AASHTO 2018 SCOBS Meeting

BIM For Bridges & Structures

Iowa DOT BIM Pilot Project
I-80/I-380 Interchange

Presented By
HDR Engineering, Inc.
AGENDA

1. PROJECT OVERVIEW

2. BENTLEY BIM DEVELOPMENT SOFTWARE

3. BIM MODEL USE DURING DESIGN

4. BIM MODEL USE DURING CONSTRUCTION

5. FINAL THOUGHTS
PROJECT OVERVIEW
PROJECT OVERVIEW

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

- 5 Span With Diverging Gore
- 3 Span Curved Ramp
- 13 Span Curved Ramp

- TOTAL LENGTH = 4200 FT
- DIVERGING GORE
- DISCONTINUOUS GIRDER
- COMPLEX SUPERELEVATION AT GORE
- INSPECTION WALKWAYS
- AESTHETIC PIERS & ABUTMENTS
PROJECT OVERVIEW

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PROJECT OVERVIEW

3 Complex Curved Steel Plate Girder Bridges

- Total Length = 4200 ft
- Diverging Gore
- Discontinuous Girders
- Complex SuperElevation at Gore
- Inspection Walkways
- Aesthetic Piers & Abutments
PROJECT OVERVIEW
3 Complex Curved Steel Plate Girder Bridges

TOTAL LENGTH = 4200 FT
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DISCONTINUOUS GIRDERS
COMPLEX SUPERELEVATION AT GORE
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BENTLEY BIM
DEVELOPMENT SOFTWARE
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

NAVIGATOR CONNECTS
For multi-platform viewing with limited element information
MODEL DEVELOPMENT
OpenBridge Modeler

OBM ELEMENTS
BRIDGE DECK, HAUNCH
BARRIERS
GIRDERS, PLATES & STIFFENERS
CROSS-FRAMES
FOOTINGS & PILES
MODEL DEVELOPMENT
OpenBridge Modeler

ADVANTAGES
- CREATING ELEMENTS BASED ON HORIZONTAL & VERTICAL GEOMETRY
- COMPLEX STEEL FRAMING
- PLACE NON-NATIVE CELLS AT STATION & OFFSETS
- NATIVE ELEMENT INFORMATION POPULATION
MODEL DEVELOPMENT

OpenBridge Modeler

ISSUES

- OBM ELEMENTS CANNOT BE CUSTOMIZED
- SIMPLE NATIVE ELEMENTS (I.E. PIERS & ABUTMENTS)
- LIMITED QUANTITIES & NO PARTS LIST
MODEL DEVELOPMENT
ProStructures

PS ELEMENTS
- REINFORCING STEEL
- BOLTS & BOLT HOLES
- DISC BEARINGS & ANCHORAGE
- FIELD SLICES & MISC. STEEL
- ABUTMENT & PIERS
- SIGN SUPPORT & I.T.S. POLES
- DIAPHRAGMS & ACCESS DOORS
- INSPECTION ACCESS SYSTEM
- MISC. ELEMENTS
MODEL DEVELOPMENT

ProStructures

PS ELEMENTS

REINFORCING STEEL

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MISC. ELEMENTS
MODEL DEVELOPMENT

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MODEL DEVELOPMENT

ProStructures

ADVANTAGES

- Rebar layout is flexible & improving
- Higher level of development
- Can add any user-created element
- Quantity & part list capabilities
- Bill of bars
- Cut sections & clip volumes

HDR

IOWA DOT
MODEL DEVELOPMENT

ProStructures

ISSUES

- No horizontal & vertical control
- Buildings-based program
- Needs more bridge-specific native elements
- Time consuming
MODEL DEVELOPMENT
Combined OBM & ProStructures
INTEROPERABILITY

Not Parametric
• Changes in alignment or positioning in OBM does not move PS elements
• Rebar will be lost with changes to OBM model elements

Quantities for OBM elements can only be obtained within OBM (Vice-versa)
BIM MODEL USE DURING DESIGN
BIM MODEL USE DURING DESIGN

- Complex detail visualization
- Bill of bars & quantities
- Parts list
- Clash detection
- Measurements
- Section cuts
- Barrier conduit layout
- 2D plan detail development
- Interdisciplinary coordination
BIM MODEL USE DURING DESIGN

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BIM MODEL USE DURING DESIGN

Interdisciplinary Coordination

- Geotechnical
- Roadway
- Drainage
- Utilities
- Lighting
- Mechanical
BIM MODEL USE DURING CONSTRUCTION
CONSTRUCTION
Design, Bid, Build Contract

INITIAL APPROACH
Provide BIM Model for Information

FINAL APPROACH
Hybrid Model
- Ramp BH & H Bridges - 2D Plan Deliverable
  BIM Model for information
- Ramp B Bridge - BIM Model Deliverable
  BIM Model deliverable with links augmenting model

DESIRED RESULTS
- Reduce Contractor Risk
- Promote BIM usage
- Gather Information on BIM Usage
  (During construction)
BIM DELIVERABLE

Ramp BH
- 2D Plans
- BIM Info Only

Ramp B
- BIM Deliverable

Ramp H
- 2D Plans
- BIM Info Only
BIM DELIVERABLE
Ramp B

CHALLENGES

- Contractors and subs unfamiliar with software & process
- Software lacks full functionality
  - Can’t summarize complete quantities
  - Some dimensions are not easily accessible in model
  - Not all elements modeled correctly
- Additional information needed
BIM DELIVERABLE
Element Information

- Current software capabilities do not allow all information to be obtained from the model.
- Software lacks features to allow easy access to available information.
- Purpose of the links is to augment the models shortcomings.
- Detail Links needed to help define:
  - Welding Details
  - Vendor supplied items (i.e. bearings, expansion joints)
- Notes & quantities
- Items difficult to pull from the model (shear connector spacing)
- Additional Information Needed
  - Specifications
  - Horizontal dimensions
    - Span Lengths
    - Girder layout
BIM DELIVERABLE
Ramp B

SECTION A-A  (TYPICAL)  SECTION B-B
BIM DELIVERABLE
Use By Contractor
BIM DELIVERABLE

Use By Contractor
BIM DELIVERABLE
Use By Contractor
BIM DELIVERABLE
Use By Contractor
BIM DELIVERABLE
Use By Contractor
### Complete list of single parts

<table>
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<th>Position</th>
<th>Quantity</th>
<th>Component</th>
<th>Material</th>
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<th>Weight (呎)</th>
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</table>
BIM DELIVERABLE
By Contractor
FINAL THOUGHTS
FINAL THOUGHTS

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2. EVALUATE BENTLEY SOFTWARE
   - OPENBRIDGE MODELER
   - PROSTRUCTURES
   - NAVIGATOR CONNECTS
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FINAL THOUGHTS

Future Use

POST CONSTRUCTION ASSET MANAGEMENT

RATING

MAINTENANCE

DEPENDENT ON MVD & IFC DEFINITIONS

SPECIFIC TO BRIDGES
QUESTIONS