![eCP e-Construction and Partnering logo] **e-Construction and Partnering:**
A Vision for the Future

Peer-to-Peer Exchange

Arkansas and South Carolina Departments of Transportation

Little Rock, Arkansas
June 13–14, 2018

U.S. Department of Transportation
Federal Highway Administration

On-Ramp to Innovation
every day counts

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Background

The South Carolina Department of Transportation (SCDOT) has implemented several technologies to support its e-Construction and partnering initiatives, including use of laptop computers and tablets for electronic daily reports and electronic document management for contract administration and field operations. The SCDOT requested to participate in a 2-day, face-to-face peer exchange with the Arkansas Department of Transportation (ARDOT) to explore best practices and initiative improvement options.

The peer exchange, sponsored by the Federal Highway Administration (FHWA) as part of the fourth round of the Every Day Counts (EDC-4) e-Construction and Partnering (eCP) technical assistance program, was hosted by ARDOT on June 13–14, 2018. A delegation of four SCDOT representatives traveled to Little Rock, AR, to meet with several ARDOT representatives. FHWA staff from the Arkansas and South Carolina Division Offices and the Resource Center were also present. The peer exchange focused on best practices specific to implementation of electronic document management for contract administration and field operations using tablets and various software programs.

Figure 1. Photo. SCDOT and ARDOT peer exchange participants. Source: FHWA

The SCDOT and ARDOT e-Construction programs have many similarities. Both use the American Association of State Highway and Transportation Officials' AASHTOWare Project SiteManager™ as their main construction management system and have invested in Microsoft Windows® -based tablets, but there are also several differences. ARDOT has heavily customized the Project SiteManager software by developing agency-specific user input forms, known as SiteManager templates. The two agencies selected different tablet hardware options. ARDOT selected the Dell™ Latitude™ 12 tablet and SCDOT chose the Microsoft® Surface® Pro 3 tablet with Wi-Fi hotspots.

The Dell Latitude 12 tablet includes the ability to install internal air cards and GPS functionality. It also has several peripherals, such as a keyboard, stylus, and adapters for Universal Serial Bus (USB) and Ethernet. Alternatively, the Microsoft Surface Pro 3 and Wi-Fi hotspots allow multiple field staff to share the same connection. Both agencies are considering the tablets as possible laptop replacements in the future.

The two agencies differ the most in their approach to document management and electronic signatures. ARDOT chose Doc Express™, a cloud-based system from Info Tech®, to manage all documents throughout the life of the contract, starting in the pre-construction stage. SCDOT leveraged its existing licenses for Microsoft® SharePoint® and Bentley ProjectWise® for external and internal stakeholders, respectively, to manage certain documents (i.e., standard forms).

Table 1 summarizes the technologies used by SCDOT and ARDOT in their e-Construction programs.

Table 1. SCDOT and ARDOT e-Construction practices.

e-Construction Application	Technology Used by SCDOT	Technology Used by ARDOT
Advertisement and bidding	Bid Express®	Bid Express
Contract execution	Paper-based	Doc Express
Electronic daily reporting, estimates, and change orders	AASHTOWare Project SiteManager Microsoft SharePoint-based Extranet Bentley ProjectWise	AASHTOWare Project SiteManager Custom-developed SiteManager Access Reporting System (SARS[1]) and Change Order Generation System (COGS[2])
Document management	Microsoft SharePoint-based Extranet Bentley ProjectWise	Doc Express (design-bid-build) e-Builder (design-build)
Devices for accessing various systems	Standard-issue laptops and a limited pool of tablets (Microsoft Surface Pro 3) with Wi-Fi hotspots	Standard-issue laptops or Dell Latitude 12 tablets with data plan
Pre-construction collaboration for design-build projects	Bluebeam® Revu®	e-Builder®

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[1] SiteManager Access Reporting System.
[2] Change Order Generating System.

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Project Approach

SCDOT and ARDOT are challenged with increasing demands and limited resources. Both need to be innovative and efficient with construction management and oversight; however, there are stark differences in what is driving their adoption of e-Construction practices.

SCDOT adopted e-Construction practices to address a limited workforce capacity, which resulted from an increasing construction program that nearly tripled in 2015. Facing challenges to hire and keep construction staff, SCDOT relies on consultants to provide construction engineering and inspection services and sometimes contract management. When consulting partners started bringing e-Construction technologies to the job sites, SCDOT was encouraged to provide the same tools for agency staff.

SCDOT leadership made e-Construction implementation a priority when they observed how the technology was improving efficiencies with consultants, deploying approximately 50 Surface Pro tablets to allow staff to access SiteManager. SCDOT plans to improve electronic document management using Bentley ProjectWise and Microsoft SharePoint, is investigating the use of Info Tech's Mobile Inspector™ and HeadLight™ by Pavia Systems, and is planning to upgrade to the Web-based version of AASHTOWare Project Construction & Materials™ software.

ARDOT's e-Construction philosophy is to make the original source of information electronic, reduce or eliminate the need for printing, and streamline the document approval process. ARDOT has practiced e-Construction management since 1999 via the AASHTOWare Project SiteManager program and, in 2011, implemented the first customization of electronic reporting.

ARDOT started piloting electronic bidding (Bid Express) in 2010 and mandated all contracts be signed electronically in 2014. Electronic bidding has allowed the agency to streamline the process and improve efficiency and transparency. Reports and analysis of all bids are now produced automatically, and the results are posted on the ARDOT website within minutes.

In 2015, ARDOT used State Transportation Innovation Council (STIC) funds to deploy more than 60 tablets with air cards to access all its systems. This investment was followed by the piloting of Doc Express, which became the agency's official document management system in 2016 for all design-bid-build projects.

ARDOT also assembled an e-Construction committee with FHWA, ARDOT, and contractor representation to encourage an open dialog for continued improvement through partnering. ARDOT envisions its e-Construction program evolving into an "e-DOT" solution, providing enterprise-level digitization and automation that illustrates the commitment of ARDOT leadership and the recognition of e-Construction technologies' value to the program. The e-DOT initiative will drive other areas of the organization to implement paperless workflows.

Workflow

SCDOT construction management practices consist of electronic and paper-based processes, which are illustrated in Figure 2. The custom-developed Project Programming System (P2S) is used to create proposals, contracts, and pay item lists that integrate with SiteManager. Projects are advertised online, and bids are accepted electronically via Bid Express; however, the execution of projects is still paper based. The contracts are mailed to the contractor and bonding company and, once executed, they are scanned and loaded into ProjectWise. A paper copy goes to the field, and a third copy goes to the contractor. The contract execution process takes about 30 days.
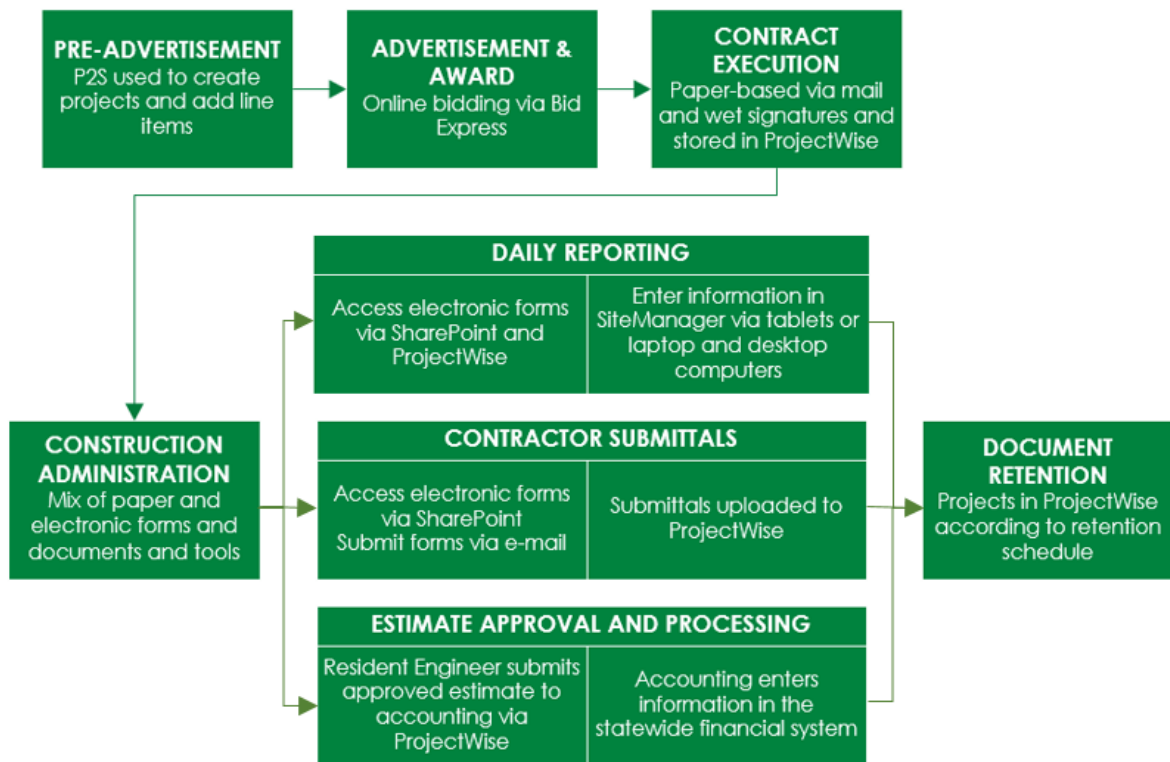

Figure 2. Flowchart. Overview of SCDOT construction management practices.

Contract administration and daily reporting is transitioning to an electronic workflow, but SCDOT is currently using a combination of paper and electronic forms in SiteManager for creating inspector daily work reports, estimates, and approvals for change orders. Some staff enter information from the field through a virtual private network (VPN) or VMWare® software. Security training is required before having access to the VMWare software. Other inspectors prefer to write paper notes in the field and enter the data when they return to the office.

Electronic forms used for documentation are accessible via SharePoint and organized by specification section (Figure 3). Contractors download the forms and submit to SCDOT via email. Forms are submitted via ProjectWise, where they are stored using a folder structure, organized by county. Construction information is organized in subfolders by contract identifier. When documents are added to ProjectWise folders, a notification email is sent to a review committee. The project documents remain in ProjectWise until the retention period expires.
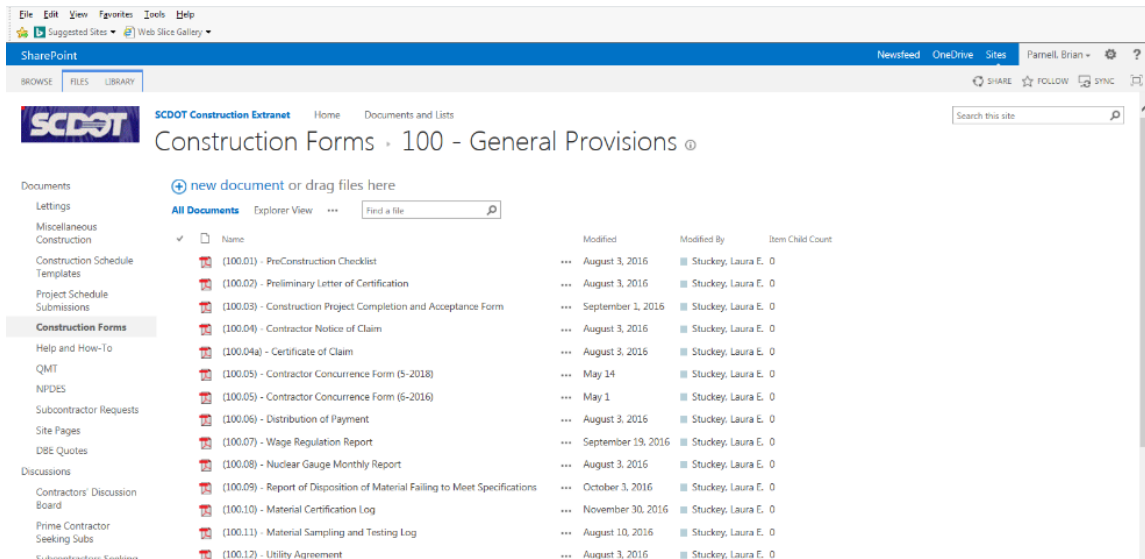

Figure 3 Screenshot. SCDOT construction form masters on the Extranet. Source: SCDOT

The SCDOT workflow for processing estimates is also a combination of electronic and paper-based methods. Estimates are sent to accounting through ProjectWise and SharePoint. Some Resident Engineers (REs) affix wet signatures on estimates, while others sign digitally using Adobe® signatures. The accounting staff then enter information manually from the approved estimates into the statewide financial system.

ARDOT's construction administration and daily reporting processes (Figure 4) are fully digital, and field staff use tablets and laptops to capture data for their electronic daily reports. Contracts are prepared using AASHTOWare Project Preconstruction, which are then advertised online, and bids are only accepted electronically using Bid Express. Upon award, the contract is executed electronically using Doc Express. Bid bonds must still be printed and notarized before uploading them to the document management system. Once a contract has been executed, all construction management is conducted electronically via SiteManager, SARS, COGS, and Doc Express.

COGS and SARS are menu-based Microsoft Access® databases that ARDOT uses during construction. COGS is used for generating, tracking and reporting change orders, and SARS is used to query SiteManager daily report information to automate reports for review and quality control audits. It required significant upfront development

and implementation effort, but has since paid dividends with its granularity and automation. Internal ARDOT auditors can use SARS to review data on demand. SiteManager Administration staff can initiate automated audit checks that identify deficiencies in reports and prevent viewing/approval until deficiencies are resolved.

Doc Express is ARDOT's primary construction document management and digital signature solution. There are predefined workflows for each contract that show what stage the document is in in the workflow. These documents are signed electronically using Doc Express role-based authentication workflows. Contracts can be signed and executed within hours. Change order reports are created in COGS.

Change orders over $20,000 require wet signatures, so they are printed and mailed to the contractor or sent via Doc Express. Supporting documentation (computer-aided design [CAD] files, Microsoft Excel® spreadsheets, etc.) can be attached to the Portable Document Form (PDF) cover letter submission as a supporting document, but each file is limited to 200 megabytes in size. After construction is complete and the project is closed-out, ARDOT locks the project files, and the service provider makes the files available for 6 years.
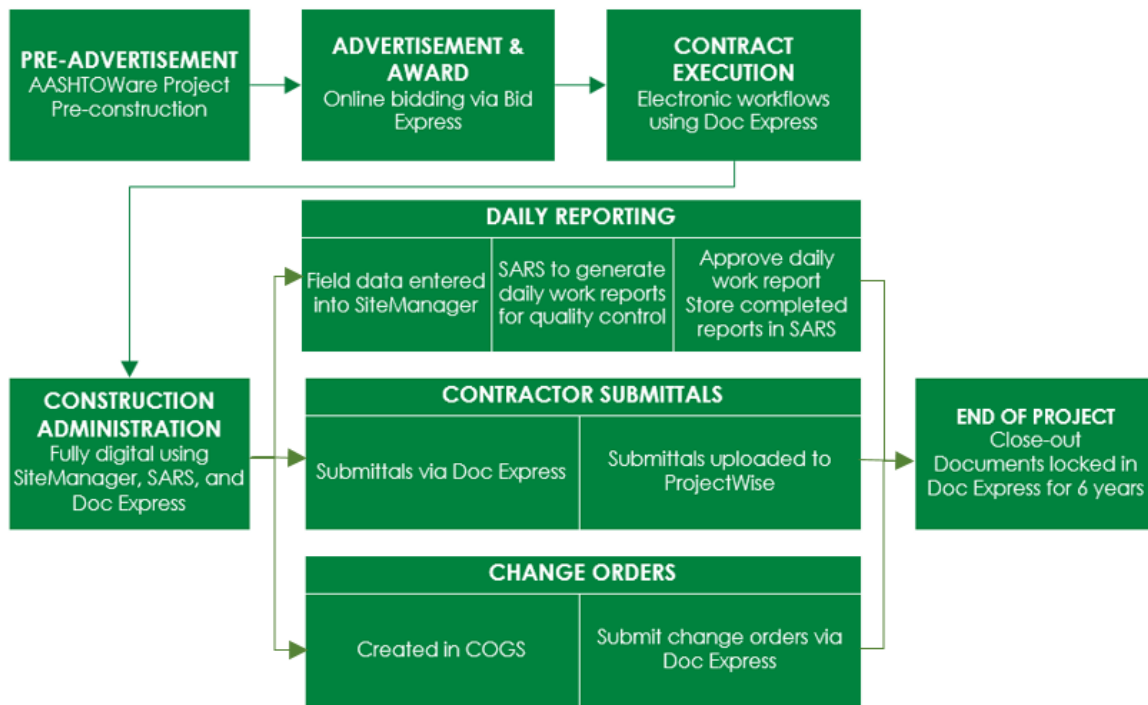

Figure 4. Flowchart. ARDOT Daily Work Report process.

ARDOT also has an Online Ticket Tracking and Reporting System (OTTRS), which is another custom solution developed by the agency. This solution interfaces with SiteManager and the materials management system. It is designed to work offline for inspectors entering information between loads. OTTRS creates reports on load information and ticket information in an automated form.

Cost and Benefits

The costs associated with SCDOT and ARDOT e-Construction activities include purchasing the hardware, software, and subscription services plus the expended labor for training, installation, troubleshooting, and system administration. ARDOT also incurred the cost associated with the subscription of Doc Express and labor for support staff. ARDOT negotiated an annual fee structure of about $125,000 per site license, which allows for up to 500 active contracts. SiteManager was already owned by both agencies, and SCDOT already owned an enterprise license of ProjectWise. Another cost associated with e-Construction is the cost for the contractor to provide Internet access at the project office per contract specifications.

While neither agency has quantified the benefits of its e-Construction investments, both agreed that streamlining the payment process, reducing the travel time to and from the office, and accelerating turnaround times for approvals are worth the investment. Instead of taking days to get approvals, this process reduces the approval time to hours. Also, SCDOT contract execution typically takes around 30 days to obtain the necessary signatures and documents, whereas ARDOT typically executes a contract within 7 days using the Doc Express system and associated automated workflows.

Key Takeaways and Lessons Learned

ARDOT noted several areas that will help realize success with e-Construction initiatives, including bringing agency leadership on board, generating an understanding of both the software and the need for innovation, securing management support, and committing to fostering internal and external relationships.

While ARDOT committed to maximizing the capability of the SiteManager application through the development of a wide array of templates for its Daily Work Reports and materials, the upcoming implementation of AASHTOWare Project Construction & Materials may not allow these templates to migrate. However, ARDOT intends to purge templates not used or start fresh with a new strategy, taking lessons learned from the legacy processes.

ARDOT cautioned about the potential expectation for immediate benefits from implementing e-Construction innovations and for instant responses to inquiries given the ability to generate reports and results quickly. People often forget the human element to reviewing documents, validating results, thinking about implications, etc. Thus, public perception of efficiencies may be unrealistic and likely require moderating expectations.

Having a good partnering strategy with IT will help efforts to deploy tablets and maintain devices be successful, and SCDOT noted that dual monitors are recommended for using ProjectWise given the manual process to enter documents.

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Another key takeaway is that State Highway Agencies (SHA) could advance e-Construction initiatives by getting buy-in or support from the respective FHWA division offices to influence SHA leadership from a more objective perspective. Often, advocacy for innovation and technology-enabled activities from external parties could benefit the message being conveyed.

Table 2 Peer Exchange Participants' Contact Information

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