Utility Depiction and Analysis in ORD

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TEAM KENTUCKY TRANSPORTATION CABINET

wsp

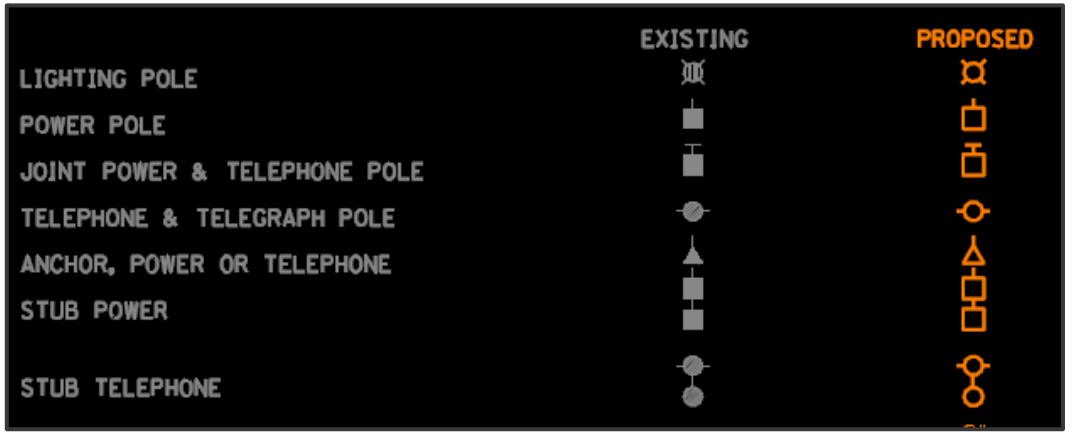
Existing 2D Roadway Plans Utility Depiction

Roadway plans include existing & proposed roadway elements/assets. The elements within roadway plans are based on standard drawings for each unique roadway element and includes subsurface data.

Utilities are *dynamic* throughout a project's life.

- Plans begin with existing utilities which may be relocated due to identified conflicts.
- Utility assets shown on roadway plans are not based on standard drawings. Hence, the subsurface foundations are not identified.

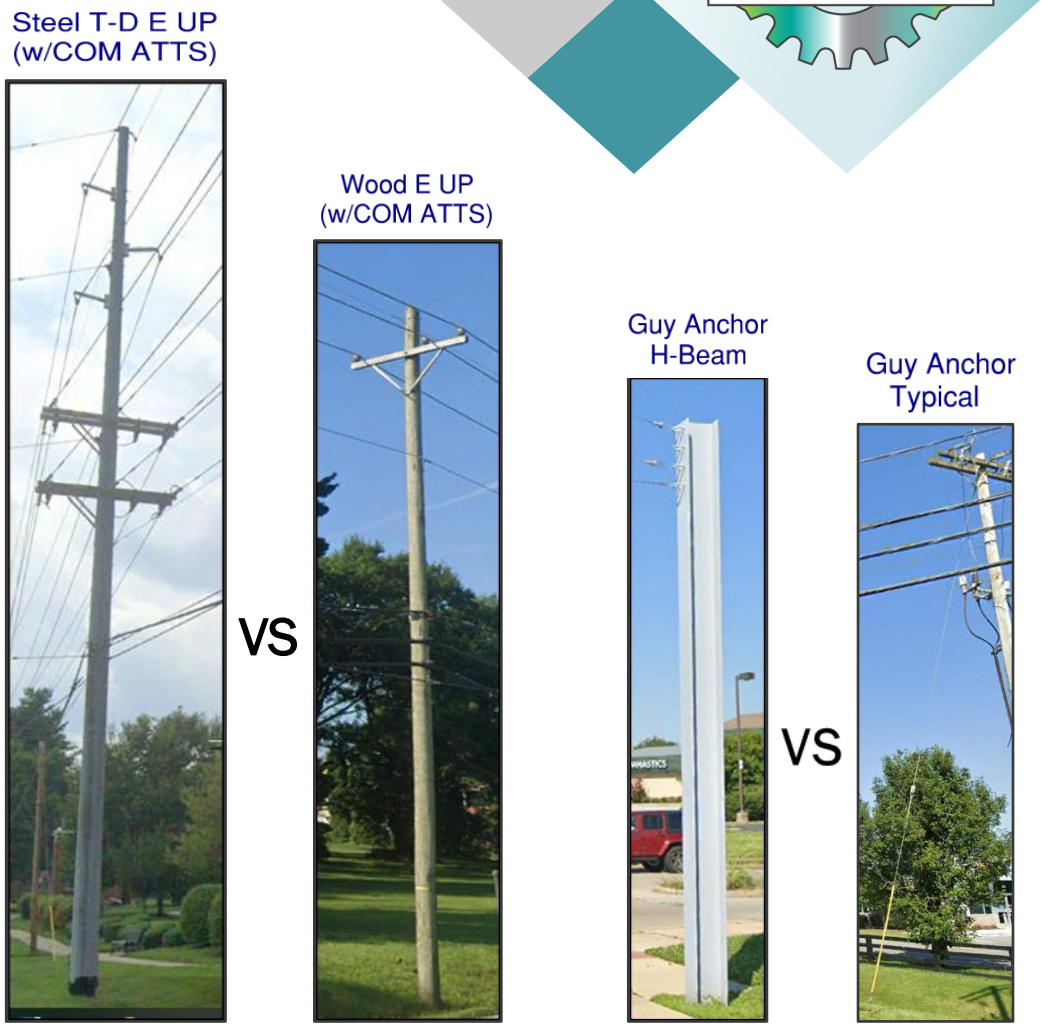
Typical Power Pole Legend



Existing 2D Roadway Plans Utility Depiction

Historically, survey has not been asked to define unique utility assets for the roadway plans. There are ***significant differences*** in ***relocation costs*** and ***subsurface data of various foundations*** among utility assets.

Previously, utilities may not of identified the exact location of utility assets, and many may not have the tools to have these exact locations digitalized.



Utility Modeling Dynamic

As noted, **utilities are *dynamic* processes** due to potential conflicts and on-going utility reviews & relocations. Other impacts to these dynamic processes:

- Utilities can be assigned multiple quality SUE levels (A, B, C & D) for a project. **The Roadway Plans and/or model should include the utility asset's SUE data throughout the life of the project. Visualization of SUE data should be standardized.**

- Field changes may be made to approved utility relocation plans due to unidentified subsurface conflicts discovered in the construction phase. **Roadway Plans and/or models should include this asbuilt data for accurate real-time utility review of roadway plans, & other utility relocation plans that may be impacted.**

Utility Modeling
What is it?

Modeling is called out under various names

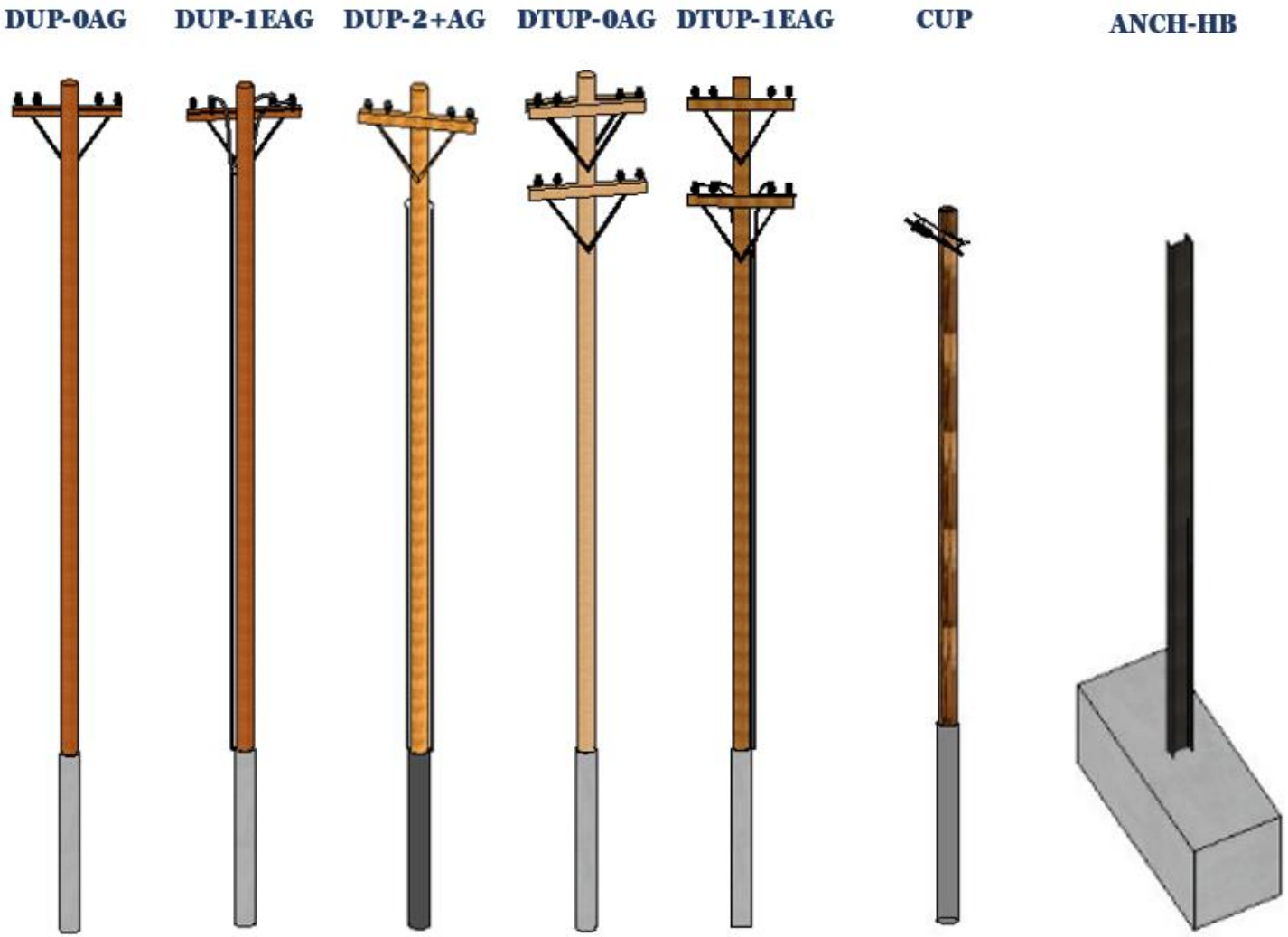
Bentley:

- BIM – Building Information Modeling
- Digital Twin – A realistic and dynamic digital representation of a physical asset or system.

KYTC:

- DPD – Digital Project Delivery is the delivery of projects utilizing digital data and 3D modeling to create a centralized living representation of our network and its assets.

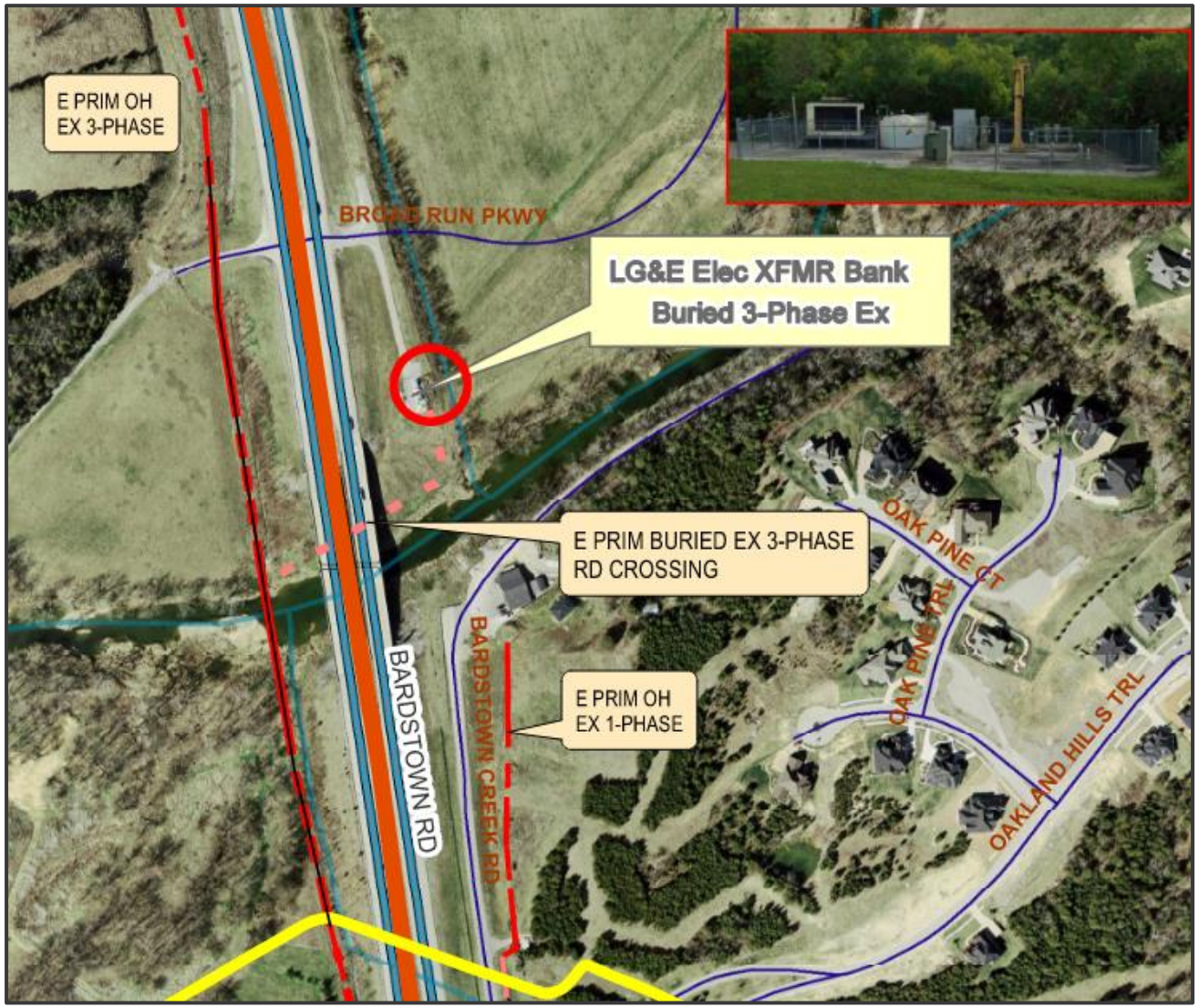
Utility Modeling
Utility Assets – Power Pole Route

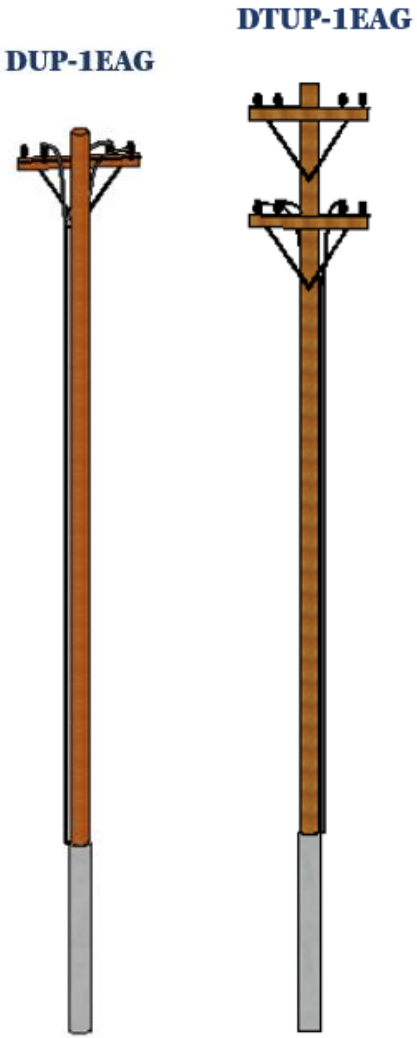


Utility Modeling
Utility Assets – Power Pole Route

Importing survey data of existing subsurface utilities to assist with utility reviews.

If the subsurface electric feed serves a sign or house ($), but if it serves a buried transformer bank ($$$).





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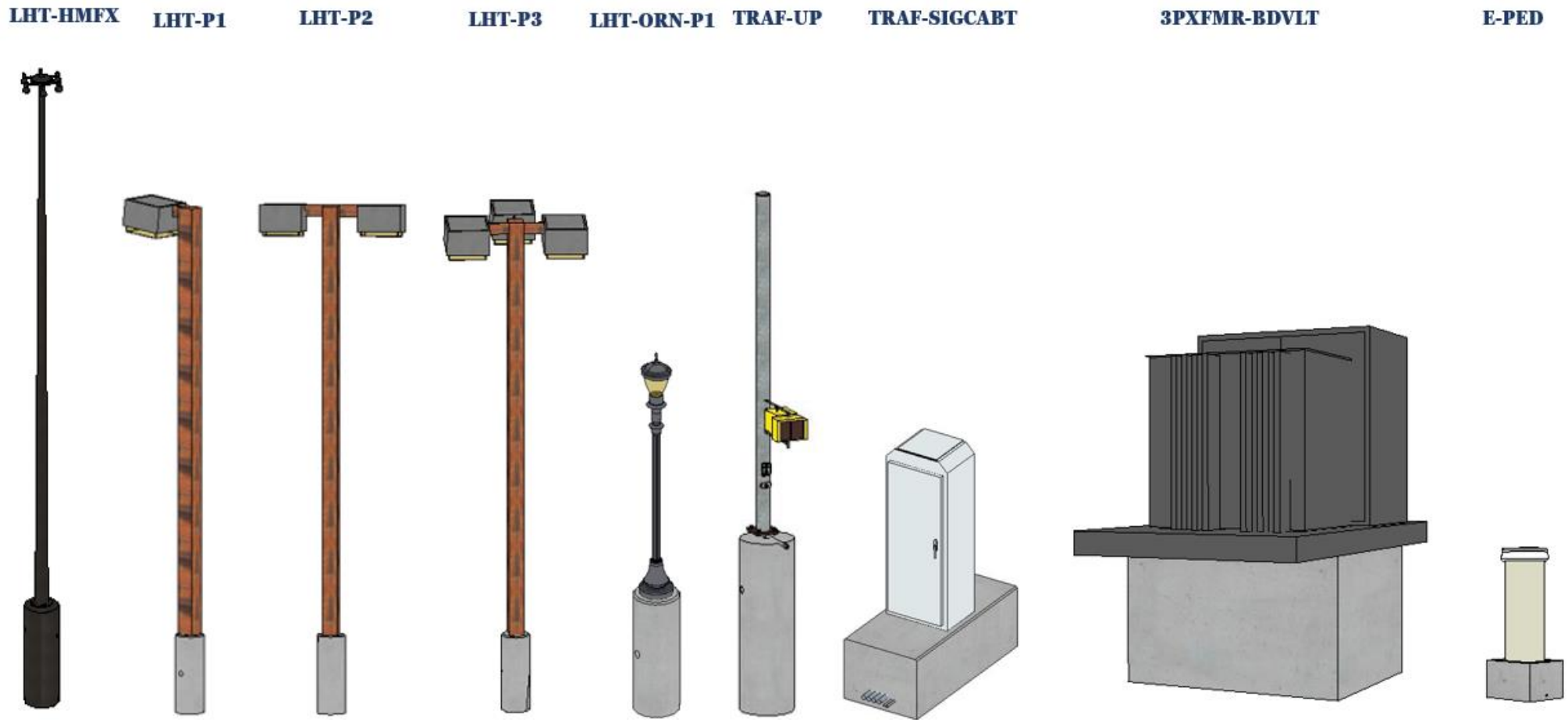
5-80261 US 31E
Planning Study

Utility Modeling
Utility Assets–Power Pole Route



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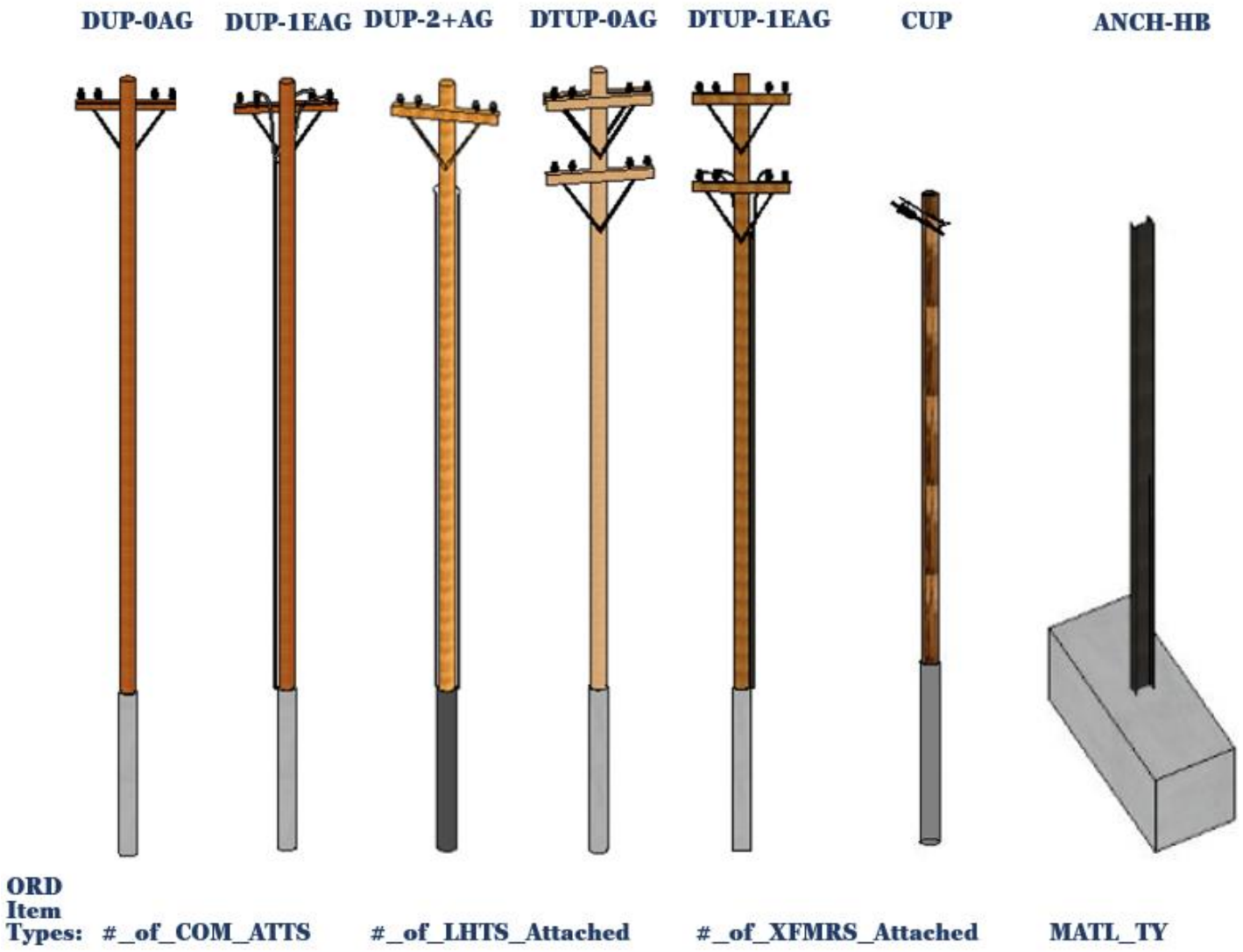
Utility Modeling
Utility Assets – ORD Item Types



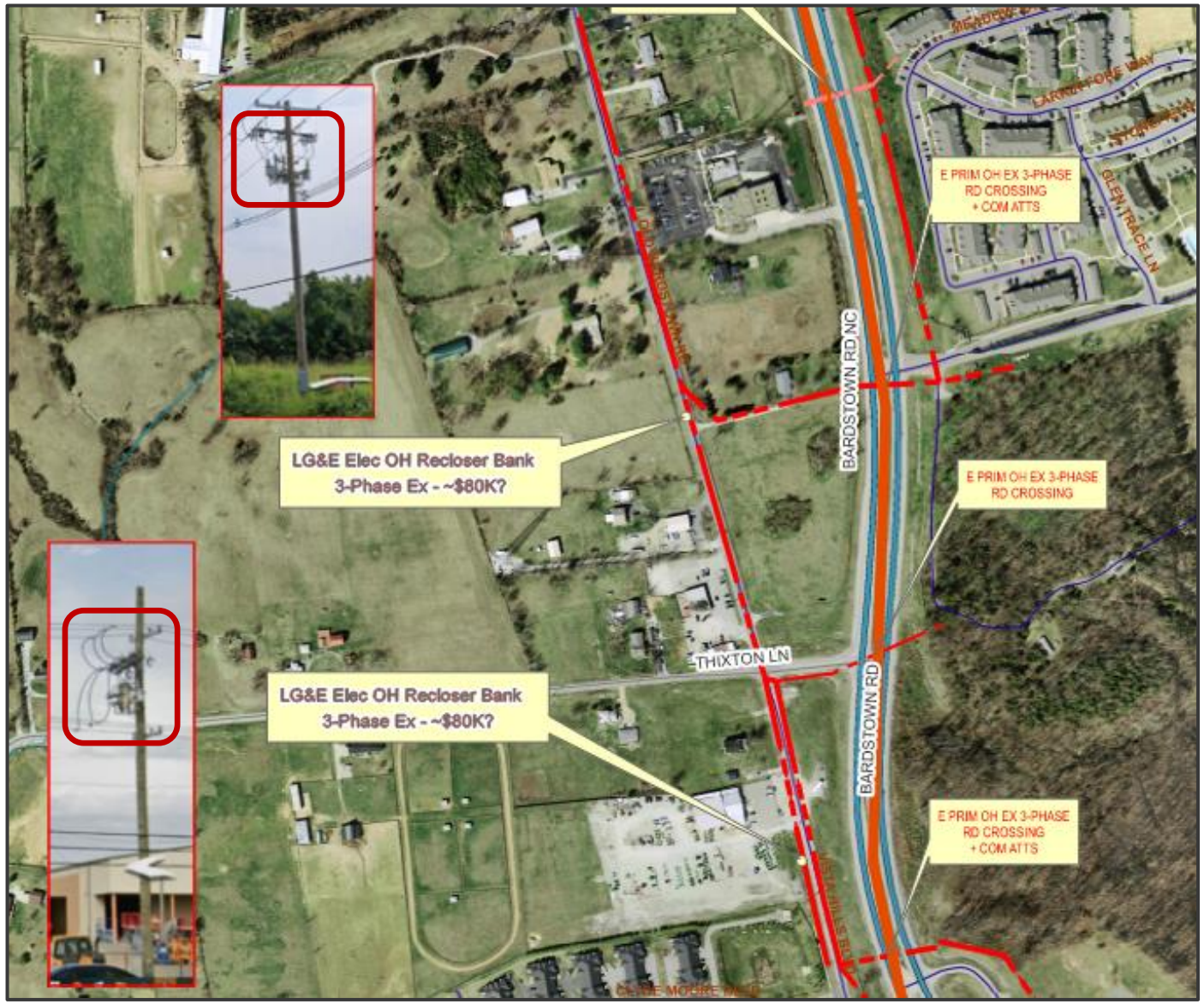
What are ORD Item Types?

Bentley: An Item Type is a set of properties used to describe an element.

For Example, when the unique utility asset is placed, unique Item Types can be preset in the asset, then this data can be added to the model without being drawn.

Analysis of specific Item Types include clash detection, thematic displays to differentiate between elements, and reporting.

Utility Assets – Item Type Benefits



5-80261 US 31E Planning Study, Electric Facility Maps shows **existing electric overhead reclosure banks**.

In this corridor, there are 7 of these overhead assets on the power pole route (estimated relocation cost of $80k each per Google). If all are relocated, estimated cost is $0.56M – good data. **Item Types could be preset into the asset to capture cost impacts for various alternatives.** etc.

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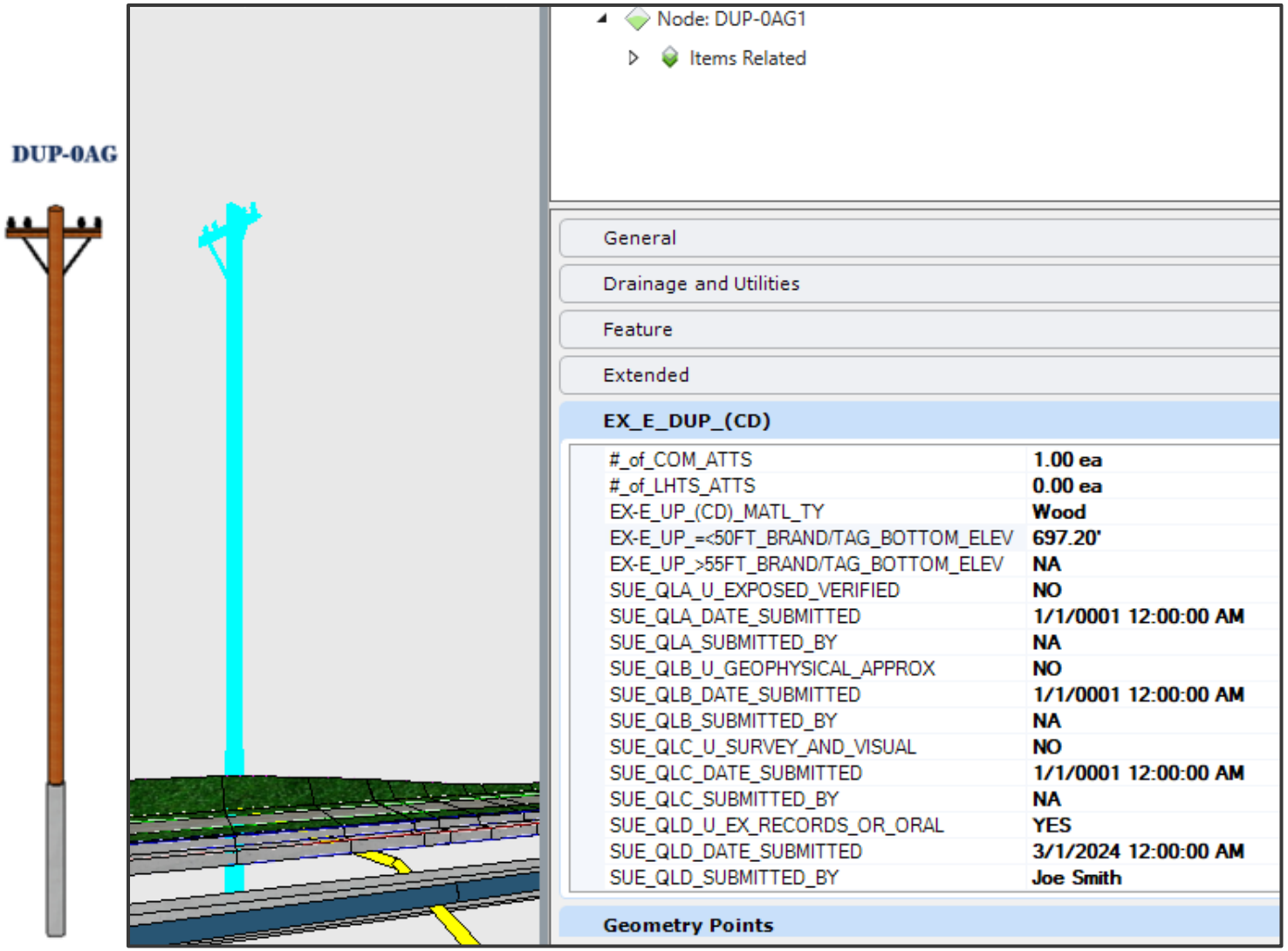
Item Type Benefits – Automate Smart Data



1. Various attachments
2. Material types
3. Estimate pole depth based on NRECA & WQC Standards:
   a. Survey bottom of pole stamp
   b. Query to analyze stamp location vs ex/pr terrains, pr cuts/fills, and pr utilities, and review pole stability for Construction.
   c. =<50’ pole, bottom of stamp must be placed 10’ 2” from the butt of pole. If stamp is 4’ above ex grade, then pole depth = 6’ 2”
3. SUE Quality Levels

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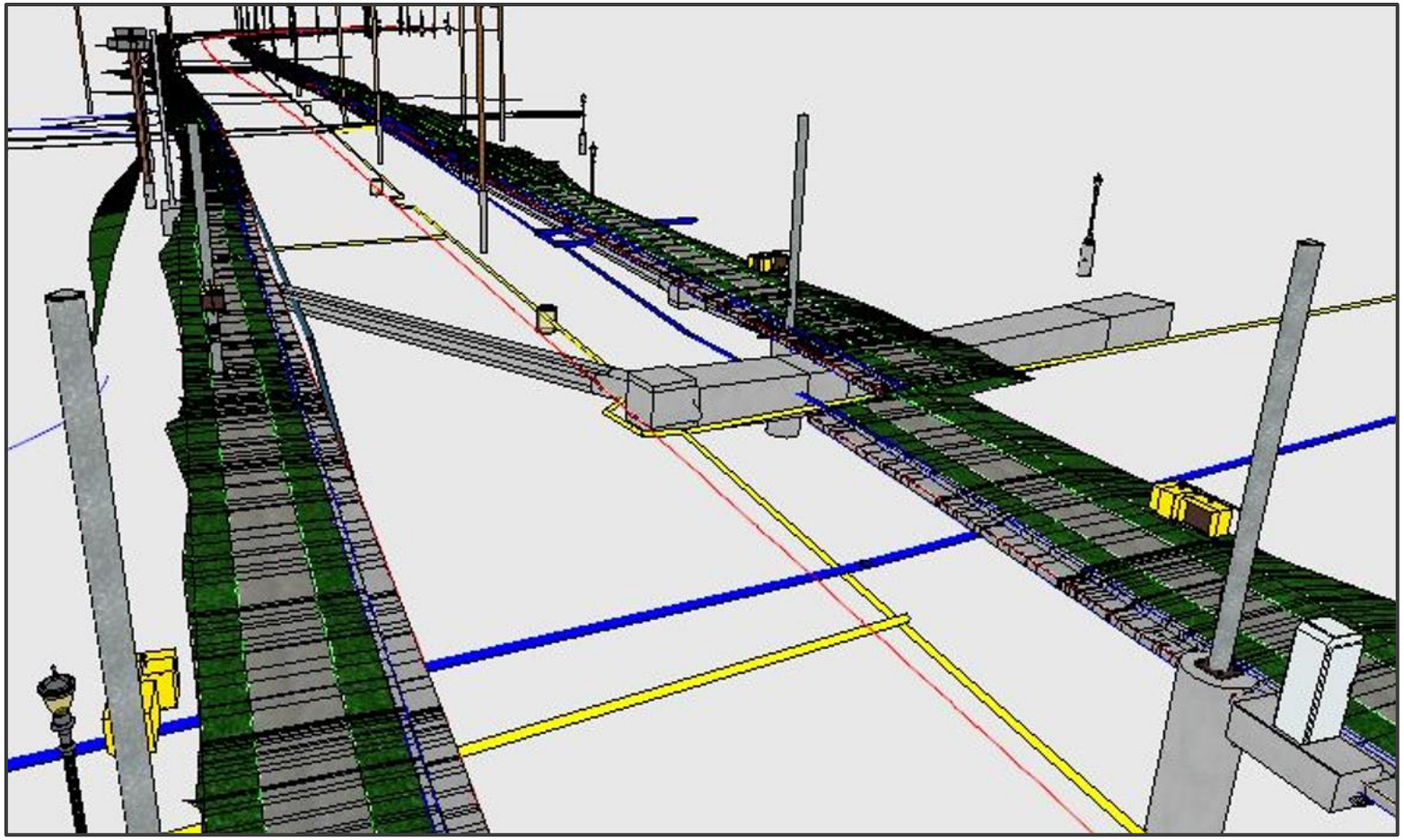
Item Type Benefits – Automate Smart Data



Item Types can control the display of an element. Item Types can drive symbology, annotation, and conditional display settings.

Display Rule Manager & Condition Editor tools can be preset to change elements color, fill, line styles, line weights, and transparency based on Item Type data.

The display rules can be incorporated into the Utility CADD Standards to automate how an ex gas main displays for SUE QLA vs SUE QLD, etc. to further support visual standardization.

Utility Assets – 3D Cells

- Utility assets are created with 3D cells within ORD.
- Utility assets should be created based on standard utility drawings & 3D cells.
- KYTC does not have access to these standard utility drawings or 3D cells.

ChatGPT Recommendation: **Obtain 3D cells from the manufacturer of utility assets.**

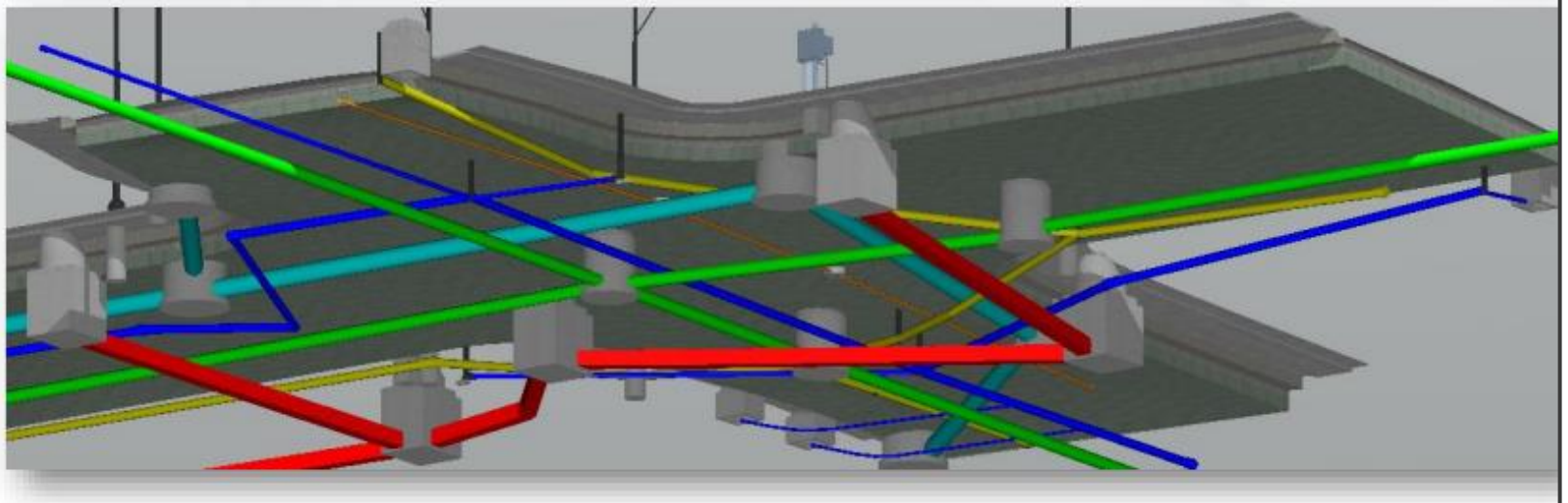
While KYTC does not need to understand the electrical design of the power pole route, KYTC does need to know the dimension of the utility asset and its' foundation.

Hence, **KYTC request either utilities provide these 3D cells, or provide enough data to source these 3D cells from the supplier and/or manufacturer.**

Utility Model from Survey

Model Existing Utilities From Survey

- Create 3D utility models, including drainage and wastewater features
  - Pipes, cables, ducts of all sorts
  - Virtually everything underground
- Elevations from the 3D survey features or from terrain.



Bentley

Utility Modeling - KYTC Survey Codes

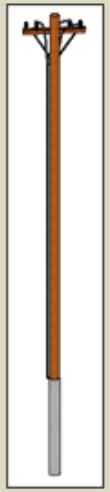
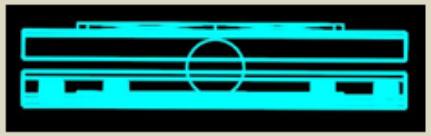
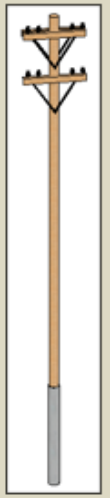
Ultimately, the survey code will automate the modeling process. The unique survey codes will be read by the Utility CADD Standards to populate the 2D plan & model. Each utility asset with the same survey code will be tagged with that code and subsequent numbering.

For example:

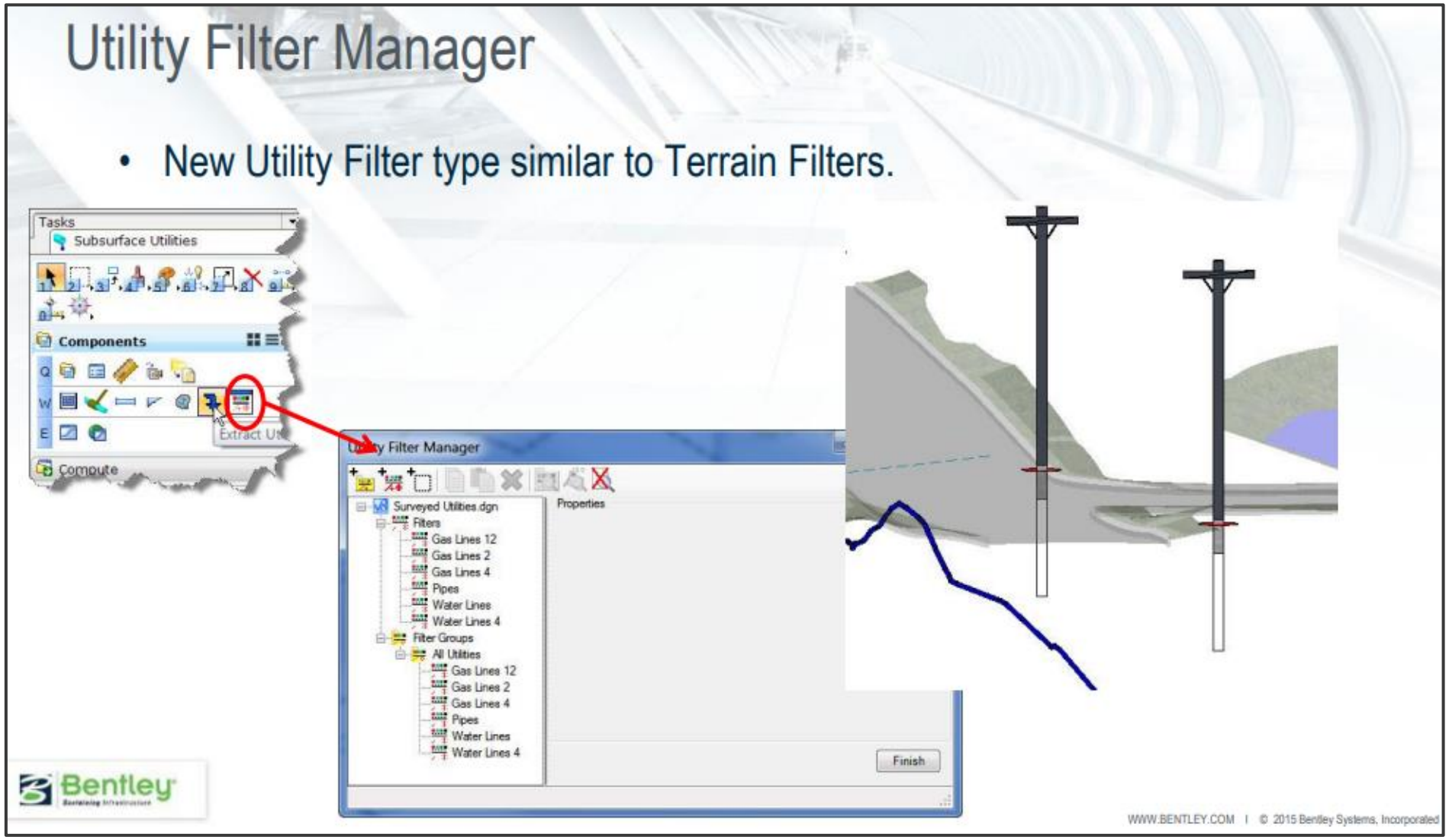
DUP-1EAG

DUP-1EAG1

DUP-1EAG2

Feature Definition	Feature Code	Cell Name / ORD 2D Cell	Shot Location & Orientation (use offsets as needed)	ORD 3D Cell
POLE E UP DIST ONLY (1) E-AERIAL-TO-GRD (CD)	DUP-1EAG	UP DIST ONLY (1) E-AERIAL-TO-GRD (CD) 	Origin - center of pole; & LT/RT PTs of Cross-Arm? TBD	
POLE E UP DIST-TRANS (0) AERIAL-TO-GRD (CD)	DTUP-0AG	UP DIST-TRANS (0) E-AERIAL-TO-GRD (CD) 	Origin - center of pole; & LT/RT PTs of Cross-Arm? TBD	

ORD Utility Filter Manager



Power pole assets are being place in ORD manually as the Utility CADD Standards are being developed.

Ultimately, the Utility Filter Manager tool would read/process the survey codes creating the model.

Utility Modeling - Clash Detection

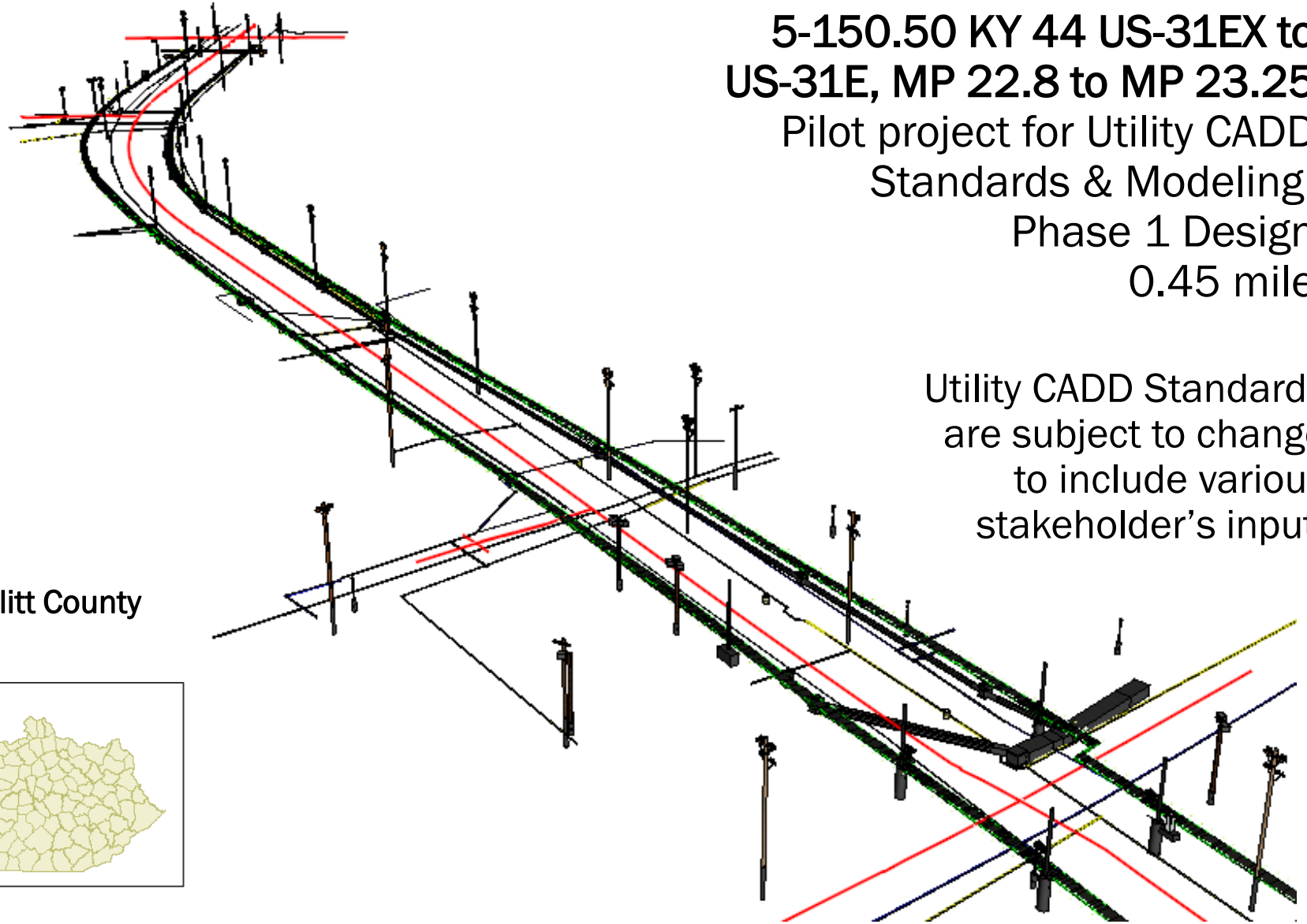
ORD Clash Detection Tool – SYNCHRO Tool - TBD

“Bentley: Analytical tool – allows one to identify graphical elements and detect geometrical clashes between these object element sets. You can interactively and graphically review these clashes, annotate specific clashes, then assign them for follow up.”

NOTE: Modeling with clash detection is a dynamic conflict analysis tool that improves communication and collaboration with various stakeholders. With clash detection tools, utility conflicts can be assigned to others and communicated electronically for further collaboration regarding the conflict. Clash detection provides an audit trail of the conflicts.

Pilot Project 5-150.50 KY 44 US 31E

Project Location Maps: Bullitt County



5-150.50 KY 44 US-31EX to US-31E, MP 22.8 to MP 23.25

Pilot project for Utility CADD Standards & Modeling.

Phase 1 Design

0.45 mile

Utility CADD Standards are subject to change to include various stakeholder's input.

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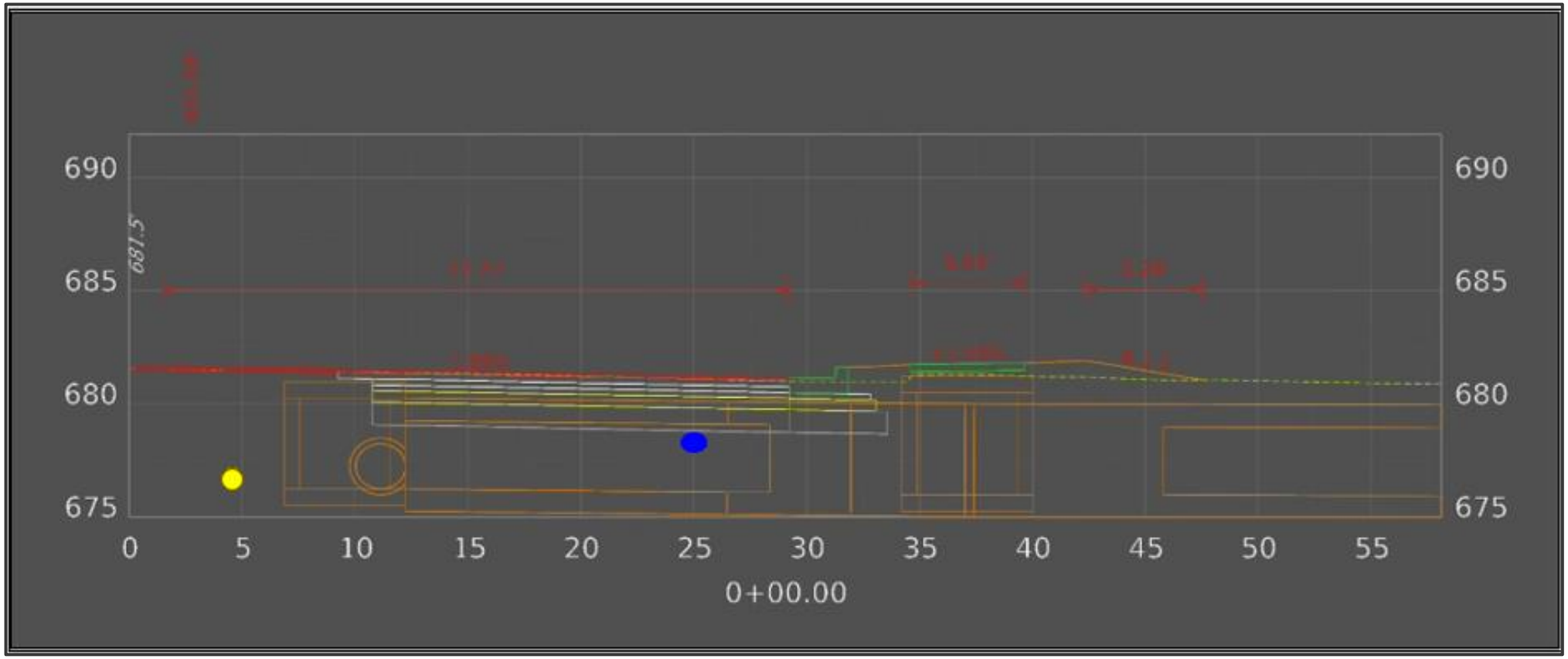
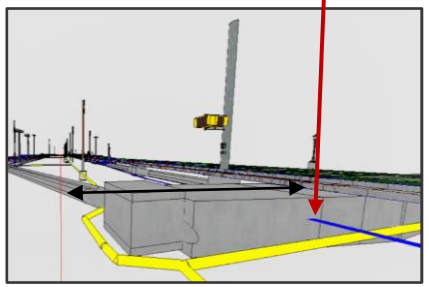
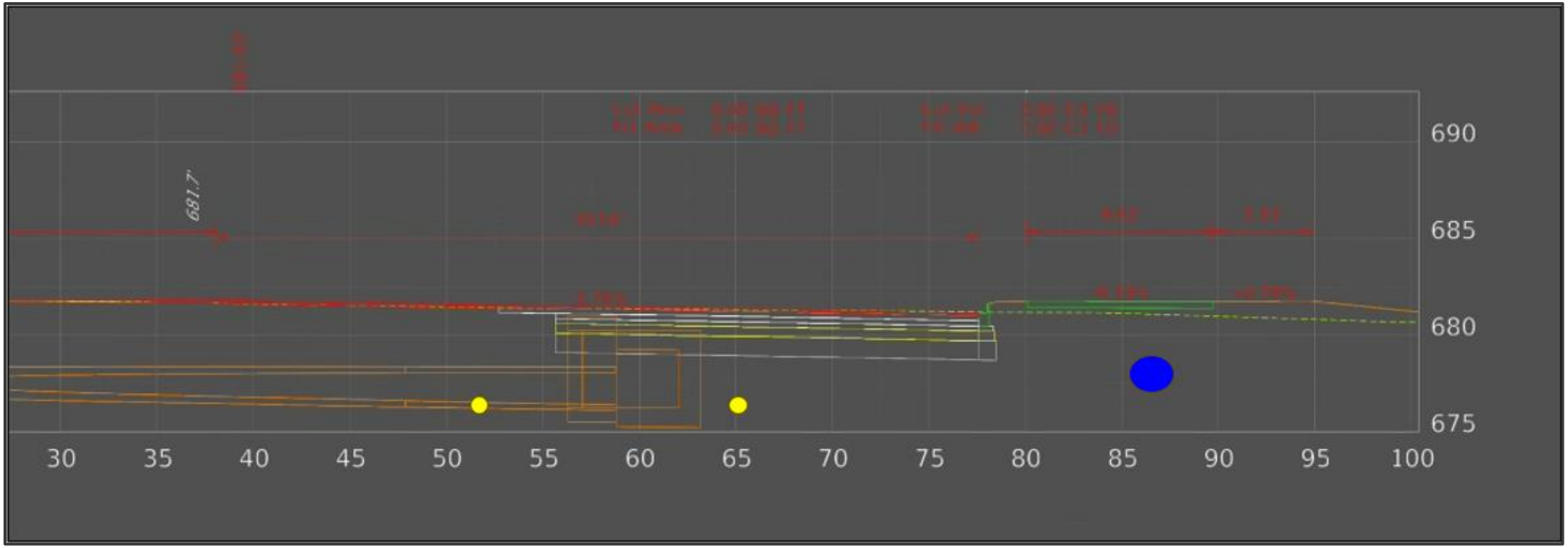
Utility Conflict Analysis



Conflict Analysis



Utility Conflict Analysis



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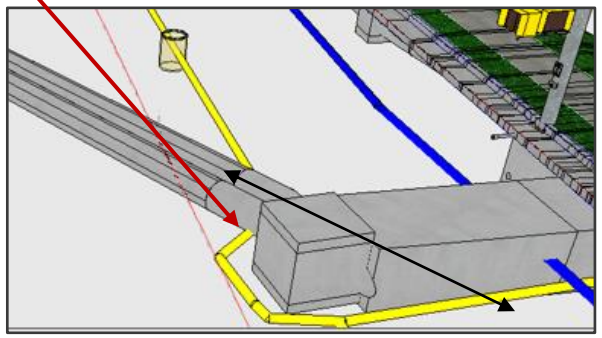
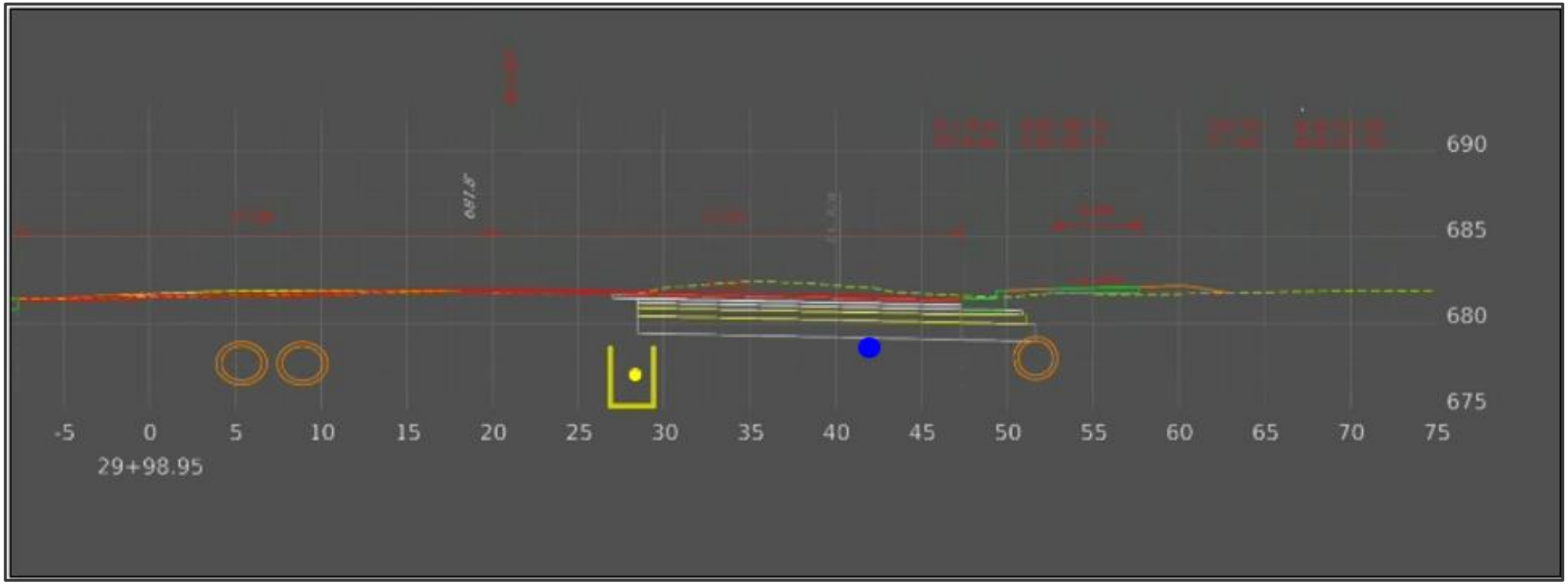
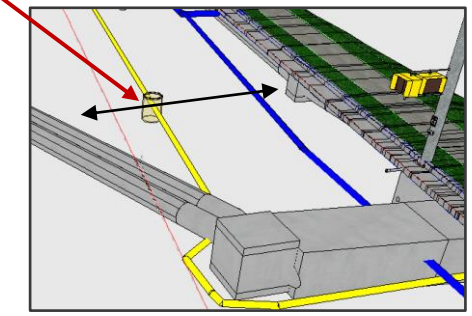


Utility Analysis

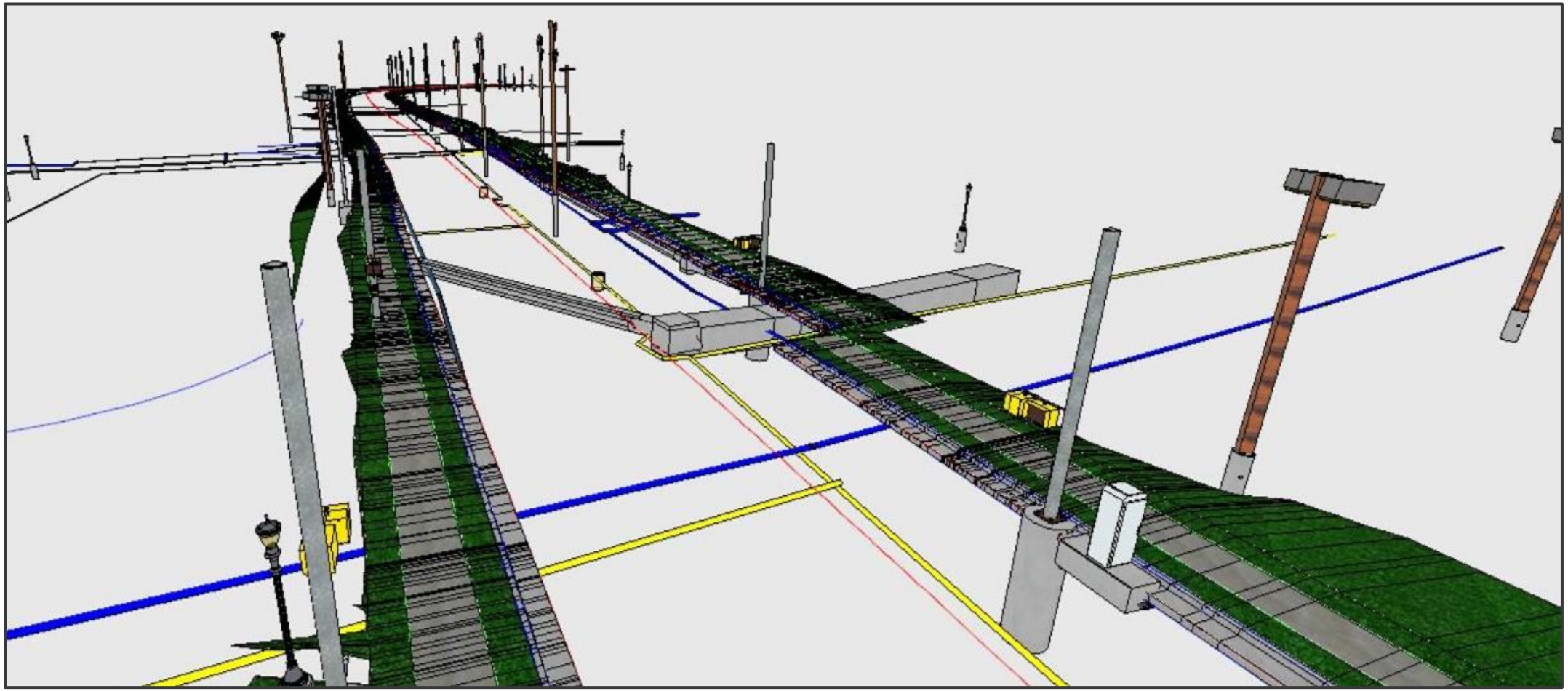


Utility Analysis



Project has 4 SUE Level A data points for the Ex. GM. GMs should be buried at a depth of 60” under roadways, ramps, & ditches; and at a minimum depth of 42” in all other areas. Technically, this GM should be at 60”. As a proof of concept, a SUE Node for SUE Level A GM data was created. The Node has a cylinder height of 42”.

Utility Modeling – 3D Walk Through



5-150.50 Utility Depiction & Analysis in ORD - 3D Walk Through

What is the future of AR in Construction?

FHWA Study (Summer 2020 FHWA, Pub #FHWA-HRT-20-004. Issue Vol. 84 #2):

Dr. Kelly Regal, Associate Administrator, FHWA Office of Research, Development, and Technology: “Considering AR’s benefits and success in the entertainment and video game industries, leveraging AR appears to be an opportunity in construction management for highway infrastructure assets”

George Lukes, UDOT Standards & Design Engineer: “Although it may take a significant amount of time to populate an underground utility database, the potential for substantial reduction or elimination of delays due to utility conflict is impressive,” “AR will undoubtedly increase construction efficiency with accurate representations of the underground utilities.”

AR has arrived in Construction with 3D Modeling

Immersive simulations to enhance safety, design, construction, communication and collaboration while reducing cost.

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Utility Depiction and Analysis in ORD (9:00am)