



**Introduction and Agenda** 

Collaboration between DOTs: BIM Week 2024

Tampa's Westshore Interchange

– All in on 3D Modeling

Building 3D Models with a Purpose in Mind

FDOT Perspective and Future Direction

Software Benefits...and Limitations

**06** Questions



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# Collaboration between DOTs: BIM Week 2024



**Problem** 

Interopobility issues with different software between stakeholders



#### Solution

Digital information exchange and national open data standards



#### Vision

Design in whatever software

Export to IFC for owner to advertise

Open Exchange Format

Contractor imports and uses their preferred software

Digital as-builts (Open Exchange format)

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# Collaboration between DOTs: BIM Week 2024

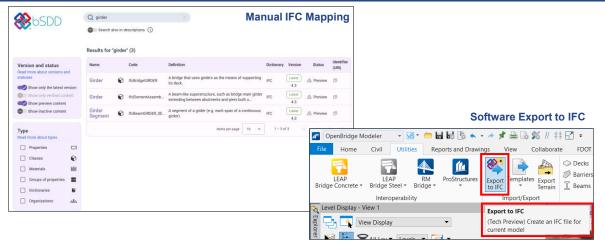
# Bridge Lifecycle Management Overview Map The state of t

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Source: https://bimforbridgesus.com

## Collaboration between DOTs: BIM Week 2024



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# **Building 3D Models with a Purpose in Mind**



**Level 1: For Information Only** 

Lower Level of Detail

- "Fill the Gap" for OpenRoads Projects
- Only out-of-the-box OBM tools



Level 2: Model-Centric Plans (and/or Contractor Coordination)

Medium Level of Detail

- Accurate concrete dimensions with solids modifications and/or parametric cells
- No rebar modeled
- Standard details often omitted



**Level 3: Contract Document** 

High Level of Detail

- Model as legal document for construction
- Full rebar modeling
- Shop drawings possible from model
- Significant metadata attached

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# Software Benefits...and Limitations – Bentley Suite of Transportation Software



# MicroStation CE (MSCE)

Basic CADD software – without previous InRoads, Geopak, etc. Lines on paper; can do manual 3D CADD.



## OpenRoads Designer (ORD)

Builds on MSCE, while adding in Civil tools (previously InRoads, Geopak, etc).



## OpenBridge Modeler (OBM)

Builds on ORD (and thus MSCE) to include 3D Bridge Modeling tools. Most ORD tools available in OBM.



#### **ProStructures**

Can be used with an OBM model to model rebar or detail steel. Can use standalone PS software or within OBM.



## OpenBridge Designer (OBD)

Suite of software to bring together multiple components of bridge design/detailing (see items to the right).



## OBM, LEAP Concrete/Steel/ RM Bridge

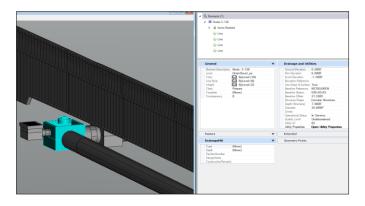
Modeling/Analysis software included in OBD.

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# Software Benefits...and Limitations - General

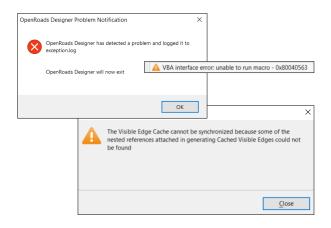


#### **Benefits**

- Interdisciplinary Coordination allows design intent to be better managed.
- Similar to non-3D, reference files
- Walls Example: Structures gives leveling pad alignment/profile, Roadway Models the physical walls
- Clash Detection/Conflict Resolution
- iTwin/Bentley Infrastructure Cloud
- Model-Centric Plans Production
- Contractor/Stakeholder/Public Coordination and Feedback
- Quantities (Built-in or FDOT tools)

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# **Software Benefits...and Limitations – General**



#### Limitations

- Model Files can be VERY slow to open/update
- Constant release of new versions
  - Updating to latest often not easy or practical
- Custom Item Types (i.e. FDOT pay items) often don't get reflected in iTwin/Bentley Infrastructure Cloud/SYNCHRO models
- Workarounds routinely required
  - Staffhours/effort difficult to estimate

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# Software Benefits...and Limitations – FDOTConnect

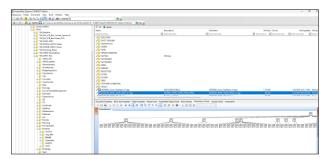
#### **Benefits**

- Well-documented workflow for most disciplines
- Custom tools and templates for efficient workflows
- Accommodate model-centric or 2D plans production
- Proven process in place for continued development
  - Collaboration with industry on bugs and Beta testing



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# Software Benefits...and Limitations – FDOTConnect



#### Limitations

- FDOT applications do not work with PW Explorer
  - Manual process of exporting mass amounts of files to use FDOT plans production tools
  - Manual process for exporting files from ProjectWise to FDOT during submittals
  - Recently worked with Bentley to work with PW Drive, but many companies not using PW Drive because of issues
  - Current FDOT Workspace should solve most issues
- FDOT Model-Based Quantity tools limitations
  - Roadway
  - Structures
  - Drainage
  - Walls

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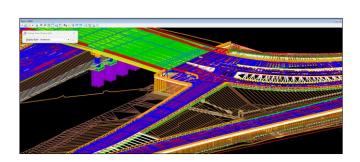
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# Software Benefits...and Limitations – OpenRoads Designer (ORD) General

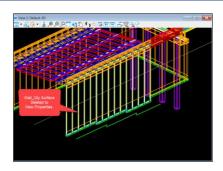
#### **Benefits**

- Visualization of design allows for better cross discipline collaboration
  - Complex grading and skewed areas
  - Analysis of clearances and clash detection
  - Interdisciplinary and constructability reviews
- Improved accuracy and ease of establishing quantities for Pay items that rely on 3D elements
  - Earthwork (Cut/Fill/Select fill)
  - SOD/Turf on slopes are more easily evaluated
- Design integrated in model allows for easier updates
  - Drainage analysis is directly linked to drainage structure sheets



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# Software Benefits...and Limitations – OpenRoads Designer (ORD) General



#### Limitations

- Modeled features do not always match Index/Spec/BOE description used for pricing
  - MSE walls are quantified up to top of Coping but modeled separately from traffic railing.
  - Inconsistencies with EQ reports not quantifying all elements or not providing sufficient geometric information (Station, LT/RT, ETC)
  - Recommend review of pay items to align with limitations of software.
- The software cannot model specific criteria required in the Standard Index
  - Parabolic Super elevation transitions per index 000-510 cannot be modeled
  - Discrepancy created between gutter grade shown in model and what is required.
- 3D model still needs to be supplemented with traditional plans for construction
  - Quantities provided in compliance with BOE is not always possible
- Flexibility in models to accommodate project specific concerns
  - TWI phasing of Drainage installations

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# Software Benefits...and Limitations – OpenBridge Modeler (OBM)

#### **Benefits**

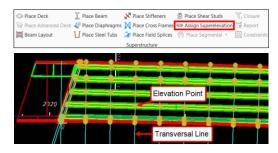
- Parametric/repeatable for long spans
  - Template-based workflow
  - Easy to make changes for preliminary layouts





Modify Multi SupportLines							×
		Name	Station	Angle	Span Length	Length	Horizontal Offset
٠	1	CL_PIER9-1	208+80.35	-00°00'00"	0:0	60:0	-10:0
	2	CL_PIER9-2	209+89.37	00*00'00"	109:0 1/4	60:0	-10:0
	3	CL_PIER9-3	211+47.17	00*00'00"	157:9 5/8	60:0	-10:0
	4	CL_PIER9-4	213+64.14	00°00'00"	216:11 5/8	60:0	-10:0
	5	CL_PIER9-5	215+81.11	-00°00'00"	216:11 5/8	60:0	-10:0
	6	CI DIERO.6	217+62 32	00*00000*	181/2 1/2	600	-100

- Accurately generate or check geometry
  - Superelevation transitions
  - Finish Grade Elevations



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# Software Benefits...and Limitations – OpenBridge Modeler (OBM)

#### **Benefits**

- Quickly get order of magnitude quantities
  - Footing elevations set on terrain elevation







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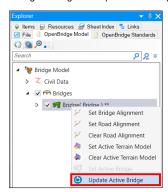
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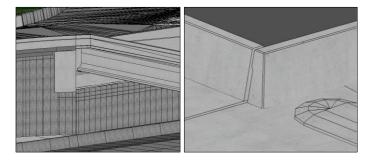
# Software Benefits...and Limitations – OpenBridge Modeler (OBM)

#### **Benefits**

■ Changes to alignments/profiles will be pushed to bridge model

■ Visualize complicated bridge geometry and details



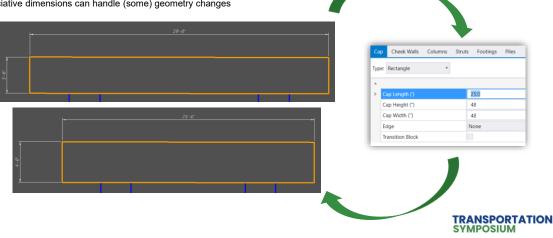


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## Software Benefits...and Limitations -OpenBridge Modeler (OBM)

#### **Benefits**

■ Associative dimensions can handle (some) geometry changes



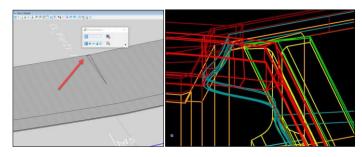
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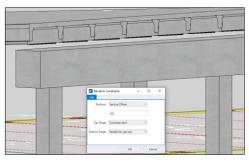
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## Software Benefits...and Limitations -**OpenBridge Modeler (OBM)**

## **Limitations (OBM Models)**

- OOB Tools set up for simple bridges (i.e. straight, no skew)
  - Often need workaround for more complex elements
  - Software sometimes doesn't react as anticipated
  - Once OBM solids are modified, future changes unpredictable
- Bentley recommends as *last* step, but for model-centric plans, needs to be done early enough in process to work on plans
- Issues with alignment/profile changes after solids mods





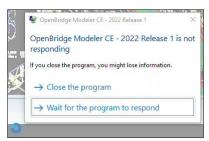
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# Software Benefits...and Limitations – OpenBridge Modeler (OBM)

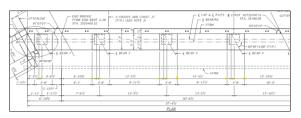
#### **Limitations (OBM Models)**

- Updates to longer bridges can take a while to process
- Design often done in separate software, unlike other disciplines
  - Mixed results for interoping tools (LEAP Concrete, LEAP Steel, RM Bridge)
- Advanced tools not well-documented, steep learning curve, gaps in functionality
  - Rebar Modeling, Parametric Cells, Generative Components



#### **Limitations (Model-Centric Plans)**

- Expectations for model-centric plans
  - "Heavy" model-centric sheets (slow navigation)
  - Unexplained crashes
- Model-centric plans difficult to clean up or modify for details
- Levels sometimes unpredictable even with proper settings
- Crossing of dimension lines with associative dimensioning

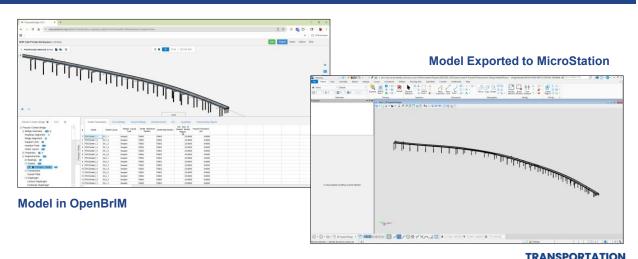


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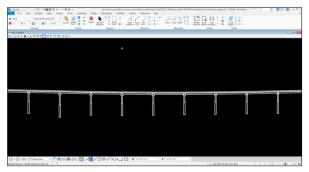
# Software Benefits...and Limitations – OpenBrIM

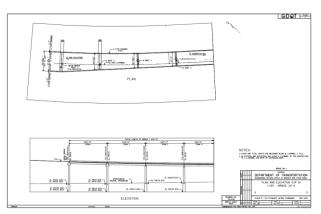


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# Software Benefits...and Limitations – OpenBrIM

## **Developed Elevation**





Preliminary P&E (GDOT Border)

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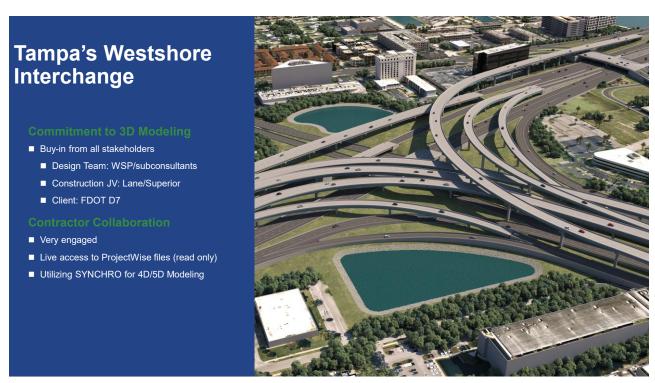
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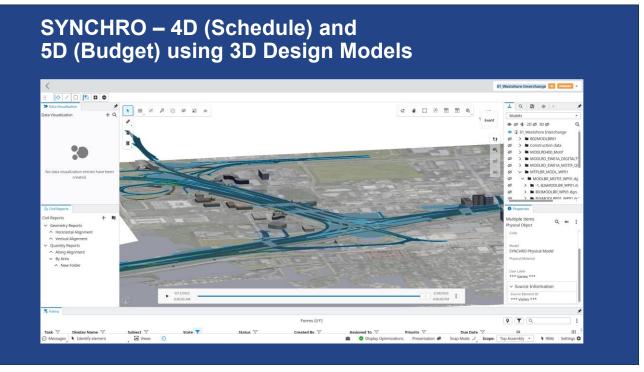
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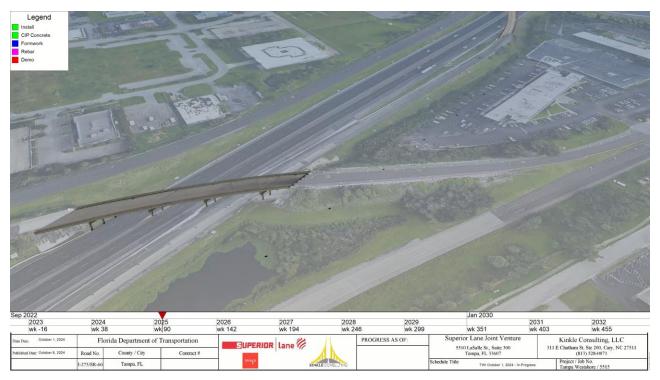
# **Software Benefits...and Limitations – OpenBrIM**

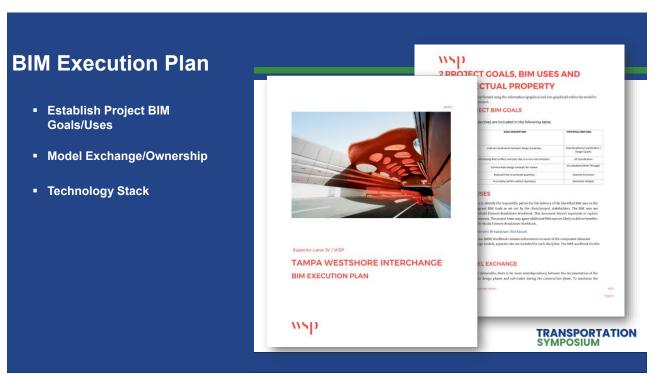


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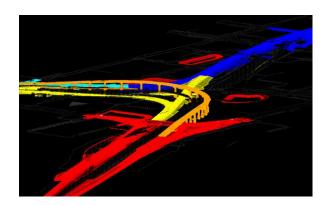
# **Motif File Organization – Working with Contractor**

## **Key challenges**

- Submit FDM compliance Vs Contractor goals
- Submit for industry bids Vs Internal Management
- Managing 15 work packages that overlap and phased

#### **Solutions**

- Outline Motif structure in BEP
- 3D submittal built from files submitted to industry
- Sync and manage in Bentley Infrastructure to track and mange 5D capabilities

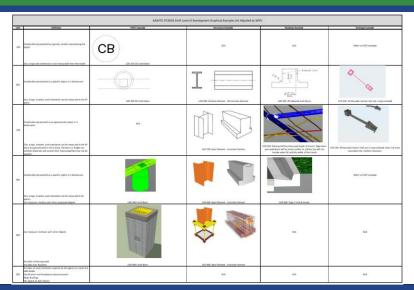


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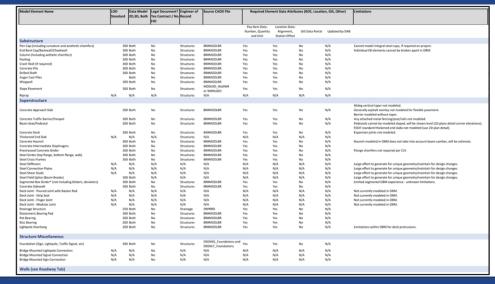
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## **Model Element Breakdown**



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## **Model Element Breakdown**

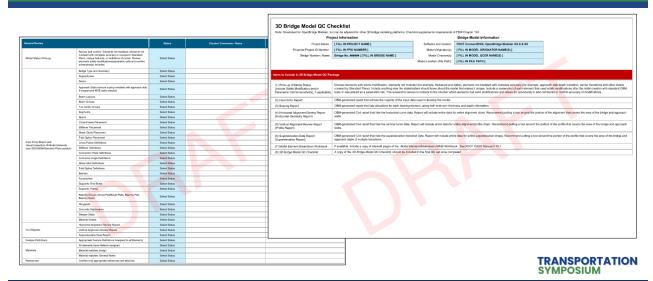


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# **Upcoming: 3D Bridge Model QC Checklist**



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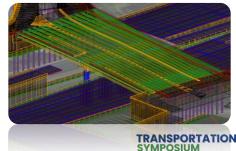
# **Tampa's Westshore Interchange**

#### **Model-Centric Plans**

- Schedule/Workflow
  - Start in 2D prioritize getting geometry right
  - Preliminary Calculations (Geometry/Beam)
  - Preliminary OBM Model (No solids mods)
  - Calculations Finalized/QC'd
  - Pre-Solids Mod OBM Model QC'd
  - Solids Modifications to OBM Model
  - Solids Mod OBM Model QC'd
  - Model-Centric Plans

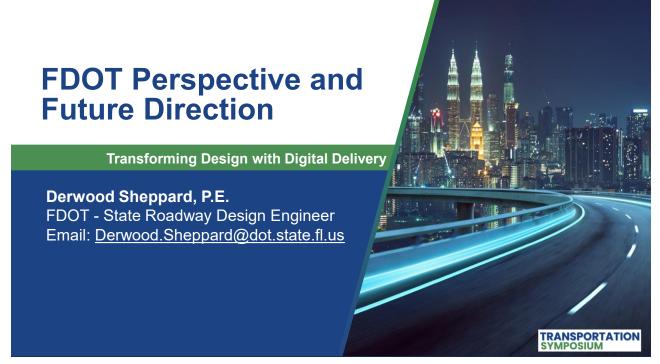
#### Lessons Learned (...So Far)

- Documentation/Input Spreadsheets
- Archive Pre-Solids Mod OBM Model
- Keep scratch linework outside of model file
- 2D Decoration levels can be manually manipulated – helpful for certain plan sheets
- Other Discipline Container File
- Reference Settings!
- File Management/Organization
  - LOTS of Work Packages
- Change Management



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# **Current Landscape**

- Hybrid Approach
- Increasing use of Building Information Modeling (BIM)
- Ongoing adoption of OpenRoads, OpenBridge, Civil 3D, and 3D visualization tools

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# Why Digital Delivery?

Alignment with National Perspective



Accuracy & Coordination

Model-based reviews

Construction automation

FHWA Every Day Counts (EDC)

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# BIM & 3D Modeling Focus Areas

- Geometry, surfaces, utilities, and structures
- Define LOD (Level of Development) Standards
- Linking data-rich elements to:

  Cost, schedule, and asset management

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# Be a part of the solution!

Production is our goal ensuring contractors have tools in hand.



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## Safety Message:



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# Thank you for attending!

## **Contact Information**



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