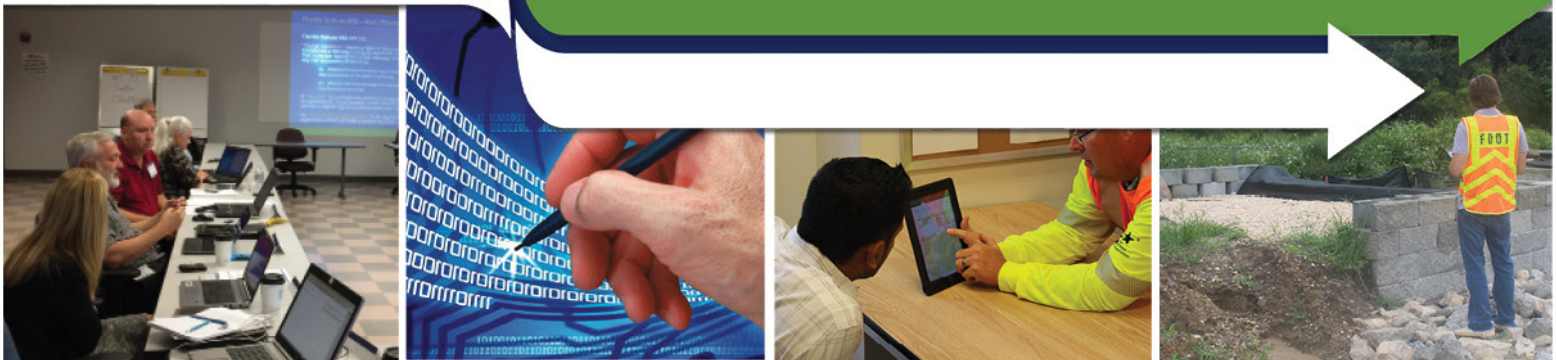




e-Construction

PEER-TO-PEER EXCHANGE

Summary Report



Ohio DOT and Iowa DOT

November 8 – 9, 2016
Aimes, Iowa



U.S. Department of Transportation
Federal Highway Administration

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1. Background

The use of electronic project documentation management systems, mobile devices, and other digital applications in construction, coined “e-Construction,” is one innovative technology application that the Federal Highway Administration (FHWA) is promoting for ensuring efficient management of public funding for infrastructure. e-Construction by definition is a paperless construction administration delivery process that includes electronic submission of all construction documentation by all stakeholders, electronic document routing and approvals (e-signature and/or digital signatures), and digital management of all construction documentation in a secure environment that allows for distribution to all authorized project stakeholders through mobile devices. e-Construction approaches offer agencies an avenue for effectively reducing costs, increasing quality, and improving employee efficiency using modern information technology tools. State departments of transportation (DOT) are providing efficiencies and working toward a “paperless” solution, with implementation through field staff, contractors, suppliers, consultants, and FHWA.

To assist agencies with advancing the implementation of e-Construction, FHWA sponsored—and the Iowa Department of Transportation (IADOT) hosted—a peer exchange with the Ohio Department of Transportation (ODOT) in Ames, Iowa, on November 8-9, 2016. The peer exchange provided a forum for participants to discuss and exchange ideas on e-Construction.

Fifteen attendees participated in the peer exchange, including Federal and State representatives along with Construction and Information Technology (IT) leaders, field personnel, representatives from the Associated General Contractors of America (AGC), and engineers from IADOT, ODOT, and FHWA Headquarters and the respective FHWA Division Offices. The peer exchange was formatted to provide a mix of presentations and facilitated roundtable discussions. This structure provided attendees with several opportunities to collect information from their peers and examine different ways to implement e-Construction. Representatives from both States shared their noteworthy practices and strategies as well as the challenges and barriers they experienced in applying e-Construction.

The event began with opening remarks from FHWA, and the respective participating agencies, along with background information on each State’s construction program and e-Construction activities. The first day included discussion sessions on implementation of document management sites, project workflows, and digital signatures. The second day consisted of discussions on the use of mobile devices for construction inspection, findings and lessons learned from the FHWA Division Office pilot program for tablet devices, and discussion on Iowa’s pilot projects for e-Ticketing for material deliveries to project sites. In addition, participants discussed the important issues and challenges, potential solutions, and e-Construction practices that have proven beneficial to agencies and contractors. To facilitate information sharing, this report includes a summary of key findings from the event, along with the full notes from the peer exchange discussions. To promote further networking with direct contact between States, a roster of participants along with contact information is included in Appendix B.

For more information, please contact:

Bryan Cawley, P.E.
Construction Management Team Leader
Office of Infrastructure, FHWA
202-366-1333
bryan.cawley@dot.gov

Kathryn Weisner, P.E.
Construction & Contract Administration Engineer
FHWA Resource Center
202-823-2267
Kathryn.weisner@dot.gov

2. e-Construction Implementation – Key Peer Exchange Findings

The peer exchange produced several relevant and practical findings identified through group roundtable discussions. The following sections outline the items that were highlighted by the group as next steps, implementation ideas, document exchanges, or focus areas—all of which are designed to assist with future implementation within the States' e-Construction programs. Where available, website links are provided for some of the practices currently in use by the agencies. Additional documentation was shared directly among participants in the group

IADOT piloted an electronic ticketing and materials tracking solution in 2015. The system is designed to tag and track trucks from their source to the material delivery location using Global Positioning System (GPS) technology and proprietary software. IADOT sees great benefit (such as improved inspector efficiencies and enhanced safety) in future uses of this system for both asphalt and Portland cement concrete (PCC).

- Shared resources for more information:
 - Link to IADOT blog site and post on e-ticketing for asphalt:
<http://www.transportationmatters.iowadot.gov/2015/12/eticketing-show-promise-of-speeding-process-and-improving-accuracy-at-asphalt-job-sites.html>
 - IADOT also shared the e-Ticketing PowerPoint presentation file with ODOT.

State policies vary in their use of **a standard set of applications (apps) and the associated protocols for users in downloading and testing new apps**. Many States allow users to download and test new work-related apps, with a feedback mechanism for pros and cons and suggestions for future use. Due to flexible IT policies on testing new apps, IADOT benefitted from a pile driving app that was used to collect data on the iPad. Participants also made a recommendation for AASHTO or a similar entity to organize all assessment information on software and applications or host a site where users can provide input to assist others with selecting the best tools to fit their needs.

IADOT implemented a Saximeter-type app for calculating the height of the stroke and the number of strokes per minute, along with blows per minute. This app has a cost of less than \$15 and can be found on the Google Play Store and iTunes by searching for “pile driving.”

- Shared resources for more information
 - Link to IADOT external ArcGIS Online for Organizations (AGOL) applications:
<http://www.iowadot.gov/gis/applications.html>
 - Link to Fulcrum app for mobile data collection and core sample position logging:
<http://www.fulcrumapp.com>
 - Link to IADOT snow plow tracking application:
<http://iowadot.maps.arcgis.com/apps/SocialMedia/index.html?appid=cb8b98296a3444a09b49e102ad57bfe8>

Standard software tools are developed and/or procured for use by State DOTs in managing construction programs electronically. IADOT and ODOT shared their experiences with developing and integrating document management systems such as **DocExpress**.

- Shared resources for more information
 - Link to DocExpress case study on IADOT's use of the software:
https://www.infotechfl.com/downloads/docexpress/doc_express_case_study.pdf

Mobile devices take a variety of forms. IADOT piloted iPads in the field, and also tested the Microsoft Surface Pro for inspection and maintenance documentation. For field inspection, IADOT chose the iPad due to simplicity of apps and geospatial orientation. Field inspectors have limited engagement with IADOT mainframe legacy software applications and database systems from mobile devices. IADOT also uses an app called Airwatch to manage software pushed out to all DOT devices, and recent software versions are compatible with various operating systems.

- Shared resources for more information

- Links to IADOT Construction Electronic Reference Libraries:
<http://www.iowadot.gov/erl/index.html>
- Link to Washington State research study on the benefits of using tablet devices for inspection:
<http://www.wsdot.wa.gov/Research/Reports/800/840.2.htm>
- Link to Airwatch mobile device application management tool:
<http://www.air-watch.com/>

Software-as-a-Service (SAS) is becoming more common as e-Construction systems may be subscription based with data housed in the Cloud as opposed to a one-time purchase model with future upgrades. Additionally, many State DOTs opt to use third-party document management hosting in the Cloud to avoid issues with internal DOT system access while still being able to archive files on internal systems inside the firewall once projects are completed. An annual contract subscription can provide benefits for ongoing projects in helping agencies more easily manage stakeholder access to all e-Construction documentation and data.

- Shared resources for more information
 - Link to FHWA standards for approved Cloud-service providers:
<http://www.fedramp.gov/>

IADOT is using PDF Expert to provide comments on documents electronically and to support as-built documentation. Inspectors and others from IADOT stated that this e-Construction tool is user friendly with minimal learning curve as opposed to other drawing tools that are also commercially available. This tool was tested with success on the iPad.

- Shared resources for more information
 - Link to more information on the PDF Expert software application:
<https://readdle.com//products/pdfexpert5/>

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 that includes contact information for each attendee.

3.1 Ohio Opening Remarks

At the beginning, one of the Ohio Deputy Directors wanted to concentrate on electronic document storage. Ohio DOT decision making is handled in the districts, but the Central Office provides control over where money is spent. They had been having a hard time finding information. The Central Office piloted an electronic scanning of documents for a \$100M project and received mixed results. Based on the pilot, they decided to move forward with a SharePoint site for document management. Ohio DOT’s leadership is in support of their e-Construction initiatives, and during the past 6-8 months, the initiative has taken off with field staff. Ohio also evaluated their existing tools to see if they could optimize current processes and systems. They began by looking to see where they could incorporate digital or electronic systems with only slight modifications to the existing systems. During the move to get SharePoint up and running, one of the Ohio districts had a major flood where they lost most of their construction documentation and had to ship all of their documentation to Texas to have everything freeze dried. That District is now the leader in the state at using electronic documentation.

Following EDC-3, Ohio put together a group to discuss all the types of documents that are on projects. They put together a list to determine which documents could be electronic, what has to be signed, what can use a digital vs. ink signature, etc. From those discussions, they started to build SharePoint sites with a folder structure to mimic what was used in the field. In addition, they had outward-facing and inward-facing for each project.

They worked with the IT department to create a virtual desktop so external consultants and contractors could access required programs within Ohio network, without having access to Ohio's full system.

The agency then moved into examining the legality of digital signatures, change orders, etc. They tasked a staff attorney to begin researching digital signatures. He investigated policies and procedures and eventually developed a draft, which he shared with a few people for comment. Eventually this draft policy moved up the chain of command to the Director's office. They began to research authentication issues and accessibility for contractor change orders. They moved forward with Right Signature program.

They were also looking to give their people access to mobile devices in the field. They applied for \$76,000 for purchase of 77 Dell Venues. These tablets were identified as good devices for engineering staff. They purchased 77 Verizon LGG tablets (Android platform). Ohio is device neutral. Ohio wanted to make sure they had a broad range of devices their staff could use.

Ohio’s Finance Department used to be the keeper of records; they are now using SharePoint to access all their documents. They are also using Mobile Inspector (InfoTech product). They started with a Pilot of 6 users and then went up to 30 users. They now have 300 users.

During this time, Ohio standardized forms and documentation/records and provided access through a system-wide SharePoint site.

Ohio has 12 Districts, and 4 Districts have really taken off with it. Probably three or four are very much lagging behind. Many of the districts realized how far behind they are and are now motivated to move forward. They are finding, when they call out districts for lack of users, those districts become motivated to not be last.

Ohio is changing their method of inspection. They want to document the quality requirements more. They are creating standard forms for quality reporting. GoForms is a digital inspection format for field people to use. They are looking at tablets as the first step to getting field users to embrace digital recording of data over the next 3-4 years.

ODOT has made significant advancements since EDC-3 and has achieved executive level/leadership buy-in. The agency developed an implementation plan and stuck to it, and now it has a motivated team to support the initiative in addition to significant long-term plans.

Q: Does Ohio have an implementation plan?

A: Yes, they executed an implementation plan. But they also have a road map they have been developing to update their approach.

They developed a 3D model from design and provided it to the contractor on a project. They collected many lessons from that, e.g., unmanageable file sizes, etc. They did not know exactly what to provide to the contractor. They still had the traditional plan set (also scanned to PDF). They were attempting to take their data and provide it to the contractor for automatic entry into their automated machine control systems.

Iowa: AASHTO subcommittee developing Electronic Engineering Standards. Iowa has been utilizing 3D models, automated machine control, etc. for years.

Q: How many inspectors does Ohio have?

A: 400 total inspectors. 70% in-house CEI. 30% Consultant CEI.

Q: How do the systems integrate with alternate delivery systems projects?

A: Lump sum payment processing requires work-arounds. They use the same tools, basically shoving a square peg into a round hole. Submittals, review times, turnaround times, generally requiring a 5-day turnaround time on reviews is compatible with their tools. Speaking to AASHTO to see if they can make AASHTOWare more compatible with lump sum processing, etc.

3.2 Iowa Opening Remarks

Greg Mulder with IADOT presented on e-Construction activities in Iowa.

Iowa is still using Field Book/Field Manager. IADOT also uses BidExpress, which is required on all projects that require precertification. Electronic bids may not be required on small demonstration projects, landscaping projects, and other minor projects. All other projects require the use of BidExpress. The agency uses FieldManager (started in 1997) and FieldBook for contractor payment documentation.

In 2015 they wrote a spec that all shop drawing submittals be submitted through Doc Express. They started using DocExpress as a means to replace the field staff's books and project records. Iowa chose 4 projects in 3 districts to pilot paperless projects, choosing innovative and motivated REs to equip with tablets and get them moving.

People who have access include:

- DOT staff
- Contracts office
- Design
- Construction inspection staff
- Materials inspection staff
- Central Complex staff
- District staff
- Contractors
- Consultants

- Suppliers/Producers
- FHWA
- Public

Iowa is 98-99% paperless (almost everything except material tickets). They tried Bluebeam, but found it was too complicated. It was a much steeper learning curve for most of their staff. They decided on PDF Expert in place of Bluebeam.

They use an in-house LIMS (Oracle-based). It took 9 years to get the first section complete, but they have moved very quickly in the last 4 years to get the rest of the LIMS system up and running. The IT department developed a script to directly transfer scale data into LIMS. They do have a few pieces of equipment that automatically transmit the data they collect into their LIMS system.

Iowa uses ProjectWise for design and anything preconstruction. Ohio DOT found that ProjectWise was not able to be used through Android devices. Iowa found that their naming convention for ProjectWise was unmanageable. Construction wanted something simpler and decided on DocExpress.

Materials Approved Product List Enterprise (MAPLE) is an automated system used to track approved suppliers and products in real time to manage version control and accessibility.

SiteExchange: populates materials.

In terms of technical training and certification, Iowa still tests individuals in-person, but the testing itself is all electronic.

Iowa shared an example of contract signing through DocExpress: the project was let on October 18 and executed by October 26 (a total of 8 days, including a weekend). They had contracts signed in less time than it would have taken to send out the original document via U.S. mail for an ink signature.

Paperless FieldBook:

FieldBook is standalone program and data is transmitted electronically or via flash drive. Data must be uploaded to FieldManager manually.

Iowa hands out iPads to all inspectors and completely equips them with a case, clamshell, carrier, chargers, screen protectors, etc. IT sets up the initial apps and pre-loads the programs to iPads. Once they turn them over to operations, operations manages them.

Contract modifications:

Processing is carried out through DocExpress. A contract modification makes it through the system within 7 days. Iowa has approximately 670 contracts in DocExpress at any given time. DocExpress allows for Dashboard views, which can be sorted based on the categories or fields that exist within DocExpress.

Q: How do we promote in a positive fashion to the public that e-Construction is saving money and increasing quality?

A: Their public outreach has been more in line with notifying the public to keep them informed, 511 sites, etc.

Q: Does Iowa use links in their pdfs?

A: Iowa has a plan room in DocExpress. If revisions are made, they are added on as they go and sent to the Resident, who is entering the revisions into DocExpress.

Q: How is cooperation between Design side & Construction side?

A: Reasonable. Iowa has worked to break down the silos internally to make communications smoother.

Q: What is Iowa's design software?

A: AutoCAD.

Q: Does Iowa have a strong Contractors' Association?

A: Yes. Iowa has engaged the Associated General Contractors (AGC) and found great success and feedback from the contractors to continue pushing e-Construction initiatives forward. Contractors have embraced it since Day 1.

Q: How many inspectors does Iowa have?

A: About 300. 95% in-house construction inspection. They are trending more toward higher utilization of consultant CEI. Consultants will have to supply their own devices. Bridge design is 70% consultant and 30% in-house. Legislature does not allow for Design-Build.

Q: Does Iowa use electronic specifications?

A: Specifications are still very paper-oriented. They are pdf versions, but also printed.

3.3 Demonstration of Host State e-Construction Technologies and Systems (DocExpress)

Dean Herbst provided an overview presentation on the use of DocExpress in Iowa. In December 2015, the agency had 26 active contracts, 5,000 documents, and 325 users. By October of 2016, the system included 633 active and 476 locked contracts, more than 174,000 documents, and more than 800 users.

DocExpress has a number of features that make it easy and useful:

- Each contract has nine potential drawers.
- You can choose default drawers or make your own drawers.
- You can add new drawers and file things in a staging drawer for items that are not yet complete, i.e. a working file.
- You can link a document into another drawer – the document is stored only once, but can be linked elsewhere.
- DocExpress can store native files in any format/program.
- All steps in the process are saved to the project log - which tracks all actions per document.
- The system shows badges for each drawer that indicate the number of items requiring action.
- If a document is rejected, user can download/open the file in its native format, make adjustments/red-line the document, then upload the red-lined version for submittal.
- Project plans can be adjusted – the project log will maintain links for previous document sets, including the As-Let set, even though the revised set is posted as current.
- The home page is searchable, and there are additional filters for contractor, contract name, location, description, etc.
- Each user sees only the contracts to which he has access.
- You can mark contracts as "Favorites," which automatically sorts to the top of your list.
- Each user can determine how they wish to see notifications for drawers (to which they have access).
- You can create summary notifications in single emails for specified info, which is delivered each morning.
 - Use of customizable notifications is one of the main features that helped with getting management buy-in.

Iowa staff can use DocExpress on locally administered projects, and contractors are pushing for this also; Iowa is just starting to investigate using this.

At present, Janet can manage groups and groups' access to various drawers, etc. She cannot manage contractors' users. Contractors can administer their accessibility settings. By default, prime contractors can see all documents in their contract, but subcontractors can only see the files they have submitted themselves. Prime contractors must provide access to subcontractors.

Naming conventions were the first big challenge – initially users were not following any general format. They were advised by auditors to be consistent and logical. And as long as document attributes are tagged properly, those documents can be found through various searching, sorting, and filtering tools.

Q: Where are documents stored?

A: InfoTech stores externally.

Q: What is the cost?

A: Cost is approximately \$100,000 per year, with no maximum number of users, for coverage on all projects, statewide.

Q: How rigid is your filing structure?

A: Very rigid. All changes are managed through system administrator. They try to keep things as consistent as possible. Contractors know that all projects will have the same consistency for filing systems, etc.

Q: How long does it take to set up each contract?

A: Janet: 45 seconds to 1 minute.

Q: Do you receive contract award data from BidExpress?

A: No. Contract award notifications are provided to Janet from the contract awards office.

Q: How is the contractor notified they've been added to a contract?

A: Janet manually sends a note to advise them they have been added to DocExpress for a specific contract.

Q: Can you drag and drop files into DocExpress?

A: No. Right now you cannot drag & drop emails for instance.

Q: Is file size an issue in DocExpress?

A: No. You can store files of any size and type in the system. However, some of the 3D models they use are extremely large and cumbersome, so they have not made it a practice to use the 3D models in DocExpress.

Q: Is there a clock/schedule tied to the submittals?

A: You can add this feature, so a PM could see on his dashboard the overall health/performance/timelines for his projects.

Q: Can you prioritize workflows?

A: Yes, workflows can be customized and prioritized for users and documents.

3.4 Electronic Workflows & Digital Signatures

DocExpress has grown far faster than anyone had imagined; as mentioned, Iowa currently has more than 800 users. At present there are 651 total active contracts in DocExpress and over 400 contracts that are locked (closed out).

- You can specify signature requirements - no signature required, check box confirmation, digital signature, etc.
- There are three levels of digital signatures:
 - Level 1 – User is authenticated through their DocExpress log in (i.e., check box confirmation).
 - Level 2 – Once the user has been authenticated through DocExpress log in, the user must then type their name to validate their identity.
 - Level 3 – True third party digital signature authentication.
- You can specify an ordered workflow.

- Shop drawings: Iowa gives the designers the option to choose signature requirements. In order for consultants to have the ability to have access to the shop drawing drawer, they must be invited by the system administrator as if they were a DOT employee.
- Signature drawer: No workflow required—anyone can sign at any time.
- Contractors, once awarded, will be directed to a contract signing drawer where they can review winning bid instructions, verify performance bonds, etc.
 - Administrators can manage system settings for accessibility to signing documents, etc.
- Iowa did experiment with DocuSign, but decided it was simpler to manage authentication through DocExpress.

Q: Is DocExpress the only software where Iowa uses digital signatures?

A: Yes.

Q: How difficult is it to onboard someone into the DocExpress system?

A: Janet, as an administrator, can invite employees through their email, which provides a link for them to complete registration, including setting up a password, etc. Once complete, that outsider will have access to the DocExpress.

Q: Do contractors/consultants have a single portal in to DocExpress for multiple state DOTs or clients?

A: Greg has access to Iowa projects and local systems project both through separate DocExpress systems. When he logs on to DocExpress, all the projects he can access for both Iowa and local systems are available through the same log in.

Ohio signature process utilizes Duo -- which authenticates by sending a message to the ODOT user via mobile phone – the system sends a unique code to their Duo account which is then entered to the digital signature. Once a user receives the six-digit code, that user has 7 seconds to enter the code for the signature; after 7 seconds it expires.

Q: Is there a cost to the contractor to get a digital signature?

A: There is no cost to provide access to the DocExpress contract signing drawer. Surety 2000 furnishes a bond ID to the contractor and charges a nominal fee per performance bond ID number. There was a learning curve for the Surety 2000 system, and Iowa had not notified the contractors that their bonding companies were required to utilize the Surety 2000 system.

Q: What happens if formats change or a digital black hole occurs?

A: Iowa is very satisfied with the simplicity and practicality of DocExpress. They will adapt as needed, but for now, the provider is reputable and the file formats are native to the documents themselves, so file formats and compatibility are not a DocExpress issue.

Q: Which states are using it?

A: Iowa, Arkansas, Tennessee, Vermont

Q: Which other programs did you review before deciding on DocExpress?

A: ProjectWise and SharePoint, neither of which quite met their needs and both of which were more complicated in comparison to DocExpress.

Q: Does Iowa specify software for scheduling?

A: No, Iowa is not currently specifying Oracle Primavera or other scheduling software.

3.5 ProjectWise Discussion – Ohio Implementation

In the next segment of the peer exchange, representatives gave an overview of the Ohio experience with ProjectWise.

Ohio launched pilot projects in various districts for ProjectWise implementation. Ohio has been engaging Bentley to assist in setting up structures and usage.

The Ohio Technology Council must develop a 1-year work plan. The Council must also identify resources and develop an implementation plan to support efforts to track the work plan. The Engineering/Design side implemented first. They started with 4 of the 12 districts and will phase more in from there. They feel it has gained much more traction because e-Construction is also involved.

The full IT staff is dedicated for this implementation. The agency has been very conscious of “change fatigue” and has begun a phased approach to eliminate SharePoint and stand up ProjectWise. The ProjectWise implementation is anticipated to:

- Provide a document retention system.
- Support collaboration between contractor/consultant/etc.

Ohio has requested a health check from InfoTech to review how it is using their products to assure they are using it most efficiently and getting the best bang for their buck.

Ohio is estimating it will take approximately 15-18 months to implement the newest edition of AASHTOWare (3.01). When they implement, they will bring in 1-5 types of staff from each district, who will be users, to engage their ideas, so they do not feel that change is being thrust onto them, to get their buy-in.

Ohio does hands-on training. Ohio will go to the end users for training, including district offices and work with users in the field, as well as consultant offices (which will include a cost)

Ohio provides Dell Venue, iPad Air2, Samsung Galaxy Tab E, etc. Consultants provide their own since Ohio's systems are device agnostic. They had to develop a naming convention for the file structure in ProjectWise. They found even during the pilot project that people were bypassing the project naming wizards and using something else. They had to develop APIs that would force down the file naming convention so that users could not name the files in any other format.

Ohio feels they have made too many customizations to be able to transition smoothly to a new system. Often, by the time they can complete upgrades, the warranty period has expired and they can no longer cost-effectively make additional changes.

Iowa has engaged InfoTech to solicit their help in implementing AASHTOWare 3.01, to help them determine how they can integrate the current LIMS into the system. Iowa has only been using the Construction element of the system through FieldManager.

3.5.1 ProjectWise Issues Identified

- The system is not compatible with Android devices.
- Not only do they have to train all of their internal staff, they must also train their consultants and contractors.
- Many contractors have been apprehensive about using Ohio's SharePoint site because they determined that when force account information is posted, it is possible for one of their workers to access the data through SharePoint and compare hourly rates, etc.

Q: Do consultants have to learn SiteManager ahead of time?

A: Yes. Ohio wants consultants to be held accountable for being paperless as well.

Q: What keeps you up at night regarding your transition to AASHTOWare 3.01?

A: Internal processes, etc. For instance, they made 98 modifications on 82 screens, none of which were documented. This type of internal process was creating clumsy systems, and may negatively affect their transition to upgrades.

Q: How do your documents get into SharePoint folders?

A: Files are either scanned in, saved into folders, or dragged and dropped.

Q: Once something is added to the SharePoint files, is there any notification provided?

A: No. They have not fully utilized all the features available in SharePoint.

Q: Are you consulting with other states specifically on ProjectWise?

A: Michigan is using ProjectWise in construction. Michigan is able to put a lot of resources on their initiatives for e-Construction.

3.6 Iowa e-Construction Mobile Devices – Maintenance & GIS

Iowa is integrating its GIS unit for asset management. The 193 Form contains material data and information that is sent to the Materials Unit. All data is manually transferred from the same form into three different systems.

Along with Survey 123, it provides a fillable form app that will automate their process at the material sample collection site. It includes a bar code function. The ultimate goal is to take the data they are collecting to push out to their RES Servers.

Iowa is piloting the tools on the storm water unit. They will be doing all storm water collection through this software. Data will then be transferred into their asset management system. They can create dashboards to view inventory/asset management data.

This app will collect the as-built data (for guardrails, for instance) at the time of installation as opposed to collecting it once at installation and then again at the time for update, when they would send out data collection for design data.

The Form 193 idea will collect the materials and data obtained during initial inspection and integrate it into a GIS-enabled database so if, for instance, they are having a performance issue on a certain section of roadway, they can pull the location coordinates and immediately access the inspection and materials data from initial installation/construction.

The Survey 123 app will house the Form 193 data and collection info. Currently Form 193 is a standalone fillable form that must be manually re-entered in multiple places.

One of the RCE offices is layering ROW data over Google Earth and creating .kmz files. Access to this information allows a construction field person to visualize themselves through Google Earth maps. This RCE office is especially tech savvy and is pushing it themselves.

3.6.1 Maintenance

Shawn Blaesing-Thompson discussed Iowa's GIS software.

The agency piloted multiple devices, but decided to choose one – the iPad, which has GPS enabling capabilities and very good photo quality/usability. The Android devices are not all GPS-enabled, and the photo capabilities are not as user-friendly. However, the app they use is device neutral. They have been using iPads for 3 years. Most of the original iPads are still being used. They are sharing some devices between Maintenance and Construction.

There are two major GIS data software providers:

- ESRI - ArcGIS online – server or cloud based. Allows Iowa to place all their core asset data into one place.
- Intergraph - Desktop based GIS software.

Iowa moved from Intergraph to ESRI.

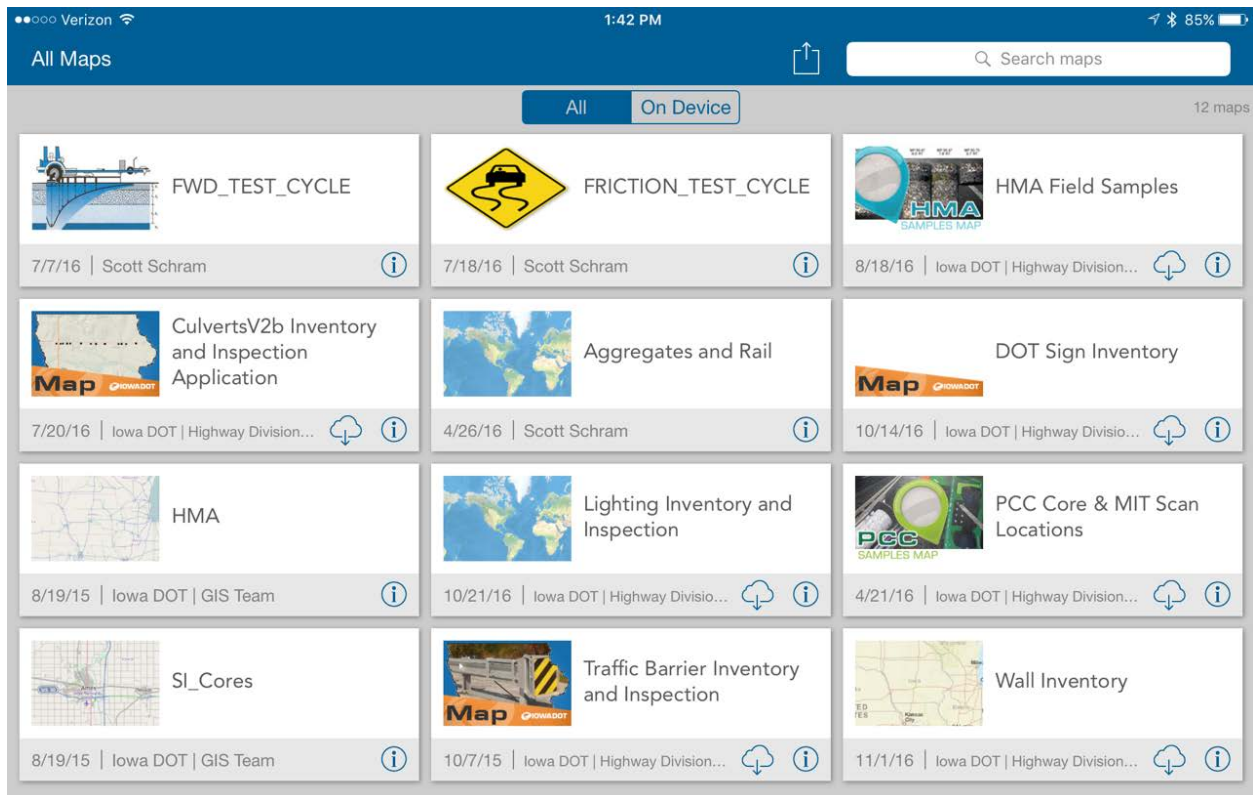
Survey 123 is part of the ArcGIS suite. It contains smart forms and includes logic based on your selections, etc. Maintenance uses ProjectWise as a storage tool for their inspectors to access documents, which requires a log in.

Through the Collector App users have access to inventory data through 5 apps:

1. Culverts
2. Traffic Barriers
3. Signs
4. Lighting
5. Walls

For assets, there is an inventory component and an inspection component.

Collector is a data collection tool, not a data analysis tool. They have other tools for data analysis and reporting. The Collector system was not developed in a vacuum – everything was done with intent and in coordination with the inspectors to develop features that would be useful. They worked with staff outside of Maintenance as well to determine how to best integrate the info they collect into other tools.



They have found that it takes about a day to a day and a half for inspectors to get comfortable with the app in the field. They also provide a lot of support to each other.

The agency has tried to take the typing out of the data collection tools – using more drop down lists to simplify data collection. Users can also take photos and attach them into the tool. The system does separate the photos and push in a different way to the database because the file sizes become unmanageable when they have to push or move data.

Consultants are also able to enter data. Iowa grants access to consultants and provides levels of security based on the user group.

The end goal is to have a single database set that can connect all of their systems, from asset management into construction, maintenance, pre-planning, and through the project cycle.

3.6.2 ESRI

Iowa has a CORE GIS team that manages the RES services and tests new software. This team includes two consultants who are embedded. They support all geo-technology for the entire DOT. They have full control over the ArcGIS services.

It is designed to be used on desktops, laptops, mobile devices, etc. One of the most utilized features is the ROW feature that identifies the ROW throughout the state. Maintenance people log all the deer kills into the system and Iowa makes that data available to the public. The team is working on some dashboards to allow them to see data in different ways.

They initially got the iPads to provide road weather reporting for snow removal. The public can access real time weather condition info. About half of each district's equipment has tracking info on it, including GPS location and cameras. The public can access the Iowa GIS website to view live road conditions as plows maintain the roads.

Q: What are Ohio's geolocation capabilities?

A: When you take photos, it captures the location where you are taking the photo. Currently, the system captures the GIS coordinates of where the inspector is located when he locks the DWR, and not where he snaps the photo.

Q: What devices are you using?

A: Dell, iPads, LG, etc. Ohio has found that individuals are not sharing information/data between users or districts.

Q: Where is the data stored?

A: They use an FME process that transfers data between the cloud and the Oracle database as the inspectors collect the data.

Q: How many users of the data collection system?

A: About 200 statewide throughout the state. They worked with a core team of 12 staff to develop the systems.

Q: Is there a log?

A: Yes, on the back-end they can view fields that show log-in, editing, and other data for all records. They have user accounts for all data collectors.

Q: How is your IT Department involved?

A: IT just did a full system assessment to analyze all of their tools and systems. They just hired a new IT person to help analyze the approach to tying their systems together and improving efficiency, etc.

In Ohio, they have identified issues with their IT:

1. Numbers/lack of resources – not enough staff to handle their requests.
2. Talent – staff not trained or equipped to deal with the specific requirements of new systems.

They have brought in consultants to assist as well. Ohio thinks they are about 60 percent consultant IT. The agency intends to bring InfoTech onsite for a minimum of 1 year once they get up and running with AASHTOWare 3.01.

In Ohio, it's highly unusual to have an Enterprise system that is owned not by the DOR but by a Division. Scott Hootman and Janet Treadway administer SiteManager as opposed to IT administering it. Ohio has developed an OPUG - an Ohio users group which meets monthly and mirrors the AASHTOWare PUG.

3.7 Contractor Perspectives, Change Order Processes, and Access to Electronic Systems

Ron Otto with Associated General Contractors of America – Iowa Chapter provided perspectives for e-Construction from the contractor's view.

AGC holds bi-monthly meetings where Iowa discusses industry issues, partnering, etc. Iowa found some contractors through AGC who were interested in piloting the e-Construction technologies.

The contractors became the champions for the e-Construction technology. During the first couple of years, they piloted about 4-5 projects. Iowa received a lot of assistance from the contractors to write the specs for DocExpress. Iowa made approximately 10 training videos for contractors' use. Iowa did this at the urging of the contractors.

AGC has been partnering with Iowa for 40+ years, but not always formally. AGC noted that the payment processing issue has been the most beneficial. DocExpress has also very much expedited the close-out process.

Sharing electronic files is still an issue; file size can be extremely cumbersome in transmitting 3D models into construction. Right now the contractors feel that there should be more electronic files available for more projects during the bidding process. There is a changing workforce out there. Younger workers are demanding this type of administration. The workforce is interested in making themselves more efficient.

AGC definitely sees the value in sharing information in peer exchanges formats, among DOT's and between agencies. Iowa is no longer doing formal partnering sessions. They have more of an informal process they follow.

AASHTO is currently updating its 2005 Partnering manual. We are looking to apply the process to alternative delivery method contracts, specifically design-build, P3, and CM/GC. There are a few states that are looking for information on how partnering has changed (PA, NV), as well as how e-Construction technology is complementing partnering and how best practices have changed. With the younger generation entering the workforce, there is a renewed push to redefine the concept of partnering. Also, many states are moving to risk-based partnering, where there is more focus on the issues of the project versus the personality trait and the feel-good steps the formal partnering process required.

Q: Were the contractors reluctant to accept the move to e-Construction technology?

A: At first, yes, there was some trepidation.

Q: Does Iowa require use of FieldManager?

A: Out of 99 Iowa counties, 22 are using it. It depends on the funding sources for the project. Federally funded projects are not required to utilize the Iowa-sponsored systems (DocExpress, FieldManager, etc.). However, they are required to meet Iowa requirements, but they can use whatever systems they want, whether it's on paper or another administrative software. The overwhelming majority of federally funded projects are let through Iowa.

Q: Do you have any specification written to address agreement on final quantities?

A: No.

Q: How does DocExpress facilitate close-out?

A: Everything is there in one place. The contractor and Iowa both have access to it. The contractor provides access to the subs if required. The project team is checking off submittals, certifications, etc. as they go, as opposed to trying to track down the certs at the end of the project. Basically the same principal applies as it did in past decades: if you do not have a cert, you do not get paid. Electronic signatures have also expedited contract finalization by reducing the time required to sign off on contract modifications for instance from weeks to days or hours.

Q: Are the contractors evolving quickly to address technology implementation?

A: At first, there was some backlash for Iowa no longer providing paper bid documents, but they have largely embraced the changes and do not seem to have issues.

Q: Have you quantified your savings?

A: Iowa has participated in an ROI study for FHWA. Turner Fairbank research team is quantifying through research with four states, including Iowa. The draft of this report may be ready in winter, or early 2017.

Q: Has AGC performed any research on the value of e-Construction to the industry?

A: They find it very difficult to quantify. AGC thinks the prices are very competitive. The process takes away the risk factors from the bidding process, such as time factors for processing of documents.

Q: Is Ohio engaging their contractors?

A: They have been reluctant at first. Ohio has not pushed this very hard onto the contractors. They have found some contractors refuse at first to participate in some initiatives, but for the most part the contractors eventually buy in. Many contractors are still printing plans.

Ohio also holds a 2-day conference specifically for their contractors where ODOT and their contractors get together and hand out awards, etc. Their participation has been increasing year after year.

3.8 The FHWA Division Office Pilot Program for Tablets

FHWA developed a program to pilot various mobile devices among FHWA division staff in six states (IA, MI, and FL got iPads, the others got Android devices). The Iowa FHWA division was given 7 iPads. Some division offices were given devices only and asked to pilot them without access to their laptops.

FHWA is still going into the field to have the face-to-face interaction with the field staff. Using the iPads has not necessarily reduced their time spent in the field, but has reduced the follow-up time required for administrative issues. iPad use has definitely reduced their paper consumption.

FHWA has had a difficult time quantifying the ROI. The agency has found that it's difficult to get people to take the time to document or categorize their savings for individual activities as they go.

The engineers in Iowa's FHWA division office have found a lot of drawbacks to the iPads. They believe they would be better served by moving to a Surface Pro device, which could be a cost savings factor through replacement of their laptops.

Their iPads have cellular connectivity. The Surface Pros would not have cellular connectivity, but they feel they can work around this through use of Wi-Fi and hot spots.

The iPad provides a very good firewall but is not compatible with the FHWA PIV card and FHWA does not have FieldManager access.

Q: How did Iowa FHWA division office get invited to the Pilot Program?

A: The Iowa office was invited based on Iowa's status as a lead state. Ohio wanted to participate, and is pushing the district administrator to allow them to get tablets. The administrator is telling them they need to wait until the pilot program is complete and FHWA provides instruction for approved devices.

3.9 The Iowa e-Ticketing Initiative

3.9.1 Hot Mix Asphalt (HMA)

The e-ticketing initiative started 2-3 years ago with a focus on HMA. Iowa talked to several contractors who were using GPS for e-ticketing, which did not quite work with what Iowa wanted.

The key to success for this type of thing is finding the right software providers who want to partner with you and develop a customized solution. Lee recommends finding those software vendors who are lean and hungry to work with them through the process and be more nimble in responding to their needs. Some of the larger vendors are not as agile at responding to specific custom systems.

In Ohio, if the DOT enters into an agreement with a software provider, any future agency-wide needs must first include consideration of using this established software provider prior to considering others. Software providers have a benefit to becoming established with the Department.

Iowa does not have an inspector at the plant, only an inspector at the point of placement.

Pilot projects with Fleetwatcher use a hardwired GPS unit that goes in the truck. There are also some portable GPS trackers that can be used in various vehicles. The GPS unit sends a location tracking ping every minute. The contractor will program based on the contractors' shifts. The GPS units have 14 hours of battery backup. The reporting system would also tell you whether the unit was plugged in and functioning properly. If the unit loses cellular service, it will store the location data and transmit it as soon as connectivity is available.

- Every morning, the contractor has to ensure they are tracking which GPS unit went into which truck.
- Purchase price for the GPS units is \$400/each or rental fee of \$200/month. Units are provided through Fleetwatcher.
- Fleetwatcher uses geozones around project-specific areas at plan, scales area at plant, and project limitations.
- Dashboard provides for truck tracking for each project - where trucks are, how many are in service, etc.
- Iowa wrote a developmental specification. Once they receive final approval, they will start adding it into select bidding documents.
- Earthwave developed the Fleetwatcher program.
- They did use paper tickets as a back-up on the pilot project.
- A good majority of their contractors own their own trucks.

Q: What is required of the vendors to participate in this system?

A: Vendors must write some specific data scripts and integrate them into a web-based transmittal system.

Q: What info gets transferred?

A: Everything Iowa asks for on a ticket is transmitted. Weights, approved mix info, etc. (as shown in the presentation - Material Summary Report with Waste and Comments).

Q: Is there a desire to integrate inspectors' material testing data with the material tickets?

A: Some inspectors would like to do so, but Iowa does not intend to.

3.9.2 Concrete

Iowa looked at multiple software providers for e-Ticketing for concrete jobs. Some were extremely expensive just to pilot. ConcreteGo used a system called iSTRADA, which is just out of beta testing phase.

Iowa has piloted one project so far; already the contractor from that one pilot project has asked Iowa to require its use on all projects in that District.

Iowa purchased 12 iPads for use in the trucks on the pilot. There is a QR code assigned to each truck. The iPad goes with the driver, so each time the driver changes trucks, they scan the QR code to begin tracking.

Once the truck arrives at the jobsite, the driver hands the iPad over to the inspector, who can use the app to enter the ticket and materials info. The inspector can reject the load directly through the app.

The app will also track truck locations and provide notifications that are available immediately to provide better timing of communications. It also provides summaries of key times recorded, status reports, and dashboard reporting per job.

Iowa is still piloting projects using this technology. One big challenge they have identified is ensuring that the drivers update the app. In just a few months there have been three updates to the app.

Q: What if the driver forgets to scan the QR code when he gets in the truck?

A: They have multiple layers in place that can pull the data.

Q: What if the driver forgets to hit the transport to jobsite button?

A: The program will automatically start tracking when the truck gets 400 yards outside the point.

Q: What happens if the material is out of specification?

A: An email is generated when the material is marked as “rejected.”

4. Summary and Conclusions

Overall, the peer exchange was helpful to both State DOTs in learning about common business practices and how technology can help.

In summary:

- Iowa is 98-99 percent paperless (almost everything except material tickets).
- Iowa has found the simplest approach has worked best for them. DocExpress has worked very well for them and fulfills the following major categories:
 - Digital signatures
 - Workflows/approvals
 - Document storage
 - Consistency
 - Communications/transparency/accountability
- In Maintenance, all the tools they developed were created with intent and in coordination with their inspectors to develop features that would be useful to the users. All was done in an effort to ensure buy-in from the users.
- A holistic approach is critical – need to understand how the data you are collecting can be used at other points during a project process.
- **Work with your contractors!**

The ODOT staff feels it may not have stepped back far enough to review processes. They would highly recommend anyone embarking on this journey to really review their project management processes, especially by an independent third party who can provide objective advice on processes, procedures, and policies.

In terms of technology, Ohio has identified that when you are identifying and attempting to implement an enterprise-wide system, the best approach is to get buy-in from end users and district staff who will feel engaged.

To support the technology deployment, it is very helpful to develop a mutually beneficial relationship with IT staff. One major challenge the agency faces is IT resources. Currently, only two individuals are administering SiteManager. They are stretched for resources, and the IT resources they have are not trained or equipped to assist in administration or maintenance.

In summary:

- There are generally two schools of thought for systems: SiteManager vs. non-SiteManager.
- There is a changing workforce out there. Younger workers are demanding this type of administration. The workforce is interested in making themselves more efficient.
- AASHTO electronic user standards are relevant. They wrote a mission/vision statement and are moving forward with development of that specification.
- Alternative project delivery methods can raise additional challenges.

Appendix A. e-Construction Peer Exchange Agenda



Ohio DOT and Iowa DOT e-Construction Peer Exchange





Central Complex Conference Room
800 Lincoln Way
Ames, Iowa 50010

Agenda

Day 1 – November 8, 2016		
Time	Topic	Presenters / Facilitators
8:00am - 8:30am	Welcoming Remarks and Introductions Peer Exchange Background and Overview	Tom Zagorski, Michael Baker Int'l Chris Schneider, FHWA Greg Mulder, Iowa DOT (IADOT) Janet Treadway, Ohio DOT (ODOT)
8:30am - 9:00am	Ohio e-Construction Implementation	Janet Treadway, ODOT
9:00 am - 10:00 am	Iowa e-Construction Overview	Greg Mulder, IADOT
10:00am - 10:15am	Break	
10:15am - 11:45am	Demonstration of Host State e- Construction Technologies and Systems - DocExpress	Dean Herbst, IADOT
11:45am - 1:00pm	Lunch	
1:00pm - 2:30pm	Electronic Workflows and Digital Signatures	IADOT/ODOT/All
2:30pm - 2:45pm	Break	
2:45pm - 3:45pm	ProjectWise Discussion - ODOT Implementation	All
3:45pm - 4:00pm	Discussion on Day 1 Takeaways for Implementation Preview of Day 2 Agenda Items	All
4:00pm	Adjourn	
Dinner on your own		

Day 2 – November 9, 2016		
Time	Topic	Presenters / Facilitators
8:00am – 8:15am	Recap of Day 1 Discussion – Challenges and Themes	Tom Zagorski, Michael Baker Int'l
8:15am – 9:45am	e-Construction Mobile Devices (iPads)	IADOT/All
9:45am – 10:00am	Break	
10:00am – 11:00am	Contractor Perspectives, Change Order Processes and Contractor Access to Electronic Systems	IADOT/ODOT/AGC/All
11:00am – 11:30am	Discussion on FHWA Division Office Pilot Program for Tablets	FHWA/All
11:30am – 12:30pm	Lunch	
12:30pm – 2:00pm	e-Ticketing Pilot: Materials Management, Pay Factors, and Certifications	IADOT/ODOT/All
2:00pm – 2:15pm	Discussion on Takeaways for Implementation	All
2:15pm – 2:30pm	Closing Remarks, Feedback on Peer Exchange, and Next Steps	All
2:30pm	Adjourn	

Appendix B. e-Construction Peer Exchange Roster

Name	Organization	Title	e-Mail
Lee Shepard	Iowa DOT	Construction Technology Specialist	Lee.shepard@dot.iowa.gov
Janet Wastenev	Iowa DOT	System Coordinator	Janet.wastenev@dot.iowa.gov
Scott Hootman	Ohio DOT	Construction Administration	Scott.hootman@dot.ohio.gov
Janet Treadway	Ohio DOT	SiteManager Administrator	Janet.treadway@dot.ohio.gov
Greg Mulder	Iowa DOT	Director of Construction & Materials	Greg.mulder@dot.iowa.gov
Tom Jacobson	Iowa DOT	Contract Administration	Thomas.jacobson@dot.iowa.gov
Tom Zagorski	Michael Baker International	Senior Vice President, National Director Construction Services	tzagorski@mbakerintl.com
Andy Thompson	FHWA Ohio Division	Transportation Engineer - District 1 & 8	Andy.thompson@dot.gov
Chase Wells	Ohio DOT	Central Office LPA Construction Contract Manager	Chase.wells@dot.ohio.gov
Eric Kahlig	Ohio DOT	Alternative Project Delivery Administrator	Eric.kahlig@dot.state.oh.us
Andy Wilson	FHWA Iowa Division	Program Delivery Team Leader	Andrew.wilson@dot.gov
Chris Schneider	FHWA HQ	Staff Engineer	Christopher.Schneider@dot.gov
Michele Horak	Michael Baker International	FHWA EDC-3 Consultant Staff	mhorak@mbakerintl.com
Ron Otto	AGC of Iowa	Technical Director	rotto@agcia.org
Shawn Blaesing-Thompson	Iowa DOT	GIS Maintenance Coordinator	Shawn.blaesing-thompson@dot.iowa.gov