Building Information Modeling (BIM) for Bridges and Structures:

Iowa DOT Demonstration Project

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Chief Structural Engineer
• Iowa DOT I-80 / I-380 Pilot Project
  – Project Overview
  – Lessons Learned
PROJECT OVERVIEW

INITIAL GOALS

1 DEVELOP BIM MODEL
   As complete as possible

2 EVALUATE BENTLEY SOFTWARE
   OpenBridge Modeler
   ProStructures
   Navigator Connect

3 ENCOURAGE CONTRACTOR USE
PROJECT OVERVIEW

3 Complex Curved Steel Plate Girder Bridges

- Total length = 4,200 ft.
- Diverging gore
- Discontinuous girders
- Complex superelevation at gore
- Inspection walkways
- Aesthetic piers & abutments
BENTLEY SOFTWARE

Bentley’s BIM Bridge Solution

OPEN BRIDGE MODELER
Defines primary bridge elements using horizontal & vertical geometry.

PROSTRUCTURES
Used to add elements not created by OBM and improve LOD.

NAVIGATOR CONNECTS
Multi-platform viewing tool. Not used for element creation.
I-MODEL TRANSFORMER

- Filter out unwanted info
- Modify descriptions
- Adjust software-generated data

MICROSTATION CONNECT

- Add custom element info
- Organize data into different categories
- Link data to spreadsheets through Item Types Plus
PDF
- Details not definable in BIM
- Maintained traditional sheet format

SPREADSHEETS
- Top of deck elevations
- Camber & deflection

WORD DOCUMENTS & WEBSITE LINKS
- Specifications
- Special provisions
MODEL DEVELOPMENT

Interdisciplinary Coordination

- Geotechnical
- Roadway
- Drainage
- Utilities
- Lighting
- Mechanical
MODEL DEVELOPMENT

Process

- OTHER DISCIPLINES
- CIVIL GEOMETRY
- CUSTOM CONCRETE SOLIDS
- LINKABLE DATA
- OPENBRIDGE MODELER
- PROSTRUCTURES
- ITEMS FROM MICROSTATION CONNECT
- I-MODEL TRANSFORMER
- FEDERATED FILE
- BENTLEY VIEW
- BENTLEY NAVIGATOR MOBILE
BIM Deliverable
Design, Bid, Build Contract

Provide BIM Model for Information

Hybrid Model

INITIAL APPROACH

FINAL APPROACH

DESIRED RESULTS

- Reduce Contractor Risk
- Promote BIM usage
- Gather Information on BIM Usage During construction

Ramp H
- 2D Plans
- BIM Info Only

Ramp BH
- 2D Plans
- BIM Info Only

Ramp B
- BIM Deliverable
BIM Deliverable

Special Provision

- List of files and access instruction
- Recommended software
- Information hierarchy
- LOD table for each element type
- List of known deficiencies
- Appendix with seal and list of covered digital files
- Referenced files

SPECIAL PROVISION DEVELOPED FOR DIGITAL CONTRACT FILES
ADVANTAGES

- Free download
- All info required for bidding is accessible
- Visualization tools similar to MicroStation & ProStructures
- Read-only i-model

ISSUES

- Limited functionality during construction
- No mobile application
## Project Letting

### Training

- Contractors & subs unfamiliar with software

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<thead>
<tr>
<th>HDR provided multiple training sessions to:</th>
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<tr>
<td>● Office of Bridges &amp; Structures</td>
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<td>● District</td>
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<td>● Contractors</td>
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<tr>
<th>Recorded hour-long training video using the Ramp B model</th>
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<th>Free Bentley support</th>
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Free Bentley support
Project Letting

- **July 31, 2018**
- **$38.2M**
- **$250K**
- **Contractor attended all AGC meetings**

**Project Awarded**

**Apparent Low Bid**

**Under Engineers Estimate**
LESSONS LEARNED

Model Development

OpenBridge Modeler OBM
- Elements cannot be customized
- Simple native elements (i.e. piers & abutments)
- Limited quantities & no parts list

ProStructures PS
- No civil geometry
- Buildings-based program
- Needs more bridge-specific tools
- Time consuming
LESSONS LEARNED

Model Development

Native Element Information

- Significant amount of software generated element information is irrelevant
  - Difficult to locate specific items
  - Repetitive information
  - Increases checking process

- Need for customized element information
  - Bid item numbers
  - Embedment depths
  - Batter angles
  - Etc.
Current software capabilities do not allow all information to be obtained from the model.

- Software lacks features to allow easy access to available information such as:
  - Shear connector spacing
  - Horizontal dimensions
  - Span Lengths
  - Girder layout

- Details needed to help define:
  - Welding Details
  - Vendor supplied items (i.e. bearings, expansion joints)

- Additional details needed:
  - Specifications
  - Notes
LESSONS LEARNED

Post Letting Feedback from contractors

- Have to invest in software in order to take full advantage of the model
- Having difficulties with generating prints for specific views
- Lack of dimensions in the model
- Helping suppliers obtain information from the model
- Getting buy-in from senior field staff
THANK YOU FOR YOUR TIME AND ATTENTION

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