depending on the size of the project. MDOT uses summer co-op students to assist with documentation for projects, saving costs over other classifications. Caltrans is working to digitize the process of capturing notes in the field with the intent to eliminate the need to transfer notes to daily reports later. These engineering observations are used for checking labor compliance and force account billings.

Caltrans creates rental rates and cost-of-ownership codes for equipment that is similar to the Blue Book process. All local agencies in California use the Caltrans rates. In the field, engineers can use these codes to identify the contractor's equipment on their daily reports which helps in the review of change order billings. These codes also allow staff to perform calculations for daily costs for claims, contract item adjustments, and to estimate project expenditures. The rates are updated annually, and one engineer manages this entire process. The calculations are automated, and a printed book is available. Caltrans uses an electronic billing system for change order billing where the contractor enters equipment codes in an online system (iEWB) in order to submit change order billings.

Caltrans is moving toward e-Construction and is looking at eliminating paper copies of the project related documents by providing field staff with a tablet device preloaded with key project documents. This pilot is being conducted on eight projects of various size and complexity.   In addition, Caltrans is piloting two daily report applications (Headlight by Pavia and a department developed application using Filemaker-Pro). Headlight by Pavia, allows users to enter "observations" which can be tagged with user defined attributes. The Headlight application captures observations that can be associated to bid items, contractor's, and can also be "tagged" with user defined attributes. Headlight allows users to filter entries by user, item, contractor, as well as other criteria. The Caltrans developed application has the look and feel of the traditional paper daily report but improves upon the paper version in that daily report entries are facilitated by the use of pull down menus for labor, equipment, and contractor. The narrative section can take voice dictation (when connected to the internet through Wi-Fi or LTE) and it includes the ability to attach photos and files to the daily report. In addition, item pay quantities can be entered directly in the daily report and then subsequently rolled up into a monthly summary for the pay estimate. In 2000, Caltrans created an electronic billing system that allows contractors to submit time and material work bills through the internet with fields that prepopulate information. Caltrans then compares the daily reports with the electronic billing system to ensure proper justification of payments. This system is an Oracle database, with a front-end system using Java and an older Oracle system.

Caltrans has a legacy system, developed in Cobol that is used for managing contractor payments. In 2005, a review was performed and the determination was made to build an internal progress payments system. Testing in 2014 showed major issues and the project was cancelled. Caltrans reverted back to the original system, but the tablet device pilot is a point of entry to work toward e-Construction. Change order documentation management is also an area of focus, along with implementation of digital signatures for workflow approvals using authentication practices based on login information.

Q: Does Caltrans rental rate book cover automated machine guidance or other attachments to equipment when used for force account work?
A: The cost of ownership rates are developed for each piece of equipment and all attachments, so rates for machine guidance would be added to the base rate for any particular piece of equipment.

Q: In Michigan, item and material associations are planned for linkage so that inspector enters a work item and the materials prepopulate. Item payments are then made when documentation is in order. How does Caltrans make payments on materials and work items?
A: Caltrans is paying by the unit for materials (such as ton); mix designs would be approved ahead of time and the ticket from the plant would reference the specifications from the asphalt plant. If incorporated without appropriate verification ahead of time, the contractor payment may be at risk. Testing for materials can occur at the source, state testing facility, or inspected and released on site depending on the material.

3.2 Host State Presentation – MDOT e-Construction Overview

Cliff Farr and Stu Laakso with MDOT provided an overview presentation on e-Construction practices in Michigan. MDOT has a 4-year time frame from financial closeout for document retention records. For National Environmental Policy Act (NEPA) evaluation and FHWA project documentation requirements, 25 years may be required. MDOT has used ProjectWise in design for years. Lost documents in construction was the primary motivation for implementation of e-Construction. Design has led the technology deployment, and construction benefitted from this implementation.

MDOT was using FieldManager, electronic bidding, and electronic plans and proposals. Given its successes with previous automation efforts, MDOT implemented FieldManager at the same time that SiteManager was being developed in the 1990s. Instead of printing to paper, MDOT printed documents to Portable Document Format (PDF) and stored the files in ProjectWise (the MDOT enterprise-wide document management system). Online guidelines and publications proved to be an integral part of e-Construction implementation for MDOT. A primary step in the process relied on breaking the reliance on paper. MDOT has a special provision for e-Construction that requires electronic submission of documentation by all stakeholders, and Construction Manager/General Contractor (CMGC) and design-build project management is also being implemented in the same way. Items can be tracked as a main contract with items, and a shadow contract is built in FieldManager (using FieldBuilder) with items and unit prices. The shadow contract shows a percentage complete, and payments are made based on the main contract.

At a mandatory pre-bid meeting for implementation of the special provision for use of e-Construction, MDOT explained the process to contractors and the requirements for future projects. MDOT implemented four pilot projects for e-Construction totaling approximately $135 million. These pilot projects began in October 2012. ProjectWise has a search tool to find documents that were mistakenly added to an incorrect contract folder. Users of ProjectWise can request that a PDF file be generated (a custom application titled "Make PDF Request") using InterPlot software from Bentley.

Allowing outside organizations to access systems within the firewall was challenging for MDOT, and buy-in from leadership within the department made it possible for solutions to be developed. MDOT's ProjectWise team developed processes to minimize risk of security incidents ahead of implementation.

Common operating network speeds for MDOT office locations are 20Mbps and 50Mbps. Proactive network monitoring enables specialists to evaluate and know that problems exist and determine solutions for them. MDOT is evaluating a reasonable throughput and how to determine what the user needs are and what is reasonable as a request for bandwidth. NetFlow is a protocol where the hardware is aware of the network usage and can report on status and needs. Caltrans uses this protocol on critical links within its network, and MDOT implemented "gateway-to-gateway" solution at rest areas. Some satellite service providers can also provide internet connectivity in remote locations that can be portable.

In the end, MDOT has a single source of truth document that is the final project record. e-Construction helped MDOT standardize the construction documentation process—this has been a key benefit and improvement to the process. MDOT has been working heavily with local agency associations to provide information on e-Construction, but there are no plans to mandate use of e-Construction by local agencies on projects with State oversight. Contractors often request e-Construction use (specifically ProjectWise for file sharing and storage) on such projects (90-day turnaround for payment has been reduced to 7 to 10 days, sometimes as short as a 4-day turnaround). Other areas within MDOT would also like to administer projects electronically; MDOT references e-Construction as one portion of the higher-level concept "e-Project."

Q: For drag and drop of files in ProjectWise, how do people know about the addition or change?
A: When the state of a document is changed, ProjectWise creates a notification email. Contractors can add a document and continue to make changes until the "submit" feature is used (and labeled "submitted"), and the routing will be on hold until the document is finalized.

3.3 Field Systems Implementation/Training/Support/Maintenance Roundtable

In Michigan, Ruth Proctor provides AASHTOWare product support, Deb Mosher is the AASHTOWare Project Manager, and Diane Jadzinski handles all software testing. Together, they led a roundtable discussion on software systems. FieldManager was created to manage MDOT's road, bridge, aeronautics, and rail construction program (partnership with the consultant that currently develops and maintains AASHTO software). The system is client-server based, and MDOT has 28 installations of FieldManager. MDOT is implementing AASHTOWare Project for several reasons, including provision for one single data model and a single application instance. Michigan implemented a single sign-on (SSO) process called MILogin, which has been integrated into the AASHTOWare Project and Construction/Materials preparation projects. Caltrans also uses SSO for some applications, such as logging into a workstation, and some web-based applications. MDOT will perform a phased process for implementation of this new AASHTOWare software.

As new releases of FieldManager are implemented, MDOT runs baseline tests and provides input to the developer on system updates. The vendor also provided some baselines. MDOT is creating test cases for use, including creation of a daily work report and a sample project entry to ensure that the updates are validated and that the outputs are correct. This is performed before full testing of the system. The same process was used to test the Preconstruction software.

Agencies can request additions to the software and can also customize the software to their agency. MDOT uses scripted testing, which relies on a predetermined script as opposed to training inspectors and asking them to enter work report data. For Caltrans, unscripted testing identified more errors than the testing that was based on pre-established scripts. MDOT plans for completion of testing and full implementation of AASHTOWare Project Construction and Materials by July 2017. Caltrans has implemented electronic bidding and is working on the civil rights and labor and materials implementation.

3.4 FieldManager and AASHTOWare Project Construction and Materials Demonstrations

Cliff Farr, Kevin Fox, and Adam Spitzley provided a presentation on and demonstrated the AASHTOWare FieldManager software and the AASHTOWare Project Construction and Materials software. MDOT has ensured that the software developed can be customized to Michigan, and assisted AASHTO with the original

development in a process that was separate but paralleled the development of SiteManager. From a field inspection perspective, MDOT is now evaluating newer products to determine the best solution. Some contractors use a software tool called Innate, an overlay that communicates with an application program interface (API) with proprietary outputs, for project management activities. MDOT plans to apply electronic data for more efficient fieldwork, including measurements and location finding. Proprietary outputs have formats that only talk with the original system that generated it, limiting the integration of data with other systems. FieldManager will be phased out for MDOT contracts once AASHTOWare Project is implemented.

MDOT decided to implement the AASHTOWare software early on. BidExpress is the most used component of the AASHTOWare suite of tools. Minnesota plans to fully implement AASHTOWare Project Construction and Materials in late summer 2016, and Michigan plans full implementation by spring 2017. The benefit of this model is the pooled funds from all States for development of the software. The Construction and Materials module is a component of AASHTOWare Project. One customization example is how an agency manages quantities placed in the field that are over the plan quantity. MDOT requires a change order before payment of the additional quantities, while some States may pay a percentage of the additional quantity as the change order process is worked through. AASHTO committees also provide a benefit to the States by collaborating with stakeholders that have experience with the solution desired. Service units provide for consulting support to the States as needed for funding the software customization.

The FieldManager software allows access to full system functionality for some users and limited functionality for others. FieldBook is a separate component to FieldManager that can be used for daily reports and operates in stand-alone mode on a desktop or as a client-server system. Mobile Inspector can also be downloaded for free, and users can sync data with FieldManager through a fee-based sync service.

FieldNet is a web-based communication link between components operating in the field and the MDOT central office. This link automates and simplifies communication between field offices/regional offices and the central office, including automation of data movement between construction site, field offices, and the MDOT central office. Web-based functions include pay estimate approval and tracking contract modification approvals and tracking daily reports.

Q: When entering a diary, including people and equipment, Caltrans enters information such as a person's name, equipment codes, and so forth. Does MDOT follow the same process for that specific information?
A: With FieldManager, users can enter this specific information. AASHTOWare Project Construction and Materials allows specific information to be added. This can be a difficult task to keep information current that is prepopulated in lists, and up-front investment in time is required.

Q: How are the FieldManager documents, such as pay estimates, signed?
A: They are printed in PDF and signed using a digital signature (the e-Construction specification requires use of PDF files with signatures). AASHTOWare Project will provide for digital approvals based on login credentials and will use email for workflow notification.

Kevin Fox provided a presentation on AASHTOWare Project, an enterprise-wide software solution that will replace the existing FieldManager system and other legacy systems. MDOT will also evaluate the potential for use of AASHTOWare Civil Rights and Labor and is currently using LCPTracker for tracking data for labor compliance. New functionality in Construction and Materials software includes electronic approvals for contract modifications, daily reports, pay estimates, and contractor performance evaluations. MDOT is currently discussing whether to automatically link document repositories, such as ProjectWise, with the

reporting functionality of the AASHTOWare suite. Consultants and contractors will not have to pay license fees for use of the new AASHTOWare Construction and Materials software.

The Construction and Materials software also includes a feature for tracking contractor performance, and the data is used to partner with contractors to improve efficiencies on future projects once closeout evaluations are performed. MDOT also uses change order reports to address FHWA reporting requirements.

Q: How does the process work to review data for projects that contain a particular item of interest, such as a guardrail?
A: The Active Reports query tool can be used to pull data on existing components or resources to answer questions and report on hot topics based on need. The data is in an Oracle database, and any query tools can be applied. Caltrans is using Crystal Reports and Discover as query tools to sort and filter data. MDOT uses another tool, Business Objects, which offers built-in flexibility for reporting.

Q: How will FHWA access the new system?
A: Users will have a login ID and their role will be defined, providing access to all contract information included.

3.5 Mobile Inspector Demonstration

Jordan Wirth with MDOT provided a demonstration of a software tool called Mobile Inspector. This tool designed to allow inspectors to create daily work reports using a mobile device. It works with FieldManager and Construction and Materials (130 devices are in use in Michigan). A Windows-based version of Mobile Inspector is currently under development. This web-based system alleviates issues with client-server systems, such as duplication in providing contractors with read-only copies of documents. The software also includes voice-to-text functionality for adding information to the report. Photographs can also be attached and can then be uploaded to the primary document management system.

Users can build reports in the software without connectivity, but network access is required to sync the information with FieldManager. Plans for MDOT also include integrating Blue Book information for equipment with Mobile Inspector.

Once a report is locked, Mobile Inspector does not allow additional changes or input; once connection is established, the report is uploaded to FieldManager. MDOT requested consideration for an enhancement to the tool that would allow users to make markups in FieldManager and then send the report back for modification in Mobile Inspector. MDOT selected this tool because it was designed to work with FieldManager and also Construction and Materials.

Q: Can you annotate photographs within Mobile Inspector?
A: Not directly on the photograph, but you can add information and descriptions in form fields. Annotation can also be performed using a separate tool, then the photograph can be imported back to the software. Once payment is made to the contractor, the information is locked.

Q: Can you apply custom filters, such as for direct interest only in structures?
A: No, there is currently no ability to filter out only certain information.

Q: When do contractors see the Mobile Inspector reports?
A: Once the report is sent to FieldManager, contractors can see it.

Q: Are photographs searchable by location?
A: Some photographs use geolocation features, but not all.

3.6 Labor Compliance Software and Data Collection Practices

Adam Strong presented on LCPTracker for management of payroll and wage data. MDOT implemented LCPTracker on a major project as a pilot and then expanded the use of the software tool to other regional offices. The existing process requires the weekly submission of hundreds of pages of documents to comply with the prevailing wage provisions of the contract. MDOT also uses a certified payroll review checklist to ensure that all requirements are met and documented in addition to the first level audits performed by LCPTracker. Wage rate interviews are also performed in the field to determine compliance and identify any issues that need resolution. Certified payrolls are uploaded to ProjectWise—an original copy with digital signature.

MDOT observed a one-third reduction in payroll submittal time by using the electronic tool (2 weeks is common currently). This tool also facilitates faster issue identification. MDOT is managing 80 active contracts valued at $550 million over 180 contractors, and LCPTracker is providing benefit to MDOT and also contractors. MDOT pays for the software license, user accounts (including for contractors), and provides training. The e-Construction specification will require the use of LCPTracker on all 2017 projects.

Q: Do you pull information from the IDR from ProjectWise for checking?
A: The resident engineer pulls the IDR information from ProjectWise.

Q: Does the contractor go into the tool and enter the payroll information directly?
A: LCPTracker allows manual entry of data and also a linkage to the contractor's payroll system.

Q: Does MDOT have automated processes for comparing data from LCPTracker to AASHTOWare systems?
A: These are separate stand-alone systems that do not currently interface.

Q: How did industry take to using this software, especially smaller contractors?
A: Some contractors are marginally resistant to technology, but many are also encouraging greater application of it due to the realized benefits. Contractor input is helping MDOT with implementation. MITA accepted LCPTracker after use on several projects.

3.7 Contractor Perspectives on e-Construction

Rachelle VanDeventer and Glenn Bukoski of MITA presented on the contractor perspective on e-Construction. MITA is a statewide construction trade association that consists of nearly 600 Michigan companies representing construction disciplines such as road and bridge, sewer and water, utility, railroad, excavation and specialty construction throughout the state of Michigan. MITA was established in 2005, when the Associated Underground Contractors (AUC) and the Michigan Road Builders Association (MRBA) merged.

Michigan contractors were focused on three primary challenges and needs: accurate daily quantities, efficient document management, and timely and accurate payments. MITA representatives visited Florida and discussed DocExpress with the developers as a solution. The approach taken involved piloting e-Construction tools using a few prime contractors to implement workflows, provide outside entity access, and

test solutions. Cash flow, real-time access to daily reports, and more efficient and timely change order processing times are all benefits realized by contractors. MITA and MDOT formed an e-Construction user group to meet regularly and discuss common issues. One primary e-Construction benefit cited is reduced time in processing contract modifications, reduced from weeks to days. MDOT is participating in EDC-3 activities to quantify the benefits of e-Construction. One contractor cited $36,000 savings due to reducing the oversight labor required by the prime contractor by 20 to 30 hours a week.

Caltrans meets frequently with the local Associated General Contractors of America (AGC) group to discuss challenges and solutions. Caltrans is also piloting the Headlight app for mobile inspection data and has fillable forms for electronic report development.

3.8   e-Ticketing

Tim Croze discussed MDOT's current activities related to electronic tickets for asphalt and concrete weights. Iowa worked with a vendor to equip contractor trucks with Global Positioning System (GPS) technologies. The data collected could be viewed online (for Hot Mix Asphalt (HMA) paving operations), and information on cycle times was available. The contractor benefitted by optimizing the truck operations. Recently, Iowa DOT linked the truck and plant scale via wireless technology to obtain weight of the material to eliminate the paper ticket. Iowa DOT is implementing this technology on pilot projects this summer.

MITA also met with the vendor and discussed the potential use by contractors, but no DOT requirement was identified to allow this to fit as a solution. MDOT does not plan to mandate this type of solution, but contractors may use it to take advantage of the efficiencies created for each company.

A next step suggested is to identify the issues and potential solutions and create a framework for an e-Ticketing solution that is agreeable to all stakeholders.

3.9   Field Review of e-Construction Mobile Devices (iPad)

Rick McGowan linked MDOT inspector Jerry Torson via FaceTime from the field to participate virtually in the peer exchange discussion on e-Construction and mobile device use. They noted some initial technology application with the I-96 megaproject with stringless paving as a technology in use on the project. This pilot project used mobile devices and also grade verification technologies (total stations and GPS). The project had the backing of MDOT, and users built surfaces for clay grade and stone grade to document levels and thickness of grades. Inspectors discussed the potential to have one person dedicated to the field measurement required by the engineer and have the tech-savvy employees handle that portion, while the others can take on other roles directly that fit them well also.

Caltrans initiated a pilot project using tablet devices for field staff to access email and libraries of information such as specification, standards, contracts documents, and construction manuals. With field testing of devices underway, Caltrans staff more easily marketed the concept to management and decision-makers. The next phase for Caltrans is implementation of inspector documentation and reporting features, and the discussions via remote connection with an MDOT inspector in the field provided benefit to Caltrans in designing their overall mobile device policies and architecture.

In California, contractors have taken 2D models and developed 3D models for Caltrans on projects. Caltrans now shares the 3D design model with contractors directly. Both States use a combination of the rover and total station for checking grade and verifying field conditions. The Caltrans process is different from MDOT in that personnel typically do not add observations directly onto the plan sheets.

MDOT uses the Adobe PDF solution and has also tested additional software for generating as-builts. MDOT does not currently have an automated process for generating as-builts but future plans will improve the process. Software company PlanGrid has a solution for the iPad that enables users to add plan sheet observations.

Q: On the survey portion of the projects, do you have specialized survey groups that set grade or does the contractor handle that?
A: MDOT does have a specialized unit, a team of surveyors at central office that provide training and support. The MDOT field staff is performing quality assurance on the process.

Q: Did MDOT use the electronic filing system on the I-96 project and how do you interact from the field on the contract administration side?
A: A SharePoint site provided a valuable tool for inspectors to document structure numbers, locations, and other items on the I-96 project. One issue with the SharePoint solution is multiple personnel working in one file at the same time and creating multiple copies of the file. ProjectWise is a solution that inspectors now use to create real-time information-sharing capability.

Q: How are you handling the data entry from the field?
A: MDOT inspectors often use laptops in the field (especially with PDF Expert), although the tablets also provide this functionality. It is easier for some inspectors to use the laptop to mark up plans and add comments.

Q: Has the electronic process helped MDOT inspectors or would they prefer paper?
A: The overall process has improved dramatically. The fillable forms are easier to fill out, e-signatures are helping with time savings, and overall the process is much more efficient than when paper was used. Some staff members were resistant to change, but with the functionality and benefits to their job apparent, they are able to transition to the new process.

Q: Do you feel comfortable carrying the iPad on the grade? How about the size, is it right for the job if it were your only device?
A: The inspector adds the iPad to a pocket in the vest and there are no issues with the environment. The current iPad is the right size; the screen is not too large. It works well with the zoom capability and with a finer-point pen for drawing directly on the screen. Battery life is good also.

Q: How do you connect to the internet?
A: The iPad has built-in cellular with data plans, and a Virtual Private Network (VPN) is used to access the State network.

Q: Was there resistance at first with going paperless?
A: With the fast implementation on the I-96 process, there was some initial resistance to the new process, but users became comfortable with ProjectWise access, electronic documentation, and PDF markups for as-builts.

Q: On quantity sheets in paper and attaching them to the diary, did MDOT change or try to improve that process?

A: In terms of automating pay item entry, following the I-96 project, MDOT upgraded technology for taking measurements in the field and developed a process for linking the data to FieldManager. Cross-references to the item codes with pay structure items have improved the process.

Q: Has the GPS rover helped with finding conflicts in the plan with what is in the field?
A: Yes, on the I-96 project inspectors found that the grade was off on a 1-mile stretch. As long as the model is checked and uploaded to the rovers, it provides the ability to check the grade thickness, for example. Microsoft has a technology (HoloLens) with glasses that enables users to look at the LiDAR scan data to determine if design issues exist. This scan must be performed in an office environment. DAQRI SMART HELMET™ uses high-resolution geospatial sensors as a virtual reality environment.

Q: How do MDOT and Caltrans handle personal use of mobile devices?
A: MDOT has an app store account that users can link to, but users are not able to purchase apps. Data usage is in a shared pool, and MDOT can monitor large usage of data from any individual device.

3.10 Data Collection and Storage Using Collaborative Project Sites (ProjectWise)

Heather VerHage and Stu Laakso with MDOT provided a demonstration of the ProjectWise document storage and project collaboration tool. ProjectWise started as a design/CADD management tool, and MDOT evaluated multiple applications for use before ultimately deciding on ProjectWise. Design, construction, and aeronautics are integrated with plans, invoices, and reference documentation. This process reduced payment times from 60–90 days to 7–10 days.

For construction project documentation, everything is organized by the seven regions and the transportation service centers that serve each geographical area. Some older projects are archived from ProjectWise into a separate system. Consultants and contractors have regulated access to ProjectWise, and some folders will be hidden if not applicable (for example, design consultants would not see a construction folder). Contractors do not have to buy ProjectWise, and MDOT assigns each contractor the appropriate access to read documents and also to upload documents as needed.

3.11 Discussion on FHWA Division Office Pilot Program for Tablets

Rob Fijol and Kat Weisner from FHWA provided information on the Division Office pilot project for tablet devices. The Michigan Division Office's current practice for use of the iPad in the field is to support Compliance Assessment Program (CAP) reviews and inspection documentation. FHWA has implemented a pilot project to evaluate use of tablet devices in the FHWA Division Offices. Currently, Florida, Michigan, and Iowa Division Offices are using iPads, and Texas, Missouri, North Carolina, Pennsylvania, Utah, Virginia, and West Virginia Division Offices are using the Surface Pro.

In Michigan, the lack of Personal Identity Verification (PIV) card for Apple devices limits the potential to use digital signatures, but being able to sign contract modifications has the potential to speed up payment to the contractor. Projects that require CAP reviews are assigned by FHWA Headquarters, and users document information using the tablet devices. FHWA Michigan users also sign contract modifications and pay estimates using the tablet devices. Users noted that a notetaking application for the iPad would also provide benefits if available.

Some firewall issues had to be worked out between FHWA and MDOT to provide access to systems inside the firewall. A key benefit from the tablet device use in Michigan Division is the electronic access to all

project information needed from any location. The iPad has some limitations, such as a cost-prohibitive PIV card reader and no mouse. Adobe software also has issues in that it does not show markups or digital signature data when a pdf is viewed on the iPad. FHWA installed Wi-Fi in the Division Office, enabling users to collaborate at any location within the office. iPads are able to wireless link to projector using Bluetooth and Wi-Fi.

FHWA California Division has a group of engineers that are interested in using tablet devices in the future and would see benefit to having an option to replace a laptop with a tablet device. FHWA sees this concept as supporting e-business overall, with e-Construction as one component of the overall electronic program.

3.12 IT Security

Heather VerHage, Andy Esch, and Nick Anderson provided a presentation on MDOT's approach to IT security. MDOT integrated 16 electronic systems with ProjectWise. Caltrans is particularly interested in how MDOT handled outside entity access to electronic systems, including rights and access. MDOT manages approximately 4,500 ProjectWise users, including MDOT, other State agencies, local agencies, consultants, FHWA, and contractors. MDOT provided a description of the ProjectWise system architecture that includes linkages and servers. Users had a technical discussion, assisting Caltrans with answers to questions related to implementation of ProjectWise and adequate levels of security.

Q: If the server stores all the documents, what goes into the database?
A: Audit trail information is one example. ProjectWise is a library—the database is the equivalent of the index cards and the folders in ProjectWise hold the actual documents.

Q: What were the architecture concerns? With 3000GB of data, how do you manage costs?
A: With storage costs, MDOT is paying for the backup needs. With management, the question was who will pay for it. A business decision has to be made for priorities; leadership within the DOT has to decide how to prioritize (e.g., LiDAR data, 3D data, GIS, CADD), especially as related to costs of storage of data.

One of the largest MDOT areas of growth in IT is in mobile devices. Applications often ask for a login; these applications mainly run inside the firewall but one runs outside the firewall. Application login could provide a user with database permissions that the DOT does not want to allow. FHWA is using a virtual cloud backup system that replaced tapes and has reduced disaster recovery from several days to a few hours when needed. FHWA leverages FedRAMP-approved vendors for cloud storage.

MDOT developed a ProjectWise Request Tool application that can create templates based on the job number when a request is made. Jobs are created and templates developed during a nightly queue of requests; the template is automatically created for the job, creating a large time savings for DOT staff. There is also a direct link between ProjectWise and Preconstruction for populating data in ProjectWise.

3.13 Enterprise-Wide Asset Management at Michigan DOT

Justin Droste, asset management engineer with MDOT, presented on the MDOT Transportation Asset Management System (TAMS) that is being piloted in several locations in Michigan. The TAMS is a vendor-developed system, and MDOT has a contract with a vendor for 7 years with 5 option years.

Inventory management for road assets, signs, culverts, and guardrails are the initial asset functions given the quantity of data available to MDOT on these assets. Core teams meet regularly to discuss the direction of each subprogram. Existing GIS data is accessible in VUEWorks. Condition assessment and reporting are two

of the primary features of the system. Road Analyzer is connected to Google Street View so that users can view photographs of the segments being evaluated. The asset is associated with the work being done at that location so that all information is attached to each asset throughout the life of the asset (a sign, for example). MobileVue is an application for field use on mobile devices to connect to TAMS.

Q: Do you take information from as-builts to populate TAMS?
A: No, the status of the current inventory is a starting point for the concept.

Michigan/Caltrans e-Construction Peer Exchange

Aeronautics Building
Executive Conference Room
2700 Port Lansing Road
Capital City Airport
Lansing Michigan 48906
517.335.9283

Agenda

June 27, 2016		
Time	**Topic**	**Presenters / Facilitators**
9:00am – 11:30am	Informal Meet and Greet/ Travel Time for All Others	Caltrans/MDOT
11:30am – 1:00pm	Lunch (provided)	
1:00pm – 1:30pm	**Welcoming Remarks and Introductions** Goals for the Peer Exchange	*Kat Weisner*, FHWA Resource Center *Jason Gutting*, Construction Field Services Division Administrator – Michigan DOT *John Hancock*, Caltrans Construction Innovation Chief
1:30pm – 2:30pm	**CalTrans e-Construction Overview** Current Practices and Future Direction	Luis Rivas & John Hancock, Caltrans
2:30pm – 2:45pm	Break	
2:45pm – 3:45pm	**Michigan e-Construction Overview** Evolution to Paperless e-Construction Architecture	Stu Laakso & Cliff Farr, MDOT
3:45pm – 4:30pm	Field Systems Implementation / Training / Support / Maintenance Round Table	Deb Mosher, Diane Jadzinski, and Ruth Proctor, MDOT
4:30pm	Adjourn	
	Dinner on your own	

June 28, 2016

Time	Topic	Presenters / Facilitators
8:30am – 10:00am	**FieldManager and Construction and Materials Demonstrations** How MDOT Evaluated Solutions Quantities, Item Work, and Billing Processes for Item and Change Order Payments How Contract Administration Works in the Field	Cliff Farr, Kevin Fox, & Adam Spitzley, MDOT
10:00am – 10:15am	Break	
10:15am – 11:45am	**Mobile Inspector Demonstration** Daily Work Report Development Online and Offline Form Completion Field Wireless Access Provisions Contractor-provided Wi-Fi	Joe Bruewer & Jordan Wirth, MDOT
11:45am – 1:00pm	Lunch (provided)	
1:00pm – 2:30pm	**Labor Compliance Software and Data Collection Practices** Selection of AASHTOWare Project – Civil Rights and Labor or LCPTracker LCPTracker Software Demonstration – Payrolls and Davis-Bacon Wages	Matt Bellgowan, Cliff Farr, & Adam Strong, MDOT
2:30pm – 2:45pm	Break	
2:45pm – 3:45pm	**Materials Management – Data Collection and e-Construction Integration** AASHTOWare Construction and Materials Phase I and II	Matt Bellgowan, Marty Foster, & Dan Burns, MDOT
3:45pm – 4:15pm	**Contractor Perspectives on e-Construction** How MDOT Obtained Industry Buy-In How e-Construction Has Benefitted Private Industry Contractor Ideas for Future e-Construction Implementation e-Ticketing in Practice	Cliff Farr, MDOT Glenn Bukoski – VP of Engineering Services & Rachelle VanDeventer – VP of Industry Relations, Michigan Infrastructure and Transportation Association Tim Croze, MDOT
4:15pm – 4:30pm	**Discussion on Key Takeaways for Implementation** **Preview of Day 3 Agenda Items/Site Visit**	Tom Zagorski – Michael Baker International Tim Luttrell – Leidos
4:30pm	Adjourn	
Dinner on your own		

June 29, 2016		
Time	**Topic**	**Presenters / Facilitators**
8:30am – 8:45am	Recap of Previous Day's Discussion Themes	Tom Zagorski – Michael Baker International
8:45am – 10:45am	**Field Review of e-Construction Mobile Devices (iPad)** Inspection Documentation and Daily Work Reports Apps in Use in the Field Typical Inspection Data Processes	Jordan Wirth & Rick McGowan, MDOT
10:45am – 11:30am	**Data Collection and Storage Using Collaborative Project Sites (ProjectWise)** File Structure and Naming Conventions User Access & Contractor/ Consultant/FHWA Input Workflow Examples and Demonstration Forms and Signatures Document Retention Policies/Solutions	Stu Laakso & Rick McGowan, MDOT
11:30am – 1:00pm	**Lunch**	
1:00pm – 1:30pm	**FHWA Division Office Pilot for Tablet Devices**	Rob Fijol, Vagas Goss, Kat Weisner, Tim Luttrell, & Tom Zagorski
1:30pm – 2:30pm	**Information Technology Security Discussion** Enterprise Architecture – How Was The Solution Implemented? PMO, Project Delivery, Document Mgmt Software Use of Cloud-Based Services for Storage and Data Security End User Experience, Feedback, and Continuous Improvement	Heather VerHage & Andy Esch, MDOT
2:30pm – 2:45pm	**Break**	
2:45pm – 3:45pm	**Enterprise Wide Asset Management at Michigan DOT**	Justin Droste, MDOT
3:45pm – 4:00pm	**Discussion on Takeaways for Implementation, Feedback, and Next Steps**	Tom Zagorski, Michael Baker International Tim Luttrell, Leidos
4:00pm	**Adjourn**	

Appendix B – e-Construction Peer Exchange Roster

Name	Agency
Matt Bellgowan	MDOT
Joe Bruewer	MDOT
Glenn Bukoski	Michigan Infrastructure and Transportation Association
Dan Burns	MDOT
Tim Croze	MDOT
Justin Droste	MDOT
Andy Esch	MDOT
Cliff Farr	MDOT
Ariana Fay	FHWA Michigan Division Office
Rob Fijol	FHWA Michigan Division Office
Marty Foster	MDOT
Kevin Fox	MDOT
Michael Gillogley	Caltrans
Vagas Goss	FHWA Headquarters
Jason Gutting	MDOT
John Hancock	Caltrans
Diane Jadzinski	MDOT
Stuart Laakso	MDOT
Tim Luttrell	Leidos
Tim Marshall	FHWA Michigan Division Office
Jean Mazur	FHWA California Division Office
Rick McGowan	MDOT
Deb Mosher	MDOT
Robert Nagy	Caltrans
Ruth Proctor	MDOT
Luis Rivas	Caltrans
Adam Strong	MDOT
Adam Spitzley	MDOT
Rachelle VanDeventer	Michigan Infrastructure and Transportation Association
Heather VerHage	MDOT
Kathryn Weisner	FHWA Resource Center
Tom Zagorski	Michael Baker International