Model Based Design & Construction (MBDC):
Use of Digital Data in Construction

Presented by: Robert Stewart, UDOT’s Director of Construction
Use of Digital Data in Construction

Overview

• UDOT Goals
• Design to Construction
• Construction
• Current Work
Why - Digital Delivery Goals

- Produce a more optimal design
- Improve Information
- Obtain & Manage Data to Improve Decision Making
- Improve Efficiency
“Become the first DOT in the country to
go completely paperless”

Carlos’s Top Ten
E-Construction gets us out of paper

E-Construction benefits:

1. Paper is incredibly slow and inefficient
2. Handoffs are much faster
3. Updates are faster
4. Distribution more comprehensive
5. Gets technology in the hands of field people.
Digital Delivery takes opens us to analytics

- [https://www.doxel.ai/#open-video](https://www.doxel.ai/#open-video)
- Don’t lose the data
- Efficient flow of information
  - Use data directly
  - Reduce errors
- Comprehensive use of information
- Can still print information
Example

- Paper field book
- Paper forms
- Electronic forms (lost a)
- Photos
- Digital
- Digitize
High need for consistency from design
Preconstruction

Requires more detailed design

• Validating existing information
• Digital Reviews at PS&E
• Mandatory Handoff Meeting
  o Designer to Contractor
  o Preconstruction Surveyor to Contractor’s Surveyor
Advertising & Bidding

No plans?

• More information
• Model as a Legal Document (MALD)
• Pre-Releasing information for Contractors
Construction

Hardware and Software
Hardware

• iPads & Laptops for all field personnel
• Contractor provided rovers, including training and maintenance
Software

- I-80 Blackrock
- Bentley Navigator
- Bentley Viewer
Software

• GIS Collector App for Field Personnel
  ○ Converting CADD file to GIS format and integrating construction software information
Current Work
Federal Aid Grant, Information Hub, GIS
Digital Delivery AID Grant Project

4 PILOT PROJECTS

- I-15 Climing Ianes Baker Canyon
- I-80 SR 201 to SR 36 Aux lane
- SR 30 SR 23 to SR 252
- SR 209 Redwood Road to I-15

BUILDING A REPEATABLE PROCESS

- Baseline workspace
- Naming conventions
- Standard attributes
- Links
- Attachments

BASELINE WORKSPACE FOR DESIGNERS

- Project data
- Customized interface
- Expanded metadata
- Consistent deliverables
- Updated processes
- Available

Lessons learned on the pilot projects will be incorporated to enhance both the workspace and the process.
Present Approach

2D for civil elements
• Why? GIS field tools do not currently support 3D and 3D is not needed for inspection work
• Working around limits of current technology

3D for breaklines
• Why? Contractors have said breaklines are most useful
• ** Exploring parametric cells
UDOT Goals for AID Grant

• A single site to support Digital Delivery
• Documented repeatable processes
• Bentley Workspace to support migration to ORD
• 3 Translation Tools:
  – Tool to enforce accountability on CAD Standards
  – Tool to extract and provide breaklines for construction
  – Tool to extract and provide data for GIS field apps
• Training strategy to support migration to Digital Delivery
• Business case for future investment
Central Hub Site

UDOT Digital Delivery

This site provides access to information about Digital Delivery with Model Based Design and Construction (MBDC).

Jump to...

Designer Resources | Construction Resources | Projects Map | FAQ | Project Previews | Library

Designer Resources

Guidance Document | Training Videos | Deviations Form
Centralized Training Resources

Digital Delivery

Training Videos

This collection of video tutorials illustrate how project teams have used Bentley software to build models for digital delivery.

Driveway Detail Modeling
- Special considerations for the detail modeling of driveways
- Reviews potential need for breaklines beyond standard template points
- Breaklines allow for the creation of accurate top and bottom mesh surfaces necessary for an model based digital delivery

Understanding Display Rules 1
- This video is the first in a series and opens up the topic of using display rules in templates to streamline the modeling process.

Understanding Display Rules 2
- This second video in a series covers the foundational steps to create a display rule the turns template components on and off.
GIS Process

Design → GIS → Field Inspections → Quantity Management

CAD to GIS supported by new standards to support downstream data users

Data easily viewed by PM’s, Inspectors, and Contractors for review and documentation.

Combination Collector and Survey 123 write field collected inspections and quantities back to GIS data
Step 1: Select Map
Step 2: Select feature for inspection
Step 3: Fill out inspection form
Field Tools

**My Survey**

### Record measurements for all sidewalks and push buttons:

<table>
<thead>
<tr>
<th>Element</th>
<th>Measurement</th>
<th>Sidewalk 1</th>
<th>Sidewalk 2</th>
<th>Sidewalk 3</th>
<th>Sidewalk 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross Slope</td>
<td>22.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passing Space</td>
<td>50’, 50’ x 200’ spacing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element</th>
<th>Measurement</th>
<th>Ped Button 1</th>
<th>Ped Button 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>4” x 2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance related turning space</td>
<td>10”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Based on your inspection, please indicate the ramp status.**

- ❌ Does Not Meet Standards
- ❌ Meets Standards
- ❌ No Longer a State Route
- ✅ Ramp Eliminated
- ✅ Technical Infeasibility

**Choose all reasons ramp failed.**
- ✅ Detectable Warning Surface
- ✅ Running Slope
- ✅ Cross Slope
- ✅ Width/Depth
- ✅ Pedestrian Push Button
- ✅ Crosswalk
- ✅ Sidewalk
- ✅ Ramp
- ✅ Turning Space

**Record measurements for all ramps:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Measurement</th>
<th>Ramp 1</th>
<th>Ramp 2</th>
<th>Ramp 3</th>
<th>Ramp 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turning Space</td>
<td>Width (Curb Cut or 4’)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depth (4”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Running Slope (≥2.0%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cross Slope (≥2.0%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grade Breaks (None)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramp</td>
<td>Running Slope (≥8.3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cross Slope (≥2.0%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grade Breaks (Yes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flare</td>
<td>Flare 1 Tool Joint (Yes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F1 in PAR slope (≥10.0%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F1 outside PAR slope (≤2.0%)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Flare 2 Tool Joint (Yes)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>F2 in PAR slope (≤10.0%)</td>
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</tr>
<tr>
<td></td>
<td>F2 outside PAR slope (≤2.0%)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Curb Cap</td>
<td>Serves single walk (24”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serves two walks (≥28”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean Space</td>
<td>Lip (≥0.5” bevel)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Size (4’ x 4”)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Within walk &amp; outside veh traffic (Yes)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Running Slope (≤5.0%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cross Slope (≥2.0%)</td>
<td></td>
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</tr>
<tr>
<td>DWS</td>
<td>Polymer, cast iron, or precast concrete</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Spans full width curb cut? (Yes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depth in ped travel direction (≤5”)</td>
<td></td>
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<tr>
<td></td>
<td>Color contrast (Yes)</td>
<td></td>
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<tr>
<td></td>
<td>Outside corners w/in 2” from BOC (Yes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panel gap (0” preferred; ≤2”)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Dashboard linked to inspection data (Draft)
Any Questions?
Thank You!!

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