



# e-Construction PEER-TO-PEER EXCHANGE

## Summary Report



West Virginia Division of Highways and  
Arkansas State Highway and Transportation  
Department

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## 1. Background

The West Virginia Division of Highways (WVDOH) hosted a peer exchange with the Arkansas State Highway and Transportation Department (AHTD) in Charleston, West Virginia on October 21-22, 2015. The focus of the peer exchange is e-Construction – or a paperless construction administration delivery process that includes electronic submission of all construction documentation by all stakeholders, electronic document routing/approvals (e-signature), and digital management of all construction documentation in a secure environment that nonetheless allows distribution to all authorized project stakeholders through mobile devices. The event was sponsored by the Federal Highway Administration (FHWA), and representatives from the Associated General Contractors of America – Arkansas Chapter and the Contractors Association of West Virginia also participated in the event.

The morning sessions on the first day served as an introduction to the peer exchange and allowed for personal introductions, along with background information on each State’s construction program and e-Construction activities. The afternoon of the first day consisted of discussion sessions on contractor perspectives on the application of e-Construction technologies and implementation of project collaboration sites and workflows. The morning of the second day consisted of additional discussion sessions on e-Construction field devices. The afternoon of the second day began with a conference call with State IT personnel and network managers who were unable to attend in person and also included a discussion session on implementation of digital signatures, followed by a summary discussion on next steps, action items, and follow-up.

The Peer Exchange was the second in a series designed to assist States with implementation, while allowing peers to network and share information across State Departments of Transportation (DOT) in a relatively small group setting. Construction and information technology (IT) leaders, field personnel, managers, and engineers from AHTD, WVDOH, and FHWA Headquarters and the FHWA Arkansas and West Virginia Division Offices participated in the event. The list of attendees, along with contact information for each, is provided as an appendix to this document to promote further networking among participants.

Participants discussed the important issues and challenges, potential solutions, and e-Construction practices that have proven beneficial to agencies and contractors. Application of e-Construction in the field through portable devices, documentation through project collaboration sites, IT security analysis and needs, and the use of digital signatures and workflows were all focus areas of the peer exchange.

This report includes a summary of key findings from the event with links to relevant documents, along with 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 “takeaways” identified by the group roundtable discussions. The following sections address the items that were highlighted by the group as a next step, implementation idea, document exchange, or focus area – 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. In some cases, WVDOH and AHTD shared documents by email and through a link to the WVDOH project collaboration site that may not currently be publically available on the internet.

***Arkansas noted the importance of one primary e-Construction philosophy – which compares a static/analog approach to a dynamic/digital approach.*** This means that systems should be designed to allow users to access data that is stored in a digital format that also represents the single source of that data. When information is in aggregate form and the systems are be able to generate real-time reports by using report queries. This philosophy is contrary to common data storage and retrieval systems where reports are generated and stored as reference documents for future use. The dynamic/digital approach supports the concept of “single source of truth” data storage. By accessing properly stored data and accessing the data through predetermined workflows/report generators instead of a static stored report, users will always be accessing the latest information. Participants agreed that this philosophy should drive the design of e-Construction systems, outputs, and workflows and agreed to keep each other apprised of progress towards achieving dynamic/digital data storage and retrieval.

***Arkansas and West Virginia develop custom reports within SiteManager and other types of collaboration and document management systems.*** Both agencies shared these templates, including Daily Work Report (DWR) templates. Both agencies used a similar report template for analysis of materials testing and sampling information. WVDOH customized their project collaboration site to meet the needs of field personnel, contractors, and project managers and engineers.

***Participants shared manuals and documentation for e-Construction systems.*** WVDOH shared their change order process manual and ProjectWise user manual with AHTD, and AHTD shared policy documents for use of their Bid Express System. WVDOH shared their policy for answering contractor questions using the Bid Express, as shown in **Appendix D**.

Link to WVDOH Engineering Publications:

<http://www.transportation.wv.gov/highways/engineering/Pages/publications.aspx>

***e-Construction software systems are often various forms of database files where customization occurs to meet the needs of the State agency.*** West Virginia shared computer coding for a running averages array for measuring materials performance, a custom report that tracks change order processing times, and also shared code for renumbering bid items in Preconstruction.

***Information Security Protocols and Policies provide for protection of information and data.*** West Virginia shared a construction contract special provision for internet connections that is used when contractors provide wired and wireless internet for field offices.

Link to WVDOH field office internet specification:

<http://www.transportation.wv.gov/highways/contractadmin/specifications/640.11fieldoffice/Pages/20130709.aspx>

***Mobile devices take the form of laptops, tablets, and even cellular phones, and policies are in place to ensure that employees understand the proper use of personal cell phones for business purposes.*** West Virginia shared a policy on use of personal devices with apps to perform calculations, manage PDF files, and connect to systems. In developing a policy on use of personal devices, the agencies considered a key element in whether the agency would need to provide these devices and the associated costs. West Virginia's policy requires that users agree to allow their device to be remotely wiped clean if lost or stolen. The cost of monthly data plans is also a key consideration in developing such policies. WVDOH is experimenting with mobile devices such as the HPX2 Elite, and is also piloting Multivista software for picture and video management.

Link to photograph processing and management software example:

<http://www.multivista.com/>

Link to Washington State research study on tablet devices for inspection:

<http://www.wsdot.wa.gov/Research/Reports/800/840.2.htm>

***Participants made a recommendation that AASHTO gather information from States and develop a central repository for code and standard report templates.*** This code could even be built into future versions of SiteManager and included in updates to AASHTOWare Project as States move toward implementation of this web-based version. This will allow interested States to benefit from templates already in use.

***File storage conventions, library structures, and naming systems are important in using document management systems such as ProjectWise.*** West Virginia shared a training manual on file storage conventions and naming systems for their ProjectWise site.

See Appendix C for WVDOH ProjectWise folder structure example.

***e-Construction systems include access by entities outside the State agency's firewall, such as for contractors and consultants.*** Participants shared information on network security protocols and suggested further investigation into Network Access Control (NAC) solutions that can scan devices that connect from outside the firewall and ensure that virus definitions are up to date and isolate users until the program determines if patches and other applications are up to date. Currently, WVDOH uses CITRIX software to allow outside access through Virtual Private Network connections, while AHTD uses Microsoft Terminal Services. Both agencies shared security protocol documentation.

Link to West Virginia Information Security Audit Policy:

[http://www.technology.wv.gov/SiteCollectionDocuments/Policies%20Issued%20by%20the%20CTO/July2015/AuditPolicy\\_July2015.pdf](http://www.technology.wv.gov/SiteCollectionDocuments/Policies%20Issued%20by%20the%20CTO/July2015/AuditPolicy_July2015.pdf)

**WVDOH is using AASHTOWare Preconstruction and provided a thorough demonstration.** AHTD is also transitioning to Preconstruction. The system supports preparation of the engineer's estimate for federal aid highway construction projects, allows projects to be combined into proposals for bid letting, permits the selection of a group of proposals for a bid letting package and aids in advertising bids, tracking plan and proposal holders, processing bid information, evaluating bids, and making award decisions.

Arkansas and West Virginia acknowledged the need and exchanged comments about AASHTO's Civil Rights module and other software packages such as LCP Tracker for **managing certified payrolls and other labor compliance related documents, including Davis-Bacon Act wages.** Both states agreed to continue to report on their progress on this type of solution.

Link to LCP Tracker software example:

<http://www.lcptracker.com/>

**WVDOH is piloting Blue Beam Revu software for as-built management.** They have also found Blue Beam as a useful tool to communicate issues from the field to the office and can also be used during the design review process.

Link to the Blue Beam Revu software example:

<http://www.bluebeam.com/us/products/revu/>

### **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. The full agenda for the Peer Exchange is included as an appendix to this document, along with a roster of participants with contact information for participants, where applicable.

Carrie Bly, WVDOH Communications Specialist, introduced the opening speakers and welcomed participants to the meeting. Paul Mattox, the West Virginia DOT Secretary and Commissioner of Highways made introductory remarks about the efficiencies of e-Construction and how it is helping administer the \$1.1 billion annual budget. Greg Bailey, the State Highway Engineer for WVDOH also welcomed participants and discussed the overlap between design and construction on implementation of e-Construction. Todd Rumbaugh, Deputy State Highway Engineer for Construction and Development for WVDOH, also gave opening remarks to the group and described how bidding processes introduced e-Construction technologies to West Virginia and how the concept developed from there, including discussion with all key stakeholders on how to implement. The final speaker in the introductory session, Bryan Cawley from FHWA, welcomed participants and provided some background on the e-Construction initiative from the federal perspective – which includes an anecdote from on State that estimated \$40K per project per calendar year is saved as a result of their e-Construction implementation and use.

#### **3.1 Exploring State Presentation – Background on Arkansas e-Construction Status and Plans**

Kevin Thornton, Assistance Chief Engineer with the Arkansas State Highway and Transportation Department, presented on plans for e-Construction implementation in Arkansas. AHTD has 10 districts with 31 resident engineer offices across the State, including a few consultant resident engineer offices. Arkansas implemented a GARVEE Bond program for rehabilitation of the Interstate Highway System. Additionally, the Connecting Arkansas Program (CAP) included a half-cent sales tax to support the transportation system and includes 35 projects along 19 corridors. One of the primary benefits of e-Construction implementation expected by AHTD involves better information obtained faster that will improve decision making processes. This primary anticipated benefit is in addition to savings from reduced paper and electronic storage of files. AHTD is also using Bid Express and realizing the cost savings, and personnel are also signing contracts electronically. Arkansas also uses SiteManager and is implementing AASHTOWare Project. SiteManager Access Reports System (SARS), Construction Materials Report and Documentation System (CoMRaDS) and Change Order Generation System (COGS) are Arkansas-developed systems that are complimentary to the AASHTOWare software systems. Arkansas signed a Minute Order that authorizes the purchase of an annual site license for Doc Express as their paperless contract management system.

Are there digital applications and data processing techniques that should be explored that can provide comparison such as contractor payroll data? SARS originated when SiteManager was deployed approximately ten years ago – the system resembles an application (a Microsoft Access based program) and is updated frequently. COGS and CoMRaDS are newer applications that are also Access based and are components within SARS, all within the AHTD firewall and are all client-based programs. Contractors also have the ability to open their estimates and see what has been paid, review stockpile data, etc. Users have privileges assigned depending on the level of access needed by user.

## 3.2 Host State Presentation – West Virginia DOT e-Construction Overview

Jason Boyd, WVDOH Director of Contract Administration presented background information on West Virginia DOT and its structure including the Division of Highways and the Turnpike Division.

When you award a contract is it paper or electronic? How long does information need to be kept? AASHTOWare Project Preconstruction sends documents to the contractor who signs and the DOT signs in wet ink. Guidance from the State Office of Technology will provide guidance on when documents can be destroyed.

Are bid bonds submitted electronically? Yes, they are received electronically. Performance bonds are signed in wet ink signatures and stored with the original contract documents. They are stored for three years after construction.

Is it mandatory to submit bid bonds with Surety 2000? It's optional to use that tool, as they can still hand deliver a check for 5% of the total bid. Proposal guaranty of \$500 or 5% of total bid, whichever is greater, is required to be submitted with each bid.

Are all change orders approved at the regional engineer level? The change order approval process provides for review by central office and FHWA as well for federal aid projects.

## 3.3 WVDOH Demonstration of e-Construction Systems and Technologies

John Taylor from WVDOH demonstrated workflow processes and provided detail on document management and the road to paperless implementation. Enterprise Resource Planning is a large system being implemented (<http://www.wvoasis.gov/>) and all e-Construction systems are designed to interface with ERP activities. WVDOH selected SiteManager for construction and materials documentation. One person handles specification changes in West Virginia – in Arkansas, specification changes are handled by a committee. Arkansas has supplementals to standard specifications as well as special provisions which can be developed by anyone. The system vendor provides an on-site person to assist with implementation of DocExpress. West Virginia changed business processes to match SiteManager instead of trying to adapt existing software tools to business processes. All change orders are approved in the same manner unless there is federal participation on a project. Arkansas has three levels of change order approvals. First, an RE change (20K or less per occurrence) can be approved by a resident engineer, a second level of district engineer approval (up to 75K), anything in dollar value above that level is approved by the Assistant Chief Engineer for Operations at the headquarters level. Arkansas uses a notification process that sends an email when an estimate is developed and the systems sees an issue that needs information shared.

Are contractors going into ProjectWise and signing documents? Using a CITRIX client, one contractor has access to SiteManager and provides approvals – this is a pilot project that has been underway for over a year. The contractor also signs a printed copy as backup. With purchase of CITRIX licenses this will be expanded across the State.

Does the software limit the number of signatures and how does that happen if more than five signatures are required? FHWA and DOT firewalls have limited the participation from FHWA in providing digital signatures. The purchasing division is not part of the WVDOH and all purchases must go through that

division. AHTD has had successes in purchasing technology and providing training for employees. Each year one-fourth of laptops are replaced – the main issue with technology is IT security protocols and firewalls. Arkansas does not allow outside entity access to systems.

What portal is used for contractor access in West Virginia? A portal is used with varying security profiles in SiteManager to allow outside entity access. For change orders, one contractor uses CITRIX and when change order goes from draft to pending, the change order is signed wet ink and sent to the surety.

### **3.4 Technical Exchange Topic #1 – Collaborative Project Sites and Workflows**

John Taylor from WVDOH continued his presentation with specifics on the WVDOH project collaboration site tailored from existing third party software. A SharePoint site was used for the core team to track the implementation of the e-Construction process – primary reason for use was that all personnel could easily access it. Documentation was included on the site for immediate access, and the SharePoint site transitioned into ProjectWise documentation as implementation occurred.

Have you found advantages to keeping up to date with SiteManager versions? West Virginia has been a beta tester of the software. In subcontracting and stockpiling materials there were some issues with the beta version. WVDOH was able to provide input to the software design that was beneficial for West Virginia. Arkansas does not upgrade often because of the time required in testing new versions of the software and the complexities involved in coordinating the push out to all users. Arkansas prefers to use customizations to resolve minor issues in the software instead of frequent upgrades. Software upgrades take one night to perform and updates are pushed to users and notification is made. In Arkansas, some offices did not have the capacity to handle the software upgrade push – both agencies reported 90% upgrade success rates within a day of the upgrade.

Do you push by MSI (Microsoft Installer File) or by script? Arkansas creates a custom MSI to push the upgrades to users.

WVDOH has custom reports in Access. Arkansas has one primary person for developing custom reports. Sharing custom reports is an area where technology can be transferred. Access administration through a server creates capacity issues – WVDOH installed Access on individual drives. A solution for a back-end process – could this be submitted to a server with notification of when the report is completed? A terminal server is used to log in and run reports on that server.

Did you have to increase bandwidth for some remote offices? No, ProjectWise stores all documents and everything is contained within the system.

Arkansas has implemented DocExpress for contract signatures but is working on full implementation in construction.

Can ProjectWise handle digital signatures? Yes, West Virginia has not implemented this but options are currently being analyzed.

Does the contractor on the pilot project have access to all files on ProjectWise? Yes, there is an outward facing web-client for ProjectWise. However, SiteManager requires CITRIX access.

Since the contractors have access to documents in ProjectWise, do they have access to design data, right-of-way, etc.? No, WVDOH users have open access except for right-of-way. Security can be set up according to groups and whether personnel are inside or outside the firewall.

WVDOH has a manual on how the documents are generated, shared, and stored. Once a contractor wins a project they email the project documents (that would have typically been mailed otherwise) to a specific address. At the project activation phase, ProjectWise folders are set up and field personnel add to and modify as the construction project is implemented. An index is created when a new project goes online – documents then get added underneath the project index. Documents are either scanned or a document or spreadsheet is converted into a PDF. Each work item is dropped into a bid item folder for that project. If a new item is added by change order, the project engineer can add a line item to the structure.

Is there a standard file naming structure – what about supplemental documents or photographs? There is a training manual with year, month, and day plus the file description in the name.

Planning and engineering will also initiate ProjectWise (at PS&E stage) in the future. Currently, construction creates the ProjectWise folders. The system allows users to display by contract identification number or project identification number, depending on the user needs. The system also allows for workflows and collaboration – workflows will be developed as digital signature structures are implemented. Application extender is another document management system in use in West Virginia.

When does a project get removed from ProjectWise? That is a decision that is being made – the structure is important as some information is archived by district and some by county. As-built plans will be retained indefinitely.

District construction engineers and their administrative personnel have access to the specific email address where incoming documents are sent. At preconstruction meetings, the email address is shared and contractors are asked to copy project engineers and supervisors when submitting documents. For example, a quality control plan for a project would be submitted with copies to the appropriate people. Personnel later place the documents into the correct folders in ProjectWise.

How much time is involved in setting up a project in ProjectWise? Approximately three minutes in a wizard that asks the appropriate questions.

Are your contractors submitting documents via email and field inspection staff creating documentation on their own and creating files in ProjectWise? Yes, folders are created from a script and documents can be uploaded directly through filing in the appropriate line item. The same file naming convention is used in SiteManager for ease of access to documents across the systems.

WVDOH is adding geospatial images to ProjectWise to locate where a particular item is on a map.

Do you plan to put all historical information into ProjectWise? Depends on the information and what the value is – the back file conversions may not allow the full value. Right of way plans may be an example of

historical information that will be added. The information from plan sets is also searchable in ProjectWise. CADD standards were also implemented through ProjectWise.

Can you use different sets of CADD standards within ProjectWise? Yes, it can handle multiple CADD standards.

WVDOH is completing roll-out in engineering with some implementation in maintenance, but planning would benefit greatly due to the revisions and updates to documents as they are developed.

Several documents are PDFs that are scanned versions – what do you determine is the final legal record? West Virginia does not have an official records manager, but ProjectWise is the final repository for the documents and the electronic version is accepted in court. The question becomes what happens with records management and what the protocol is for destroying paper versions if electronic is the final file of record.

Arkansas has an in-house document management system used for design and has also looked at ProjectWise – the internal system has design files and working documentation but no correspondence is stored there. Systems need to both include final documents but also have a location where various versions and iterations of documents can be stored. ProjectWise will also allow revision histories. Contractors see one benefit of direct access to this system in materials documentation management.

West Virginia DOH uses Bid Express question and answer section and requires all questions pertaining to a project that has already been advertised to be submitted through the system. The project manager and regional engineer review and respond and send information to contract section for release. Arkansas requires questions to be submitted to the program management division and they work with others to finalize the answer and post information to the website (users are displayed anonymously). If there is a need for a question response to become part of a contract, AHTD will issue an addendum. On design-build and public private partnership projects, WVDOH makes the response to questions part of the contract.

Project information is exported from AASHTOWare and imported into SiteManager once awarded in Preconstruction. Contractors sign documents in ink and send back to WVDOH.

If a project includes a field office, the specification requires contractors to provide wireless internet to accommodate e-Construction activities.

WVDOH uses Primavera to track schedules and perform CPM analysis. There is a final estimate in SiteManager and it generates an email with ProjectWise evaluating the final estimate for both software tools and the ProjectWise record is the final accepted version.

In West Virginia, inspectors use laptops for daily activities. Some personnel in the DOH have iPads, and a mini-laptop has also been tested. HP Slate devices did not work well. With the iPads, CITRIX licenses allow direct access to SiteManager via virtual private network. A Surface Pro was also tested but included Windows 10 which required a waiver for use of the software as it was not a currently accepted version. An HP x2 Elite is also being tested at present and WVDOH is leaning toward the HP due to an existing contract with HP for maintenance of other devices that could be used to maintain and support these devices. One participant noted that Indiana has a document that outlines the results of the pilot test of devices, and Washington State commissioned a research study to determine effectiveness of tablets for inspection. Arkansas deals primarily

with Dell and personnel primarily use Dell tablets. Both devices have detachable keyboards. The hard keyboard has to be detached in order to use tablet functionality on the HP – the Dell keyboard is softer and designed to be folded to convert to just tablet display.

Did WVDOH evaluate the iPad versus the Microsoft products? The iPad was selected because they could be purchased through existing telecommunications contracts. The iPads, though, do not integrate well with Outlook for email use but are good for web-based applications.

MultiVista has a software tool and website used to generate and store photographs of construction progress in West Virginia as part of their e-Construction implementation (“visual as-builts”). Environmental issues have surfaced on some projects and West Virginia is using this software to document various stages of project completion. This is a pilot project, and to date photographs have not been transferred to ProjectWise. MultiVista can accept photographs from various devices, and the tool can capture a panoramic view of the project. This is linked to the plan sheets.

States have asked AASHTO to include Mobile Inspector in the AASHTOWare software package.

WVDOH had users requesting Adobe Acrobat Professional, and maintaining software licenses was an issue. Bluebeam is now used for commenting on drawings and documents. Arkansas develops as-built drawings in certain cases. Customization of menus in Bluebeam is also an option to ensure only the menu items needed are displayed for simplicity.

West Virginia does not digitally sign plans – some issues exist with professional licensing boards in use of digital signatures and the engineer of record. The legal division is given access to ProjectWise and SiteManager for Freedom of Information Act requests.

All in one printer/scanner/fax machines have been installed in all field offices. Originally, a specification required contractors to provide the all-in-one machines as part of the project. Cost was a consideration in not specifying further use.

West Virginia also purchased a drone and is developing plans to pilot test techniques for monitoring construction projects. Some divisions have used drones for planning activities, and construction plans to test the technology to capture photographs of pier caps, for example, on a major bridge rehabilitation project. A current challenge with drone use includes privacy issues and needed air space regulations. The DOH also uses social media to perform outreach on projects. FHWA’s Turner Fairbanks Highway Research Center has a research project on use of drones (mounting laser scanners, etc.).

Mike Carter from the WVDOH engineering division demonstrated AASHTOWare Project. The Preconstruction module has a dashboard where search features allow review of bid items and other project information. The information is organized by project identification number and includes information on the county where the project resides, points and location information, and project estimates. The major category level represents the type of project and replaces an old PES system. Estimates will always have changes, and provisions are needed to renumber items but keep them in the same sequence.

Was the renumbering feature developed in a customized way? Yes, a vendor representative developed it.

How many users are there for Preconstruction? Approximately 8 per district, with 2 or 3 users in each district as primary users.

How are numbers for the estimate generated? Software packages are used – Oman Systems is a provider of a bid data tool. Bid Tabs Pro is a tool used by West Virginia to generate project estimates and they are tailored to the location of each project. A regional bid prices book is online and used to identify ranges of prices for bid items. A commonly used bid items estimate tool costs approximately \$1500 per user for the license and \$300 for maintenance of the tool.

Have you had any performance issues with use of Preconstruction? Sometimes, login attempts time out due to connectivity issues. Also, when using component button and selecting a feature it will stay open and require manual closure. The tool overall is very helpful and useful for WVDOH. Arkansas uses the PES system.

Does WVDOH provide public access on the bid openings? Yes, there is a webinar where bids are read and information is provided. Arkansas downloads bids and has an Access tool that is used to generate a report with all bids read from the report. The bid results are also emailed to the commission. The West Virginia webinar tool generates a report that outlines statistics from the webinar (number of users, log in information by person, location, etc.). Bid estimates are not published.

### **3.5 Contractor Perspectives in e-Construction**

Chet Rodabaugh and John Farley from the Contractors Association of West Virginia gave remarks on pros and cons of the tools in use as they relate to the private sector. Structural steel is an ever changing bid item for pricing right up until the bid time expires. If the number is in the bid, the contractor uses that supplier even if it has changed close to the bid time closing. The question and answer feature is also very important in sharing information – this creates a level playing field. Some of the larger projects may have 150 questions and the responses are incorporated into the bid items. A recent proposal was made that all change orders would be approved by the legislature, but this practice was not implemented. A reduction in the need for fire proof boxes for documentation is a key benefit in this component of e-Construction. Advertising mandatory pre-bid meetings is also a benefit from e-Construction. Digital signatures will also provide some benefit and contractors are interested in using this practice. Reduction in the need for paper plans is another key benefit. Some States scan plan sheets and an electronic plan room allows for original plan drawings for analysis and estimating. West Virginia is working to get contractor access to SiteManager – a pilot project is currently underway. In the pilot, SiteManager sends an email that a change order is ready for review and approval. A change order can be processed in one day compared with weeks to months without e-Construction.

D. B. Hill from the Arkansas Chapter of the Associated General Contractors of America also provided remarks on digital signatures and the need for access to SiteManager by contractors. In Arkansas, contractors do not approve change orders but write a letter for a new price. There is no input on overruns or underruns of quantities from the contractor side. Daily submission of traffic control device inspection reports, asphalt tickets, scale certifications, mix designs, and weekly payroll certifications are all required and e-Construction could potentially alleviate the redundant paperwork. The issue in West Virginia is whether or not trucks were weighed, and tickets are scanned and uploaded to ProjectWise. West Virginia is currently looking into Quick Response (QR) code reader technology. This applies directly to Freedom of Information Act (FOIA)

requests and also the weight limits on the roadway traveled in addition to the weight of the material itself. Often, loads will not be accepted when overweight in a process that is designed to discourage overweight vehicles.

Nationally, North Dakota uses daily summary printouts with spot checks. On public private partnership projects, trucks are equipped with RFID tags and weights are managed and data is collected. Idaho changed bid tabs for in-place measurements and quantities instead of weights for some items. The primary issues are weight limits on the Interstate Highway System and certification that the material was delivered.

How does West Virginia handle payrolls? Hard copies are mailed from the prime contractor and PDF files are emailed in to the DOT email address for the district.

Software tools also exist to generate PDF or facsimile versions of the payroll. AASHTOWare has a format for uploading contractor payrolls to the Civil Rights Module which will check for exceptions. Subcontractors can fill in spreadsheet templates with payroll information.

Day 1 concluded after a brief review and discussion of the key takeaways from the day.

### **3.6 Technical Exchange Topic #2 – Mobile Devices and Field Review**

In Lieu of the originally planned field visit and materials laboratory scan, the group decided to perform a desk review of a local project. Chris Lees from West Virginia DOH provided a demonstration of e-Construction, using materials management in ProjectWise, for a project on I-64/I-77 that involved use of precast slabs for concrete repair and cast in place. Prior to this project, WVDOH was using PRS and ProjectWise both for inputting materials information. All attachments are uploaded to ProjectWise and SiteManager has a reference to each ProjectWise document.

How do consultants access the ProjectWise system? Recently WVDOH has begun using consultants for inspection and quality assurance management. Consultants will use CITRIX to allow access to SiteManager and ProjectWise. In December, WVDOH will offer a two-day training course to show consultants how to use the e-Construction systems.

What speeds do you have for connectivity? Satellite has proven difficult to obtain acceptable speeds, although a reference to common gaming device speed allowed for establishing baseline criteria. 3 megabits per second (Mbps) download, 1/2 Mbps upload speed.

Files sent in through the common email address are downloaded and added to an incoming mail folder in ProjectWise. In the future there will be a separate folder for contractors to add files to the system.

Guidance for ProjectWise from the legislature is to maintain paper versions of documents that are submitted in paper version. The Office of Technology is writing legislation to remove the paper component from construction management processes. AHTD still keeps paper versions of submittals and maintains documents with wet signatures. Records retention requires maintaining documents for five years after project completion, and then they are scanned with the paper versions destroyed.

Concrete batch tickets are scanned through an all-in-one scanning device and uploaded to ProjectWise. Change orders have a separate file convention (beginning with 9000) and supervisors can add subfolders to the bid item in ProjectWise. SiteManager provides a direct link to the backup information in ProjectWise and takes the user to the location where the files are stored.

Have you had a situation where an employee uses their personal phone for work activities? Some personnel in West Virginia use personal devices with apps to perform calculations, manage PDF files, and connect to systems. One challenge is the potential need to provide phones to users if policy allows use of personal phones for work activities. There are also security issues with use of personal devices – remote wipe of devices is typically required for employer-provided devices and this is an issue with use of personal devices (users may need to agree to this for their personal phone in order to use it for business purposes). The cost of monthly data plans is the issue with tablets and phones.

How does the contractor participating in the pilot test access ProjectWise? The change order report and supporting documents are all emailed to the contractor. The contractor has access to ProjectWise but training on how to use the system is planned for the future. Office of Technology does not allow users to share accounts. Contractors are assigned a number beginning with “C” to identify a user as outside WVDOH. Outside users are also provided a State email account. The FHWA systems limits email attachments to 10 megabytes.

CITRIX presents the desktop to the user when they log in. This avoids installing the software on individual machines. As web-based products are deployed, users will not need CITRIX to access systems.

SiteManager will allow up to six slots for approval signatures. Currently, WVDOH uses five of the slots, and FHWA is currently not linked to the system to add a signature. FHWA still wet ink signs change orders, although WVDOH allows email approval. Given recent changes to laws, it is now illegal for the federal government to not accept an electronic signature. Arkansas FHWA Division has begun to use a PDF signature for approvals.

Arkansas has a report with a code referencing whether the contractor used 60% of forces for 60% of the day, which is the definition of a chargeable day. The question arises as to whether a DOT needs to generate reports from a database, or just review the database information to ensure current information is available. For example, if a report is filed and a change order has an update entered, a new report has to be developed.

Where would we include supporting information for a project? Instead of getting a letter from the contractor, do we provide a way for them to log in and submit the information? Arkansas would like to use log in for validation and do away with signatures on PDF documents if there is a way to have an approval in SiteManager. The most common opposing position to doing away with wet ink signatures is comfort level and change in the way of doing business. Training is needed along with development of a final process for implementation. Another concern is whether auditors will embrace new processes for use of digital signatures.

In Arkansas, estimates are turned in on Monday of each week and payments are made the Friday of the same week. With FHWA funding, payments are made weekly as well. The goal in West Virginia is 3 days to process payments for reimbursement. Arkansas uses a cash forecast program to manage cash flow with projections for the next two years of payments. Arkansas bills on Friday and receives payment on Tuesday.

ProjectWise also has the ability to store photographs, and a linkage to the tablet devices with cameras provide an additional opportunity to document projects. Additionally, a user stays logged in to ProjectWise based on a Windows login, while SiteManager login is required each time the software is accessed.

In West Virginia, progress estimates are printed so that reference numbers can be added and a date received stamp added to the document. It is then scanned back in.

There are counties in West Virginia that have limited cellular service, limiting access from air cards in laptops. Arkansas generally does not have the same issue, and a worst case is within a five to ten minute drive of nearly all projects, inspectors can get cellular access. At one time AHTD debated having contractors provide the air cards. The issue is that all cellular cards provide direct built-in VPN connection to the State network and cellular providers will only bill AHTD for these cards.

Audit reports and final estimates should be error free in the calculations – e-Construction systems have eliminated human error and have sped up finalization of projects. Arkansas has performed customization of user interfaces to eliminate unnecessary fields and allow for ease of access to the field where data is entered.

Has West Virginia looked into systems for electronic weight ticket systems? Yes, research into QR code systems has documented some possibilities for options.

### **3.7 Materials Management in West Virginia**

Cliff Yuill, a consultant to WVDOH, presented on the materials management systems in use in West Virginia. WVDOH uses the AASHTOWare Materials Module. Default sampling and testing requirements are developed within SiteManager to start. Often, the default requirements will vary by project. WVDOH has a sampling and testing checklist that shows what materials samples are required on every project.

Where are mix designs included in the process? Does the materials office communicate with the contractor through SiteManager? Contractors submit their mix designs and they have to meet certain criteria and they are given a reference lab number that can be used on any project. Mix designs are sent to the district and they submit them to the materials laboratory for approval. Materials is engaged in ProjectWise at the testing level but not at the approval level, and mix designs are good for three years and can be used on any project statewide.

West Virginia DOH and Arkansas HTD both use a template that is customized to show materials information summaries. WVDOH may add a button to open ProjectWise from the SiteManager module.

Contractor Quality Control (QC) Plans are submitted manually with the intent being that the contractor log in and create the QC plan and samples. COMRAD system is still in development stage, and contractors are not allowed access to materials modules. For every ten tests the contractor runs, WVDOH will run one test for quality assurance (QA).

Arkansas and Kentucky have contractors submit spreadsheets with materials data and then upload the data to the system after processing. West Virginia has a sampling checklist that looks at both the daily work report

template and materials template. In Arkansas, templates are developed based on units used and how the decimal places are rounded (cubic yards, square feet, etc.). PowerBuilder is a proprietary tool that is used to customize the report templates.

Materials certification takes many forms – if there is a price adjustment done because a material did not meet specification requirements, all records associated with the process is included in ProjectWise. Certification letters are generated from SiteManager using form letters with exceptions. This report is sent to the district and the estimate is updated to show a price reduction.

Are aggregate samples tied to a project even though the mix design is valid for three years? Yes, aggregate samples are tied to each project.

How do you associate the contractors test with the verification test? It's done on the actual QC sample – there is a link in the QC information in SiteManager to the QA information. A custom report evaluates whether a material meets the specification or if a price reduction is needed. Arkansas is running verifications but not averages by supplier.

What impact has the integration of materials data and construction data had on the processes compared to the old way of doing it? The documentation with the e-Construction systems allowed for newer employees to understand what tests need to be run and what to look for. Veteran employees did not have the issue, and transparency is improved using the system. Before implementation of materials and the Laboratory Information Management System (LIMS), checking status was more difficult in that phone calls had to be made or emails had to be sent. Status of samples can be determined and where the sample is in the system can be reviewed electronically. Faster and better information relates to faster determination of whether we have a good product, which generates payment faster, or a bad product which needs to be corrected. Daily Materials Inspection Reports are available much faster as problems are found.

### **3.8 Conference Call Discussion on IT Security**

Jim Weathersby with the West Virginia Office of Technology IT, and Bryan Stewart and Sydney Foggo – Computer Services Division, AHTD dialed in to the conference call portion of the peer exchange to discuss network needs and IT security protocols, challenges, and lessons learned.

There are very few public access points to the network – a VPN connection allows access through apps like CITRIX. All authentications occur through active directory. There is also a ProjectWise public facing web portal. CITRIX terminal services is used to access SiteManager and this is the preferred method – if not publicly facing then user accounts would have to be set up to allow access. Consultants and FHWA and the contractor participating in the pilot can all access ProjectWise, SiteManager, and a reports database. WVDOH has discussed allowing materials to be included in outside entity access, and AASHTOWare Project will alleviate some of these issues.

OT is available to assist with ensuring that protective needs are met based on the requirements for data security and accessibility established by the WVDOH. WVDOH is hosting a CITRIX environment and is starting with a block of 50 accounts as a trial basis. WVDOH will charge outside entities \$1000 for the first year and \$400-\$500 per year as an option to access internal systems. This is optional because the web-based

systems will take care of the issue in the future, and this will provide an opportunity for contractors to learn the systems and be trained on access and functionality.

Arkansas is providing some external access to applications for consultants – access to SiteManager and SARS is available through a domain account. Access is limited and using VPN access impacts bandwidth for this application.

A pro for web-based applications is that they can be hosted outside the firewall and do not require State server access to use the software applications. Maintaining appropriate levels of security on information that could be used to give an advantage to someone in the bidding process is key. Keeping security involved throughout the process is important and allows for issues to be addressed early.

Do you scan any computers that connect to the network from outside the network? That would be a good solution but nothing is in place at present. A Network Access Control (NAC) solution would isolate a user until the program determines if patches and virus software and other applications are up to date.

Can your security documents be shared? Yes, most are available on policies issued by CTO website for West Virginia.

Another option is to work outside the firewall until a project is final, and then documentation can be placed on internal systems for archiving.

Does Arkansas use any Wide Area Network (WAN) optimization software? Yes, Riverbed was evaluated as part of the Office 365 implementation. Cost may be a hindering factor for this software.

What does your State's network infrastructure look like? Fiber optic agreements with telecommunications companies allow direct connections to districts on 100MB systems. A few resident engineer offices are not connected at that speed. Field offices use cellular technology access and other networks that are available.

Does Arkansas use site to site VPN? Yes.

What is your internet bandwidth in West Virginia? 3G out to the backbone for internet – most district offices are connected on 100MB systems. 10G systems are throttled down on the backbone and the systems are for all State offices.

From a security standpoint, the largest concern is whether the data is regulated and what protections are needed for it. As items are moved to the cloud, bandwidth will be increased.

With personally identifiable information (PII), security and protection has to occur and the question involves what type of notifications might be required should a breach occur or unauthorized access take place. Cloud providers may be certified and requirements should be identified and added to Request for Proposals (RFP) or Request for Qualifications (RFQ).

West Virginia has developed an RFQ for 50 licenses to get started with using a document mark-up tool. Bluebeam REVU is a document mark-up tool that is being tested on a trial basis by WVDOH to comment on plans and as-builts and create libraries and distribute to users in a profile. Hyperlinks to documents can

also be added along with use of digital signatures and PE stamps for design applications. Audit trails can also be added to PDFs.

Project engineers are certifying that the as-builts are correct. A digital plotting pen has also been tested to generate as-builts. The REVU software also allows for scaling to the plan sheet scale and adding dimensions to the scaled drawing, and area or distance can be calculated, including curves and non-linear features.

Arkansas uses Adobe but not widely throughout construction since as-builts may not be developed. However, erosion control does have as-builts and a system that is cost effective would be a good solution and provide benefit to Arkansas.

Using the information and data for maintenance and asset management is also a discussion that WVDOH plans to have once a solution is put into place.

### **3.9 Digital Signatures for Document Approvals**

Arkansas had discussions about how to eliminate the need for so many ink signatures within the last few years. Upper management is extremely interested in this topic. AHTD performed a review of what can be done and the necessary guidelines that are associated with implementation. Log in information was determined to be just as valid as the process that obtains an ink signature. Contracts are loaded into DocExpress and a workflow sends a notification to those responsible and it allows initialing by individuals with the ultimate signature by the director. Once routed/approved, document cannot be modified and the originator can see the progress of the document within the workflow.

What does the document look like? There is a contract signing drawer – in this case there is a link to download the document. A signature can be placed without having to open the document.

How does the contractor get the document to sign first? All required forms are downloaded from DocExpress and signed files are uploaded back to the system. The Equal Employment Opportunity (EEO) office also reviews Disadvantaged Business Enterprise (DBE) certifications through DocExpress, and once all documentation is together the actual contract is produced and the workflow is organized and signatures by the contractor and surety are placed through the system. Signatures are checked to ensure that they match valid signatures for responsible parties.

In Arkansas, a revision to a plan initiates removal of a signature placed earlier than the revision. Therefore, a solution will require that changes be accommodated that allow for the document to be re-signed digitally.

The peer exchange concluded with agreement by each State to follow up with additional documentation that can be shared. This documentation is made available on the WVDOH collaborative e-Construction site along with copies of the presentations from the peer exchange.

## Appendix A – e-Construction Peer Exchange Agenda



### Arkansas/West Virginia e-Construction Peer Exchange

1900 Kanawha Blvd. East  
WVDOH, Building 5, Rm 738  
Charleston, West Virginia  
25305



### Agenda

Day 1 – October 21, 2015		
Time	Topic	Presenters / Facilitators
8:00am – 8:20am	Welcoming Remarks and Introductions	Paul Mattox, Jr., Secretary of Transportation/Commissioner of Highways Greg Bailey, State Highway Engineer Stephen “Todd” Rumbaugh, Deputy State Highway Engineer – Construction and Development Bryan Cawley, Construction Management Team Leader, FHWA
8:20am – 8:30am	Peer Exchange Background and Overview	Tim Luttrell, Leidos Tom Zagorski, Michael Baker International
8:30am – 9:00am	Arkansas e-Construction Status and Plans	Kevin Thornton, Arkansas State Highway and Transportation Department (AHTD)
9:00 am – 10:00 am	West Virginia e-Construction Overview	Jason Boyd/John Taylor, West Virginia Division of Highways (WVDOH)
10:00am – 10:15am	Break	
10:15am – 11:45am	Demonstration of Host State e-Construction Technologies and Systems	West Virginia DOH/All
11:45am – 1:00pm	Lunch	
1:00pm – 2:30pm	Technical Exchange Topic #1: Collaborative Project Sites and Workflows – Migration from Paper	AHTD/WVDOH/All
2:30pm – 2:45pm	Break	
2:45pm – 3:45pm	Contractor Perspectives in e-Construction	Chet Rodabaugh/John Farley, Contractors Association of West Virginia D. B. Hill, AGC of America – Arkansas All
3:45pm – 4:15pm	Discussion on Day 1 Takeaways for Implementation	Tom Zagorski, Michael Baker International
4:15pm – 4:30pm	Preview of Day 2 Agenda Items	Tom Zagorski, Michael Baker International
4:30pm	Adjourn	
Dinner on your own		

**Day 2 – October 22, 2015**

<b>Time</b>	<b>Topic</b>	<b>Presenters / Facilitators</b>
8:00am – 8:30am	Recap of Day 1 Discussion/ Field Visit Safety Briefing	All
8:30am – 11:30am	Technical Exchange Topic #2: Mobile Devices and Field Review of e-Construction Technologies	WVDOH/All
11:30am – 12:45pm	Lunch	
12:45pm – 1:15pm	Discussion on IT Security*	All/AHTD and WVDOH IT
1:15pm – 2:15pm	Exchange Topic #3: Electronic/Digital Signatures for Document Approvals	WVDOH/All
2:15pm – 2:30pm	Break	
2:30pm – 3:15pm	Report Out and Discussion on Takeaways for Implementation	Tom Zagorski, Michael Baker International Tim Luttrell, Leidos
3:15pm – 3:30pm	Closing Remarks, Feedback on Peer Exchange, and Next Steps	All
3:30pm	Adjourn	



## Appendix B – e-Construction Peer Exchange Roster

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## Appendix C – WVD0H ProjectWise Folder Structure Template

Folder Document View Tools Help			
<input type="checkbox"/>	Name	Folder Name	Created
<input type="checkbox"/>	<a href="#">00-Mail - Incoming Mail</a>	Construction	10/24/2015 1:34:30 PM
<input type="checkbox"/>	<a href="#">01-Draft Documents</a>	Construction	10/24/2015 1:34:31 PM
<input type="checkbox"/>	<a href="#">02-Contract Documents</a>	Construction	10/24/2015 1:34:31 PM
<input type="checkbox"/>	<a href="#">03-Agreements - Utilities</a>	Construction	10/24/2015 1:34:33 PM
<input type="checkbox"/>	<a href="#">04-Correspondence</a>	Construction	10/24/2015 1:34:34 PM
<input type="checkbox"/>	<a href="#">05-Progress - Time</a>	Construction	10/24/2015 1:34:34 PM
<input type="checkbox"/>	<a href="#">06-Labor Compliance - Payrolls</a>	Construction	10/24/2015 1:34:35 PM
<input type="checkbox"/>	<a href="#">07-Safety - Accidents</a>	Construction	10/24/2015 1:34:35 PM
<input type="checkbox"/>	<a href="#">08-Environmental</a>	Construction	10/24/2015 1:34:36 PM
<input type="checkbox"/>	<a href="#">09-Estimates - Progress</a>	Construction	10/24/2015 1:34:37 PM
<input type="checkbox"/>	<a href="#">10-Change Orders</a>	Construction	10/24/2015 1:34:37 PM
<input type="checkbox"/>	<a href="#">11-DWR Attachments</a>	Construction	10/24/2015 1:34:37 PM
<input type="checkbox"/>	<a href="#">12-Diary Attachments</a>	Construction	10/24/2015 1:34:37 PM
<input type="checkbox"/>	<a href="#">13-Bid Items - Materials</a>	Construction	10/24/2015 1:34:38 PM
<input type="checkbox"/>	<a href="#">14-Finalization</a>	Construction	10/24/2015 1:34:38 PM
<input type="checkbox"/>	<a href="#">15-Photos</a>	Construction	10/24/2015 1:34:39 PM

## **Appendix D – WVDOH Policy for Answering Contractor Questions Using e-Construction Technologies**

### WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

#### DIVISION OF HIGHWAYS

#### CONTRACT ADMINISTRATION DIVISION

### EXTERNAL POLICY FOR ANSWERING CONTRACTOR QUESTIONS FOR ADVERTISED PROJECTS

#### **Questions and Answers General Procedures**

All projects advertised by WVDOH for bidding via the Bid Express website at <http://www.b1dx.com> will require questions to be asked using the Question and Answer feature link displayed in the "Also Available" section of the proposal page. Questions received through phone, email or other mechanisms shall not be answered and will otherwise be considered void.

Everyone will have the opportunity to ask a question and read through questions that have already been answered. Please note that individuals do not have to be a member of Bid Express to ask a question or read through questions that have already been answered.

Question and Answers are for "INFORMATIONAL PURPOSES ONLY" and shall not be intended as an alternative to the addendum process.

Any individual that communicates directly to WVDOH personnel concerning an advertised project will be directed to the Question and Answer feature on the Bid Express website at <http://www.b1dx.com>. No WVDOH personnel shall communicate any issues concerning an advertised project with anyone outside of the Agency.

## Questions and Answers in BIDX

Go to <http://www.bidx.com> and select Questions and Answers in the Also Available section for a proposal (See Attachment #1). The Bid Express service goes to the Questions page (See Attachment #2).

If you've already submitted a question, it will appear on this page. Questions that have been answered by WVDOH are also displayed here.

You have the option of asking a question or searching previously asked questions about the proposal that have been answered.

## Ask a Question in BIDX

Select Submit a Question from the upper right corner. The Bid Express service goes to the Ask a New Question page (See Attachment #3).

Verify your company and contact information. Please note that you can enter "anonymous" as first and last name if you so desire.

Enter your question(s) subject in the Subject field.

Ask your question (please limit only one (1) question per request) in the question field.

Click ASK. The Bid Express service displays your Question on the Question page and sends notification about the Question to the WVDOH.

Click the proposal in the navigation trail to return to the proposal page.

## Delete a Question in BIDX

You can delete a question by clicking Questions and Answers in the Also Available section for a proposal. Click the X for the question on the Questions for Proposal page and then click ok in the confirmation window. Questions that have already been answered by the WVDOH cannot be deleted. Once a question is deleted, it cannot be recovered.

## View and Edit Your Question In BIDX

To view your question, click the question on the Questions for Proposal page. Click Edit in the lower right corner to edit your question.

When the WVDOH replies, a date is entered in the Last Reply column. Click the title of your question on the Questions for Proposal page to see the answer. Once a question is answered by the WVDOH, it cannot be edited or deleted.

### Search Questions in BIDX

Select Search Questions In the upper right corner. The Bid Express service displays the Search Questions page.

Enter your search criteria in the available fields. The Bid Express starts the search as soon as there is an entry.

Any question that has not been answered by the WVDOH will not be included in the search.

### **TIMELINE**

Questions can be asked via <http://www.bidx.com> up to the time of the posted Letting with no exceptions. Please note however, that some advertised projects may stipulate deadlines for questions being asked such as the case with Design Build projects.

It is the intent of the WVDOH to issue all addendums no later than seven (7) days prior to the posted Letting date to modify the Project, if necessary. Therefore, Questions should be asked TWELVE (12) calendar days in advance to give the WVDOH time to adequately address your concerns and Issues.

It is the intent of the WVDOH that questions received three (3) working days in advance of a posted Letting should be answered prior to the time of the posted Letting. Questions received within three (3) working days of the posted time of Letting may or may not be answered as time allows.

It is the intent of WVDOH that if a question goes "unanswered" and the proposal for which the question was asked has not been "pulled" or "deferred" then the Contractor shall bid the said proposal "AS IS".

### **POSTING**

All valid questions received and answered will be made public via <http://www.bidx.com> for viewing by anyone.