

e-Construction Summit
October 26-27, 2016
Portsmouth-Norfolk, Virginia

**The e-Construction system increases the quality, efficiency,
environmental sustainability and productivity of the construction industry at
large, all while saving time, money and capacity.**

Hosted by:

Federal Highway Administration (FHWA)
US Department of Transportation (USDOT)
UVA Transportation Training Academy (UVA TTA)
Virginia Department of Transportation (VDOT)

e-Construction: An Every Day Counts Initiative

The future of transportation design and construction is not only in innovative technologies, materials and approaches, but also in the widespread adoption of e-Construction processes. As part of the Federal Highway Administration's (FHWA) [Every Day Counts](https://www.fhwa.dot.gov/innovation/everydaycounts/) (EDC) (<https://www.fhwa.dot.gov/innovation/everydaycounts/>) initiative (one of several strategic innovation deployment programs aimed at identifying and prioritizing new ways to plan, design, build and maintain highways), e-Construction is a paperless construction administration delivery process. It incorporates:

- electronic submission of all construction documentation by all stakeholders
- electronic document routing/approvals (e-signature)
- digital management of all construction documentation in a secure environment allowing distribution to all project stakeholders through mobile devices.

By eliminating the traditional paper-based approach, significant savings in paper, printing and storage costs, as well as decreased communication delays and transmittal times are realized. The e-Construction process allows faster approvals, increased accuracy and enhanced document tracking, all while increasing transparency.

Overview of the e-Construction Summit

Over 100 DOT staff members, consultants and other transportation professionals convened at the e-Construction Summit held October 26-27, 2016 in Portsmouth, VA to discuss how e-Construction processes can be used to improve efficiencies, collaboration and safety while increasing accuracy and decreasing costs. Hosted by the FHWA, the Virginia Department of Transportation (VDOT), the US Department of Transportation (USDOT) and the UVA Transportation Training Academy (TTA) serving as the LTAP Center for the Commonwealth of Virginia, the conference provided a forum to learn about the various ways that DOTs, industry and consultants are leveraging e-construction technology on construction projects, and the challenges they face implementing e-construction initiatives as part of their construction management programs.

Implementing e-Construction Initiatives: Experiences from the Field

Document Management

Electronic document management systems facilitate the creation, distribution, review, approval and storage of project documents in a paperless and secured environment by all stakeholders, ideally an environment that supports use of mobile devices such as tablets and smartphones. Several DOTs have implemented Electronic Document Management and provided overviews of their technical solutions.

Florida Department of Transportation (FDOT)

FDOT is using ProjectSolve SP to organize electronic data; this tool allows them to upload and review project documents, logs, punch lists and plans. It contains a library of various forms that guide the construction manager or inspector through FDOT's construction process. After these documents have been finalized and approved, they are uploaded to EDMS (long term storage system). The price for ProjectSolve SP is \$125.00 per month per contract.

Another tool that FDOT uses to keep a paperless environment is Bluebeam Extreme. Using this program, the contractors, construction managers, inspectors and engineers can do markups in real time and in different locations in a set of plans without creating different versions of the same documents. Programs like this help to keep an updated and clean document management system.

Pennsylvania Department of Transportation (Penn DOT)

Penn DOT has developed and implements a "stick-built" EDMS solution called CDSv3 (Construction Documentations System Version 3). CDSv3 identifies the source of different supplies needed for a project, keeps track of project site activities and reports facility and project punch lists. The development cost for CDSv3 is \$3.1 million and the overall savings have gone up to \$13.5 million in the past three years. Penn DOT processes all project submittal documentation electronically through the Penn DOT Project Collaboration Center (PPCC).

Delaware Department of Transportation (DelDOT)

DelDOT tried different options and realized that SiteManager did not address their needs. They needed something that worked with Primavera P6; therefore, their software of choice was Primavera Unifier. In this program, different forms are ready for use such as daily reports in PDF and monthly diary review reports. The future vision is to improve the fields of construction document management, construction cost management, and expand to more divisions.

Virginia Department of Transportation (VDOT)

VDOT currently spends \$2.5 million annually to address forgotten files, lost emails and file boxes in inspector's vehicles. SharePoint and K2-Blackpearl Workflow Engine are the software

tools used by VDOT, allowing the engineer to access and coordinate with no VPN connection required (meaning they can be accessed without a VDOT computer).

Another program used by VDOT is CADAC (used by the Route 29 Solutions team). CADAC is a communication management tool enabling engineers to access the system and work with the data around-the-clock. For the Route 29 Solutions Project in Charlottesville, CADAC sped up the process and allowed the project to run day and night, weekdays and weekends. Contract documents, submittal management, construction revisions, design reviews and monthly schedule updates were all at the engineers' fingertips.

Mobile Devices

The FHWA supports the switch from paper to tablets to create a more secure, organized and accessible work environment.

Florida Department of Transportation (FDOT)

FDOT first implemented Windows mobile devices and failed because of bigger size and poor battery life. In 2015, iPad with Wi-Fi + cellular were implemented and succeeded thanks to their long battery, durability and size. The iPad 2 Air has capabilities to use enterprise, ProjectSolve SP, go-to-meeting, Blue Beam and Outlook in the field. The cost is \$210,000 for 287 users.

Pennsylvania Department of Transportation (Penn DOT)

With a login and password, inspectors at Penn DOT use the iPad to gain access to several projects while in the field. A file manager for each project keeps everything organized in different folders. Inspectors can access PCC documents, merge different files and share them. Finally, the DWR is done through the iPad, including inputting different tasks such as inspector's hours, adding different contractor labor, work items, the work done each day and quantities, adding pictures and noting weather. All information is synced into one report and uploaded onto the PSA Dashboard for approval.

Delaware Department of Transportation (DeIDOT)

DeIDOT did a 3-month pilot using three different devices: the Dell Venue, Microsoft Surface, and Apple iPad. After the pilot period, inspectors participated in a survey resulting in DeIDOT choosing the Apple iPad. Fifty-six iPad 2s were purchased and distributed in early 2015. Mobile devices are also used at DeIDOT for MDS (Material Delivery Solution) making data taking simpler.

Virginia Department of Transportation (VDOT)

VDOT realized that by implementing 3D roadway design techniques, the utilization of mobile devices is necessary in order to take the design out of the office. I-Model is an application that

allows the user to navigate through Openroads from a mobile device. This tool creates better communication between the engineers and the field.

Unmanned Aerial Systems (UAS)

The use of UAS, commonly known as “drones”, on construction projects has become a hot topic among different DOTs. There are two types of UAS: fixed wing and rotorcraft.

Navigator CS, LLC

Navigator CS, LLC is a consulting company that uses UAS to enhance its surveying and photogrammetry capabilities. One of Navigator’s most commonly used UAS is the eBee RTK fixed wing craft, covering an area of 3 square miles on a single battery charge. A great variety of data can be obtained from these drones including photos, video, photogrammetry, point cloud, infrared, normalized difference vegetation index, laser scanning, light detection and ranging. This increases accessibility on the field in many ways, by either using the hovering features for details or fixed-wings to cover large areas.

To ensure legal compliance, the aircraft must be registered with the FAA and comply with 14 CFR 107 or obtain a section 333 exemption if used for commercial purposes (under 55 lbs.). UAS may only be operated for daytime flights at a maximum 400 ft. altitude. Most importantly, the company must have insurance. Navigator CS, LLC is helping UAS operators ensure that their operations are legal and safe by preparing and filing their petitions.

AGC of America

AGC of America discussed the industry’s perspective on the use of UAS. There are approximately 1500 drones under the section 333 exception that are used for construction purposes. Drones can be used in many scenarios such as analyzing project progress, measuring quantities, doing inspections and checking environmental compliance. UAS pilots must follow the federal rules to not fly over the public or at night operations and keep lines of sight. It is important to remember state laws and local laws may differ. UAS are data vacuums; a good data management system is required to make the best out of the data collected.

3D and 4D Design Documents

As technology progresses and data is collected more efficiently, 3D and 4D models are being developed to make construction more efficient. These models will facilitate quantity take-off on the bidding process and will help with constructability and cost savings in the long term. An ongoing concern is the liability for errors in the actual models. Use of these models means a new way of sealing and signing new sets of plans will be needed.

Delaware Department of Transportation (DelDOT)

DelDOT has a new specification requiring 3D Model As-Built when the proper level of data is provided. Current efforts aimed at 3D mapping utility data will save millions of dollars while preventing utilities incidents. The new specification requires the contractor to collect utilities data in the XYZ coordinates.

Virginia Department of Transportation (VDOT)

VDOT uses 3D models in roadway design implemented by using Openroads. One of its unique features is that a 3D model can be designed and integrated on the fly, detecting utilities conflicts and errors and omissions earlier in the design process. The program shows better visualizations and opens new opportunities to alternatives.

Utah Department of Transportation (UDOT)

Digital data is critical to better manage the billions in assets that are being managed by UDOT. 3D models are part of the IDC initiative (Intelligent Design and Construction) including 3D models at the design stage, surfaces, design detail and information document. UDOT's plan consists of 3D surveying, 3D design, automated constructions and maintenance operations.

Digital Signatures

A digital signature ensures that a document is encrypted with digital codes that are difficult to duplicate and demonstrates the authenticity of the message or document, enabling efficient routing and approvals.

Florida Department of Transportation (FDOT)

In January 2015, FDOT received approval to use digital signatures, creating Florida Statute 668 and 471.025 and the rule of Florida Administrative Code 61G15-23.003. FDOT accepts different electronic signatures from different providers such as DigiCertinc, GlobalSign, IdenTrust, and Cybertrust/Verizon. The price FDOT pays for 390 signatures is \$39,000 for 2 years.

Virginia Department of Transportation (VDOT)

VDOT uses IdenTrust to pair digital signatures and public key infrastructure certificates. This signature can be used for BlueBeam or Adobe review and follows all the requirements of DPOR for P.E. sealing. The user logs in to sign the required document.

e-Ticketing

Electronic ticketing (e-ticketing) can be used by the transportation industry as a paperless, efficient process for documenting deliveries to construction sites.

Iowa DOT

Iowa DOT's current ticketing process consists of a truck being paired with a tablet via QR Code. After the batch material gets tested, the inspector records the test result on the tablet and the ticket gets emailed. This saves the inspector summing the ticket for contractor pay, keeping the tickets clean, writing down readable information, sorting them and verifying them. As a result, the inspector has more time to focus on testing and materials. IOWA DOT is using HMA e-tickets system by FleetWatcher. GPS on the truck provides both the inspector and contractor the exact location of the truck and when they are pouring.

Delaware Department of Transportation (DelDOT)

DelDOT started a pilot project in fall of 2016 using FleetWatcher for a Material Delivery Solution. All transporters were tracked and the data was mobile-enabled.

The IT Perspective

What are some of the challenges faced by IT departments to create systems supporting e-Construction? The changes made by the IT department depend on cultural change and people. The SCRUM method consists of listing the requirements and choosing the highest priority requirement to become the spring backlog. The developer then works to satisfy the requirement and this process becomes a "spring". Each spring lasts between 2 and 4 weeks, and finally each spring result is delivered with a key functionality.

Virginia Department of Transportation (VDOT)

VDOT is becoming agile by training and launching agile spring teams and redefining the consumer experience. They are adopting Lean Kit, a new way to communicate with other divisions. VDOT has established enterprise architecture and created standard estimation tool and templates.

Closing Remarks

Kathryn Weisner, FHWA Resource Center, invited attendees to visit the [FHWA website](https://www.fhwa.dot.gov/innovation/everydaycounts/edc-3/econstruction.cfm) at <https://www.fhwa.dot.gov/innovation/everydaycounts/edc-3/econstruction.cfm> for on-going e-Construction updates and resources. Contact [Kathryn Weisner](mailto:Kathryn.Weisner@dot.gov) at Kathryn.Weisner@dot.gov for additional information.

Presentations

e-Construction and *Every Day Counts* Initiatives

Kathryn Weisner, FHWA

e-Construction Development and Implementation – IT Perspective

Robert Osmond, IT Director, VDOT

e-Construction and Risk Management Using 3D/4D/5D Modeling and the Gilmerton Bridge Project

Jeff Wyatt, VDOT; Jim Holtje, PE, PCL Civil Constructors; Marc Papini, Haley & Aldrich

Industry Perspectives

Brian Deery, AGC of America

Unmanned Aerial Systems (UAS) and Construction

Paul Beckwith, PE, CCM, LEED Navigator CS

Use of e-Construction on the Route 29 Solutions Project, Charlottesville, VA

Edwin Elmendorp, CADAC; Dave Covington, VDOT

Departments of Transportation Presentations

Delaware DOT e-Construction Initiatives

Bill Sweeney; John Ledger, PE

Florida DOT e-Construction Initiatives

Amy Tootle, PE

Iowa DOT e-Ticketing and e-Construction

Greg Mulder, PE

Pennsylvania DOT e-Construction Initiatives

Jim Foringer, PE; Lori Miles; John Myler; Phil Petrina; David Hou

Utah DOT e-Construction Initiatives – Looking Ahead

Rob Wight, PE

Virginia DOT Electronic Document Management System

Omar Ahmed, PE