CIM, eConstruction and the Future of Project Delivery

David Esse | DTSD Innovation Officer
WI Dept. of Transportation

WCPA 2017 Annual Concrete Pavement Workshop
February 16th, 2017
Today’s Topics

• **Innovation:** Culture | Structure | Projects
• **eConstruction:** CIM | ePD | eConstruction
• **UAS:** Challenges | Opportunities | Actions
“Innovation is all about people. Innovation thrives when the population is diverse, accepting and willing to cooperate.”
WisDOT Innovation Culture, Structure

DTSD INNOVATION PROGRAM

JUST DO IT!
FHWA Every Day Counts Initiative

EDC Provides:
• Underutilized, market-ready technologies
• FHWA Support & Resources
• Peer Support by lead states
• Funding Incentives
  • STIC and AID grants

By the numbers:
• 50 EDC Innovations offered by FHWA
• WisDOT has taken advantage of 38 with over 50% implemented with remaining in pilot or development phase
Member Submission Examples

ACEC
- Quiet Rumble Strips
- Reviewing MnDOT Spec for “Mumbles”
- NCHRP Project report data
- Looking for pilot locations

WTBA
- Use of 3D location data for subsurface utilities
- Improving utility coordination process
- Pilot projects using SPAR
eSignatures (DocuSign) Pilot

- Business Drivers: Staff efficiency/eProject Delivery
- Signature process evaluation as a Lean project
- Phase I: Learned tool and confirmed usage on a few, low risk documents
- Phase II: Expanded pilot and confirmed benefit
- Projecting ~2,000 documents in FY2017

By the numbers:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Users</th>
<th>Test Cases</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot Phase I</td>
<td>16</td>
<td>5</td>
<td>~150</td>
</tr>
<tr>
<td>Pilot Phase II</td>
<td>52</td>
<td>9</td>
<td>~785</td>
</tr>
</tbody>
</table>
Mobile Devices & Field Technologies

• Business Drivers: Staff Efficiency/eProject Delivery

• Current Status:
  • 525+ Smartphones, 155+ Tablets, 30 Geo 7x

• Pilots & Deployments
  • App pilots (OnStation, Raxar, ARC Collector)
  • Trimble Geo7x device deployment
  • BTS/TSS Geotech and Hydrology pilot
  • Traffic Operations Asset Management System (TOAMS)
Bluebeam Revu eXtreme Pilot

• Business Drivers: eConstruction/eProject Delivery/CIM

• Business processes targeted
  • Plats Review Process and As-Builts (Statewide)
  • Construction document review (SE Freeways)
  • Informal Pilots

• Future business processes
  • PS&E reviews
  • Structures shop drawing review
3D Engineering Models & CIM

• Business Drivers: eConstruction/eProject Delivery/CIM
• Statewide program
  • Focused on creation of 3D surface models for constructor use of models / AMG
  • Sub-surface utility conflict resolution during design

• Next steps:
  • Improve integration and model use between design and construction phases
  • Discover tools for engineering file mgmt.
  • Identify post-construction uses of models
WisDOT CIM | ePD | eCon Initiatives
FHWA’s Definition of CIM

“Civil Integrated Management (CIM) is the collection, organization, and managed accessibility to accurate data and information related to a highway facility. The concept may be used by all affected parties for a wide range of purposes, including planning, environmental assessment, surveying, construction, maintenance, asset management, and risk assessment.”
Civil Integrated Management (CIM)

- CIM leverages knowledge and experience from BIM

- First attempts at using BIM for transportation industry proved there are many differences between vertical and horizontal needs

- Nationally, there seems to be a variety of interpretations as to what Civil Integrated Management (CIM) is and does.
What is CIM, really?

- Supports the *integration of data* from one process to the next and between processes
- Focuses on the *entire lifecycle* of a transportation asset
- Will have *large impacts* on both Division and Enterprise
What is ePD?

- Focused on Project Delivery portion of transportation asset lifecycle
- Will have large impacts on TS and PD business areas
- From Concept Definition through Closeout
Current State

Field Devices (Flip Phones, Hand Written Data Collection and Rekeying)

Materials Acceptance System

Electronic 2D Plans & Proposals (Civil 3D)

Acceptance System

Systems & Tool Integration

(eProject Delivery & CIM Compliant Systems)

(e-Project Delivery & CIM Compliant Systems)

Support Process System Integration and Workflows

(Utilities, Real Estate, Materials, Survey/Mapping, Financial)

Electronic Bidding System (BidExpress)

Consultant Contract Administration (CARS 4, Masterworks, ProjectWise)

Materials Acceptance (MTS, MRS, eTickets)

Construction Contract Administration (AASHTOWare Project 3.0, STAR)

Wet Signatures and Paper-driven Approvals

Paper Plan Sets, Manuals, Documents and Review Processes

Individual Support Business Processes (Data silos and independent systems)

Contract Administration AASHTOWare, CAS, CARS, PMP

Electronic Approvals (Approval workflow and eSignatures)

Document/Data Progression (Paper to Digital Spectrum)

Electronic Review Processes (Paperless, Electronic As-builts, Collaboration)

Document/Content Management Systems (Engineering & Non-Eng.)

Electronic Documents/Digital Data (Digital Progression: Paperless to Digital)

iBooks & Online Manuals (CMM, FDM, Mobile Plan Sets)

2017 WCPA Concrete Pavement Workshop

Wisconsin Concrete Pavement Association

February 16, 2017
What is eConstruction?

“e-Construction is defined as the collection, review, approval, and distribution of highway construction contract documents in a paperless environment.”

It is a piece of CIM, yet addresses a specific portion of the Project Delivery process.
What is eConstruction?

A paperless environment includes...

- Secure electronic document and workflow management
  - eSubmission of construction documentation
  - Automation of document review & approval
  - eSignatures throughout project delivery

- Increased use of field technology
  - Electronic capture of construction data and documentation
  - Accessibility of data and documents through mobile devices
What does it mean to go paperless?

<table>
<thead>
<tr>
<th>Information</th>
<th>Handwritten, Printed</th>
<th>Image</th>
<th>Data</th>
<th>Object</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Cabinets</strong></td>
<td>.pdf, .bmp</td>
<td>.dxf, .csv</td>
<td>model, services</td>
<td></td>
</tr>
<tr>
<td><strong>Workflow</strong></td>
<td><strong>Organic</strong></td>
<td><strong>Implied</strong></td>
<td><strong>Explicit</strong></td>
<td><strong>Seamless</strong></td>
</tr>
<tr>
<td><strong>Learned</strong></td>
<td>email inbox</td>
<td>documented, semi-automated, semi-measured</td>
<td>automated, notifications, performance management</td>
<td></td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>None</td>
<td>Shared</td>
<td>Interoperable</td>
<td>Integrated</td>
</tr>
<tr>
<td>printed &amp; filled-out forms, snail or inter-d-mail</td>
<td>email a roadway design pdf</td>
<td>dxf emailed from consultant to DOT and back again</td>
<td>some model accessed, reviewed, marked up by all parties, auto-push of model data to traffic/maint. operations sys.</td>
<td></td>
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eConstruction Benefit Examples

• Streamlining of key processes to reduce project and program schedules
• Increased collaboration and transparency
• Reduced use of paper, printing and mailing
• Reduction in written data transposition through direct data entry
• Reduced trips between the jobsite, field office and central office
• Faster document access, distribution, submission, review and approval
### Key Areas of eConstruction Automation

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<tr>
<td>Electronic bidding and contract award</td>
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<tr>
<td>Digital review of project documents</td>
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<tr>
<td>Project construction management</td>
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<tr>
<td>Digital management of construction documentation using a project collaboration tool</td>
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<tr>
<td>Automated machine guidance (AMG) for construction operations</td>
</tr>
<tr>
<td>Requirement of digital as-builts</td>
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<tr>
<td>Use of Digital signatures (including electronic document routing and electronic approvals)</td>
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<tr>
<td>Mobile devices</td>
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eConstruction Implementation

• CARS
• Masterworks
• AASHTOware Project (*Pre-con, Con., Materials*)
• Mobile and Field Technologies (*iPads/Geo7x*)
• Electronic Review (*Bluebeam*)
• Electronic Approvals/eSignatures
• Document Management and Collaboration
Unmanned Aerial Systems:
Challenges | Opportunities | Actions
# UAS Terminology

- **FAA**
  - Federal Aviation Administration
- **FPPOV**
  - First Person Point of View
- **sUAS**
  - Small UAS (< 55 lbs / 24.95 kg)
- **mUAS**
  - Micro UAS (< 0.55 lbs / 250g)

- **Part 107**
  - FAA Small Unmanned Aircraft Regulations
- **Operation**
  - Flight plan w/ a purpose
- **VLOS**
  - Visual Line of Sight
Types of UAS

- Rotor / Copter
- Fixed Wing
- Micro
Small Unmanned Aircraft Regulations (Part 107)

- Highlights from Part 107
  - Covers sUAS under 55lbs (24.95 kg)
  - Max altitude of 400 ft; higher if closer than 400ft to a structure
  - Max velocity of 100 mph (87 knots)
  - Operator must maintain VLOS (unaided); or have a spotter when applicable
  - Daylight operations only
  - May NOT operate over any person not directly involved in operation
  - Operators need a remote pilot airman certificate with a small UAS rating, or be under the direct supervision of a person who holds such a certificate

Small Unmanned Aircraft Regulations (Part 107)

You can’t fly a small UAS over anyone who is not directly participating in the operation, not under a covered structure, or not inside a covered stationary vehicle. No operations from a moving vehicle are allowed unless you are flying over a sparsely populated area.

You can request a waiver of most operational restrictions if you can show that your proposed operation can be conducted safely under a waiver. The FAA will make an online portal available to apply for such waivers.
Micro UAS Guidance (in development)

With all of these factors in mind, because of the low level of risk of injury posed by flying objects weighing 250 grams or less, the ARC recommends no performance-based standards be required for unmanned aircraft in this category. The manufacturers will be required to indicate on the retail packaging the actual flying weight, or a statement that the aircraft weight is less than 250 grams. To provide flexibility in the future, the ARC does, however, recommend that the FAA invite industry to create voluntary, non-binding standards for product marking of UAS weighing 250 grams or less to make it clear to users that these UAS meet the requirement to operate over people.

Why UAS?

- Aerial images provide specific benefits, accuracy and coverage
- Ground level survey can be very accurate, but time consuming
- Need a tool(s) that fits between aerial and surface data collection
DTSD Innovation Development Process

**Incubate**
- Discussion and documentation of idea Determine what business process will be improved
- Discuss feasibility and conduct financial assessment
- Identify potential stakeholders and/or end users

**Demonstrate**
- Chance to “kick the tires”
- Collect/review existing research
- Demonstrations from vendors, lead states or other agencies
- When software related; trial period for potential pilot participants

**Pilot**
- Pilot phase proves concept
- Practitioners test the innovation
- Measure and validate expected benefits
- Identify needs for implementation (e.g. support, training, maint.)

**Communicate**
- Share results and best practices with stakeholders
- Determine width and depth of implementation
- Leverage monthly staff and functional team meetings to share pilot outcomes

**Implement**
- Creation of an implementation plan
- Selection of implementation champions
- Critical factors such as cost, training needs, timelines are considered

Go/No-Go
DTSD UAS Program Development Process

**Short Term**

**Proof of Concept**
- Develop pilot projects to prove concepts of UAS use for select projects or business processes
- Target multiple business areas to gain experience with data collection/consumption
- Develop knowledge base of regulatory and safety requirements

**Mid Term**

**Project-by-Project**
- Pending success from short term objectives, widen use of UAS to other statewide projects
- Develop Dept./Division specifications/requirements and document
- Package requirements and identify contract mechanisms (i.e. RFP to develop approved list)

**Long Term**

**Standardized Practice & Procurement**
- Implement UAS as a tool for projects
- Continue to evaluate new tools (cameras, LiDAR, thermos, UAS Types, etc.)
- Make decisions on need to own/operate at state level
DTSD UAS Program Development Roadmap

• Bridge Inspection
  • Pilot Complete – pending report

• Construction Data Collection
  • Pilot approved – RFP in Progress

• Design Data Collection
  • Pilot in Development – 75%

• Wetlands Monitoring
  • Pilot in Development – 25%

• Traffic Incident Response
  Pilot in Development – 25%
DTSD UAS Pilot Project: Bridge Inspections

PROS:

- Improved inspector safety
- Reduced lane closures and reduced delay
- Ability to gather high quality data
- Can get a first look without dropping lanes and rigging
- Able to inspect elements that previously were out of reach
- Video capture, stills and point clouds
- Geo referenced photos
- First Person POV technology

http://www.newportri.com/newportdailynews/news/page_one/it-had-a-happy-ending/article_19072897-6a3a-5a49-951c-039429b32ff8.html
DTSD UAS Pilot Project: Bridge Inspections

• CHALLENGES:
  • Weather conditions:
  • Getting in tight spaces
  • Poor view of bearings from all angles
  • Unable to fly over traffic/traffic volume
  • Potential magnetic interference with steel overhead truss structures
  • Correlation to thermographic images
  • Data storage, sharing, access
DTSD UAS Pilot Project: Bridge Inspections

• IT Impacts
  • Large volume of data collected/stored
    • Images captured by 38MP camera (~8-10 MB)
    • Volume of video (1 minute video = 250MB)
    • Thermographic imagery
    • LiDAR data and 3-D point cloud data
  
• Software
  • Processing and visualization tools
  • Specialized photo viewers and video players
  • Location reference tools and repository
  • Enhancements to HSIS?

• New tools and mobile apps
Parting Thoughts

• The innovation program is changing our culture and is structured to include your input and ideas

• eConstruction is a major DTSD initiative and will require partnerships to be successful

• When thinking about UAS, the technology is just a piece of the puzzle – the true effort will be in process improvement

• You are encouraged to share your best practices and get involved!
Thank you!

David Esse
DTSD Innovation Officer
WisDOT
Office - (608) 261.6068
Mobile - (608) 215.9293
david.esse@dot.wi.gov

And remember...
Innovation is Awesome!