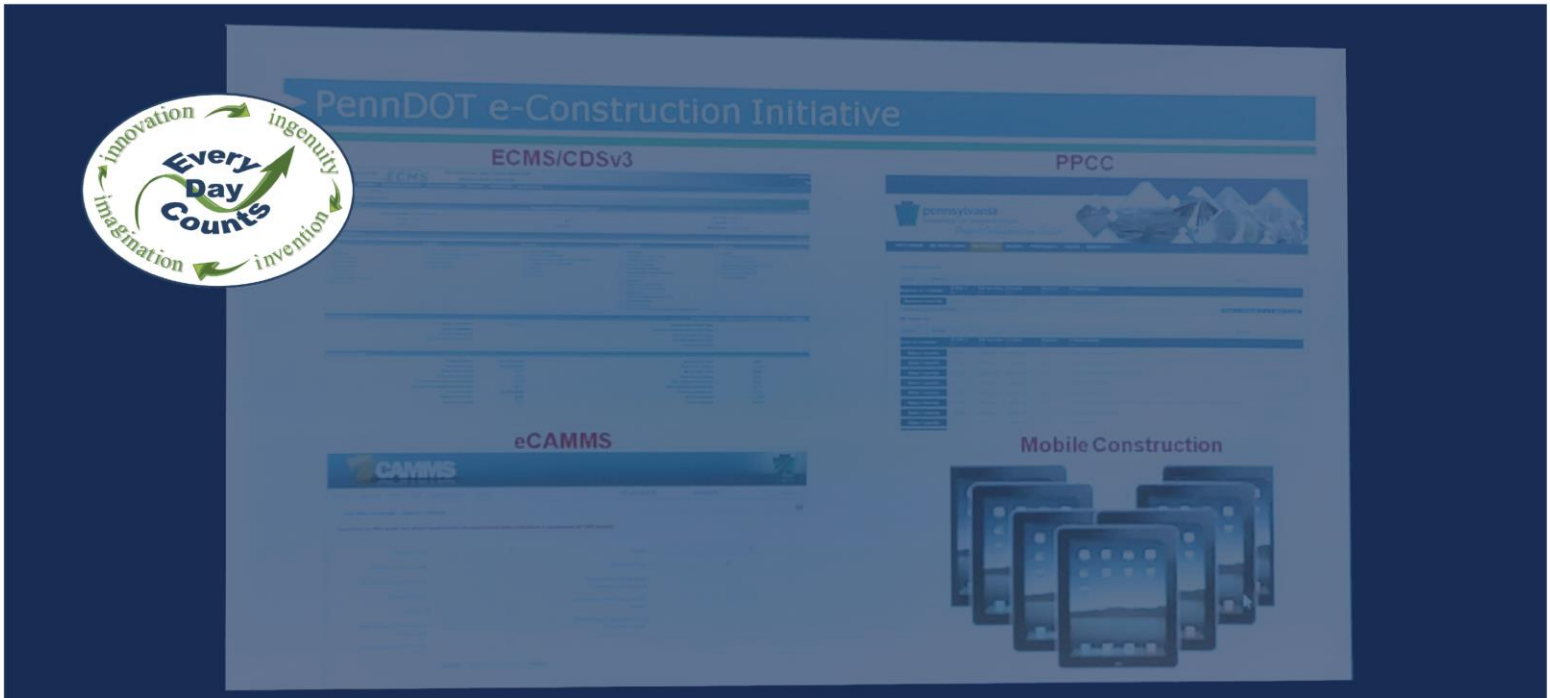
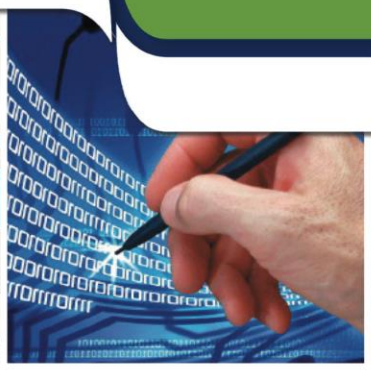
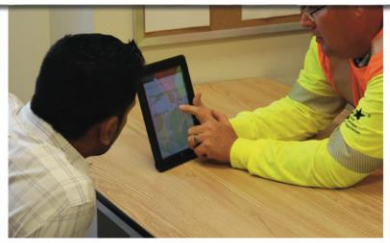


e-Construction
PEER-TO-PEER EXCHANGE
Summary Report


Pennsylvania DOT and
Alabama DOT

August 1 - 2, 2017
Pittsburgh, PA

pennsylvania
DEPARTMENT OF TRANSPORTATION

U.S. Department of Transportation
Federal Highway Administration

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1. Background

The Pennsylvania Department of Transportation (PennDOT) hosted a peer exchange on e-Construction with the Alabama Department of Transportation (ALDOT) in Pittsburgh, Pennsylvania, on August 1 and 2, 2017. e-Construction is defined as paperless construction administration delivery processes that include 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 each participating State's FHWA Division Office also participated in the event. Representatives from the Maryland State Highway Administration (MDSHA) participated as observers in anticipation of hosting a separate peer exchange in the near future.

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. PennDOT also provided a presentation on the PennDOT Project Collaboration Center (PPCC) that uses a SharePoint-based platform for managing construction project documentation. The afternoon of the first day consisted of presentations and discussion sessions on the PennDOT Engineering and Construction Management System (ECMS) along with ALDOT's Construction and Materials Management System (CAMMS). The group also discussed practices for application of digital signatures and electronic approvals, along with ALDOT's deployment of e-Construction for inspection on a local project using an FHWA Accelerated Innovation Deployment (AID) Grant as a funding source. The morning of the second day consisted of additional discussion sessions on e-Construction field devices with a focus on the use of iPads in Pennsylvania and Alabama. The peer exchange concluded with discussion on the PennDOT processes for obtaining feedback from users of e-Construction systems and tablet devices and a session on materials management, including mix designs and materials test results and sample tracking. The group concluded with discussion on next steps, action items, and follow-up activities.

The event also included a presentation and discussion session on a recent FHWA project to deploy mobile devices in several FHWA Division Offices, including Pennsylvania as a user of the Surface Pro 3. 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. The pilot project is expanding to additional States in 2016.

The Peer Exchange is the twelfth in a series designed to assist States with implementation while allowing 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 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, Web site links are provided for some of the practices currently in use by the agencies. PennDOT and ALDOT also shared some documents, presentations, and information by email that are not publicly available on the internet.

To further enhance project efficiencies through e-Construction, **ALDOT has implemented a 3D model data specification** for use by contractors on projects within the State. This specification requires data collection and submission to support as-built drawing development on 3D projects. Additionally, ALDOT uses SiteManager for materials documentation and management along with CAMMS for construction documentation and collaboration.

> Link to ALDOT points of contact for the Construction and Materials Management System (CAMMS):
> http://www.dot.state.al.us/conweb/doc/Environment/SM%20Contacts.pdf
>
> See ALDOT specification for 3D Engineered Models for construction
>
> Link to NCHRP Report "Legal Issues Surrounding the Use of Digital Intellectual Property on Design and Construction Projects":
> http://www.trb.org/Publications/Blurbs/168710.aspx
>
> Link to list of ALDOT e-Construction systems under development or in use:
> https://www.dot.state.al.us/csweb/CAMMS.html

PennDOT uses ECMS, PPCC, and eCAMMS as the primary technologies for administering construction contracts and managing construction and materials data. ECMS handles bidding, estimates, approvals, work orders, consultant agreements, and project closeout documentation including final quantities. PPCC allows for submittals from both PennDOT and contractors with automated workflows and shared project files and photographs. PPCC is estimated to provide an overall cost savings of $29.1 million, with $5.2 million in development costs. PennDOT manages these systems through an Information Technology Governance Structure that provides for decision-making and adequate communication through three primary channels: a Project Governance Committee (PGC), a Project Execution Management Team (PEMT), and a Project Execution Team (PET).

> Link to PennDOT ECMS Manual for contractors:
> https://www.dot.state.pa.us/public/PubsForms/Publications/Pub%20637.pdf
>
> Link to PennDOT YouTube videos on ECMS use for consultants and contractors:
> https://www.youtube.com/watch?v=74zwrgyolsI
>
> See PennDOT Infrastructure Architecture Diagram and Release Notes for PPCC.
>
> See PennDOT roles and permission levels spreadsheet for user-based functions.

Mobile applications (apps) provide field users with tools to input and manage data on mobile devices. PennDOT shared a list of current apps in use, which includes Mobile Construction (MC) Docs which allows field staff to access plans and other project documentation from ECMS on their iPads, MC Project Site Activity (PSA) for inspection data input, and MC Punchlist for managing contractor requirements throughout the project duration to avoid a last-minute rush to closeout. PennDOT estimates that MC apps realized an overall cost savings of $28 million. Another app used by PennDOT is Office Lens, which converts scanned images or photos to editable documents. Air Watch is also used as a mobile device application management tool, and PennDOT only allows users to download the standard configuration of approved apps.

Links to Office Lens software (included with Office 365):
https://www.microsoft.com/en-us/store/p/office-lens/9wzdncrfj3t8
https://play.google.com/store/apps/details?id=com.microsoft.office.officelens&hl=en (Android)
https://itunes.apple.com/us/app/office-lens/id975925059?mt=8 (iOS)

Link to Air watch mobile device application management tool:
http://www.air-watch.com/

Link to Share Plus software for use of SharePoint on mobile devices:
http://www.infragistics.com/enterprise-solutions/enterprise-mobility/shareplus

See PennDOT wording used in contract with Apple for Business to Business customization of apps.

PennDOT and ALDOT use electronic approvals in certain instances, with formal digital signatures in others such as for contract documents and change orders. PennDOT developed an e-Signature process using Adobe Acrobat that allows application of digital signatures using login credentials by user. Additionally, a strike-off letter addresses the application of digital signatures to PDF documents.

See PennDOT PowerPoint presentation on the e-Signature process used.

See PennDOT Strike-Off Letter for implementation of digital signatures.

See PennDOT user guide for creating and exporting Adobe Reader and Acrobat Signature Certificates.

Grants are available for implementation of e-Construction, and ALDOT was awarded a Grant to support digital data collection on a local project as well as provide for efficiencies and cost savings in administering the construction contract. ALDOT has purchased 245 iPads for inspectors to use statewide.

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 each presentation and demonstration (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 including contact information.

Kat Weisner welcomed participants to the peer exchange and Jim Foringer, the Assistant District Executive - Construction with District 11, provided a safety briefing to the group. PennDOT is a decentralized organization with more than $400 million in project lettings annually. e-Construction at PennDOT began with an Engineering and Construction Management System along with the PennDOT Project Collaboration Center, as these systems relate to business processes and needs.

Skip Powe of Alabama DOT indicated that his agency began with e-Construction in 1998 and was one of the first SiteManager States. Given the detailed specifications that Alabama DOT uses, they decided to build a custom system that more closely matched their specifications and internal business processes. Alabama DOT has experienced the benefits of costs savings with e-Construction already and is working to explore goals and opportunities with the intent of letting those elements drive decisions as to new systems. There are paper processes in use where digital applications would provide additional cost savings, especially with less paper and printing costs. One of the primary challenges is how to develop a document management system, use the cloud, digital signatures, and processes for external access to Alabama DOT systems. Another challenge is funding development costs and providing adequate training for users. ALDOT recently purchased 245 iPads for use by inspectors in capturing information in the field.

3.1 Document Management and Collaborative Project Sites – PennDOT's Project Collaboration Center (SharePoint)

Mike Lentz, Doug Seeley and Peter Rosenkrans provided an overview presentation of the PPCC, including electronic submittal processes and transfer of design files and documents during the design process. The system was primarily developed for construction to minimize paperwork and improve review times and provide for time savings.

Central office personnel have higher level administrative rights within PPCC. The system utilizes role based security assigned by job title and permitted access and functions are designed based on each role. Customizable at the district level, the system provides automated workflows and approval processes. When promotions occur, a form is used to elevate access as needed based on the title and role of the individual. PennDOT employees have a specific login interface that is different from a link that business partners use.

PennDOT provides announcements and current information on the first screen after log in. There are two interfaces, a portal for announcements (by project) and a project specific interface. Quick links to standards and specifications used in construction are also available. Projects are identified by ECMS number, and a work queue shows active submittals that require PennDOT action. Contractors electronically submit Requests for Information (RFI) to PennDOT for any questions that arise on projects that require attention. General correspondence is also submitted, along with project required submittals, i.e., schedules, shop drawings, labor compliance, quality control plans and structure related such as demolition and erection plans. PennDOT can also comment on contractor correspondence securely, which can only be seen internally (access excludes prime contractor and subcontractor roles). Subcontractors submit correspondence through the prime contractor, and the prime submits to PennDOT and the official completion time requirements begin once the prime submits the documentation.

The architecture of PPCC is based on SharePoint 2010 with JavaScript and .net on the user's PC. There are batch processes to publish users to roles. A migration to SharePoint 2016 is planned, but there is additional functionality built into SharePoint 2016 and screens will need to be rewritten. List sizes will also increase, allowing additional documents to be stored. One issue for SharePoint is that each project is separate and the portal must search each project and create an index, which gets populated on the server. This is referred to as a "crawl," and the crawl is performed every six minutes.

Alabama DOT has reviewed software called Submittal Exchange and has also evaluated SharePoint. ALDOT uses SharePoint for document management but has not included workflows within SharePoint.

PennDOT sets up a baseline for a project on SharePoint. There are a lot of features associated with each project that are activated (roles, users, submittal types, workflows, and other key features). All of this is customized, and PennDOT's assistant construction engineer initiates that process manually at the district level. Often projects have submittals prior to letting, and the project can be created once in ECMS. PennDOT is also planning to automate project documentation archival in Enterprise Content Services (ECS) which is currently being developed. Documents will be stored in ECS for the designated retention period for the document and then they will be destroyed. The only exception to this will be projects where claims or other legal activities require maintenance of the documents beyond that timeframe. . For ECMS and ECS, all files are currently stored on local servers as opposed to the Cloud. There are nearly 2,500 projects currently included in PPCC. PennDOT has an enterprise license for SharePoint.

PennDOT evaluated AASHTOWare software and other solutions in addition to mobile applications. At the time the other solutions were not web-based; therefore, PennDOT decided on the custom developed solution.

Q: Who gets external accounts and how is access granted?
A: The central office sets up accounts in ECMS for users. PennDOT has a legal agreement that business partners sign to obtain an administrator ID and password for the company. . The administrator then sets up access for others within that company.

Q: How are due dates and days remaining established?
A: Due dates and days remaining are set up when the initial information is submitted, generally 21 days or as required per the Publication 408 Specification to respond back to the contractor.

Q: Are users alerted to action items outside of ECMS?
A: Yes, and each user can turn off email notifications as necessary. For delegations, email notification is automatic.

Q: Are approvals linked to a person or just a role?
A: As roles are assigned, the system connects people with roles, and multiple individuals could be in an approval process allowing any one individual to provide the required response.

Q: How are ECMS and PPCC linked?
A: PPCC is a portal, and each individual project has a separate website. When set up, PPCC gathers data on projects from ECMS. This is all accomplished in SharePoint for PPCC to take advantage of the user-friendly interface. PennDOT also mapped all workflows prior to development of PPCC to help create standard templates that are user friendly.

Q: Does PPCC operate outside the firewall?
A: Yes, PennDOT has multiple firewalls and the system runs over secure internet protocol.

Q: Can multiple file types be shared?
A: Only .exe or .dll files are not allowed to be shared, otherwise all files are accepted. There is a 500MB limit for files or if upload times out.

Q: Is the PennDOT server farm internally owned? Are there any latency issues?
A: The Commonwealth of Pennsylvania owns the servers in the Office of Administration. Alabama DOT owns the IT resources that handle documentation storage. The crawl issue is the only latency issue.

Q: What was the initial timeline for implementation of PPCC?
A: It took a year to become operational.

Q: Are there naming conventions for files, especially photos?
A: There is a basic naming structure, and the initial structure is set up for every project. This occurs at the folder level, while file names are generated based on the device used. PennDOT is working on more detailed file naming conventions.

Q: Is there a backup for when employees are on the approval workflow but may be on leave?
A: If assigned to a role instead of a specific person, others can be added to a role. Anyone can be added to a role to act on those action items in the absence of the primary approver.

3.2 Pennsylvania DOT e-Construction Overview

Construction Documentation System began as a DOS-based system in the early 1990s without web-faced connectivity. CAMMS was the original materials and testing system, and PennDOT also used a Construction Management System (CMS). The CMS made payments and organized information accordingly. Electronic bidding was one of the initial e-Construction implementations, which occurred in the new web-based system called Engineering and Construction Management System (ECMS), and in 2003 an Access database system, CDS NeXtGen, was implemented for payment activities that was installed on a personal computer. In 2013, additional enhancements were made to the ECMS system to incorporate the Construction Documentation System (CDSv3), and during this same year an initial pilot of the SharePoint occurred. eCAMMS is also web-based and went into production in 2014. The Pennsylvania Department of Agriculture used the Laboratory Information Management System (LIMS) which became the basis of eCAMMS.

Automatic withholdings of pay items based on certification requirements is a process that will also be included in ECMS. The finance and contract management is handled through ECMS, including project site activities, change orders, estimates, etc. Mobile data from inspector's Project Site Activities is uploaded to ECMS including offline capture and sync once online again.

3.3 Alabama DOT e-Construction Overview

The State has 67 Counties with 9 divisions that used to be centralized. The 9 divisions became 5 regions with 10 area offices that report to the regions. Items that have been administered by the central office are now being administered by the area offices. At present, the State has $2.2 billion in active contracts, including a major interstate reconstruction project with incentives/disincentives. ALDOT has approximately 420 inspectors with approximately 190 consultant inspectors and an additional 100 to account for county and local field staff. Plans are to manage all projects, including local oversight, using e-Construction. ALDOT is using SiteManager for

Materials and CAMMS is used for Construction documentation. Construction is fully operational, and once the materials system is fully operational, additional refinements will be made to the construction system.

One area had additional equipment funding and this allowed for the purchase of 245 iPads. The key ALDOT initiatives include:

- tablets
- e-plans
- e-forms
- converting the construction manual, standard specifications, and special provisions to an e-book format
- contractor integration
- digital signatures
- document management; document retention
- e-Ticketing
- bar codes
- RFID
- 3D models
- Unmanned Aerial System (UAS) usage

iPads are currently used in one district as a pilot project. ALDOT is also using Headlight software linked to mobile devices and has plans for UASs on upcoming projects. 2D plan sets are still used with 3D models for earthwork and automated machine guidance and also for clash detection. ALDOT has a specification used on 3D projects that requires contractors to provide data to support as-built drawings. Additional plans include UASs for estimating quantities in the field. ALDOT has several software systems used for electronic bidding, including Expedite and AASHTOWare Project Construction and Materials.

For change orders, ink signatures are still used.

3.4 Overview of the Engineering and Construction Management System (ECMS)

Lori Miles with PennDOT provided a demonstration of ECMS, including the forms used as requests for user IDs and profiles along with locations where key information is stored. Design documents and consultant engineering agreements are also stored in ECMS. PennDOT uses Expedite for electronic bidding, but has plans to implement another solution soon. Maryland State Highway Administration noted using BidExpress for electronic bidding as a recent implementation.

PennDOT is obtaining electronic bonds from bonding companies through ECMS (Iowa DOT is another State that has implemented this practice using Surety 2000). The bonding companies are registered business partners with credentials similar to other external entities through ECMS. ECMS also has a mileage and hours log portal for consultant inspectors to use for reimbursement. Advanced search features in ECMS allow users to find information on project status by district, all projects still in construction, etc.

FHWA has access to ECMS for approvals; however, all inspection reports performed by FHWA are delivered electronically via email. Electronic signatures are used by FHWA and are linked to the individual based on the login information provided.

PennDOT has a Multimodal Planning and Management System (MPMS) system as well, and much of the information in ECMS is populated in the planning stage for projects.

Workflows within ECMS utilize electronic approvals via user authentication and actions.

There are two ways a Project Site Activity (PSA) can be developed – generating it and uploading information to ECMS, or using the app on the iPad. This documentation is not reflected in PPCC. The Project Site Activity

reflects the contractors work performed, capturing the contractor's work force and equipment. The PSA documents contract items of work along with pay quantities with a quick calculation option. There is a reports facility available to view and print PDF reports.

PennDOT generates pay estimates twice per month, while ALDOT and MDSHA generate pay estimates once per month.

Q: What is the contractor's project number?
A: The ECMS number is used as the project number. Plans do include the project number. ALDOT has a contract ID with the potential for multiple project numbers under that contract.

Q: Regarding the edit link, who has access to update information in ECMS?
A: Access is limited for editing the information – only certain profiles have that capability.

Q: Have you tried using the 3D model to pay quantities?
A: No, PennDOT has not implemented this practice.

Q: ALDOT is having issues getting digital contracts and plans – did PennDOT have any issues with this? Also, optical character recognition (OCR) is sometimes lost when scanned versions of plans are created.
A: PennDOT's design and contracts teams initiated the process, so there were really no issues with this. PennDOT scans title sheets but the plans are generated and printed to PDF so that features such as optical character recognition can be utilized. Each plan sheet page is stored as a separate file due to bandwidth issues. 3D model files are stored within ECMS also. Recognizing text in a PDF document can also allow scanned files to be searchable.

3.5 Maryland SHA e-Construction Overview

During the mid-1990s, MCMS Maryland Construction Management System was developed. MDSHA historically used hand-written field inspector reports submitted to resident engineers who then built logs and estimates from that point. Hard copy signatures were applied at that point. MDSHA has made the decision to move forward with a standalone product that is customized. MDSHA has selected a consultant to begin work on a system, and pilot projects are underway with field staff using iPads for documentation and inspection reporting. The next step will be to implement one document management system for storage and collaboration. MDSHA has a materials management system, and contractors are submitting all materials information electronically. Some systems are standalone and not integrated with other systems. Consultant contracts awarded in 2017 require tablet devices, and the nearly 1000 inspectors statewide will also implement tablet devices. Maryland also recently passed a tax increase, and this stimulated the construction program. The newly developed system will work best on the iPad, and MDSHA is planning to make the system work regardless of platform.

Q: Does the materials management system include source of supply information?
A: Yes.

Q: For mobile devices, are users accessing through a web browser or will apps be used?
A: There is a CCMS app on the iPad, but otherwise software is mostly web-based. Software will be provided to consultants through the specific device's store.

Q: ALDOT does mostly has working day contracts but has a few completion date and calendar day projects. How would you handle the fact that a rainy period could be offset later by drought conditions, but just after the rainy period the contractor asks for a time extension?
A: PennDOT went to all completion date contracts and no time extensions are given for weather unless an official emergency has been declared.

3.6 Discussion on Digital Signatures: Electronic Contracts and Change Orders

PennDOT has used electronic signatures for the past two years. PennDOT has approximately 300 people signed up, including half as contractors, and PennDOT documented the process that can be used. Users sign up for a digital certificate, create their digital signature following the instruction provided by PennDOT and the user sends their public digital certificate to the eConstruct website. This is primarily used on PDF documents that require a hand signature, with electronic approvals on other activities within ECMS. Federal and State law allows for use of digital signatures in Pennsylvania. The digital certificate obtained is secured by a password, which then allows placement of a signature on a document. PennDOT uses Adobe software to apply digital signatures.

Florida DOT has a digital seal and stamp design for application to documentation. This is a National Institutes of Science and Technology (NIST) Level 3 digitally encrypted signature.

Alabama DOT is contemplating a process for using digital signatures department wide. External to the construction management system, a decision has not been made on use of a third party authentication process.

Certifications for employees are also available in the system, and certificates have QR codes that can be scanned to view all certifications by person. PennDOT has a text in feature that can be used to text information to the system.

Q: How do you verify identity for contractors?
A: Verification occurs through roles and user login information specific to each person that is assigned to that role. Signatures are applied within ECMS based on login credentials and checking an approval button. Materials certifications, mix design, quality control plans, and shop drawings are all examples of where digital signatures are accepted.

Q: Are approvals occurring in ECMS only, or also in PPCC?
A: Approvals are also included in PPCC such as for shop drawings.

Q: Does PennDOT assign the Adobe accounts or does PennDOT maintain a list of certified users?
A: PennDOT just keeps a list of certified users. The eConstruct website has a list of certified users.

Q: How much have lawyers been involved?
A: They were involved early on in the discussions on PennDOT's business partner processes.

3.7 CAMS Demonstration and Pickens County e-Construction Inspection Project

Hunter Gholson with ALDOT provided a demonstration of the CAMS system, which is ALDOT's Construction and Materials Management System. All construction information in the system is based on the Contract ID. ALDOT requires a diary for each day of the project, and the "time charges began" field is the official work start date for reference. A primary project manager is assigned to each project and can have

multiple projects. A support project manager can approve quantities and daily work reports in the interim, but the primary project manager has final approval of all the information. A forecasting report is used to track overruns and underruns on projects as projected quantities are entered.

ALDOT is currently focusing on system preservation and maintenance as opposed to capacity improvement projects. A few corridors are designated for completion of capacity projects. Recently ALDOT was awarded an Accelerated Innovation Deployment (AID) Demonstration grant in the amount of $456,450 to deploy e-Construction for the inspection of a project in Pickens County. This pilot project includes development of a 3D model. The Headlight software will also be implemented so that inspectors can gather data on the iPad in locations where a cellular signal is not available. ALDOT has also prototyped a version of CAMS that will work offline in a similar way and allow for data sync once connectivity is established. This includes an app running in a test environment.

Q: Does the contractor submit the estimate back to the DOT with an invoice?
A: The estimate process is such that ALDOT monitors results in the field, documents the progress, and issues payments upon checking that the work is satisfactory. The comptrollers require an invoice number on each estimate. PennDOT has a preliminary estimate that can be shared with the contractor.

Q: Did the contractor provide rovers for quality assurance?
A: Yes, the contract requires data to be collected and reported.

3.8 e-Construction Mobile Devices and Applications

John Myler, Phil Petrina, Randy Pletzer, and Travis Luckenbaugh with PennDOT provided background information on implementation of mobile devices at PennDOT along with a demonstration of the Mobile Construction (MC) apps in use. In 2013, PennDOT began by looking for technology to collect data that would eliminate paper, a need that was filled using the iPad 4 (and now the iPad Air model). PennDOT issued over 300 iPads to department staff to begin testing, and they used the devices for entry of MC Docs information. Some districts took field notes on paper and entered the data into ECMS at the end of each week. This stage of implementation was designed to allow inspectors to become familiar with the devices to check email, weather, and other basic uses.

The next phase looked at how to implement the iPads for consultant personnel. PennDOT has approximately 800 consultant inspectors, and issues arose in securing personal information on consultant employees as devices were assigned. The Apple Business-to-Business service provides review and approval of apps developed by PennDOT, and access to these apps is limited to those that have business credentials, such as consultants.

Office Lens is an app PennDOT uses that was originally designed for phones and allows photo capture of documents and creation of a PDF or Word document. This app is part of the Office 365 Suite. PennDOT has an iOS developer that is also a graphic artist as a dedicated resource to develop apps for the iPad. A help desk is also available to users for basic needs, and if a more detailed issue arises then the mobile team gets involved to troubleshoot the issue with the user so that updates can be made to fix the problem. PennDOT has a 15 person help desk that supports the department. ALDOT has a separate help desk for e-Construction needs as opposed to general IT and network support needs.

MC PSA allows users to manually sync data from the device to ECMS. PennDOT decided to maintain a manual sync process so that inspectors can make the decision on when to sync the data gathered in the field.

MC Punch List is also used to document items throughout construction, and contractors can see the punch list information throughout the term of the contract, which allows for efficiencies in timing and use of resources.

PennDOT also uses a work zone app to gather information on traffic control reviews, including signage and other devices. The app allows for photos and comments to be included, and the data is used for liability reasons in the future. A force account app is also used to manage application of force account work by project. PennDOT uses EquipmentWatch software to apply blue book rates for equipment. An agency can obtain access to EquipmentWatch to connect based on a license held by the contractor. PennDOT is also in the early stages of an app for Americans with Disabilities Act (ADA) ramp requirements.

Safety of users is also a consideration in app development. If screens have the appropriate level of detail for inspectors, they can easily review and input data and be aware of their surroundings while in the field. Safe zones are also established to ensure the appropriate locations are available for cell phone and tablet use.

Q: Did implementation of mobile devices begin at the district level?
A: The idea for mobile construction apps came out of a State Transportation Innovation Council (STIC) initiative.

Q: How does the distribution or requirement to use certain apps work?
A: Consultants can get apps that they want from the store, but there are some that PennDOT requires use of, and access to apps is based on ECMS credentials that are role based. The consulting company is responsible for employee credentials and for discontinuing access when employees sever employment.

Q: Do you only allow downloads from your store?
A: Yes, Air watch allows mobile device management and helps PennDOT maintain access to business-use apps.

Q: Do you have a release document that is sent each time an update occurs?
A: Yes, that can be shared with the group.

Q: What size drive is used on the iPad?
A: PennDOT uses the 32GB iPad. ALDOT has 128GB fifth generation iPad.

Q: Can PennDOT create 3D model PDF files?
A: No, that feature is not yet available for PennDOT.

Q: How long did it take to develop the Punchlist app?
A: Approximately four months.

Q: Is the efficiency being quantified for use of all e-Construction devices?
A: For MCDocs and MCPSA, the quantifiable benefits were determined early on. ALDOT has performed before and after surveys. PennDOT average 1.75 hours per inspector per day for $17.5M in cost savings through the use of the apps.

Q: How do you prioritize PennDOT IT resources and what percentage of time is spent on construction activities and needs?
A: It is based on agency priorities and often the size of the request or need, but the IT portfolio process handles priority rankings. It is difficult to tell the portion of time allocated to agencies.

3.9 Discussion on FHWA Division Office Pilot Program for Tablets

Representatives from FHWA discussed a current 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 and Utah Division Offices are using the Surface Pro. FHWA has support costs built in to the reported costs of each device, and the Surface Pro is comparable in price to the standard laptop configuration. Participants from FHWA Divisions discussed the addition of Surface Pro devices to the pilot for use in Missouri, as FHWA has expanded the pilot to include Missouri, North Carolina, Pennsylvania, Virginia, and West Virginia. One important discussion point for the FHWA Missouri Division is the connection to SiteManager and how it works from the tablet device. Participants will meet with representatives from Utah and Texas at the user forum to discuss. MSAR app is preloaded on iPads….

3.10 Piloting e-Construction: Lessons Learned and User Acceptance

PennDOT is proactive with sharing information across the agency as groups and teams meet to plan out implementation activities. ALDOT also has advocates within the construction department to ensure that the input of field personnel is accounted for in decision making. Buy in from construction and those who are leading business process analysis is key to implementation of e-Construction, along with input from users in the field. Get input from potential users, but ensure that a core group of decision makers is small enough to ensure that items are accomplished. PennDOT uses webinars to share information among users.

PennDOT's IT governance process is robust, and the Project Execution Management Team and Project Execution Team coordinate with department leaders to ensure participation. PennDOT has a monthly meeting between the design and construction engineers within each district to discuss e-Construction.

Q: How do you track requests for new enhancements?
A: The mobile group uses a spreadsheet of backlog requests and meets regularly to prioritize requests. There are also database systems to capture information on requests and manage the action items included.

3.11 eCAMMS Demonstration – Plant Books, Mix Designs, Sampling Test Results, Approved Source Bulletins

Sherry Hartman, System Administrator for eCAMMS, provided a demonstration of the web-based software. eCAMMS has grown over the years to be used to certify materials, approve materials, and for project closeout under Federal requirements. When users log in, the first screen shows announcements and updates on the software. Sample information in the systems includes the location taken, the type of material, batch or lot, the quantity, the contract, and how it relates to the standard specifications. The information is then transferred to the laboratory. eCAMMS is a stand-alone system that pulls data from ECMS.

If the material has not physically reached the laboratory and obtained a laboratory number, the information can be edited. When a sample is received at the laboratory, each sample has a bar code applied and it is scanned to log receipt of the sample. Once a laboratory number has been assigned, the data can no longer be modified in eCAMMS by the originator.

ALDOT is using SiteManager for materials information, but is transitioning to CAMMS. ALDOT also uses a similar process for locking down the information once a sample has been received by the laboratory. PennDOT is down to a few paper processes for materials management but is encouraging each district to use the electronic process.

ALDOT may include a specification that local offices provide internet access to secure access to e-Construction systems. Some agencies have installed fiber, while others have allowed providers to install fiber and allow use of the infrastructure by the DOT.

All mix designs are online for PennDOT as well, and no paper copies are used.

Q: Who handles the testing?
A: PennDOT performs most materials testing in Harrisburg, with some at local asphalt laboratories. Some of the testing is also performed by those who place the material or local inspectors on that project. For rapid bridge replacement, the material testing is contracted out to certified laboratories. ALDOT's central laboratory does some of the testing, and areas handle others locally.

Q: Is there fraud prevention built in? Does technology assist with this?
A: Bar codes help. Once a sample is taken from the field it is retained as department ownership. Samples are tested at the producer's facility, and numbered locking tags are used. Contractors can also expedite samples to Harrisburg and security tape is applied prior to transporting. PennDOT has also looked into RFID tags, but the cost is high.

Q: Does the data stay with the asset?
A: PennDOT is gathering a lot of information but does not have a way to tie it to performance in the field. A next step would be to determine what mixes perform the best in the field. With records retention being often shorter than the service life of the material, we will have to determine what data to save in the long term file management and how long do we keep it.

Appendix A – e-Construction Peer Exchange Agenda

pennsylvania
DEPARTMENT OF TRANSPORTATION

Pennsylvania DOT and Alabama DOT e-Construction Peer Exchange

45 Thoms Run Road
Bridgeville, PA 15017

Agenda

Day 1 – August 1, 2017		
Time	**Topic**	**Presenters / Facilitators**
8:00am – 8:15am	Welcoming Remarks and Introductions Peer Exchange Background and Overview Goals and Objectives	Kat Weisner – FHWA Jim Foringer – Pennsylvania DOT Skip Powe – Alabama DOT Stephen Bucy – Maryland SHA Tom Zagorski – Michael Baker International
8:15am – 9:30am	Document Management and Collaborative Project Sites – PennDOT's Project Collaboration Center (SharePoint)	Doug Seeley – Pennsylvania DOT Peter Rosenkrans – Pennsylvania DOT
9:30am – 10:00am	Background on Alabama DOT's e-Construction Activities and Plans	Skip Powe – Alabama DOT
10:00am – 10:15am	Pennsylvania DOT e-Construction Overview	Jim Foringer – Pennsylvania DOT
10:15am – 10:30am	Break	
10:30am – 11:30am	Overview of the Engineering and Construction Management System (ECMS)	Lori Miles – Pennsylvania DOT
11:30am – 12:45pm	Working Lunch (Demo of ECMS)	
12:45pm – 1:30pm	Overview of the Engineering and Construction Management System (continued)	Lori Miles – Pennsylvania DOT
1:30pm – 3:00pm	Discussion on Digital Signatures: Electronic Contracts and Change Orders	PennDOT/ALDOT
3:00pm – 3:15pm	Break	
3:15pm – 3:45pm	Pickens County e-Construction Inspection Project – AID Grant	Skip Powe – Alabama DOT
3:45pm – 4:00pm	Discussion on Day 1 Takeaways for Implementation Preview of Day 2 Agenda Items	Tom Zagorski – Michael Baker International
4:00pm	Adjourn	
Dinner on our own		

Day 2 – August 2, 2017		
Time	**Topic**	**Presenters / Facilitators**
8:00am – 8:15am	Recap of Day 1 Discussion Themes	Tom Zagorski – Michael Baker International
8:15am – 10:00am	e-Construction Mobile Devices and Applications: MC Docs, MC PSA, MC Punchlist, Planned Force Account Management Apps	John Myler - PennDOT
10:00am – 10:15am	Break	
10:15am – 11:00am	Piloting e-Construction: Lessons Learned and User Acceptance	PennDOT
11:00am – 1130am	Discussion on FHWA Division Office Pilot Program for Tablets	FHWA/All
11:30am – 12:45pm	Working Lunch eCAMMS Introduction	
1245pm – 2:30pm	eCAMMS Demonstration – plant books, mix designs, sampling test results, approved source bulletins	Brian Myler / Deborah Reihart / Sherry Hartman via conference call - PennDOT
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	

Appendix B – e-Construction Peer Exchange Roster

Name	Agency	Email Address
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