National Perspective – Design to Asset Management

2022 Mid-Continent Transportation Research Symposium

September 14, 2022
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BIM for Infrastructure Overview
Data Deliverables

BUILDING DELIVERABLES FOR COMPUTERS
Components of BIM

- People and Skills
- Data and Standards
- Policies and Processes
- Tools and Technologies
From 3D CADD to Asset Data Requirements

BUILDING INFORMATION MODELING WORKFLOW

CONCEPT
Spatial Understanding and Visualization

DESIGN
Convey Design Intent, Pull Quantities, Coordinate Disciplines

CONSTRUCTION
Fabrication Details, Phasing, Layout, AMG

ASSET MANAGEMENT
Preventative Maintenance, Condition Assessment, Maintenance Records
From 3D CADD to Asset Data Requirements

**INFORMATION WORKFLOW**

**CONCEPT**
- Spatial Understanding and Visualization
- Classification
- Early Quantities
- Early Spatial Information

**DESIGN**
- Convey Design Intent, Pull Quantities, Coordinate Disciplines
- Classification
- Inspection IDs
- LRS Info
- Pay Item #
- Engineering Data
- Materials
- Quantities

**CONSTRUCTION**
- Fabrication Details, Phasing, Layout, AMG
- Fabrication Data
- Schedule info
- Layout Info
- Inspection Results
- Install Date

**ASSET MANAGEMENT**
- Preventative Maintenance, Condition Assessment, Maintenance Records
- Pavement DB
- Bridge DB
- Other Assets DB
Shift to Digital Delivery and Open Standards
Key Milestones Advancing Data Standardization and MALD

2017
- Creation of BIM for Bridges and Structures Pooled Fund
- AASHTO AR-1-19 was issued
- Adoption of IFC Schema as the national standard for AASHTO States
- Form the Joint Subcommittee on Data Standardization (J-STAN)

2019
- Creation of BIM for Infrastructure Pooled Fund

2021
- AASHTO COBS adopts national standard for open exchange of bridge data
AASHTO Joint Committee on Data Standardization

- Data Management and Analytics
- Bridges and Structures
- Design
- Construction
- AASHTOWare
- Performance Based Management
- AASHTO Staff
- Stakeholders
# Joint Technical Committee on Electronic Engineering Standards

## State / Federal Transportation Agencies
- FHWA
- AASHTO
- Iowa DOT
- Tennessee DOT
- Arizona DOT
- Connecticut DOT
- Florida DOT
- Georgia DOT
- Maine DOT
- Michigan DOT
- Nebraska DOT
- New Hampshire DOT
- North Carolina DOT
- Pennsylvania DOT
- Texas DOT
- Utah DOT
- Vermont DOT
- Virginia DOT

## Other Stakeholders
- ACEC
- AGC

## Consultants
- CDM Smith
- HDR
- Mead & Hunt

## Vendors
- Autodesk
- Bentley Systems
- Trimble Inc.
AASHTO Transportation Pooled Fund Efforts

- **AEGIST** is National Pooled Fund led by FHWA Office of Planning and Safety
- States DOTs Participating: 18; Engaged 5
- Coordination with Standards Development Organization
  - buildingSMART International (bSI)
  - Open Geospatial Consortium (OGC)
- Coordination with Tools and Technology Vendors

**BIM for Infrastructure Pooled Fund**

**Committed States and FHWA**

**Preliminary Scope of Work**
- Develop BIM use case and workflows
- Establish BIM processes
- Enhance skills and collaboration
- Deploy data management tool and technique
- Information exchange

**Applications in Enterprise GIS in Transportation (AEGIST) TPF**
State DOT Digital Delivery Initiatives
Additional National & International BIM Efforts

**FHWA**
- Research Projects
- EDC-6: e-Ticketing and Digital As-Builts
- BIM National Strategic Roadmap Published – [link](#)
- Advanced Digital Construction Management Systems Program

**buildingSMART International**
- IFC Infra Extensions Projects (Road, Ports, Bridges)
- buildingSMART USA Chapter

**National Institute of Building Sciences (NIBS)**
- U.S. National BIM Program Steering Committee
- Goal - Enable digital processes that will streamline industry practices and procedures on a national scale
Digital Delivery
Project Examples
Iowa DOT, I-80/I-380 BIM Pilot
JOHNSON COUNTY, IA

SCOPE OF WORK

• 5 span diverging gore (FIO)
• 13 span curved ramp carrying the NB movement (FIO)
• 3 span curved ramp carrying the SB movement (MALD)
• Develop BIM for the bridges as complete as possible,
• Evaluate the BIM software and assess the model use during construction

BLUEBEAM
BENTLEY
• OpenBridge SS4
• Prostructures SS4
• MicroStation
• View
• Navigator

DELIVERY TYPE
D-B-B

MODEL AS THE LEGAL DOCUMENT
Iowa DOT, I-80/I-380 BIM Pilot
JOHNSON COUNTY, IA

Digital As-Builts

• Construction completed in late 2020
• Project received additional STIC funding to incorporate as-builds
• Objectives
  o Update modeled elements
  o Incorporate non-model-based data
  o Explore options to ensure future accessibility
• Next step: Explore asset management tools
UDOT I-84 Over Weber River & UPRR Bridge Replacement  (WEBER COUNTY, UT)

PROJECT DETAILS

• I-80: Bridge replacement
  • MALD: Roadway, structure and drainage models
  • Limited Sheets for UPRR coordination
• Used iTwin Review software for model-based review

Images courtesy of HDR and Utah DOT
MDOT, I-94 Bridge Pilot Project

SCOPE OF WORK

• Develop BIM models for 2-span steel girder bridge and 2-span prestressed concrete girder bridge

• MDOT in-house design

• Create 3D bridge information models to re-create the General Plan of Site and Structure sheets

• Verify design interoperability in OpenBridge

DELIVERY TYPE

D-B-B

MODEL AS THE LEGAL DOCUMENT

BLUEBEAM
ALLPLAN
BENTLEY

• OpenBridge Connect
• MicroStation Connect
UDOT, SR-68 (Redwood Road)  
SALT LAKE CITY, UT

SCOPE OF WORK

- $44M roadway widening
- Phase: construction completed (2018)
- Model as legal document
- Plan sheets for multi-disciplinary collaboration
- 3D line strings, surfaces and corridor files contractual
- ICM and i-models FIO
MDT: Salmon Lake Highway Reconstruction
MISSOULA COUNTY, MT

PROJECT DETAILS

- 4-mile corridor with digital delivery requirements
  - Utilize model review software
  - Document the process and define expectations
  - 30% Submittal: limited plans with 3D model review
  - 60%-90%-100% Submittal: standard plan deliverables

BENTLEY
- ProjectWise
- Geopak SS10 (OpenRoads technology)
- iTwin Design Review

DELIVERY TYPE
- CMCG

MODEL FOR INFORMATION ONLY

Images courtesy of HDR and Montana DOT
Consultant and Agency Considerations
HOW IS RISK DIFFERENT WHEN USING BIM AS A CONTRACTUAL DELIVERABLE?
Top 5 Risks/Concerns for Consultants
Model as the Legal Document

- DATA SECURITY (CONTRACTURAL DELIVERABLES)
- CLEAR DEFINITION OF MODEL ACCURACIES AND TOLERANCES
- QUALITY CONTROL PROCESS FOR 3D MODELS
- LACK OF CONTRACTOR EXPERIENCE (3D MODEL INFORMATION)
- INVESTMENT (LEARNING CURVE, SOFTWARE, TRAINING)

Source: ACEC Consultant Survey – February 2020
Level of Development Specification

**LOD 100: Preliminary Engineering (Profile Line & Grade Model)**
- Roadway geometry is approximate, and model is at 30% development
- Only structures types, sizes and locations have been identified, model may be at 5% development
- Major drainage crossing locations have been identified, model may be at 5% development
- No utilities are modeled, model at 0% development
- No quantities can be derived from model

**LOD 200: Final Design Intermediate Design Model**
- Roadway typical section is developed at 60%. Preliminary quantities may be derived for pavements, earthworks, flatwork, utility relocation, MOT, lighting, and ROW takings
- Drainage features have been laid out in the model based on preliminary calculations
- Bridge span arrangement, width and skew, superstructure depth and bridge barriers, and substructure types and locations have been determined.
- Quantities and estimates are still being adjusted

**LOD 300: Final Design PS&E Model**
- All engineering designs for all disciplines have been approved
- Design teams are increasing levels of details and information for each model object at this point
- All project quantities and estimates have high level of certainty (90%), but are not final
- Signing and lighting models developed to communicate final sign types, locations and messages, and lighting requirements, but not yet approved.
- Pavement marking details are added
- MOT details include locations, types of signs and traffic control devices through work zone

**LOD 350: Final Design Bid Model**
- Owner provided model as legal document in lieu of plans (100% completed)
- Location, dimensions, quantities and information related to bidding and construction design intent may be derived from this model
- Official model used for inspection, acceptance, and payment of quantities
- Surfaces and line strings may be used for AMG construction activities
Workforce Development

Training

• Agency Strategic Direction
  • What are we doing and why?
  • How are we going to get there?

• Specific software “picks and clicks”
  • 3D design for all disciplines
  • Review of 3D design for non-CADD users

• Update and streamline our processes to optimize job tasks
  • Design, construction
  • Reviews and approvals
Technology Infrastructure

- **Hardware**
  - Right computers for the job
  - Tablets for construction inspection staff
  - Surveying equipment for key construction staff

- **Software**
  - 3D design (all disciplines)
  - Design review
  - Clash detection
  - Construction inspection

- **Cloud/Collaboration**
  - External hosted services
Key Takeaways

- Assess your current status
- Set a goal with your leadership
- Plan your next steps
- Identify your champions
- Learn from others
- Ask for help
- Embrace open data standards
SAVE THE DATE
JOIN US VIRTUALLY FOR A FREE WEBINAR

BIM FOR INFRASTRUCTURE IN THE U.S. TRANSPORTATION INDUSTRY
WEBINAR 6: Contractor Perspectives with Digital Delivery Projects
Planned late October / Early November
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