e-CONSTRUCTION

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202-366-1333

Efficiency through technology and collaboration
Objectives

• What is e-Construction?
• What can we expect to accelerate deployment of e-Construction:
  – AASHTO Innovation Initiative (Aii)
  – FHWA Every Day Counts (EDC-3)
• Tools under development
• States Experiences
  – Iowa
  – Minnesota
  – Michigan
**e-CONSTRUCTION**

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

- Electronically capturing construction data
- Electronic submission of all construction documentation
- Increased use of mobile devices
- Increased automation of document review & approval
- Essential use of electronic signatures by all parties throughout the process
- Secure document and workflow management accessible to all stakeholders on any device
Federal Government Support

• “electronic” found 81 times within MAP-21
  – Fullest extent possible, agencies eliminate paper and use electronic record keeping
• Government Paperwork Elimination Act (GPEA) 1998
• FHWA memo September 21, 1989
  – Secure
  – Reliability of Records
  – Storage of Records
What can we expect from FHWA EDC-3 and AASHTO Aii to accelerate deployment of e-Construction?

• Fall/Winter 2014
  – 7 regional summits
    • Explanation of technology
    • 2 State Subject Matter Experts presenting how and why they adopted e-Construction
    • Collecting suggested activities to accelerate implementation nationally
  – Implementation plan for e-Construction

• 2015 and 1016
  – Support and deliver implementation plan activities
<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard Beckes</td>
<td>Minnesota DOT</td>
<td>651-366-4236</td>
<td><a href="mailto:richard.beckes@state.mn.us">richard.beckes@state.mn.us</a></td>
</tr>
<tr>
<td>Amy Tootle</td>
<td>Florida DOT</td>
<td>850-414-4364</td>
<td><a href="mailto:amy.tootle@dot.state.fl.us">amy.tootle@dot.state.fl.us</a></td>
</tr>
<tr>
<td>Rafiq Darji</td>
<td>Florida, FHWA</td>
<td>850-553-2242</td>
<td><a href="mailto:rafiq.darji@dot.gov">rafiq.darji@dot.gov</a></td>
</tr>
<tr>
<td>Mark Van Port Fleet</td>
<td>Michigan DOT</td>
<td>517-335-2345</td>
<td><a href="mailto:vanportfleetm@michigan.gov">vanportfleetm@michigan.gov</a></td>
</tr>
<tr>
<td>Amy Tootle</td>
<td>Florida DOT</td>
<td>850-414-4364</td>
<td><a href="mailto:amy.tootle@dot.state.fl.us">amy.tootle@dot.state.fl.us</a></td>
</tr>
<tr>
<td>Stuart Laakso</td>
<td>Michigan DOT</td>
<td>517-373-0541</td>
<td><a href="mailto:laaksos@michigan.gov">laaksos@michigan.gov</a></td>
</tr>
<tr>
<td>Jason Clark</td>
<td>Michigan DOT</td>
<td>517-242-6378</td>
<td><a href="mailto:clarkj25@michigan.gov">clarkj25@michigan.gov</a></td>
</tr>
<tr>
<td>Robert Fijol</td>
<td>Michigan, FHWA</td>
<td>517-702-1841</td>
<td><a href="mailto:robert.fijol@dot.gov">robert.fijol@dot.gov</a></td>
</tr>
<tr>
<td>Greg Mulder</td>
<td>Iowa DOT</td>
<td>515-239-1843</td>
<td><a href="mailto:greg.mulder@dot.iowa.gov">greg.mulder@dot.iowa.gov</a></td>
</tr>
<tr>
<td>John Obr</td>
<td>Texas DOT</td>
<td>512-416-2559</td>
<td><a href="mailto:john.obr@txdot.gov">john.obr@txdot.gov</a></td>
</tr>
<tr>
<td>Roxana Garcia</td>
<td>Texas DOT</td>
<td>512-416-2482</td>
<td><a href="mailto:roxana.garcia@txdot.gov">roxana.garcia@txdot.gov</a></td>
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<tr>
<td>Rob Wight</td>
<td>Utah DOT</td>
<td>801-633-6252</td>
<td><a href="mailto:rwight@utah.gov">rwight@utah.gov</a></td>
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<tr>
<td>Richard Duval</td>
<td>TFHRC, FHWA</td>
<td>202-493-3365</td>
<td><a href="mailto:richard.duval@dot.gov">richard.duval@dot.gov</a></td>
</tr>
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<td>Bryan Cawley</td>
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</tr>
<tr>
<td>Greta Smith</td>
<td>AASHTO</td>
<td>202-624-5815</td>
<td><a href="mailto:gsmith@aashto.org">gsmith@aashto.org</a></td>
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</table>
Definitions:
National Leader - Has constructed 2 or more projects using technology
Exploring – Investigation and/or piloting EDC-3 technology
Discussing – Not taking part in national EDC-3 technology initiative
Definitions:
- **National Leader** - Has constructed 2 or more projects using technology
- **Exploring** – Investigation and piloting EDC-3 technology
- **Discussing** – Not taking part in national EDC-3 technology initiative
# Implementation Plan Activities (AASHTO)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Level transportation industry presentations</td>
<td>AASHTO and all</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Resource website (AASHTO users blog site)</td>
<td>AASHTO and FHWA</td>
<td>Ongoing</td>
</tr>
<tr>
<td>AASHTO-sponsored or proprietary solutions</td>
<td>AASHTO</td>
<td>Winter 2016</td>
</tr>
<tr>
<td>IT security awareness outreach</td>
<td>AASHTO and all</td>
<td>Spring 2016</td>
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</table>
# Implementation Plan Activities (FHWA)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
<th>Due</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing lessons learned</td>
<td>All</td>
<td>December 2016</td>
<td>3 State DOT Organized Regional Workshops</td>
</tr>
<tr>
<td>Peer exchanges (in-person and virtual) with documentation for sharing</td>
<td>FHWA and all</td>
<td>As soon as possible</td>
<td>FHWA Procurement</td>
</tr>
<tr>
<td>Application and tool roadmap</td>
<td>FHWA and all</td>
<td>Fall 2015</td>
<td>Captured within Shared Lessons and Peer Exchanges</td>
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<tr>
<td>Technology webinar series</td>
<td>MDOT and FHWA and all</td>
<td>Fall and Winter, 2015</td>
<td>Michigan DOT Lead Series</td>
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<tr>
<td>How-to guide</td>
<td>FDOT, MDOT, and FHWA</td>
<td>Summer 2015</td>
<td>Florida DOT Lead</td>
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<tr>
<td>e-Construction example specifications</td>
<td>FHWA</td>
<td>Fall 2016</td>
<td>FHWA Procurement</td>
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<tr>
<td>Document Return on Investment</td>
<td>FHWA – TFHRC</td>
<td>Fall 2015</td>
<td>TFHRC</td>
</tr>
<tr>
<td>FHWA Federal Lands and Division Office pilot</td>
<td>FHWA</td>
<td>Fall 2015</td>
<td>FHWA Procurement</td>
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# e-Construction Return on Investment (Why)

*interim findings*

<table>
<thead>
<tr>
<th>State</th>
<th>Why e-Construction</th>
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<tbody>
<tr>
<td>Florida</td>
<td>• About $40,000 per project/year savings as compared to paper</td>
</tr>
<tr>
<td>Iowa</td>
<td>• Reduced costs for all stakeholders</td>
</tr>
<tr>
<td></td>
<td>• Faster document processing</td>
</tr>
<tr>
<td></td>
<td>• Faster payment</td>
</tr>
<tr>
<td></td>
<td>• Increased access and transparency</td>
</tr>
<tr>
<td></td>
<td>• Secure documents with multiple backups</td>
</tr>
<tr>
<td></td>
<td>• Reduction in paper is environmentally friendly</td>
</tr>
<tr>
<td>Kentucky</td>
<td>• Eliminated about 300,000 pages of paper documents annually</td>
</tr>
<tr>
<td>Michigan</td>
<td>• About $40,000 per project/year savings as compared to paper</td>
</tr>
<tr>
<td></td>
<td>• Contract modification processing from 30 to 3 days</td>
</tr>
<tr>
<td>State</td>
<td>Why e-Construction</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>New Jersey</td>
<td>• Estimated $150,000 savings a year</td>
</tr>
<tr>
<td>North Carolina</td>
<td>• Estimated $1,000,000 annual savings for pilot program of 2 out of 40 construction offices</td>
</tr>
<tr>
<td>Dallas Fort Worth Connector Project</td>
<td>• Saved $5,100,000 through e-Construction</td>
</tr>
<tr>
<td></td>
<td>• 1 year ahead of schedule</td>
</tr>
</tbody>
</table>
6 Districts
14 Resident Construction Engineer offices
157 full time inspectors
150 cross trained inspectors used

Greg L. Mulder, P.E.
Director, Office of Construction and Materials
Iowa DOT
Paperless or e-construction

- What does e-construction mean to Iowa?
- To us **e-construction** meant:
  - Complete as much work as possible using electronic means.

- **Piloted 4 contracts in 2014**
- 1 small project – Bridge replacement
- 1 HMA overlay with CIP recycling
- 2 major interstate reconstruction contracts with 4-5 projects tied together.
Electronic Records Library

Current ERL Issue - Oct. 21, 2014

The printed version governs if there is a discrepancy between the electronic and printed versions.

- Standard Specifications with GS-12005
- Supplemental Specifications
- Materials I.M.s
- Standard Road Plans
- Standard Culvert Plans
- Standard Bridge Plans
- Sign Truss Standards
- Construction Manual
- Flagger's Handbook
- SUDAS Standard Specifications

Notice:

ERL web app now available at myIowaDOT
Current technology

New technology
The Doc Express Evolution in Iowa

- Partial Pilot Projects in 2010
- Full Pilot Projects in 2011
- Initial Focus was on Materials Certification
- Added Diaries and Payrolls in early 2012
- Changed Diaries to Contract Docs in 2013
- Added electronic signatures in early 2014
- Added a working drawer in 2014
Where are we going

- As let plans from Contracts
- Electronic as-buils in the field (Data only?)
- New electronic shop drawing process (DocExpress)
- Straight line diagraming for project plans?
- 3D project plan vision
- GIS based smart plans?
Geospatial Data Lifecycle – Future Data Inputs and Processes

- **Design**
  Pre-Construction data collected including attribute information for critical assets.

- **Letting**
  Official project design file: Extract and store critical asset geometries and attributes from CADD system. Update project geometry for use in LRS.

- **Construction**
  Use mobile, web and desktop technology to view and manage changes for critical assets.

- **Maintenance/Operation**
  Use mobile, web and desktop technology to collect, manage and maintain critical assets.

- **Project Initiation**
  Project number and geometry is created.

Enterprise Geospatial Database(s) – Storage of critical assets that provide accesses to many systems, reports, maps, users and tools.
Iowa DOT Summary

- Reduces costs for all stakeholders
- Document distribution is immediate
  - No time or money wasted printing & mailing documents
- Documents approved faster
- Faster, more accurate payments to contractors
- Transparency: Documents available for viewing by all project partners
- Accountable: Submittal/approval dates readily available to all
- Portable: Available from any device, any time, any where
- Documents are secure & backed up
- Responds to reality of less staff
- Paper reduction supports “green” environment
Minnesota DOT.....MnDOT

- Minnesota has 87 counties
- 8 Districts
- 24 Resident Construction Offices
- 2013 – 276 projects awarded
- Award Amount $1,187 million

Rick Beckes
Construction Project Controls Specialist
Minnesota DOT
Current e-Construction Practices

• Letting, Award, and Approval
  • e-Plan Room
  • Electronic advertising and bidding
  • Electronic signing of contract
• Contract Administration Electronic
  • Special Provisions and Plans
  • Administration and Inspection
• Contract Administration/Inspection--Projects
FieldOps

- MnDOT Construction Contract Management System Field Operations Module
- Used by Project personnel to document quantities, create diaries, produce estimates, etc.
- Developed in-house...has evolved over 25 years to it’s current version
- Visual FoxPro based program
### FieldOps - Project Selection

<table>
<thead>
<tr>
<th>Low Sp Number</th>
<th>Contract #</th>
<th>Contractor Name</th>
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<tbody>
<tr>
<td>0102-23</td>
<td>120177</td>
<td>LANDWEHR CONSTRUCTION, INC</td>
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<tr>
<td>0105-11</td>
<td>120113</td>
<td>CENTRAL SPECIALTIES, INC</td>
</tr>
<tr>
<td>0108-21</td>
<td>S05153</td>
<td>HARDRIVES INC</td>
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<tr>
<td>0109-19</td>
<td>130308</td>
<td>CENTRAL SPECIALTIES, INC</td>
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<tr>
<td>0111-25</td>
<td>S07018</td>
<td>HAWKINSON CONST CO INC</td>
</tr>
<tr>
<td>0112-01013A</td>
<td>100814</td>
<td>ROBERT R SCHROEDER CONST CO</td>
</tr>
<tr>
<td>0112-47</td>
<td>R09629</td>
<td>HARDRIVES INC</td>
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</tbody>
</table>

Location: TH 18, AT SEASTADE CREEK

Type of Work: GRADING, BIT PAVING, AND BRIDGE

Project Engineer: Hughes, Tony

Engineer's Phone: 218 828-5736

Date Let: 06/22/2012

Award Date: 07/18/2012

Approval Date: 07/25/2012

Funds Encumbered: $304,015.56

Voucher no.: 3

Voucher Date: 05/13/2013

Value Certified to Date: $298,427.23

Work Performed to Date: $298,427.23

Const. Office: BAXTER

Work this Voucher: $0.00

% Complete: 98.16

Contract no.: 120177

Dist. 03

New Download

Environment: Network Production

EXIT
Payment and Documentation Options

- **Update**: Update IRA, SA, CO, WO, Backsheets (Enter Quantities for Payment)
- **Estimate**: Work with Partial Estimate for Payment (View, Print, Email)
- **Backsheets**: Create, Edit or Delete Backsheets (WO, CO, Inc/Dis, Withholding and Common Deducts)
- **Material on Hand**: Create and Add Material-On-Hand Pay Items
- **Supplemental Agreements**: Work with Supplemental Agreements and Additional Encumbrances for Overruns
- **Certify**: Certify Final Quantities and Documentation Location
- **Final**: Create and Produce Draft Final Voucher and Overrun/underrun Report
- **Reports**: Print Data Collection Sheets, % Complete, Status and other Project Related Reports
### Daily Construction Reports (DCR)

#### MnDOT Design Bid Build Daily Reports

<table>
<thead>
<tr>
<th>Report Number</th>
<th>Period</th>
<th>Date</th>
<th>Employee</th>
<th>Finalized</th>
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<td>SEP-11</td>
<td>09/23/2011</td>
<td>Robert Abfalter</td>
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<td>R2A111001-01</td>
<td>OCT-11</td>
<td>10/01/2011</td>
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<td>No</td>
<td>No</td>
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<tr>
<td>R2A111003-01</td>
<td>OCT-11</td>
<td>10/03/2011</td>
<td>Robert Abfalter</td>
<td>Yes</td>
<td>No</td>
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</table>
Report Number: R2A120503-01  Date: 05/03/2012 DOW: Thursday

Project Name: 0503-75 - TH 23, FROM 682 FEET EAST OF TH 95 TO 1756 FEET WEST OF

Builder: Report By: Robert Abisair

Weather: Cm, pm  Temp (F): 42 to 71  Prod Check? NO

Activity: 2105 - Excavation and Embankment

General Contractor Field Notes

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>ML-1150: No scraper work - too wet.</td>
</tr>
<tr>
<td></td>
<td>N/A: Got word from Derrick Duenstock (MnDOT foundations), that Hoffman can place another 2' lift of granular borrow on LTF sta 334+340+51, will pass along to contractor.</td>
</tr>
<tr>
<td>HCC</td>
<td>GS-1085: Hoffman finish slopes on Glen St. w/backhoe sta 712-727+00.</td>
</tr>
<tr>
<td>HCC</td>
<td>HSN: Hoffman grade out entrances off of TH25 sta 941+59 R1, 941+50 Lt (city street) in anticipation of being paved.</td>
</tr>
<tr>
<td>HCC</td>
<td>GS-1085: Hoffman shape topped on Glenn St. sta 720-725+00.</td>
</tr>
<tr>
<td>HCC</td>
<td>ML-B1040: Hoffman strip common borrow pit at Bartholomew.</td>
</tr>
<tr>
<td>HCC</td>
<td>EC-1120: Hoffman place GB back where the bench had been made to install the CL3 riprap.</td>
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<tr>
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<td>ML-B1050: Hoffman haul suitable from the Bartholomew pit to TH23 WB sta 350-351+55.</td>
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<td>ML-G1030: Hoffman haul suitable to EBTH23 sta 645-665+00.</td>
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<tr>
<td>HCC</td>
<td>Pl 1030: Hoffman complete track healing pond suitable grading to EBTH23 grade sta 520-530+00.</td>
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</table>
Primavera P6v8-Enterprise Management

• For projects with Critical Path Method (CPM) schedule requirement; Contractor’s are required to build and maintain schedules on MnDOT servers
Minnesota - The Future of e-Construction

- FieldOps and TRACS are in poor technical health (VFP); will be replaced
- AASHTOware Project Construction & Materials 3.0 scheduled to replace FieldOps
- MnDOT will pilot C&M 3.0 on approximately 25 projects in 2015
- Find replacement for TRACS....SharePoint????
- Rover
Upcoming Initiatives in Minnesota

- ProjectWise
- 3D Modeling
- Electronic Data Collection (DWRs, prequalification, reporting requirements, insurance, certifications)
- QR Code (for materials, core custody)
Paperless Components Already in Place at Michigan DOT

- Electronic Document Management System
- Construction Administration Software
- Electronic Plans & Proposals
- Electronic Bidding

Cliff Farr P.E.
Technology and Training Engineer
Michigan DOT
Number of People Involved in a Construction Project

Users & Stakeholders

Consultants

Government: State DOT, Local County/City, & FHWA

Contractors, Subcontractors, Suppliers, Fabricators, Vendors, etc.
What Does e-Construction Look Like?

**Contractors**
- Opportunities to cut costs resulting in lower bid prices / more competitive
- Precise knowledge when submittals are approved
- Transparent access to all project information, reducing claims
- Ability to efficiently monitor subcontractor/supplier submittals
- Faster payments
What Does e-Construction Look Like?

**Engineers**
- Increased & timely oversight
- Access to all project documents remotely from mobile devices
- Paperwork starts & stays electronic
- Reduces lost paperwork
- Ability to electronically sign documents remotely
- Increased communication & efficiency
- Quicker management approvals
What Does e-Construction Look Like?

Inspectors

- Efficiency gains
  - Easier data collection with tools like voice data entry
  - Elimination of copying / faxing / scanning and distribution of field forms
  - Faster problem solving with interactive real-time access to statewide experts & partners (FaceTime)
  - Easier access to manuals, plans & project information in electronic format
  - Ability to markup plans on mobile device

- Translates to more time on job site
Pilot Projects

• 2012 Pilots Projects Selected
  • I-96 Latson Road ($25M)
  • M-231 Little Robinson Creek ($5M)
  • M-231 over the Grand River ($68M)
  • I-75 Zilwaukee Bridge ($35M)

• 2013
  • Pilot projects under construction

• 2014
  • Each field office had at least one e-Construction paperless project
  • Also utilized on large I-96 project ($160M)
Results

• Estimated $12 M annual cost savings
  – Accounts for estimated contractor + DOT Savings
• Estimated 6 million pieces of paper saved annually
• Field staff on jobsite for higher percentage of time
• Increased employee & stakeholder engagement
  – Enthusiasm drove the process
  – Users presented ideas to further enhance process
Where Is MDOT Today?

The following stakeholders are in production, including:

- All MDOT construction & materials offices
- 119 contracting firms
  - 322 contractor users
- 31 construction consultant firms
  - 156 consultant users
- 22 FHWA users
- 31 active contracts
  - $354 million as-let contracts
Next Steps

• Address Delivery Tickets
• Enterprise E-Signature Validations
• Broaden the User Base
  – Local Agency Programs
For Additional Information

https://www.fhwa.dot.gov/construction/
http://www.fhwa.dot.gov/accelerating/edc3.cfm
http://aii.transportation.org/Pages/e-Construction.aspx