

 Hollywood, FL

 June 13-14, 2024

2024 TRANSPORTATION SYMPOSIUM

Model-Centric Design Initiatives



Vern Danforth, PE – State CADD Engineer

Production Support CADD Office -FDOT

Objectives:

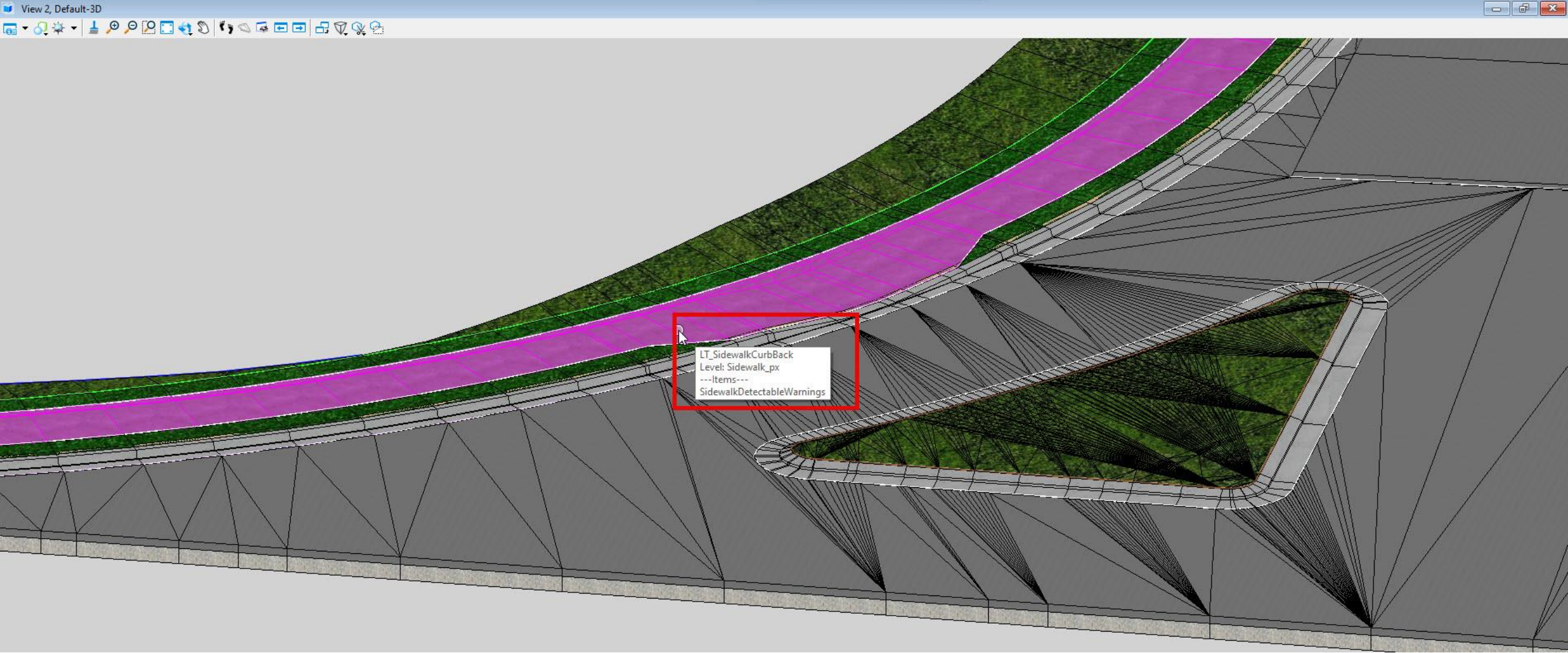


- Source: Jerry Maguire

Why invest?

Why Invest...	Yields
Survey Data Collection	More accurate design improvements
Geotech Sampling	Mitigate surprises in construction
Utility Verification	Identify potential clashes
Pavement Cores	Validate existing conditions
Drainage and Environmental Assessment	Mitigate construction impacts
Then...	
Model centric design	All of the above!

Curbs, Sidewalks, Curb Ramps:



Bridge Deck, Beams, Piers, Slope Walls:

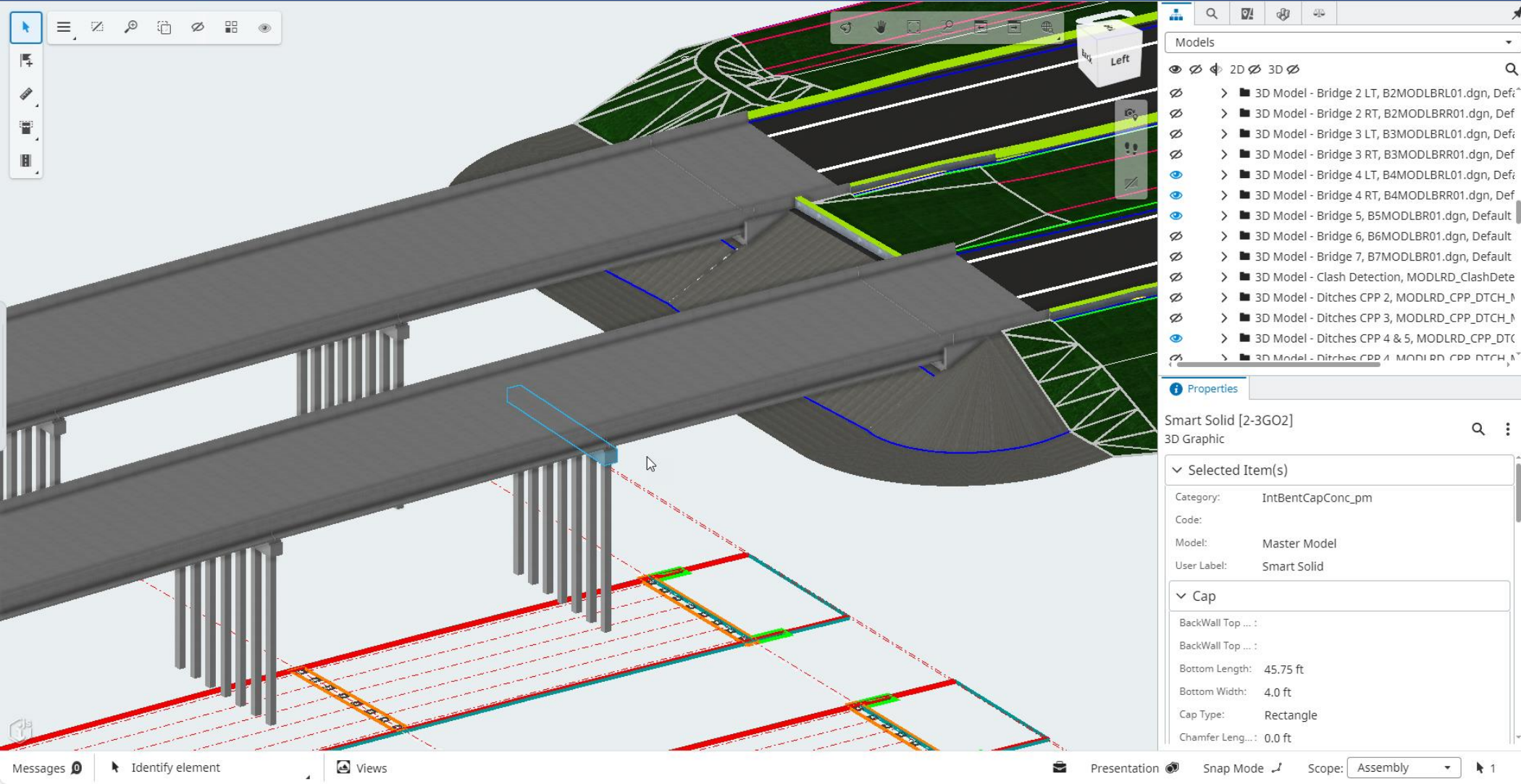


Image Source:
Design Review – CPP
TPE/PGA Contract

Barriers:

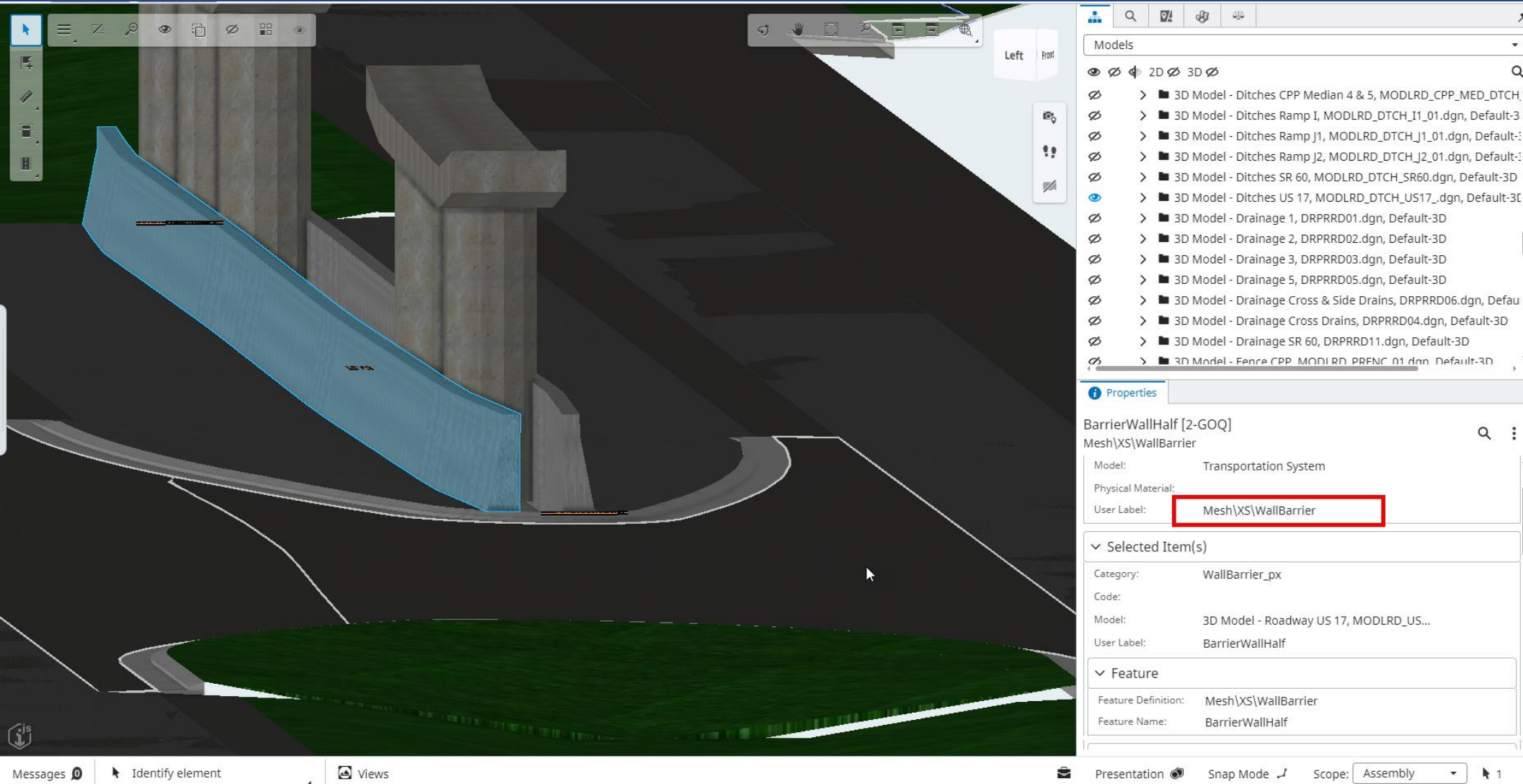


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Sheet Pile Walls:

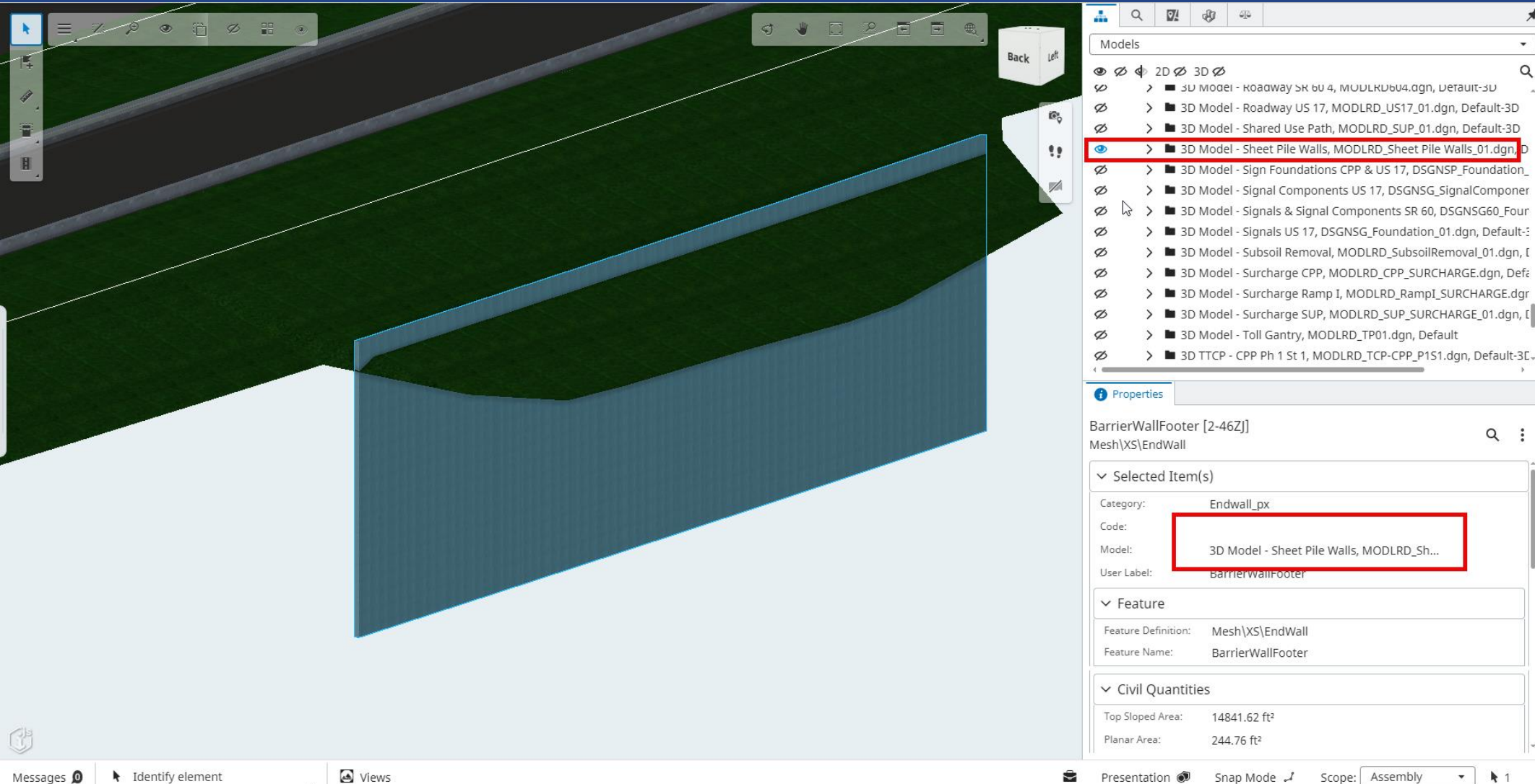


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SWMF:

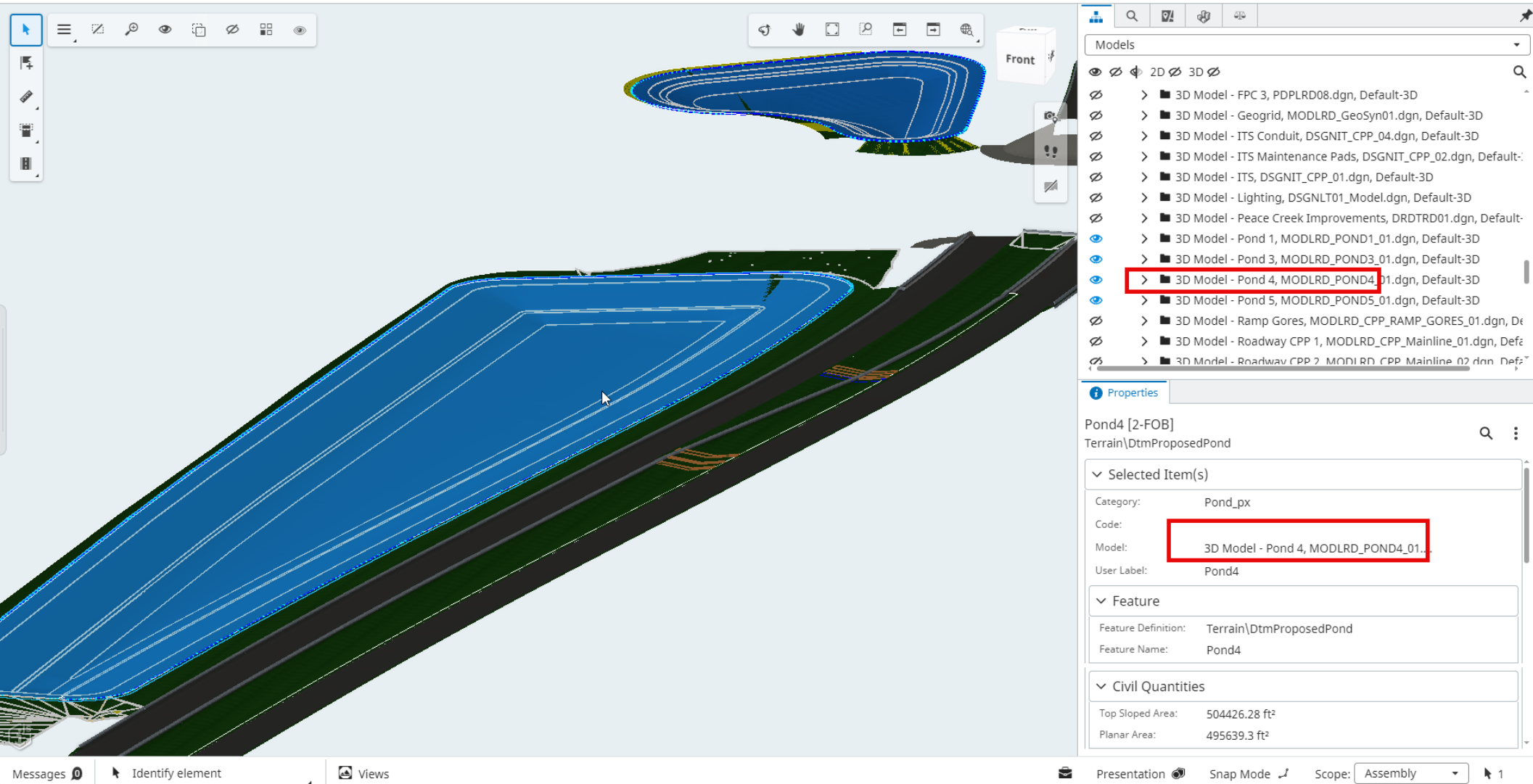


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SWMF Control Structures:

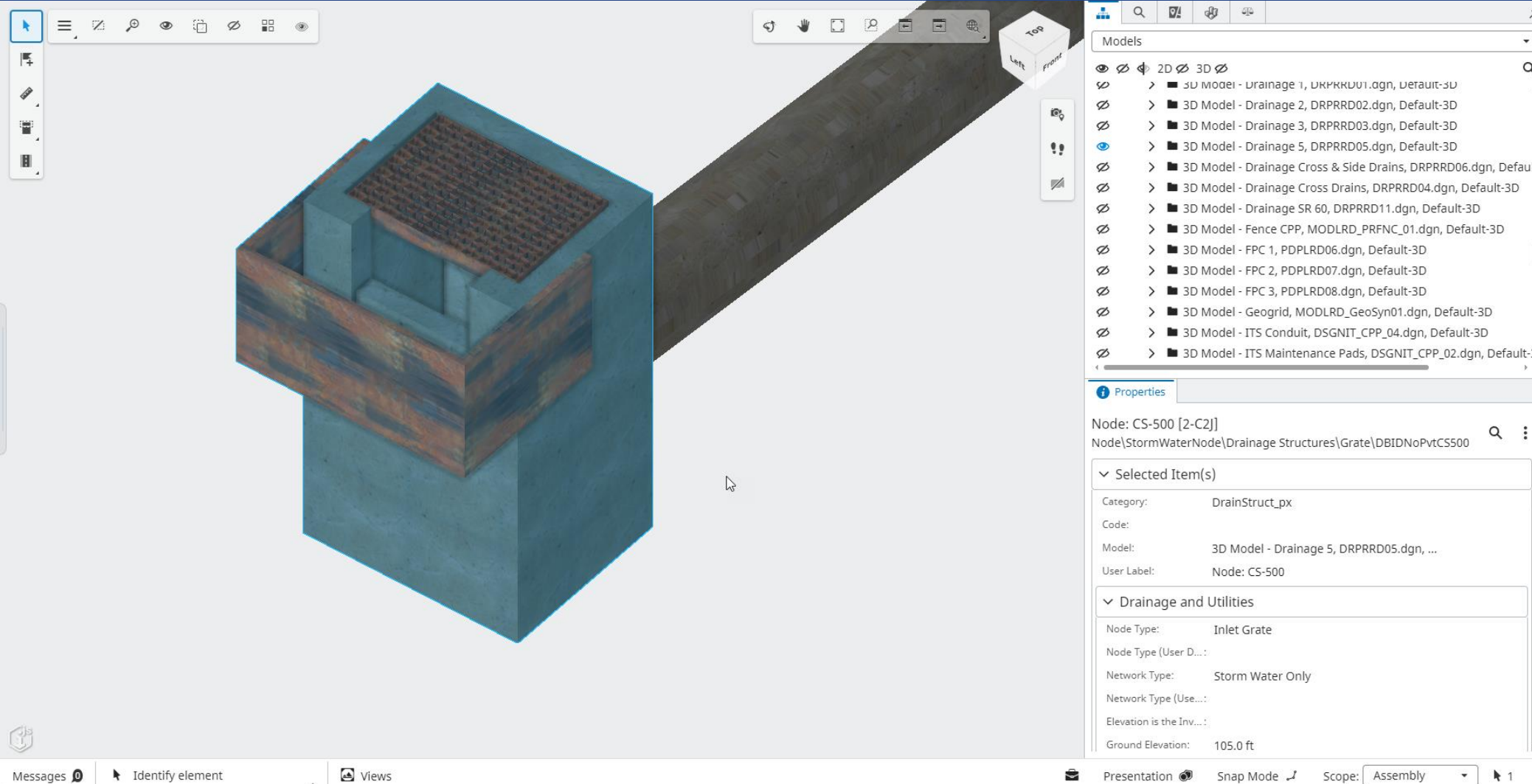


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Existing Roads, Drainage, Utilities:

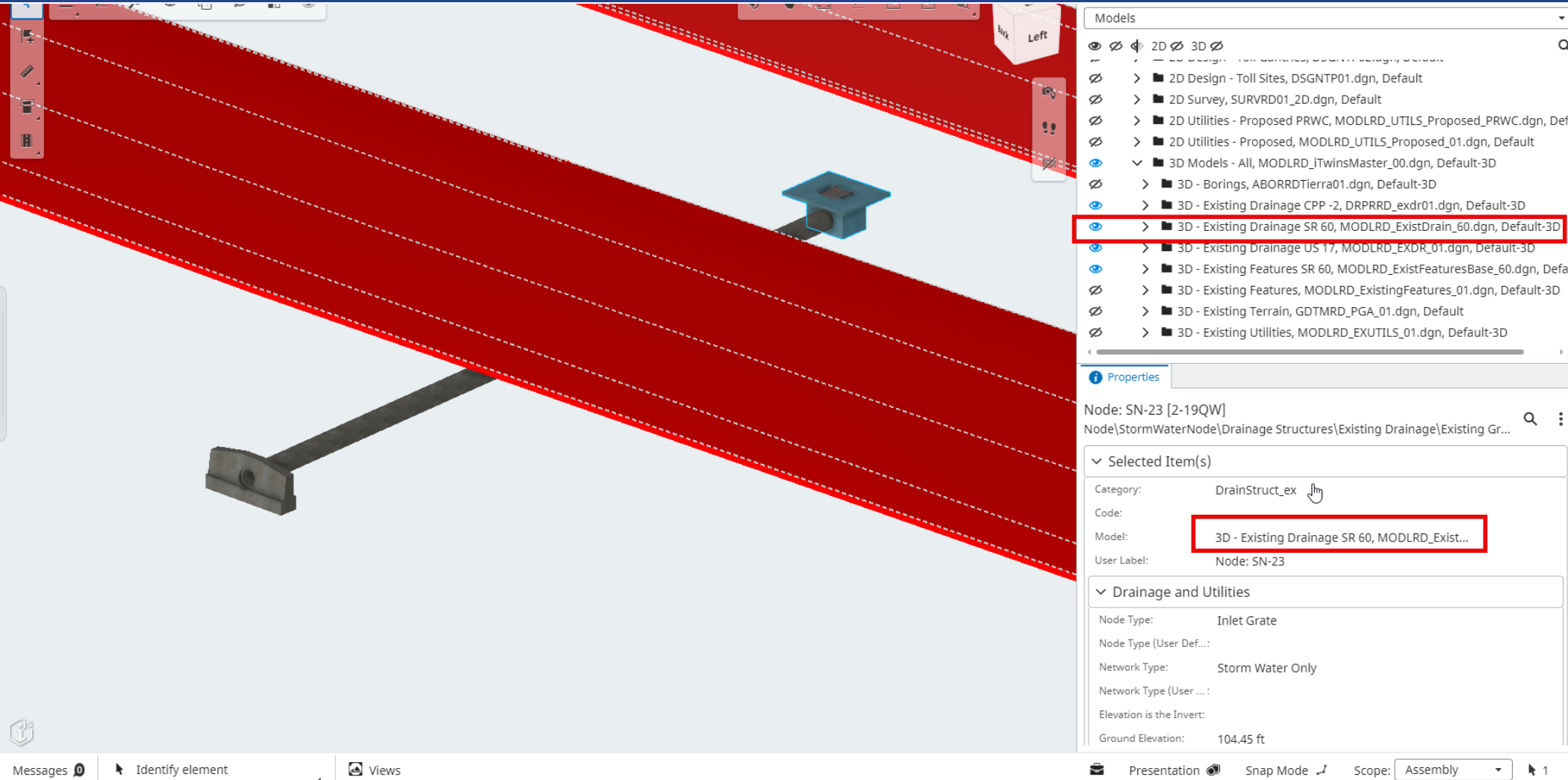


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Proposed Roads, Drainage, Utilities:

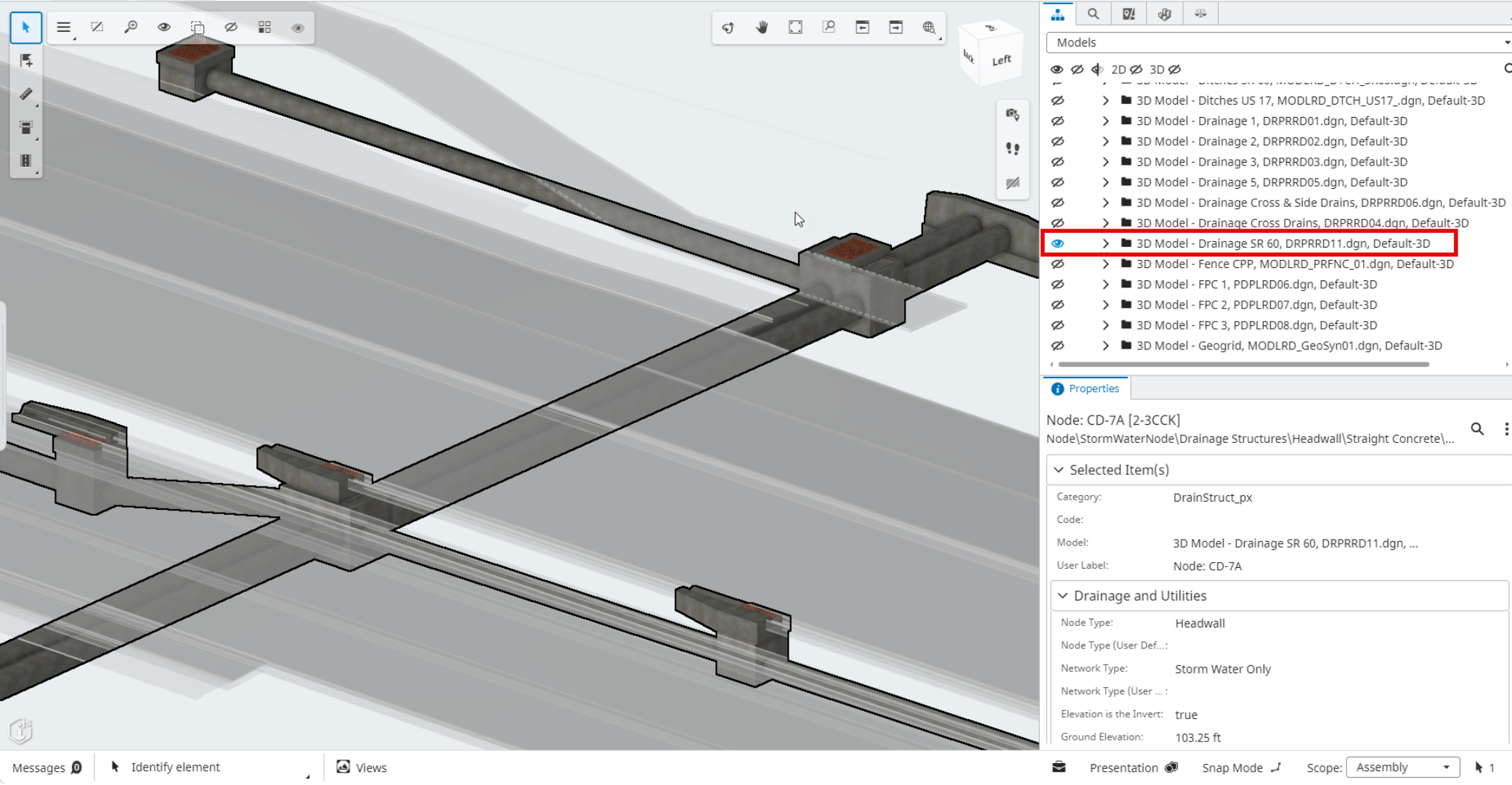


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Proposed Ramps, Gores, Guardrail:

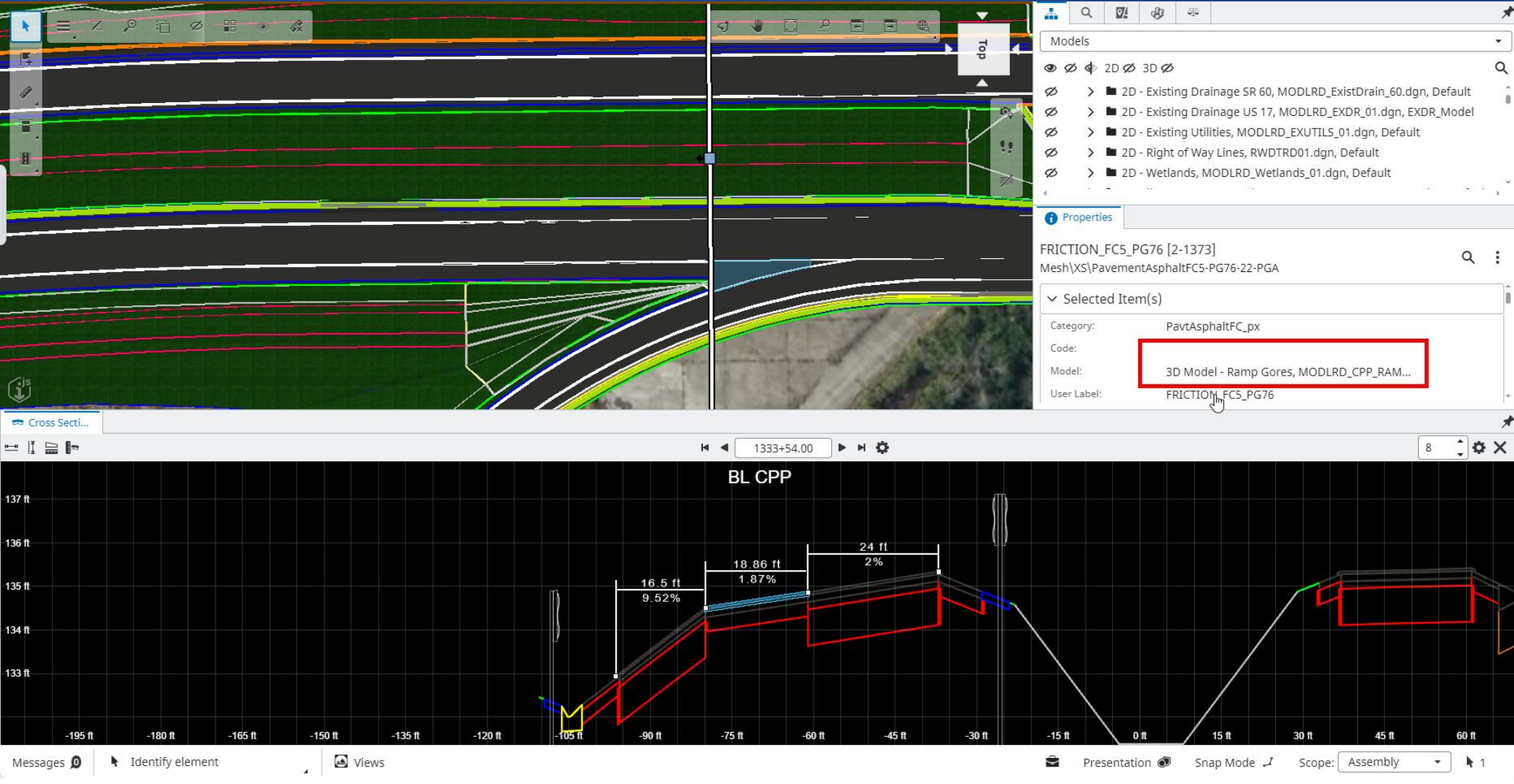


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Drainage Level of Detail:

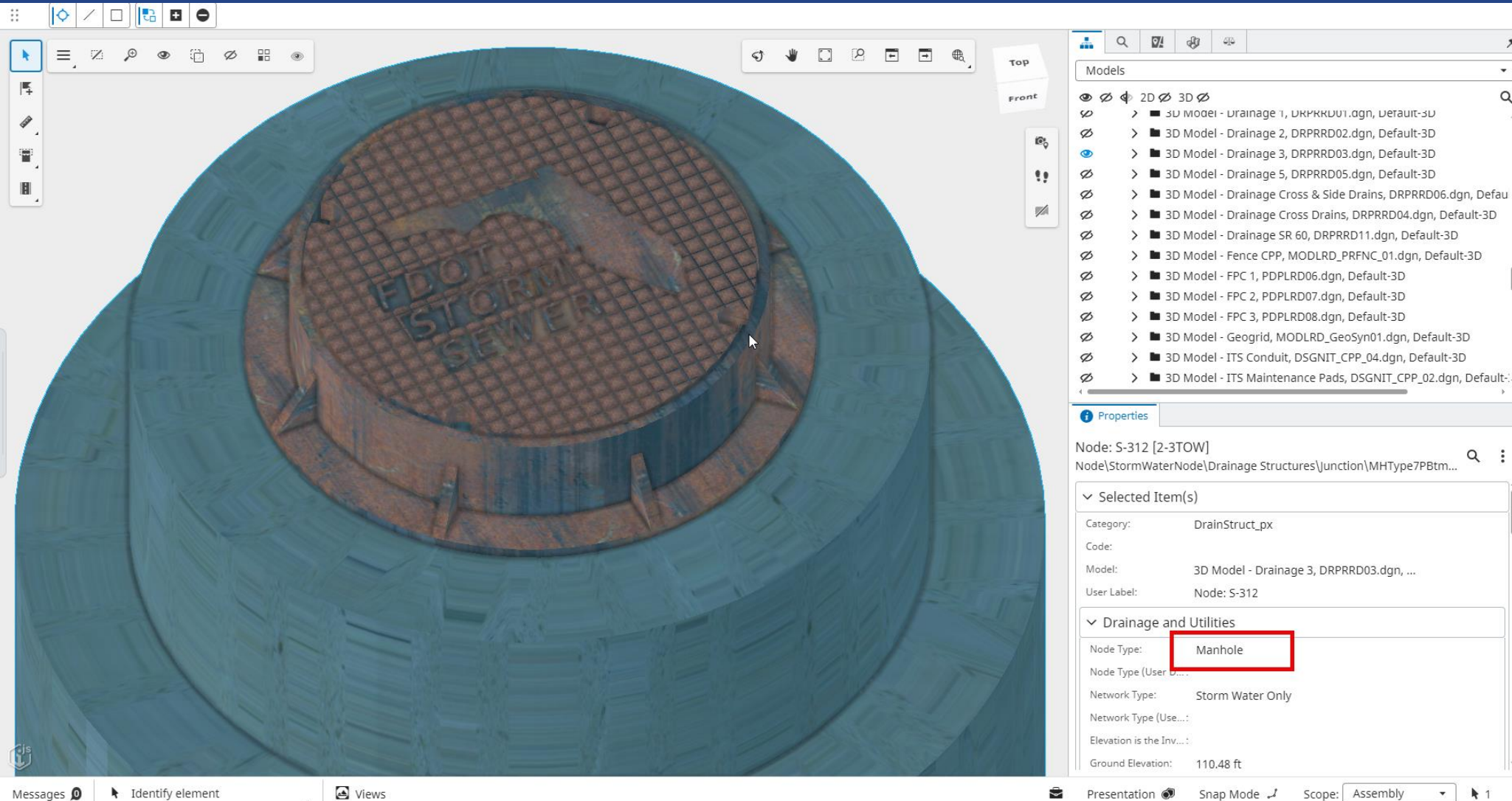


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Drainage, Utilities Clashes:

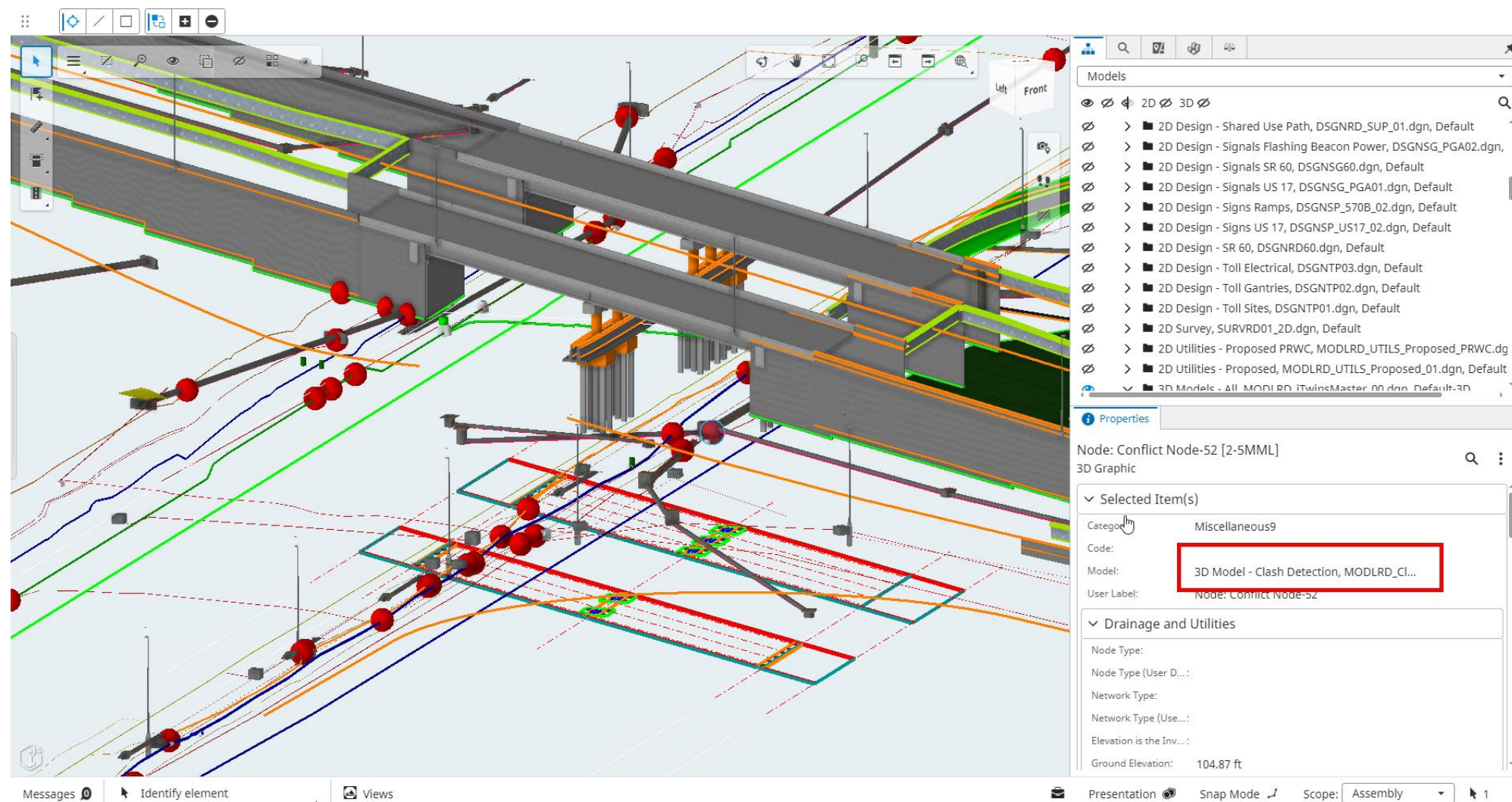


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Lighting:

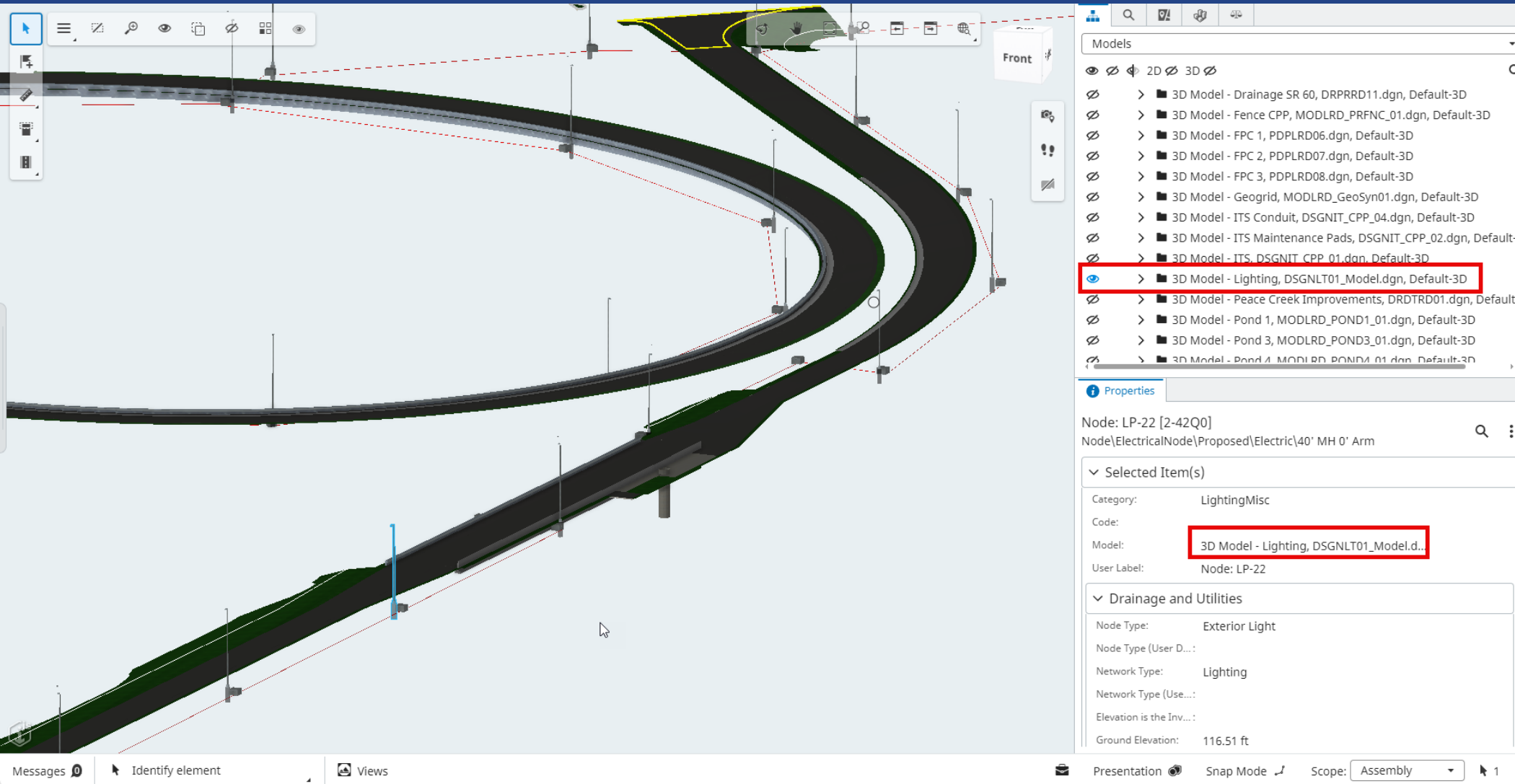


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Signal and Sign Foundations:

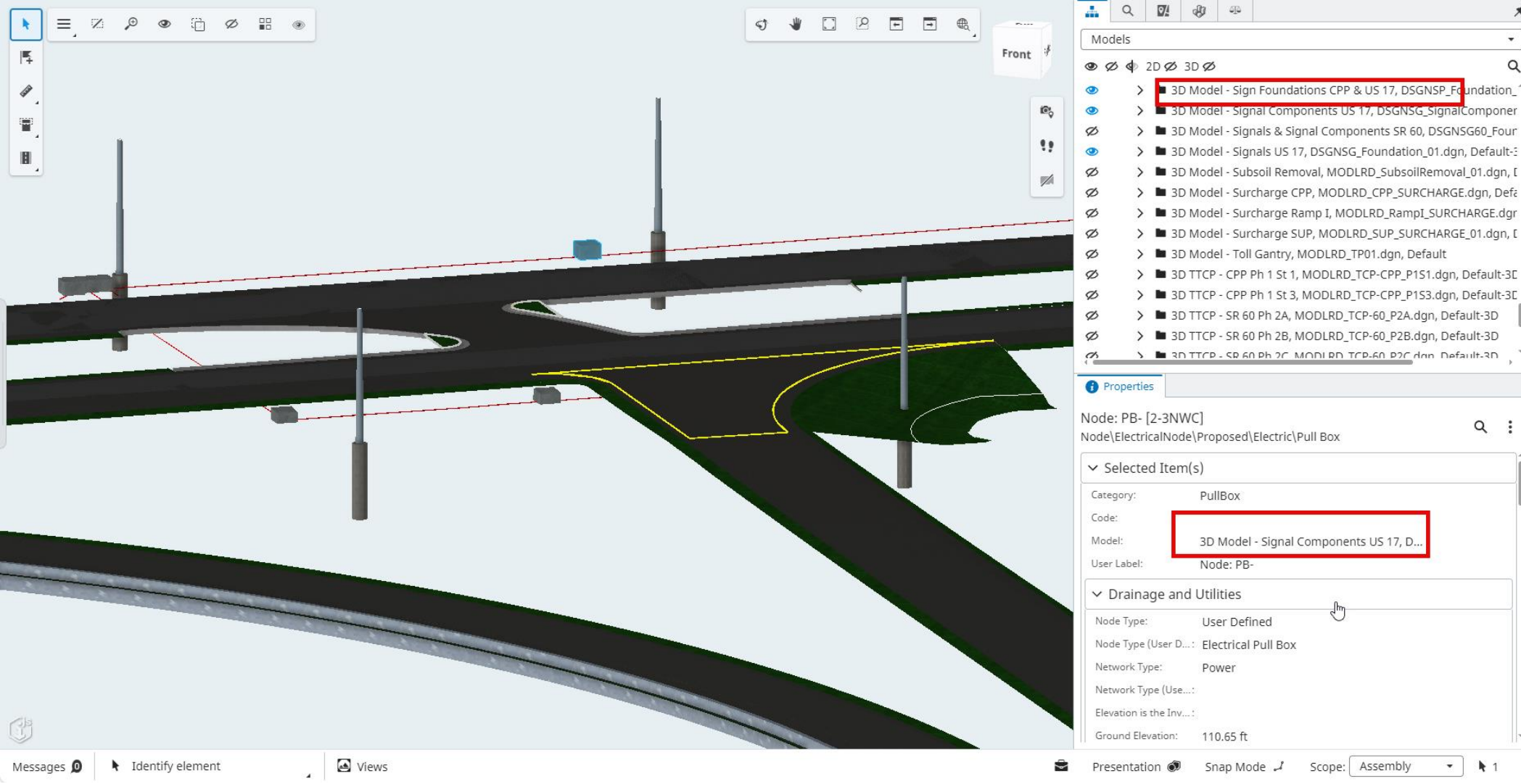


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Geotechnical Cores:

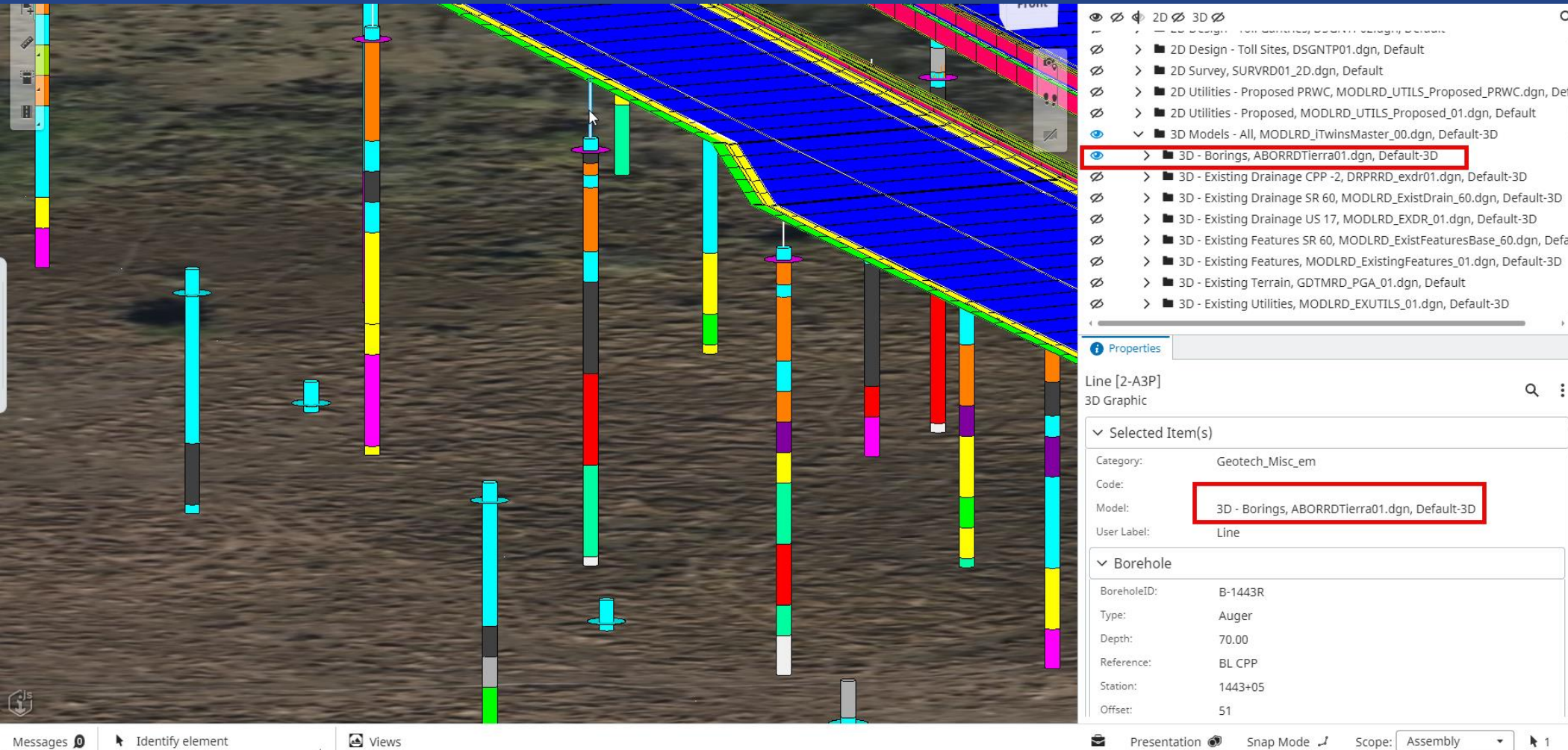
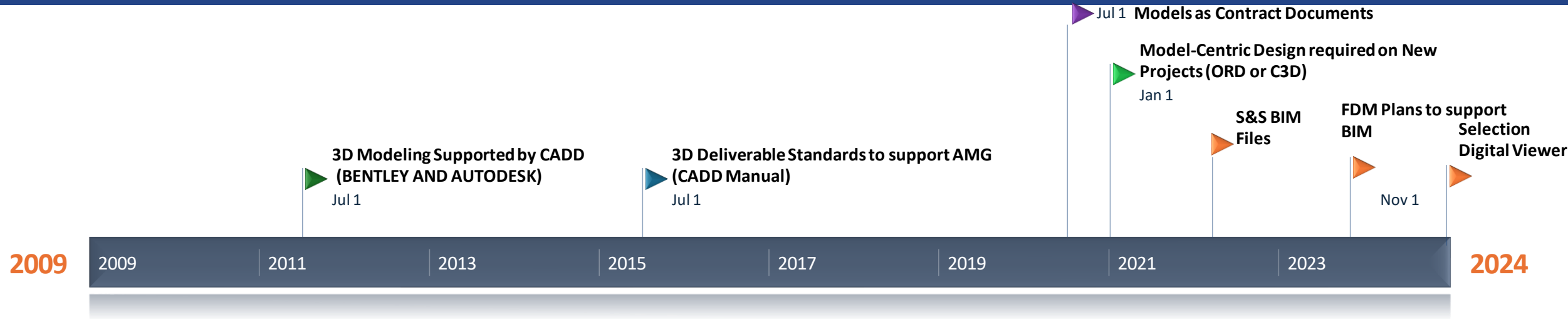


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Objectives:

- Timeline
- FDOT Mission and objectives
- BIM!
- Standards, Criteria, Production, Contracts
- National objectives

What's Happening at the DOTs:



3D CADD INITIATIVES

Standards for AMG

Digital Delivery for Construction AMG

Model Centric Plans and Quantities

Models as Contract Documents

Digital Delivery Viewing Tools

Model-based Design Initiatives – 15 years

Design CADD Adopted Mission:

To move the department toward designing and delivering integrated 2D and 3D models



Why?

1. Designing in 3D is better!
2. To provide for Automated Machine Guidance (AMG)- contractor files
3. To deliver a Model as Contract Document – QA/QC by EOR
4. To Support Building Information Modeling (BIM) – pay it forward



Model-based design:

Provides:

- Geospatial Orientation State Plane Coordinates XYZ
- Higher quality of design intent; better visually and quantitatively
- Better spatial relationships; utilities, drainage, bridges
- Improved constructability considerations; walls, slopes, ramps
- Better detailing; foundations, drainage boxes, slopes



Automated Machine Guidance (AMG):

- Provides horizontal and vertical guidance in real time to construction equipment operators.
- Assists agencies and contractors in finishing projects in less time and with lower overall cost while providing higher quality and better safety.



Model as a Contract Document:

Intelligent BIM Modeling throughout the project, including linking Operation, Maintenance, and Asset data to the model (created from the Design, Construction, 4D Coordination Models, and Subcontractor Fabrication Models) to deliver a record model to the owner or facility manager.



What's Happening at the DOTs:

<https://youtu.be/bEI-TCPmmT0-USDOTFHWA>



The Current Situation

FHWA

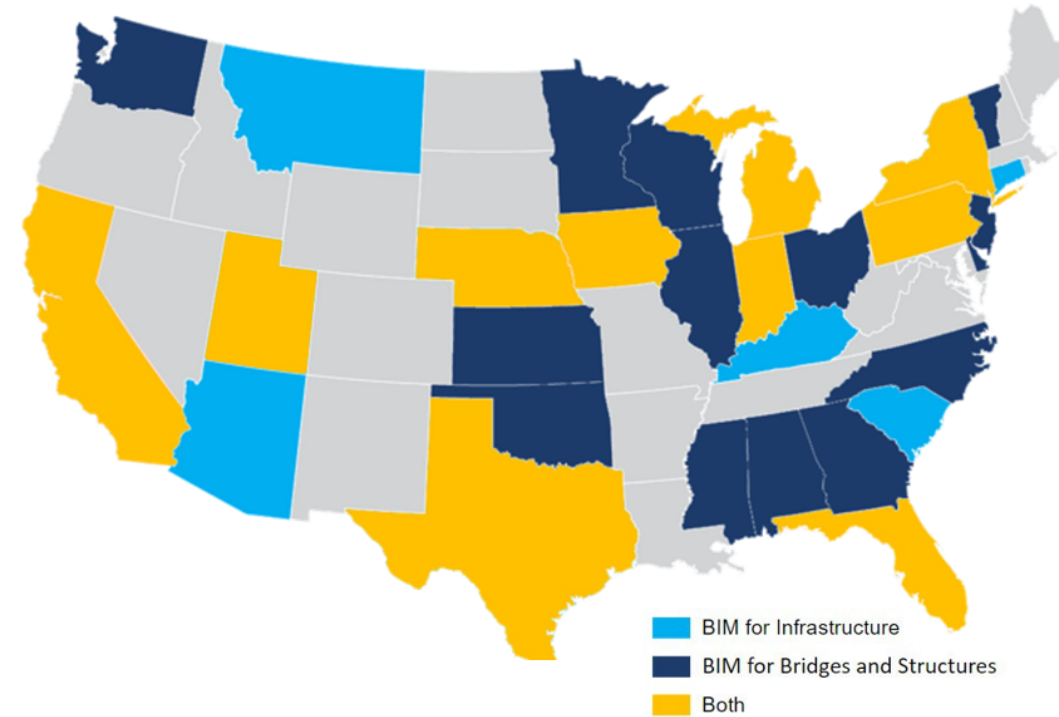
Ongoing BIM Pooled Fund Studies

BIM for Infrastructure [TPF-5\(480\)](#)

BIM for Bridges and Structures [TPF-5\(372\)](#)

Key objectives:

- Advance BIM for Infrastructure collaboratively
- Build off the foundational work in *Advancing BIM for Infrastructure: National Strategic Roadmap* (Mallela and Bhargava 2021)
- Conduct capacity-building activities
- Provide a forum to share experiences



Original map: © smarques27 – Stock.Adobe.com. Modifications by FHWA.



Turner-Fairbank
Highway Research Center

By Alexa Mitchell, P.E., Jennifer Steen, P.E., PMP, ENV SP, and Will Sharp, P.E., PTOE

HDR recently completed benefit-cost analysis research for TRB and the Federal Highway Administration that validates the benefits of model-based delivery, showing that it makes financial sense for transportation agencies to make this change. After 18 months of analysis, the research team identified 29 benefits of BIM and 13 costs, with the biggest benefit being a reduction in change orders.

FDOT Standards and Policy Updates

FDM 900: NexGen Plans

Model Based - Estimated Quantities (EQ) Report

BIM Standards Delivery – Level of Development Specs.

3D Project BIM File Delivery

Design Services Staff Hour Guidelines

AMG Modified Special Provisions

3D CEI Contract Scope Changes



FDM 900 Series Updates:

Changed the definition of Plans...

To include digitally signed pdf 2D plans and digitally signed 3D BIM files.

2D Plan show location, character, some dimensions, and details of the work

3D Model is utilized for construction specific data; xyz of design intent

To include implementation of large format sheets 24x36, 36x48, and 36x72

To include 11x17 worksheets for printing purposes



Model-centric Estimated Quantities reports:

Where applicable; Pay Item quantities are derived from the BIM file
Other “Each, or Lump Sum” quantities are derived from the 2D plans
Earthwork volumes are computed from surface to surface algorithms and can be checked using average end area



BIM Standards for Level of Development:

3D Deliverables for AMG Standard Folder in CADD/BIM files
Modeling Standards FDOT CADD manual Section 5.16
Published BIM LOD Standards; 100, 200, 300, 350, 400 levels



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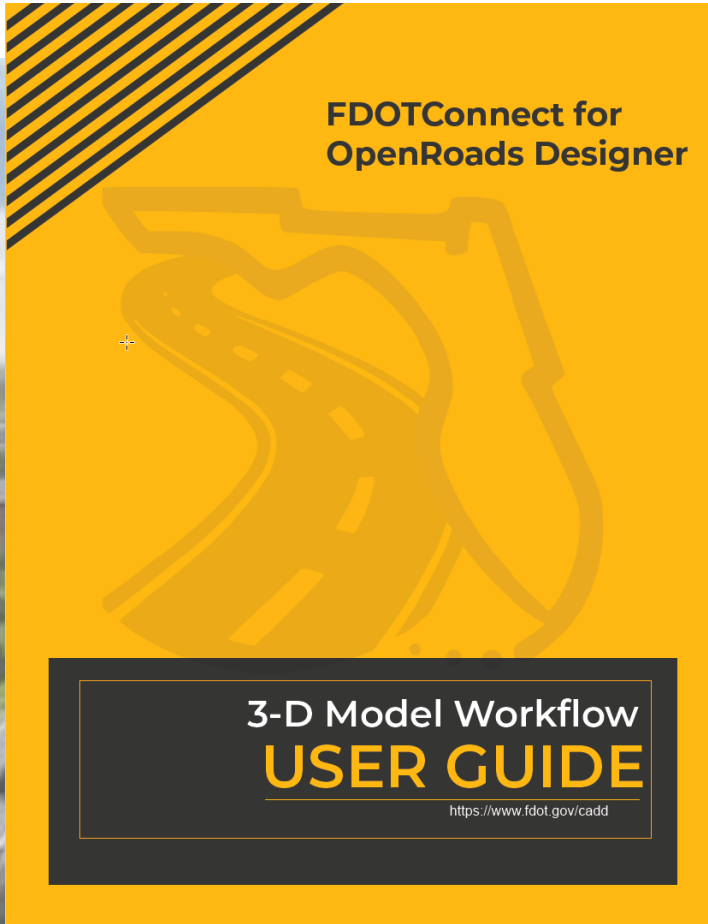
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Model-Centric Production Training:



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FDOTCONNECT TRAINING LAB CATALOG

OpenRoads Designer and Connect Edition Applications

- + [FDOTConnect Essentials](#)
- + [Bridge Design & Modeling](#)
- + [Existing Modeling](#)
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- + [Roadway Design 3D Modeling](#)
- + [Plan Development Workflows](#)
- + [Drainage for Design & 3D Modeling with Plans Development & Pond Design](#)
- + [Traffic Design](#)

Project Management Updates:

Updating Staff Hour Estimate Guidelines available January 2024
3D model standard by project type for each design component

FDOT 3D Model Project Reviews – Standard View tool RFP

Pilot Projects – help develop norms, best practices and better guidelines



Modified Special Provisions:

AMG Modified Special Provisions

Developed for:

Definition of “Plans and working drawings”

Milling and Resurfacing Operations

Engineering and Layout (Control of Work)

Excavation and Embankment

Stabilization

Optional Base Course

Hot Mix Asphalt



3D CEI Services:

3D CEI Contract Scope Changes:

Additional Needs for Personnel with Modeling Experience

Additional Needs for Personnel with Advanced Survey Methods Experience

Need for Advanced Equipment; Rovers, SiteVision, Etc.

AS-BUILT Model development work ??

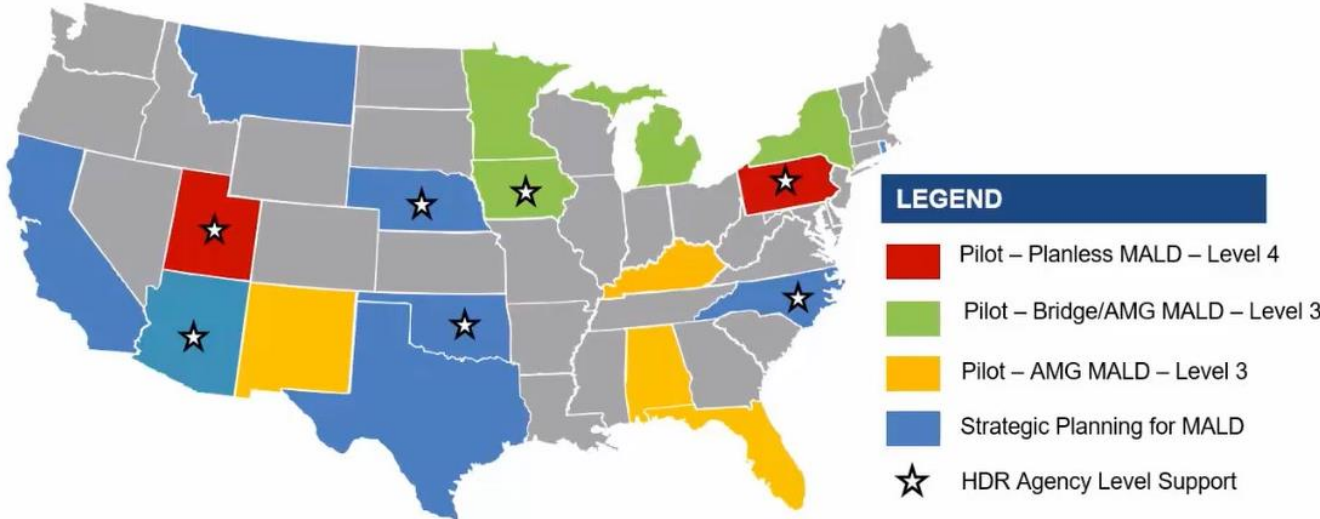
Additional As-Built Asset Information



Nationally - DOTs:

Digital Delivery State of the Practice

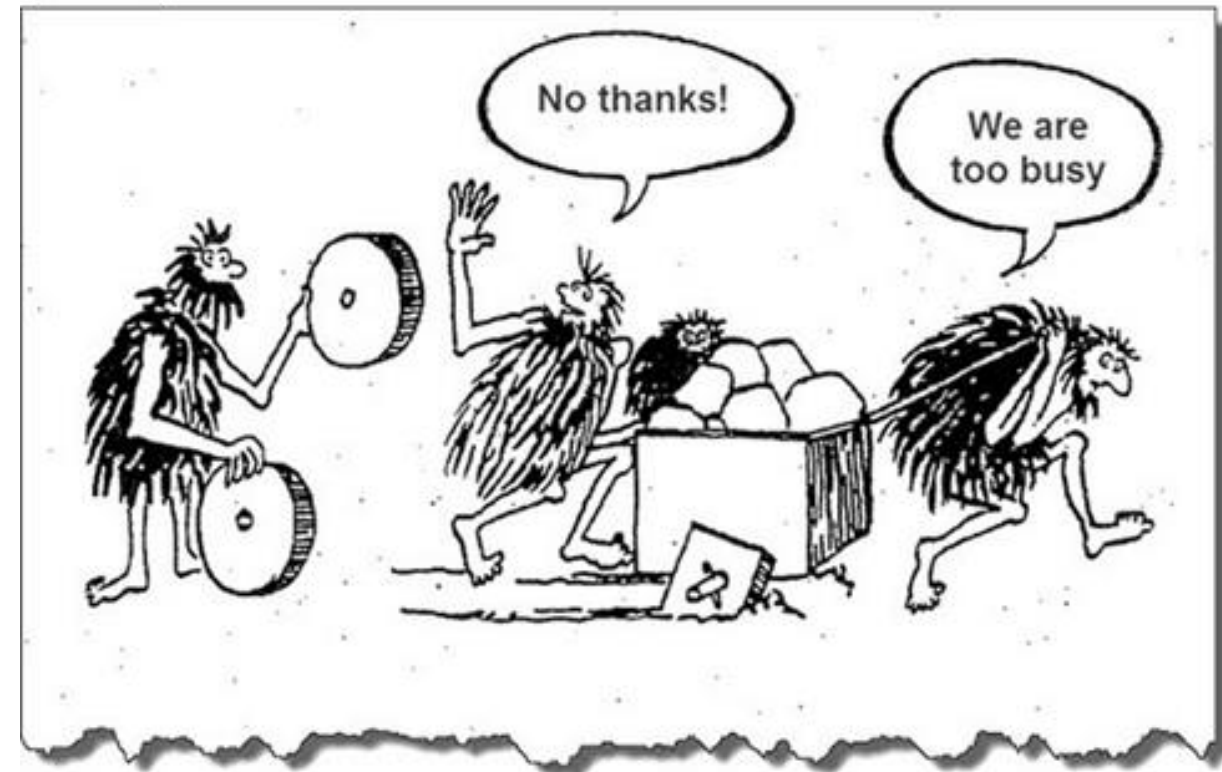
Model as the Legal Document



Source: HDR - September 2023

What's Happening at the DOTs:

- Applying for Grants (AID, STIC, RAISE, ADCMS)
- Hiring Consultants
- Creating Positions for Chief Data Officer, etc.
- Conducting Peer Exchanges
- Conducting Pilot Projects
- Creating & Publishing Strategic Roadmaps
- Encouraging Technology Partners to Collaborate
- Working with FHWA and AASHTO
- Working with ACEC and AGC Groups
- Updating Agency Standards
- Updating Training Programs
- Sharing Results at Industry Events



Challenges:

What's special about openBIM?

- openBIM[®] extends the benefits of BIM by **improving the accessibility, usability, management, and sustainability of digital data in the built asset industry.**



Enhances
Collaboration



Facilitates
common data
environments



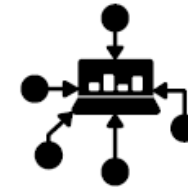
Unlocks Data for
Continuing Access
Over Time and
Between Vendors



Extends the Utility
Applicability of
BIM deliverables



Enables Data
Coordination &
Re-use, Reduces
Redundant Entry



Empowers Multi-
functional Digital
Twins & Simplifies
Data Integration

Challenges:

Identify the benefits and challenges to BIM adoption



INVESTMENT



DATA



TRAINING



PROCESS

- The biggest investment in BIM adoption is **time** to **change mindsets**, **practices**, and **workflows** such as creating **new contract versions**, and **fee structures**. There may be new or changing **technology requirements** that lead to loss of productivity during implementation. In order to achieve overall project success, barriers to collaboration will need to be identified and removed.

Data Environment:

Common Data Environment (CDE)

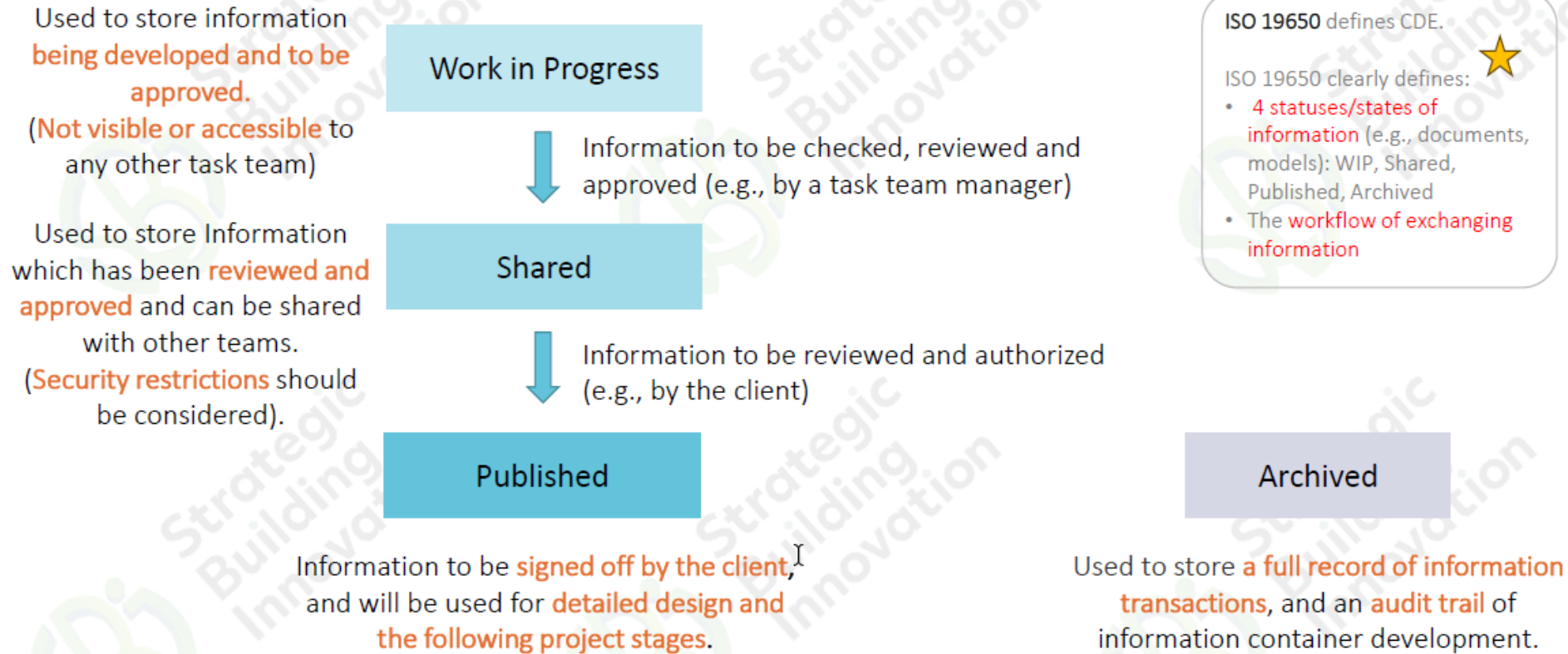
The common data environment (CDE) is a **central repository** where construction project information is housed. A CDE is for the **management of all information containers** that are developed and exchanged with the appointing parties throughout the project/asset lifecycle from each delivery team.



The CDE workflow describes the processes to be used for **collecting, managing and disseminating structured and unstructured information**, and the CDE solution is the technology that enables these processes.

Versioning:

Typical structure of the four key states of information



Professional Development:

Leveraging openBIM® for Project Management

Course Overview

openBIM® Management



Integrating openBIM® for
Project & Contract
Management

Quality Assurance/
Quality Control

Managing Objectives &
Collaborative Achievement

Managing Specifications
Contract Requirements &
Processes

Managing Technologies,
Standards & Formats

This course for **Project Managers** and **Teammates** better prepares them to **specify** requirements, **manage** and **execute** Integrated Digital Delivery projects, leveraging new technologies and processes to optimize outcomes.

Highlights

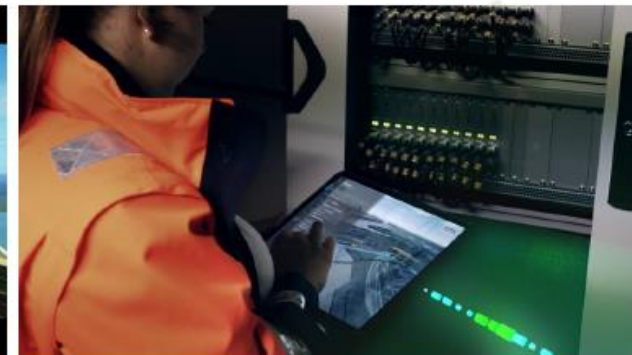
- **essential knowledge & skills** essential to manage all openBIM® projects
- **overall concepts** providing context, value, & meaning for key elements
- **practical guidelines** and **procedures** to successfully manage openBIM
- the course is presented in **three 3-hour sessions**:

3 Modules — 90 minutes per module

- openBIM® Fundamentals and Teamwork
- Digital Deliverables Management
- Supporting Standards and Technologies



Source: <https://vimeo.com/645228800>



Source: <https://vimeo.com/645165252>



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SYMPOSIUM**

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FLORIDA'S FUTURE DEPENDS ON IT.



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E-mail: vern.danforth@dot.state.fl.us

<http://www.fdot.gov/cadd/>



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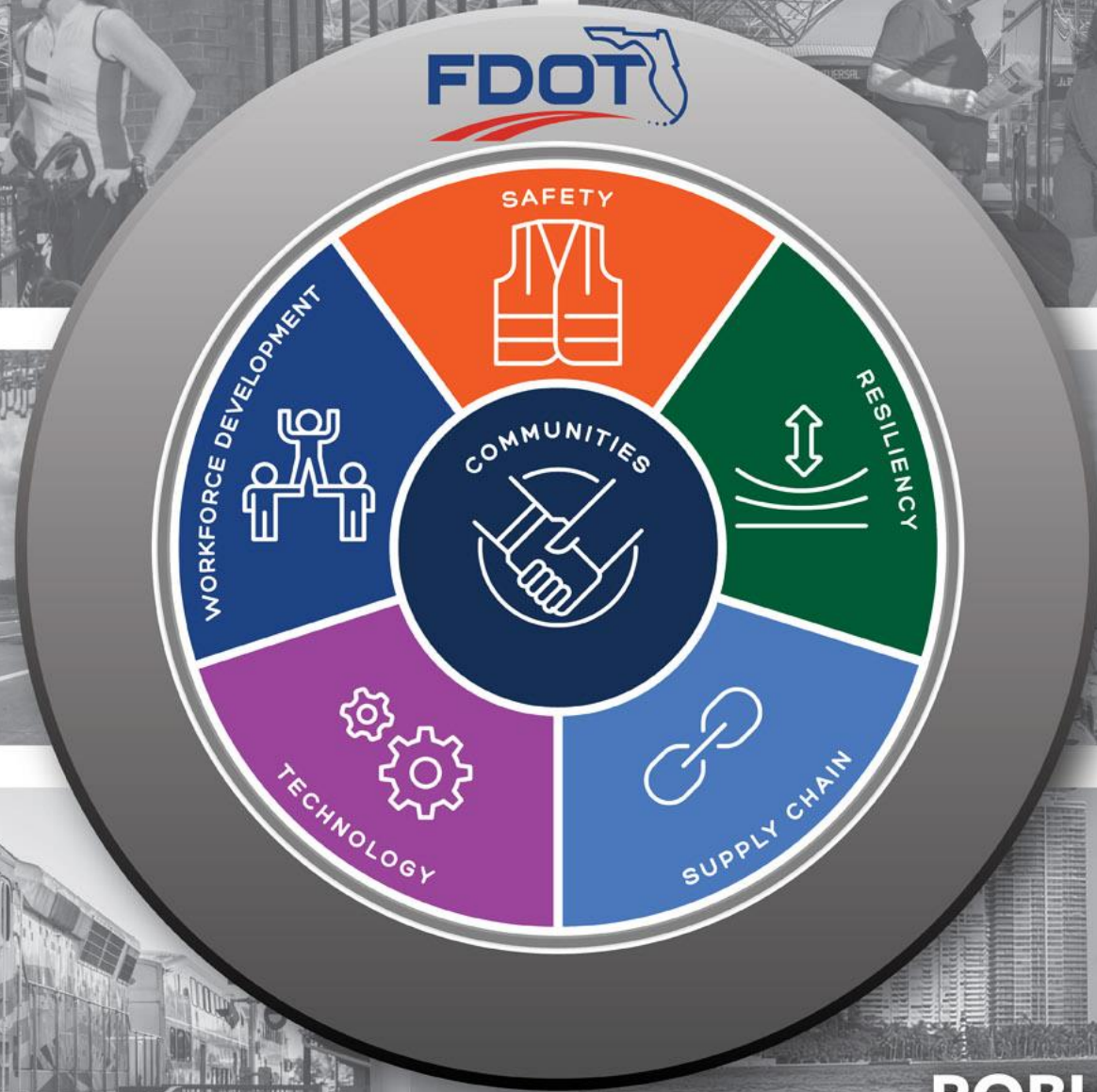
SAFETY



COMMUNITIES



**WORKFORCE
DEVELOPMENT**



RESILIENCY



TECHNOLOGY



ROBUST SUPPLY CHAIN