

Innovations in Geospatial Data Management

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Senior Research Engineer, TTI

Florida Transportation Data Symposium, 2014

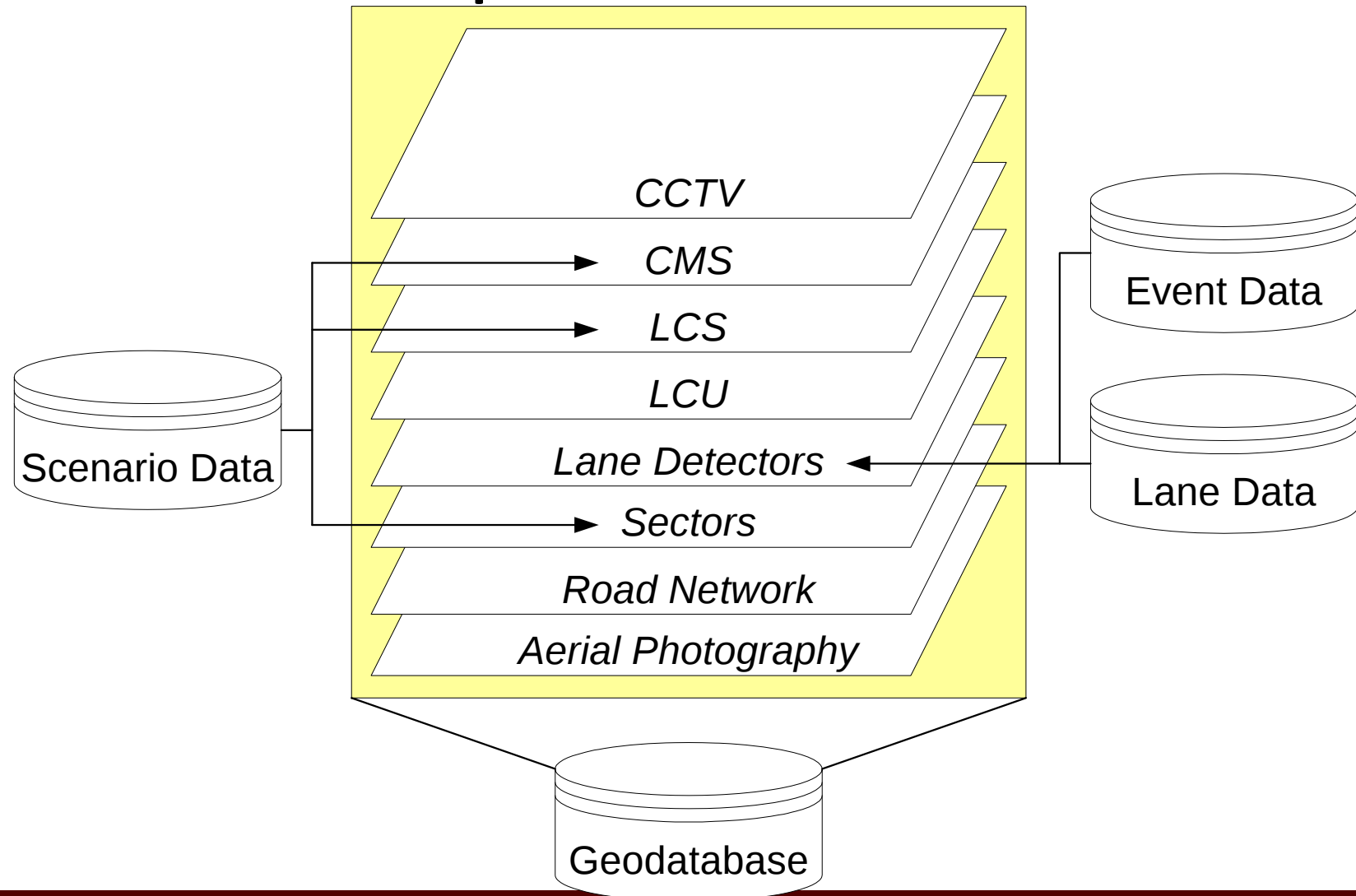
Agenda/Topics

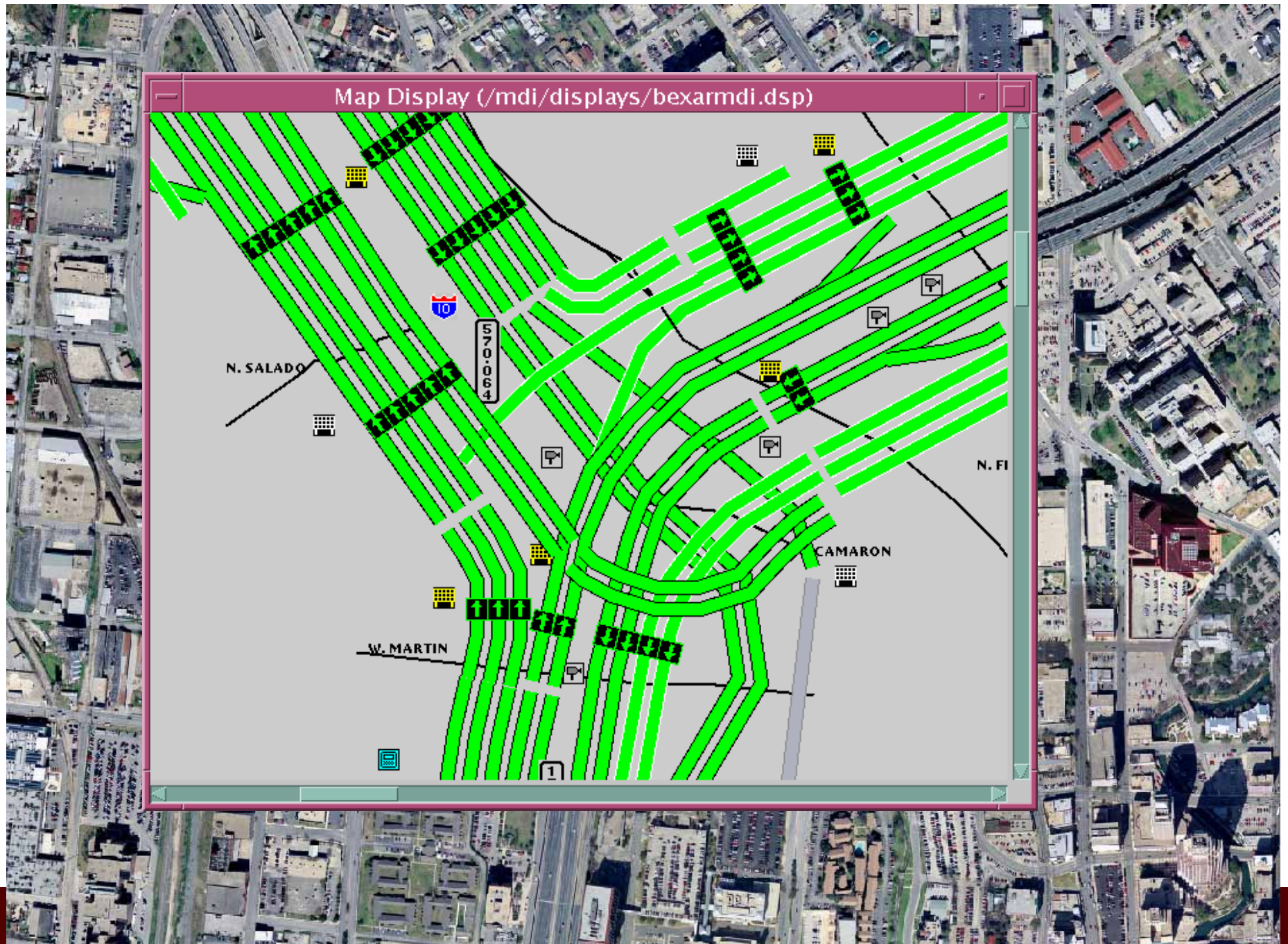
- Legacy data and interoperability
- Project development/delivery data integration
- Management of utility and ROW data
- Case studies:
 - ITS infrastructure management
 - Engineering design data model (EDDM)
 - FDOT Strategic plan for utility and ROW data
 - SHRP 2 R15B and R15C projects
 - FHWA project on 3D technologies

ITS Infrastructure Management

- San Antonio's ITS infrastructure:
 - 1,443 lane detectors, 140 CCTV cameras
 - 167 CMSs, 237 LCSs, 222 LCUs
- March 2002 – April 2004 data:
 - 20-sec lane data: 3.4 billion records
 - Scenario data: 61K scenario records
 - Event data: 202K alarm records

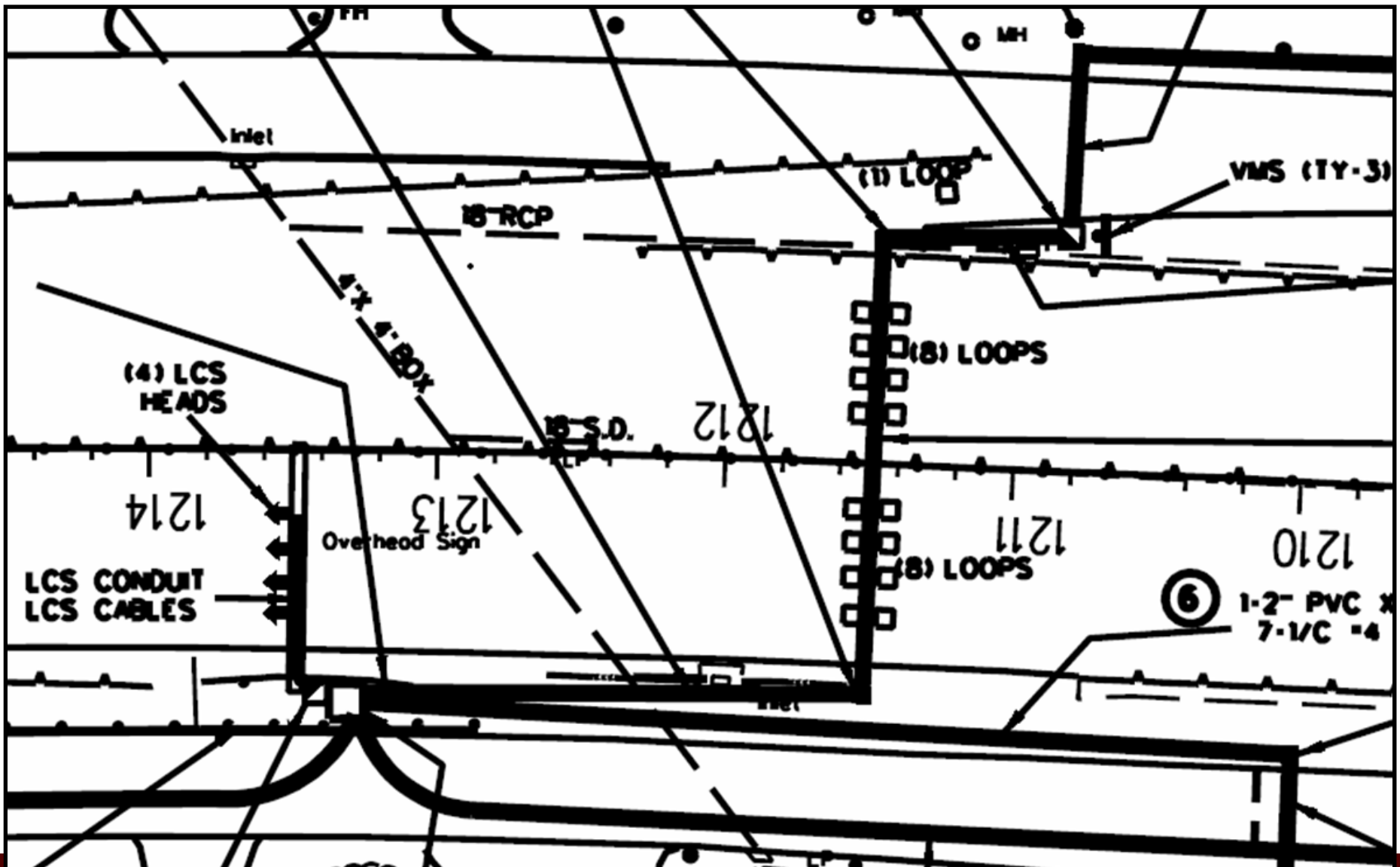
Conceptual Data Model





Geodatabase Development

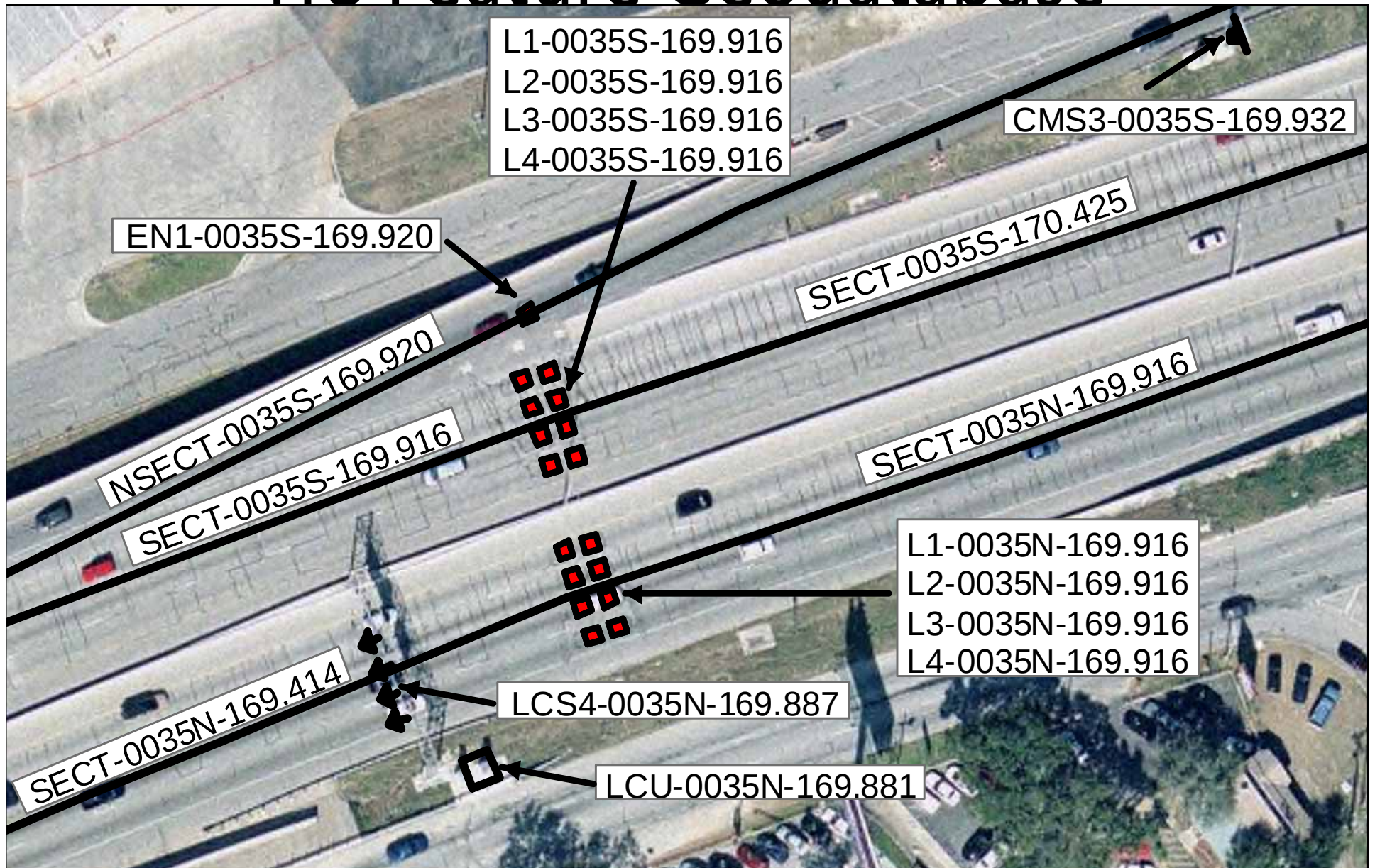
- Data sources
 - Roadway network base maps
 - ITS equipment as-built plans
 - Aerial photography
 - GPS data locations







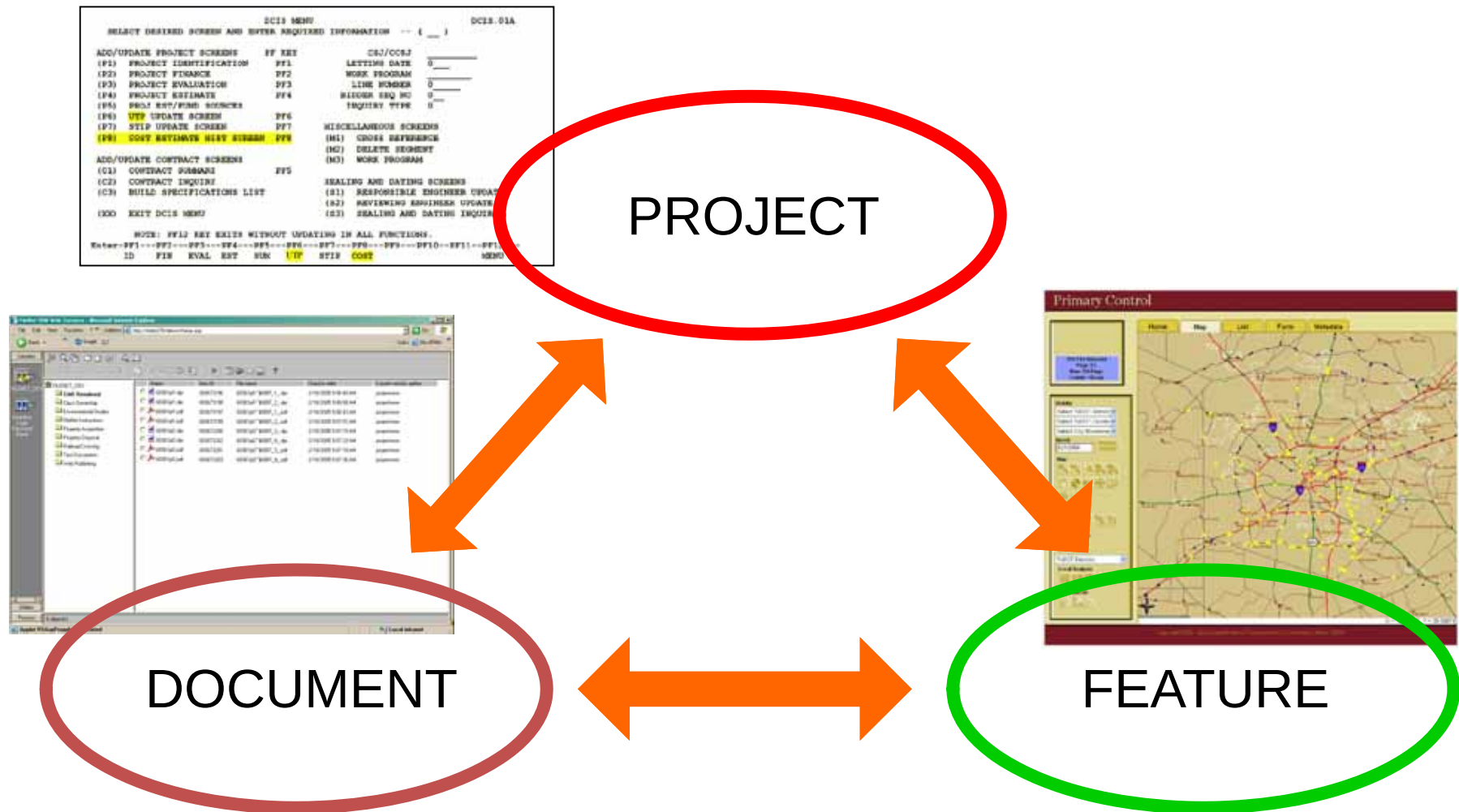
ITS Feature Geodatabase

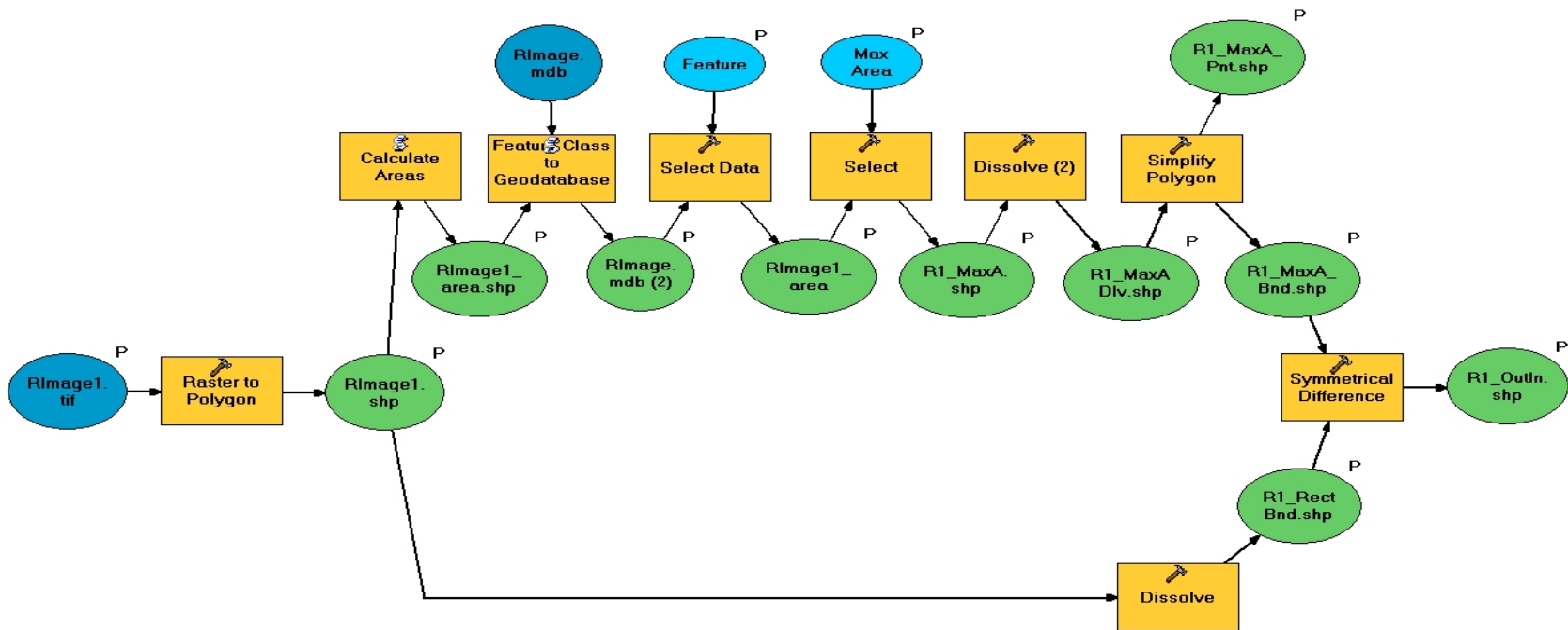
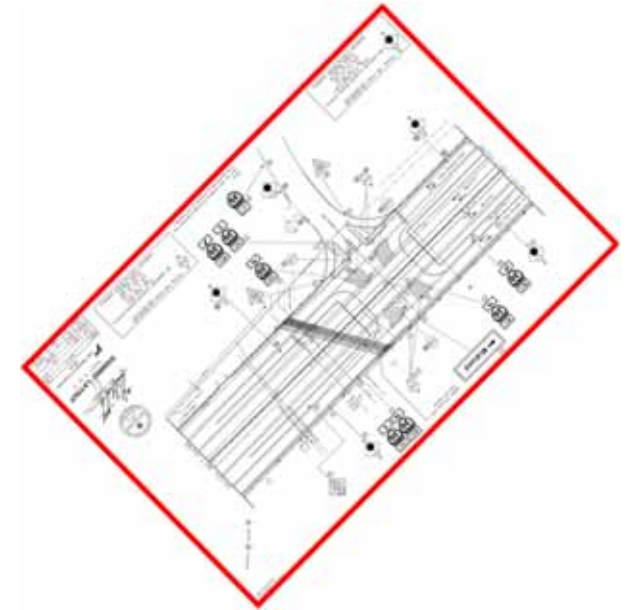
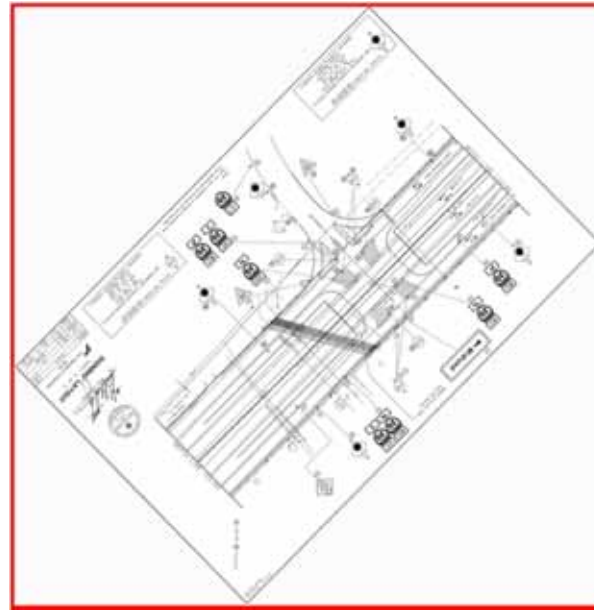
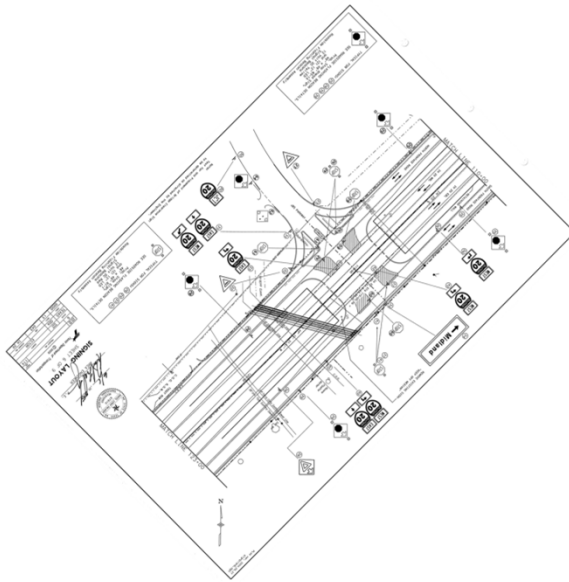


Case Studies

- ITS infrastructure management
- **Engineering design data model (EDDM)**
- FDOT Strategic plan for utility and ROW data
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Engineering Design Data Model (EDDM)





Engineering Design Data Model (EDDM)

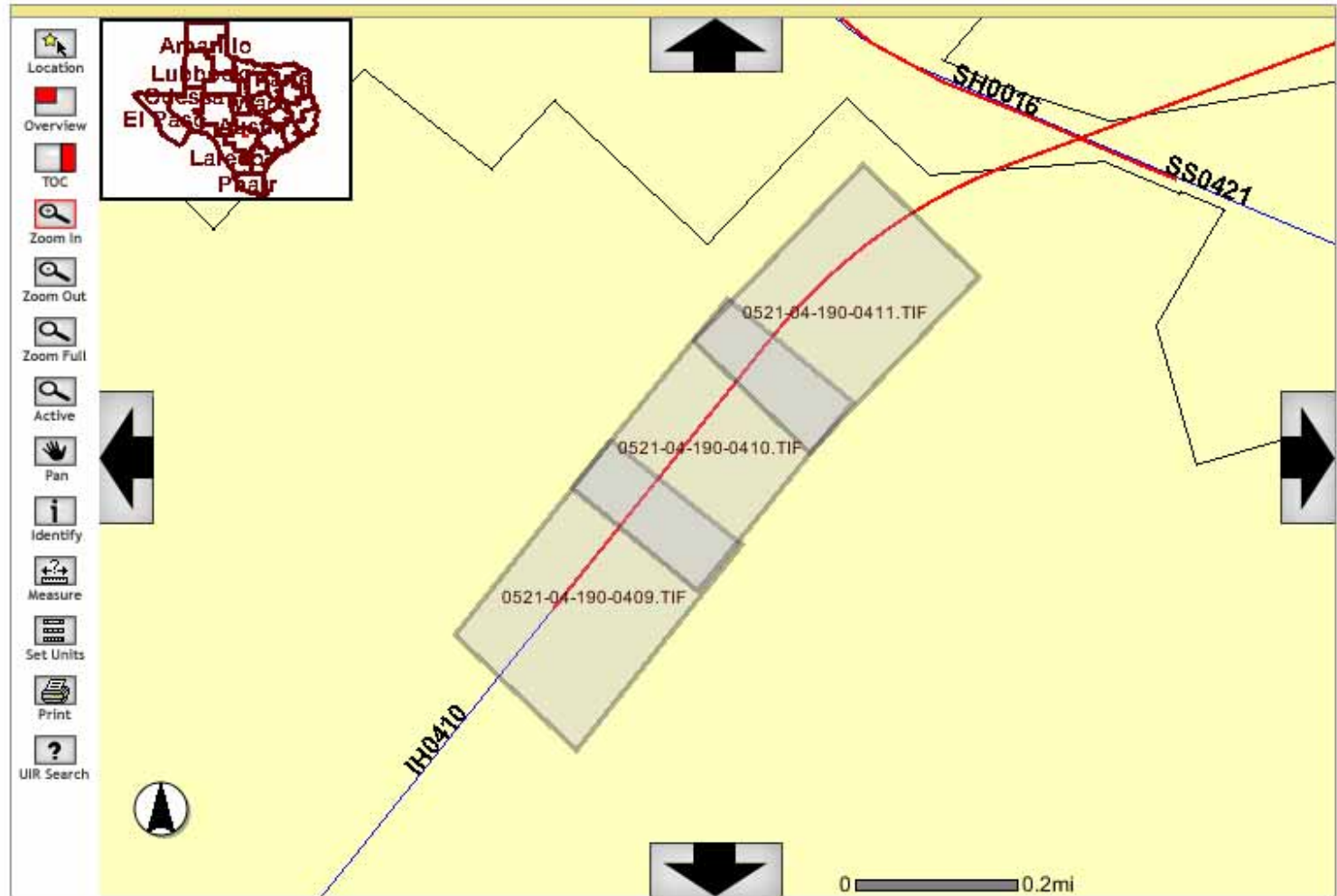
[Home](#)[Data Entry](#)[Data Query](#)[Spatial Data Query](#)[Project Info](#)

Resources

[Project Delivery and Project Management Guidelines](#)[Project Development Process Manual](#)[Plans, Specifications and Estimates Preparation Manual](#)[TxDOT Standard Specifications](#)[Special Provisions](#)[TxDOT Traffic Engineering Standard Plan Sheets](#)[ROW Maps](#)[Survey Control Points](#)[Feedback](#)

Legend:

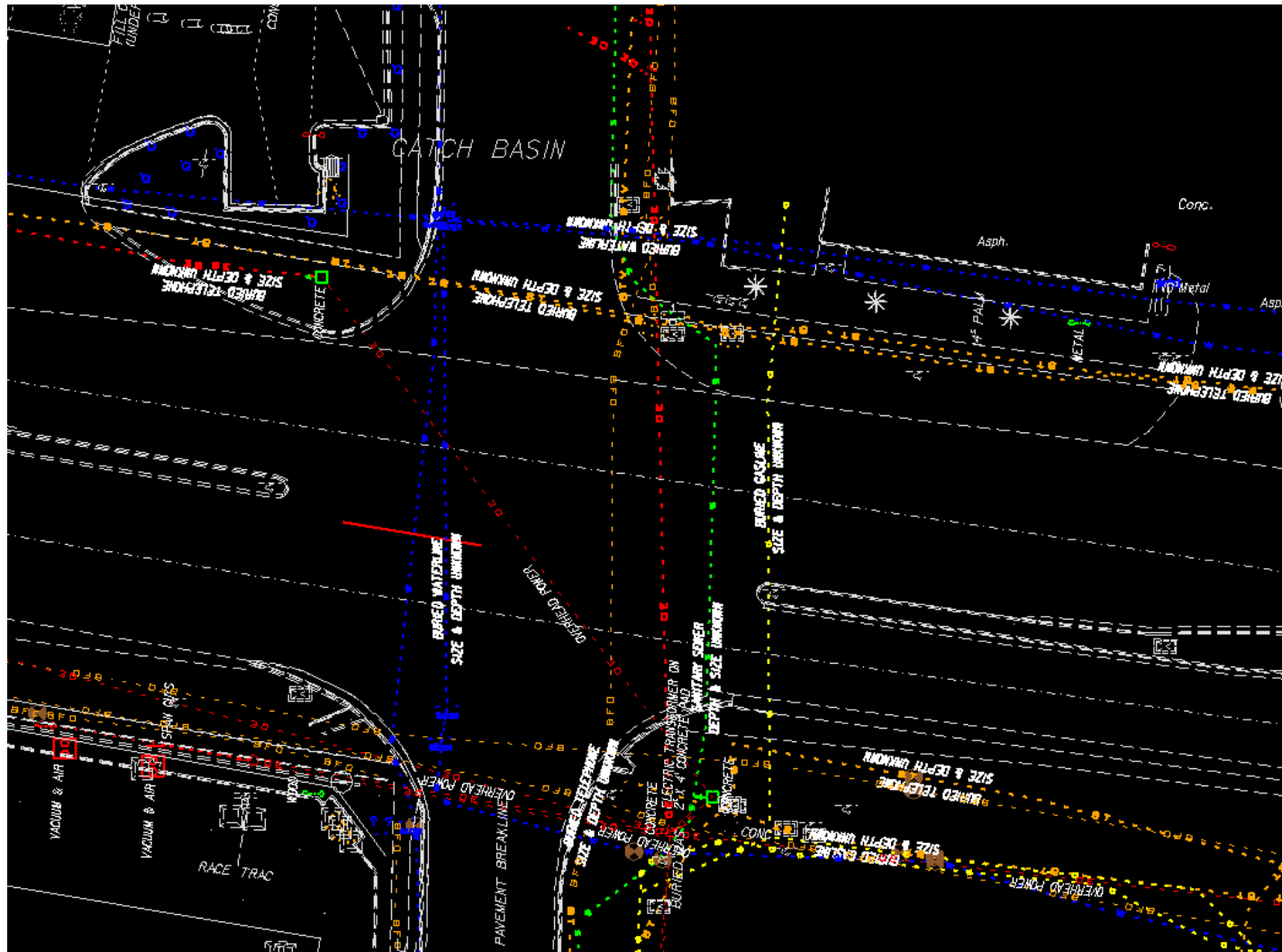
-  Project Limits
-  Routes
-  Control Sections
-  Other
-  Parks
-  Cities
-  Counties

 Counties Districts

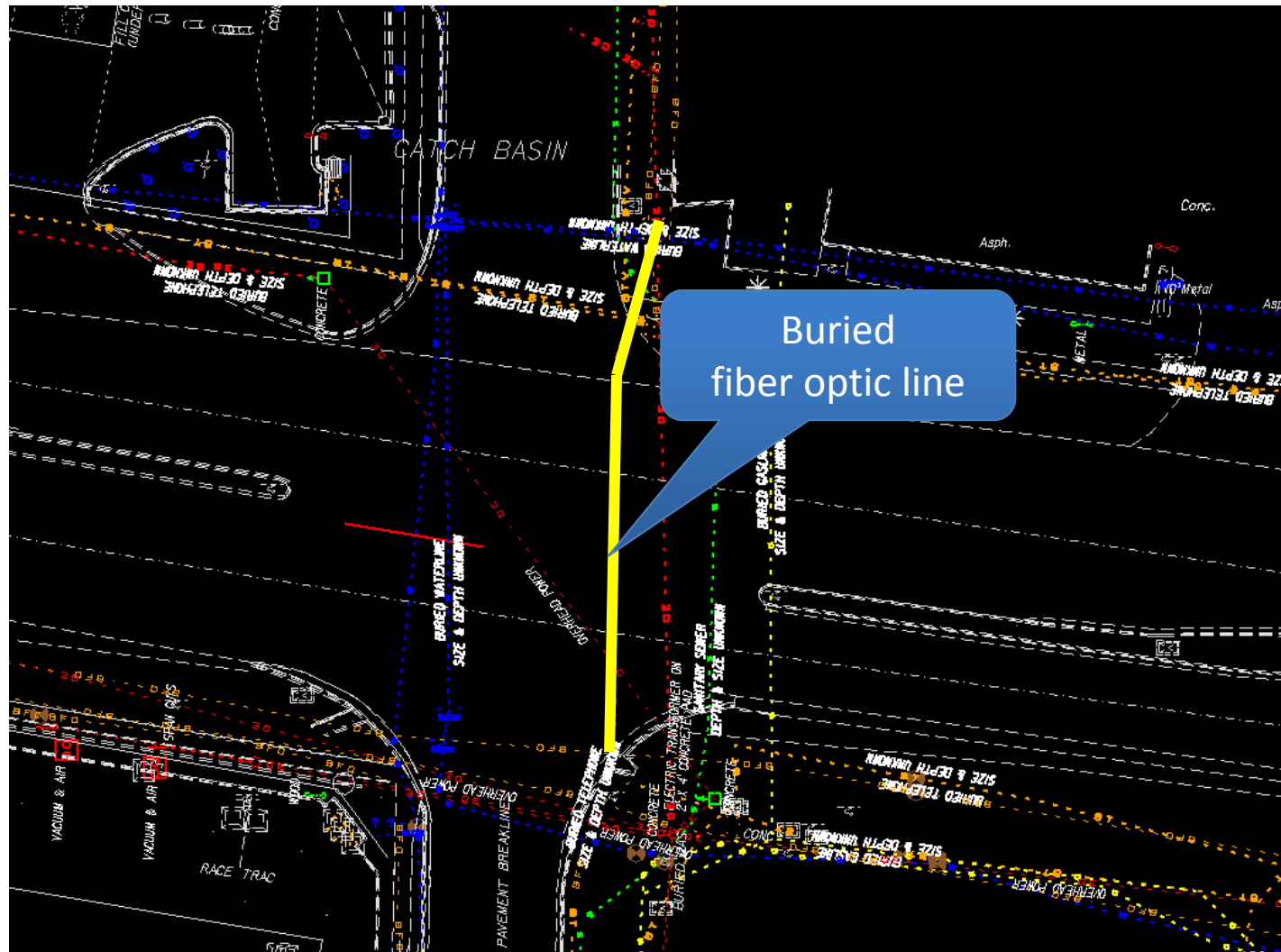
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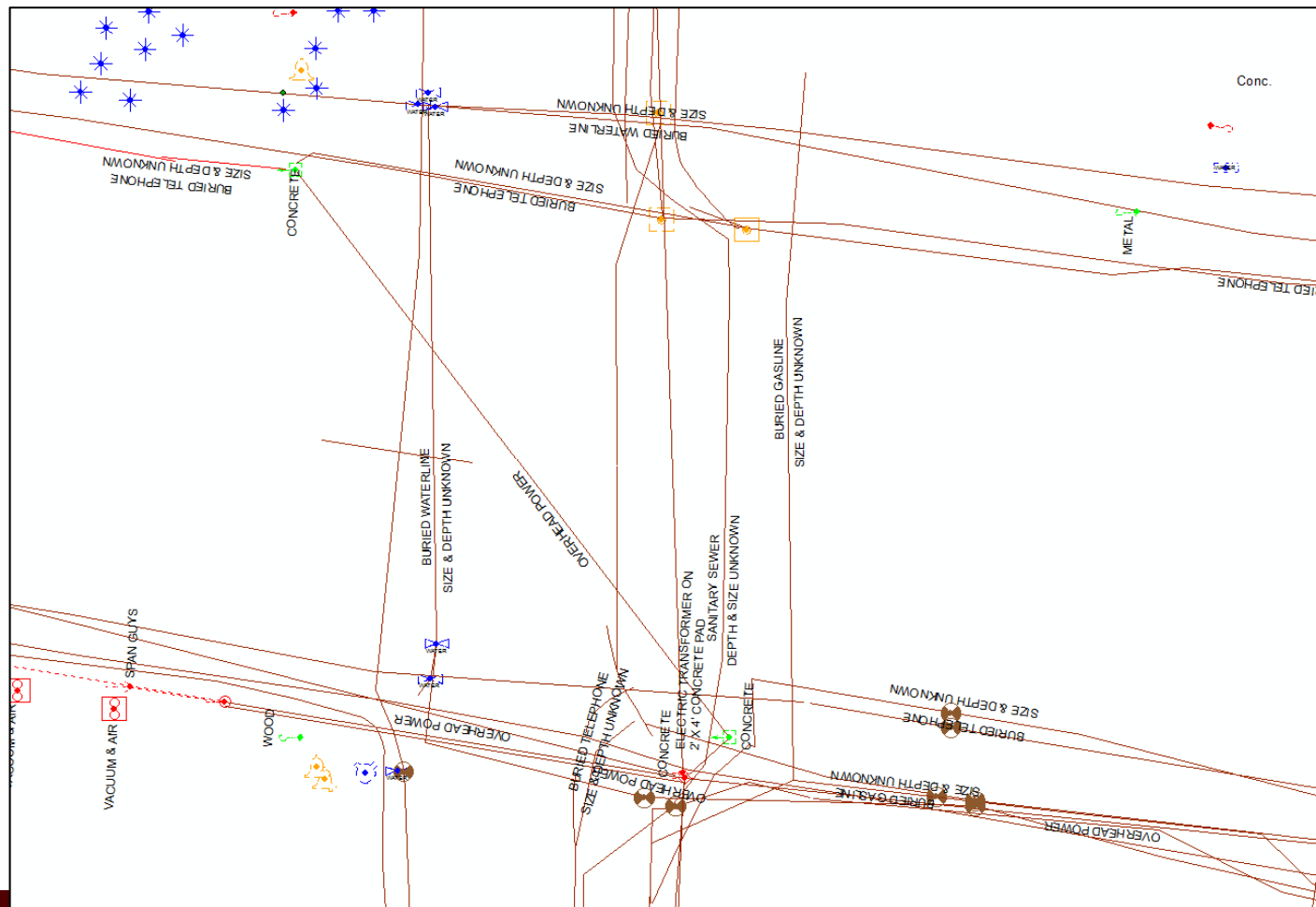
Utility Features in MicroStation



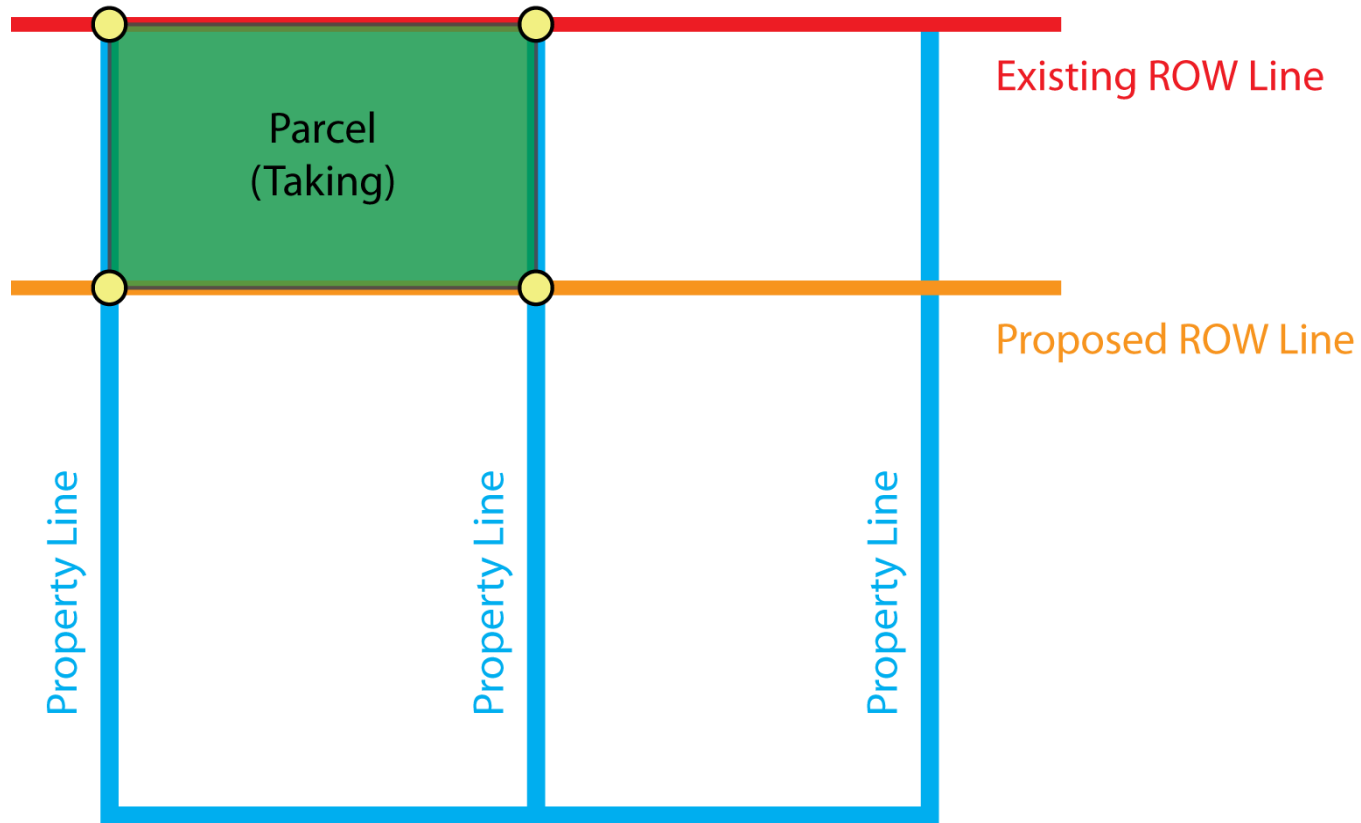
Utility Features in MicroStation



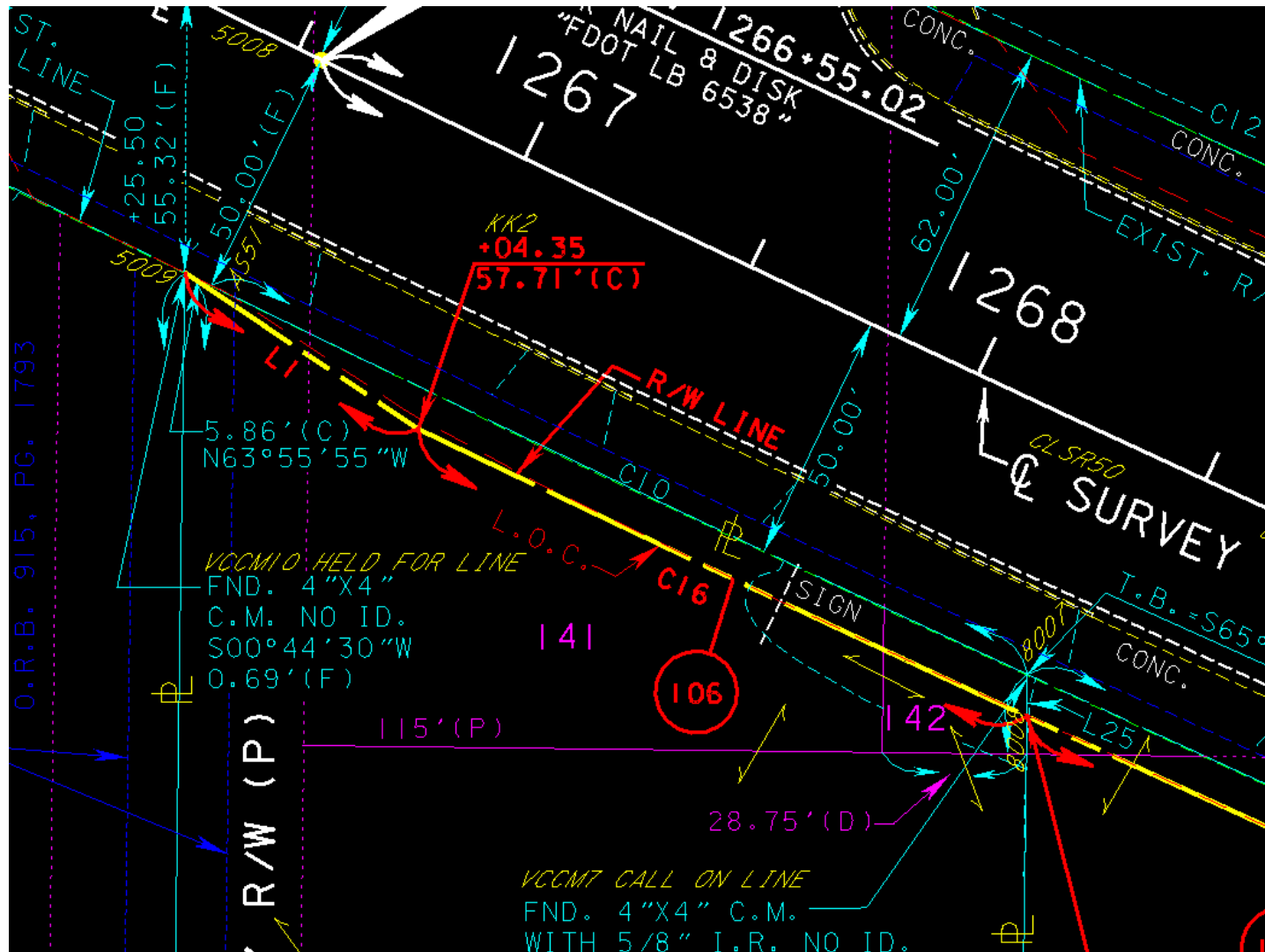
MicroStation Import in ArcGIS



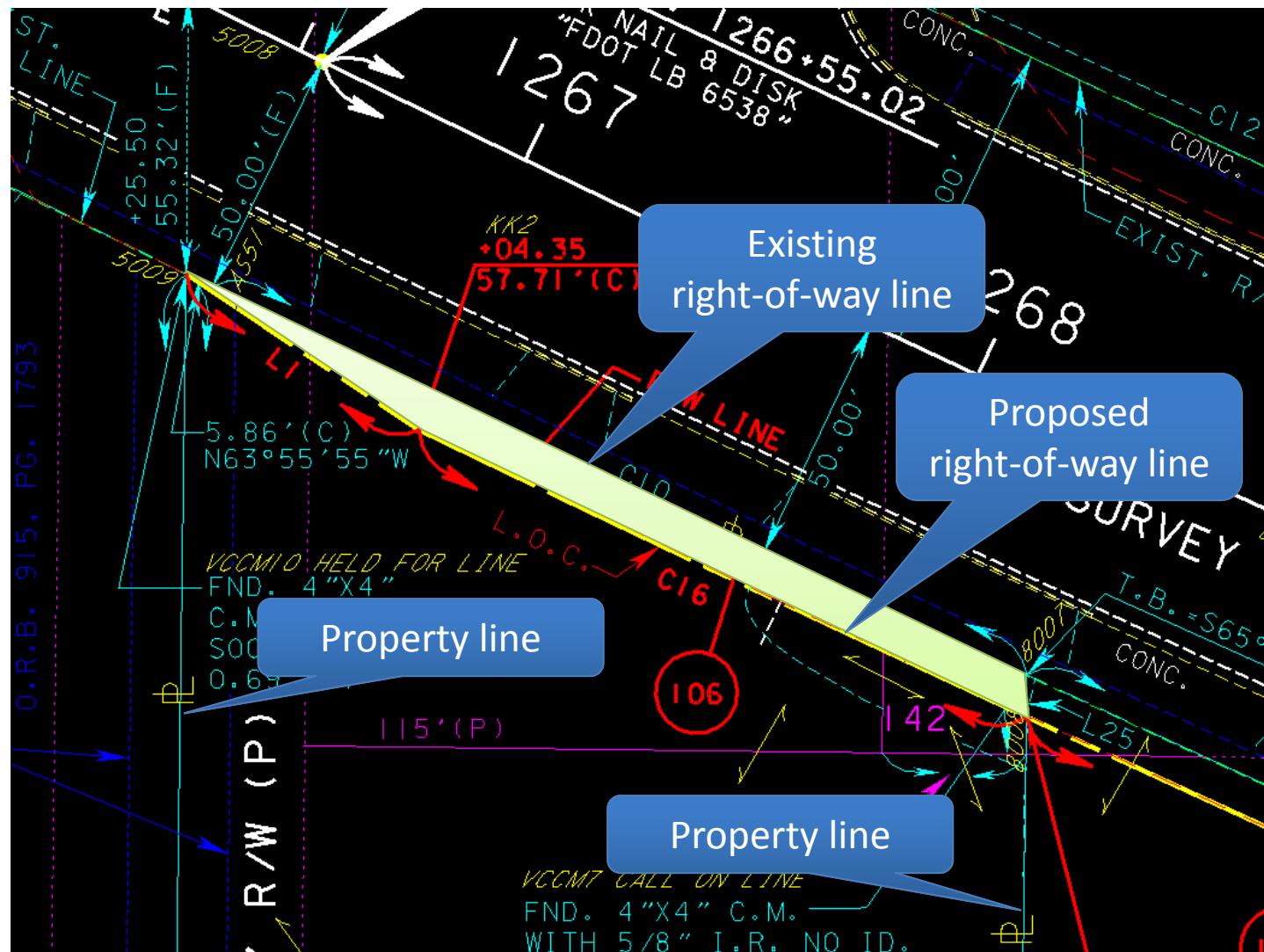
Parcel Features



Parcels in MicroStation



Parcels in MicroStation



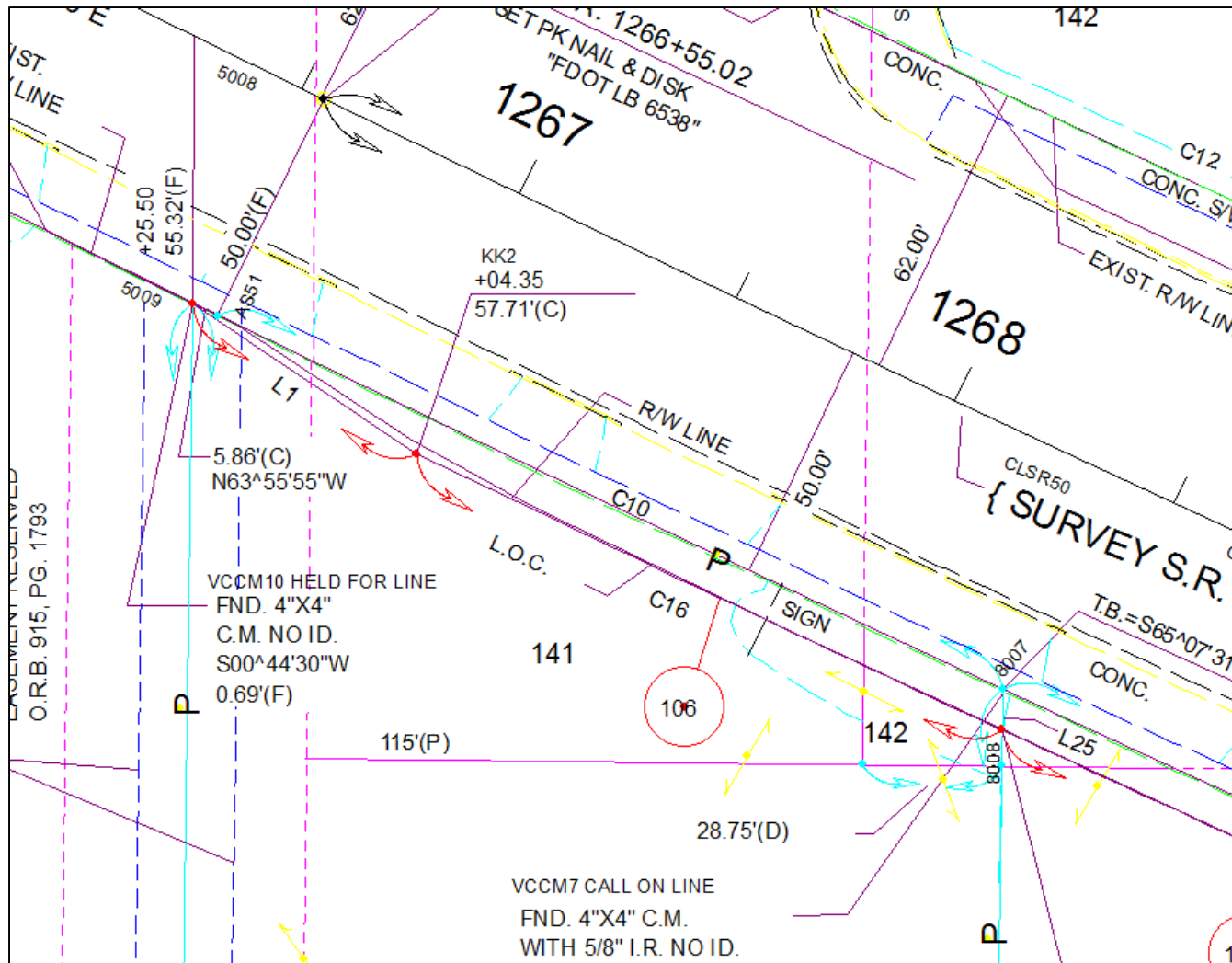
Slide 21

CAQ2

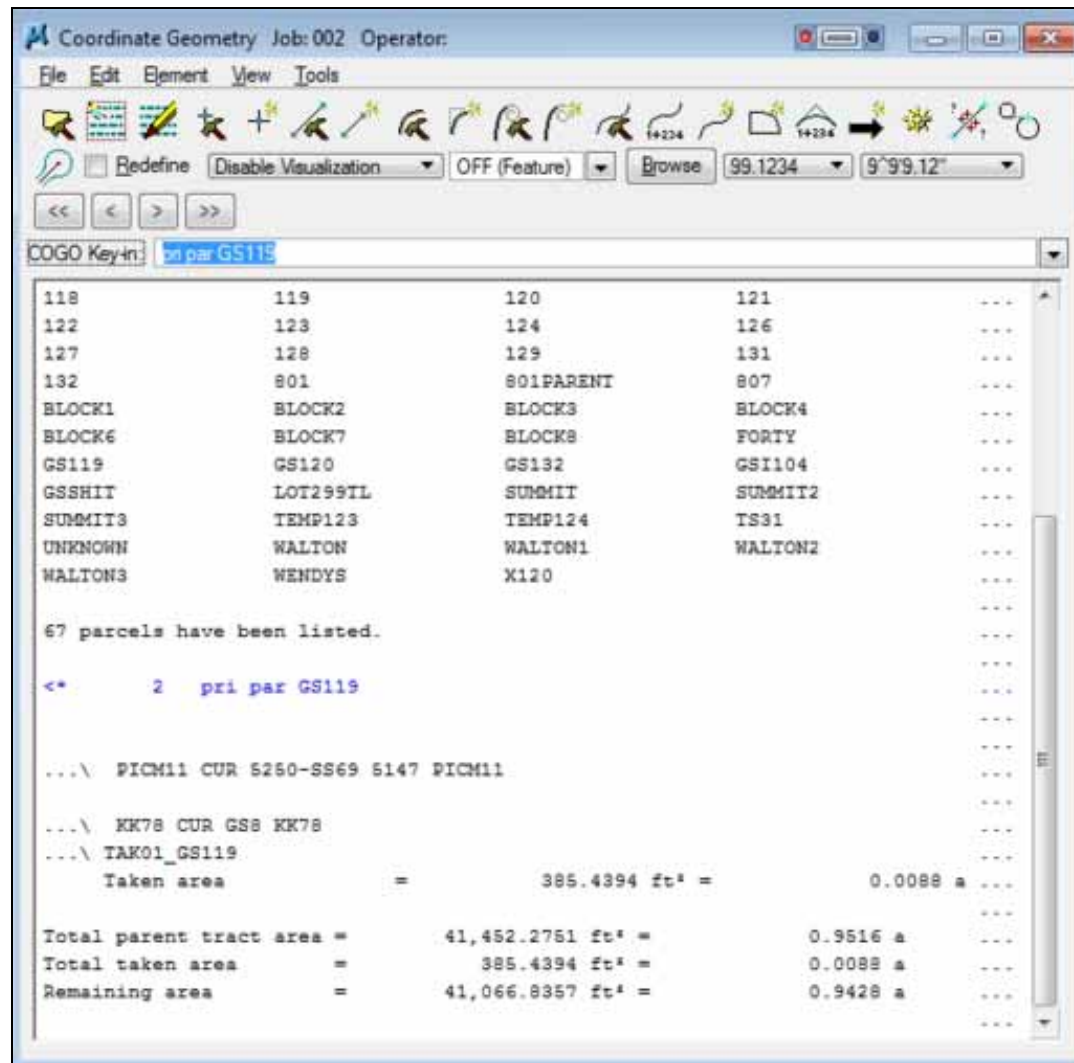
See previous comment about "Taking Line" versus "Proposed right-of-way line"

Quiroga, Cesar, 2/23/2013

MicroStation Import in ArcGIS



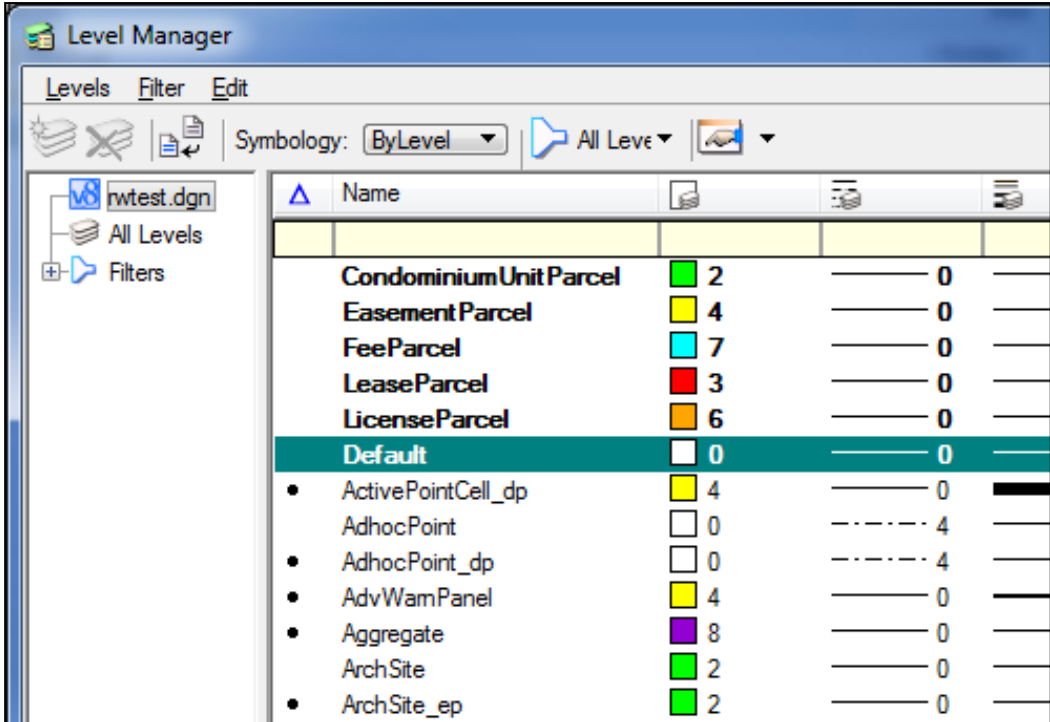
Parcel Data in GEOPAK



Modified Design Library

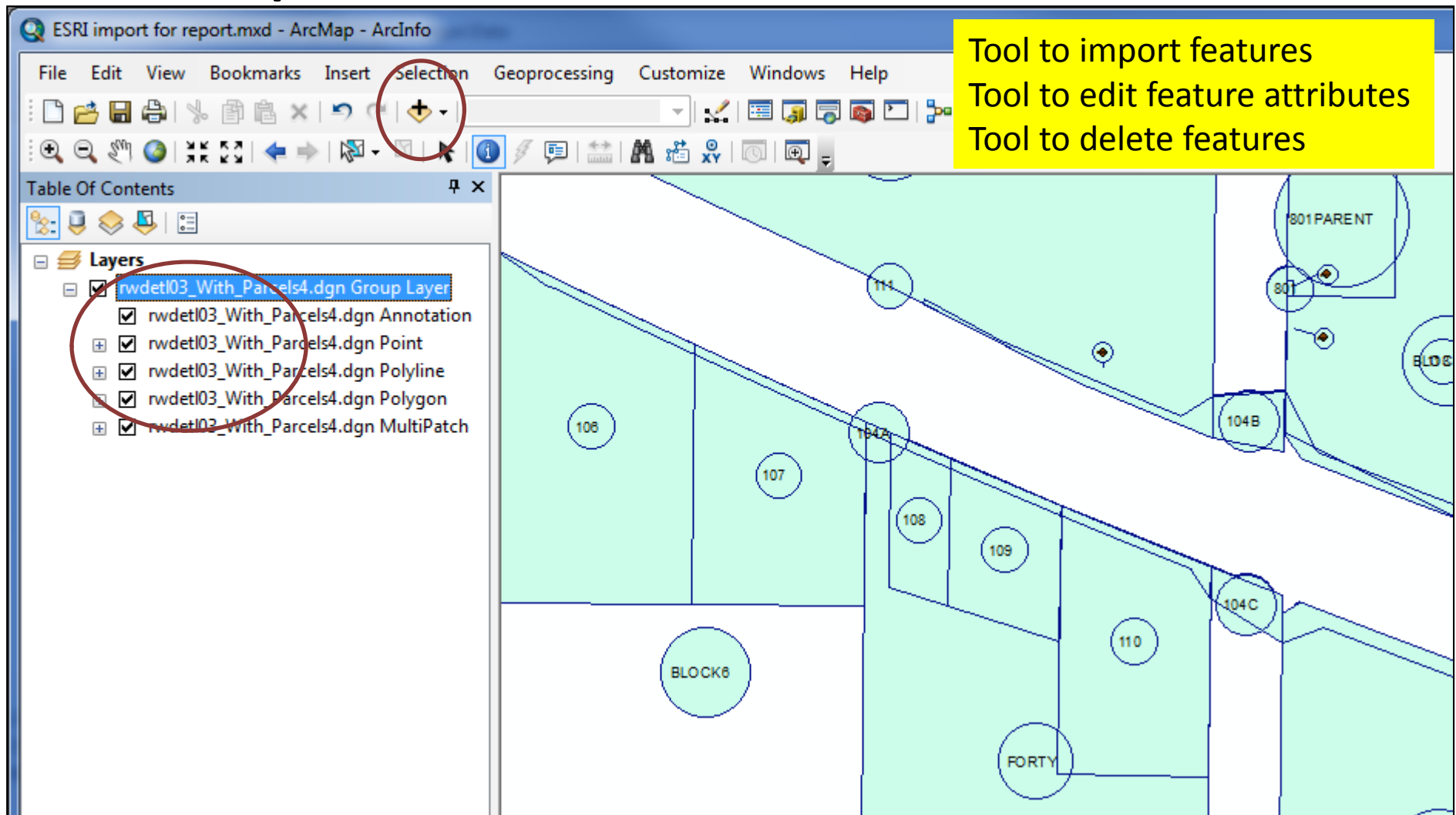
- 5 new MicroStation levels

- Fee Parcel
- Easement Parcel
- Lease Parcel
- License Parcel
- Condominium Unit Parcel



Name	Color	Number	Line Style	Line Weight
CondominiumUnitParcel	Green	2	———	0
EasementParcel	Yellow	4	———	0
FeeParcel	Cyan	7	———	0
LeaseParcel	Red	3	———	0
LicenseParcel	Orange	6	———	0
Default	White	0	———	0
• ActivePointCell_dp	Yellow	4	———	0
• AdhocPoint	White	0	----	4
• AdhocPoint_dp	White	0	----	4
• AdvWarnPanel	Yellow	4	———	0
• Aggregate	Purple	8	———	0
• ArchSite	Green	2	———	0
• ArchSite_ep	Green	2	———	0

Import MicroStation to ArcGIS



Case Studies

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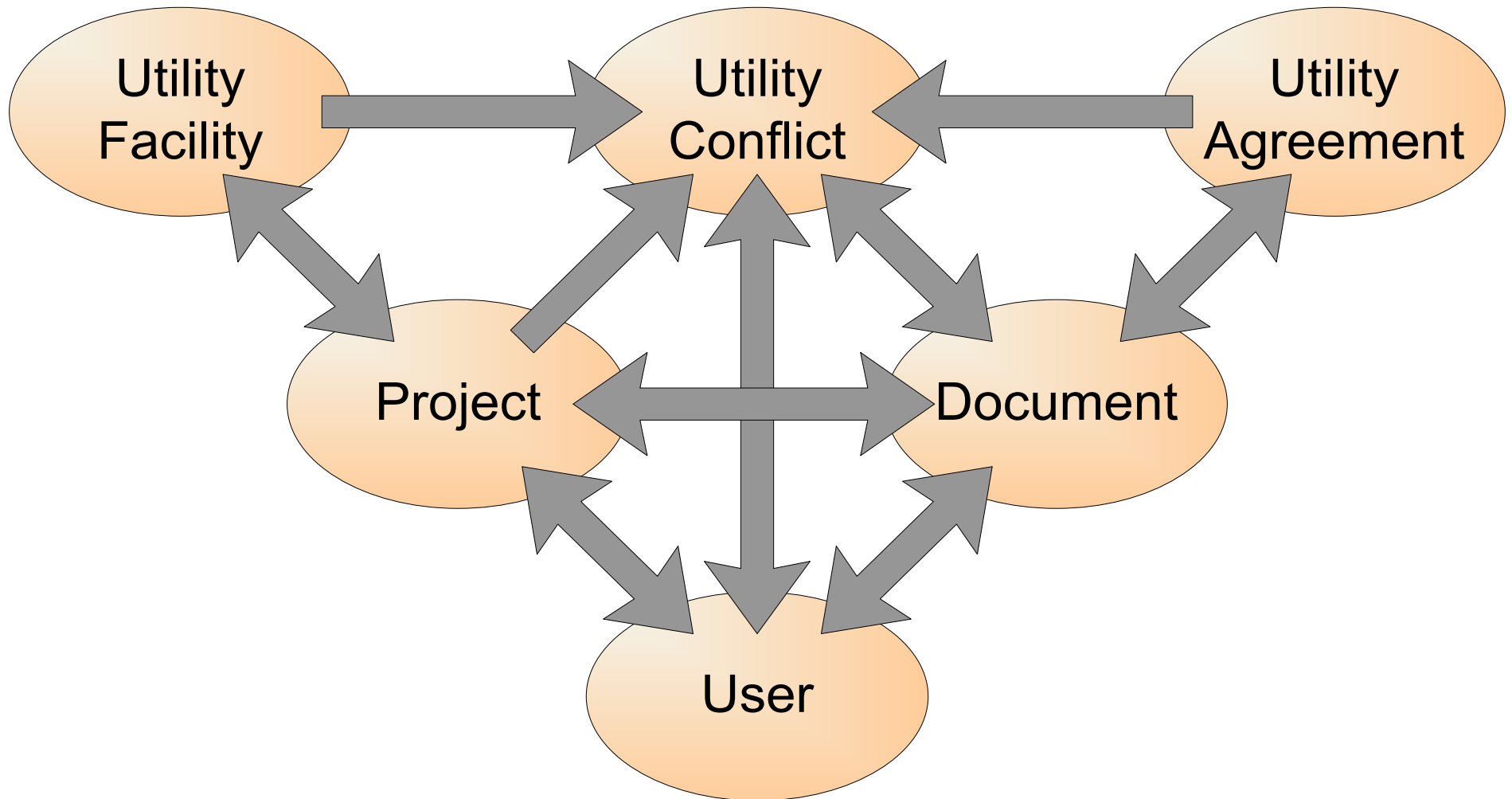
SHRP 2 R15B/R15C Products

- Product 1: Compact, standalone utility conflict matrix (UCM)
- Product 2: Utility conflict data model and database
- Product 3: One-day UCM training course

Product 1: Utility Conflict Matrix

[illegible]

Product 2: Data Model and Database



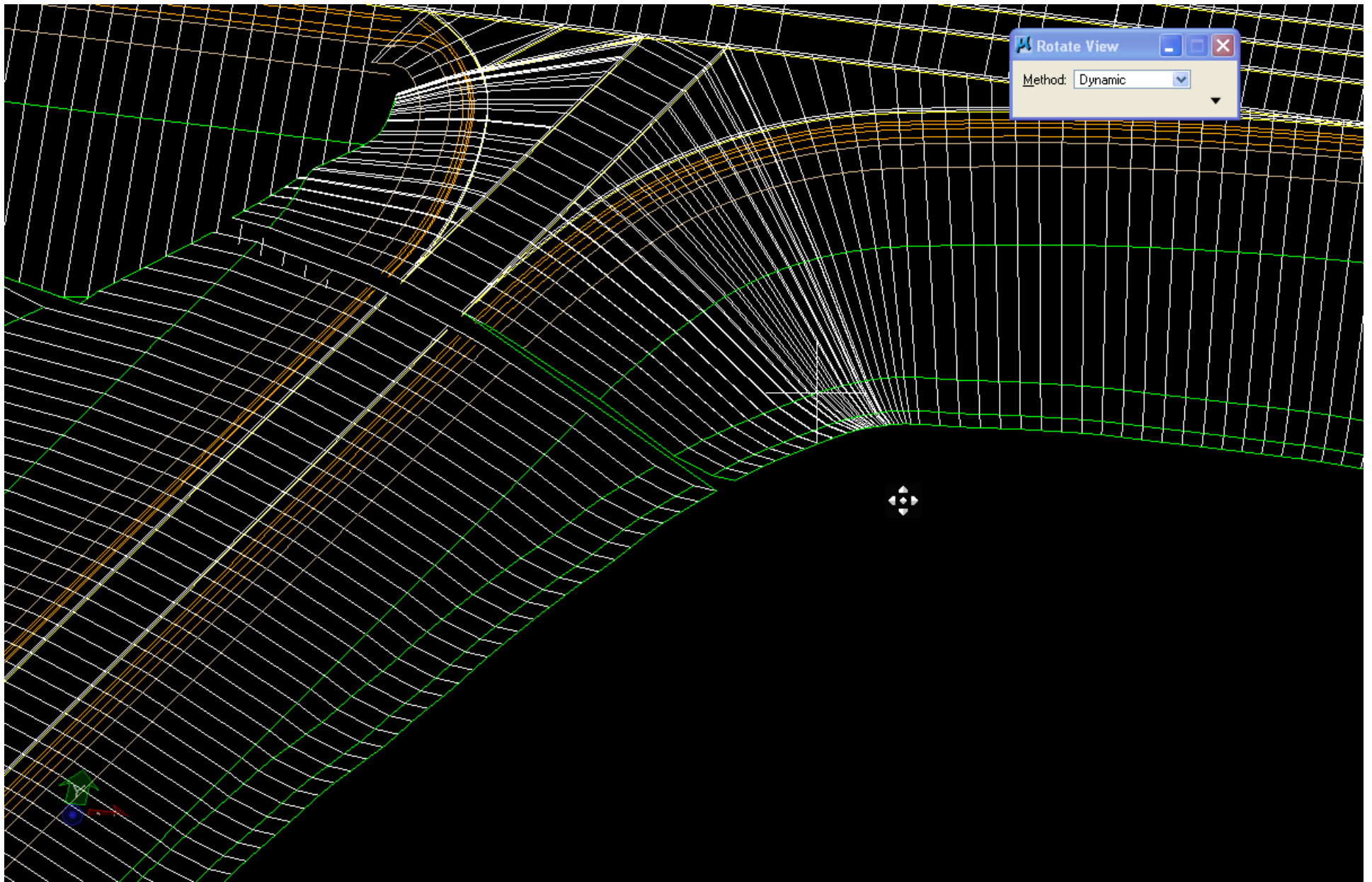


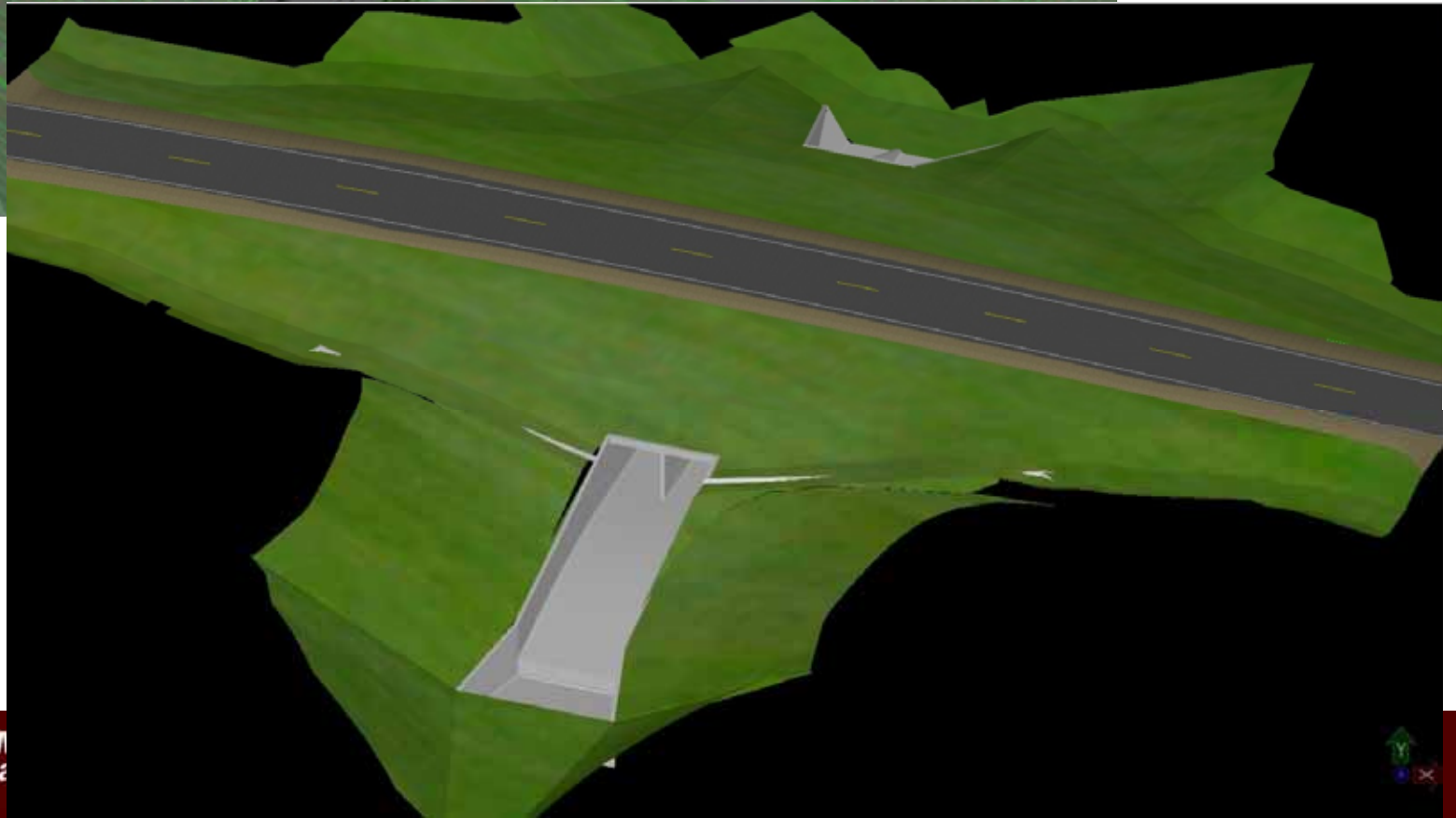
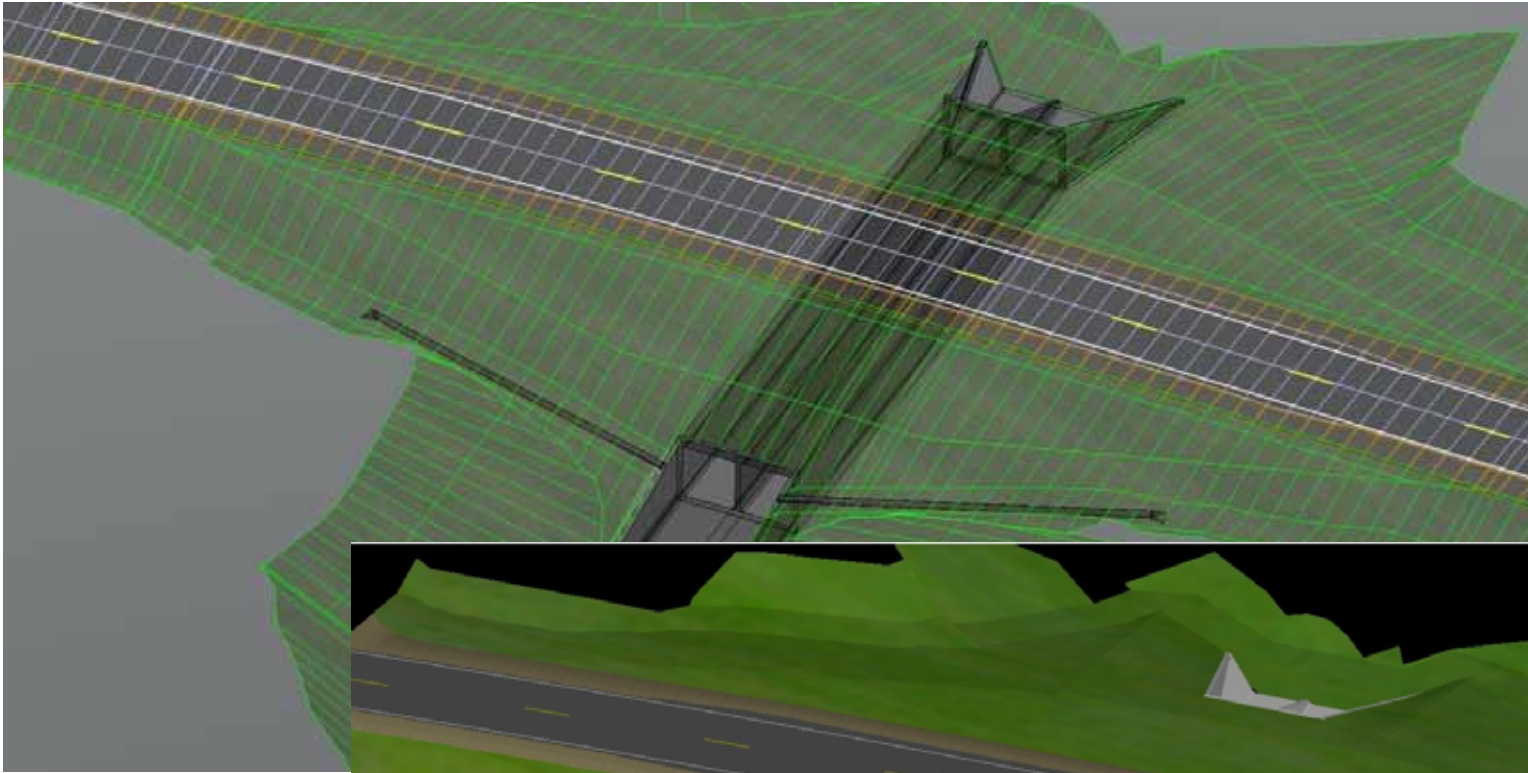
MD 32 Project Lessons Learned

- Avoided \$500,000 gas line relocation, resolved utility conflicts by changing drainage design
- 4-6 months time savings
- Changed construction sequencing, avoiding other conflicts
- Improved working relationship with utility owners, creating goodwill for future projects
- UCM challenged designers to think out of the box, facilitated teamwork
 - Made designers aware of utility issues on the project
 - Helped utility coordinators understand design process better
 - Brought district staff closer together

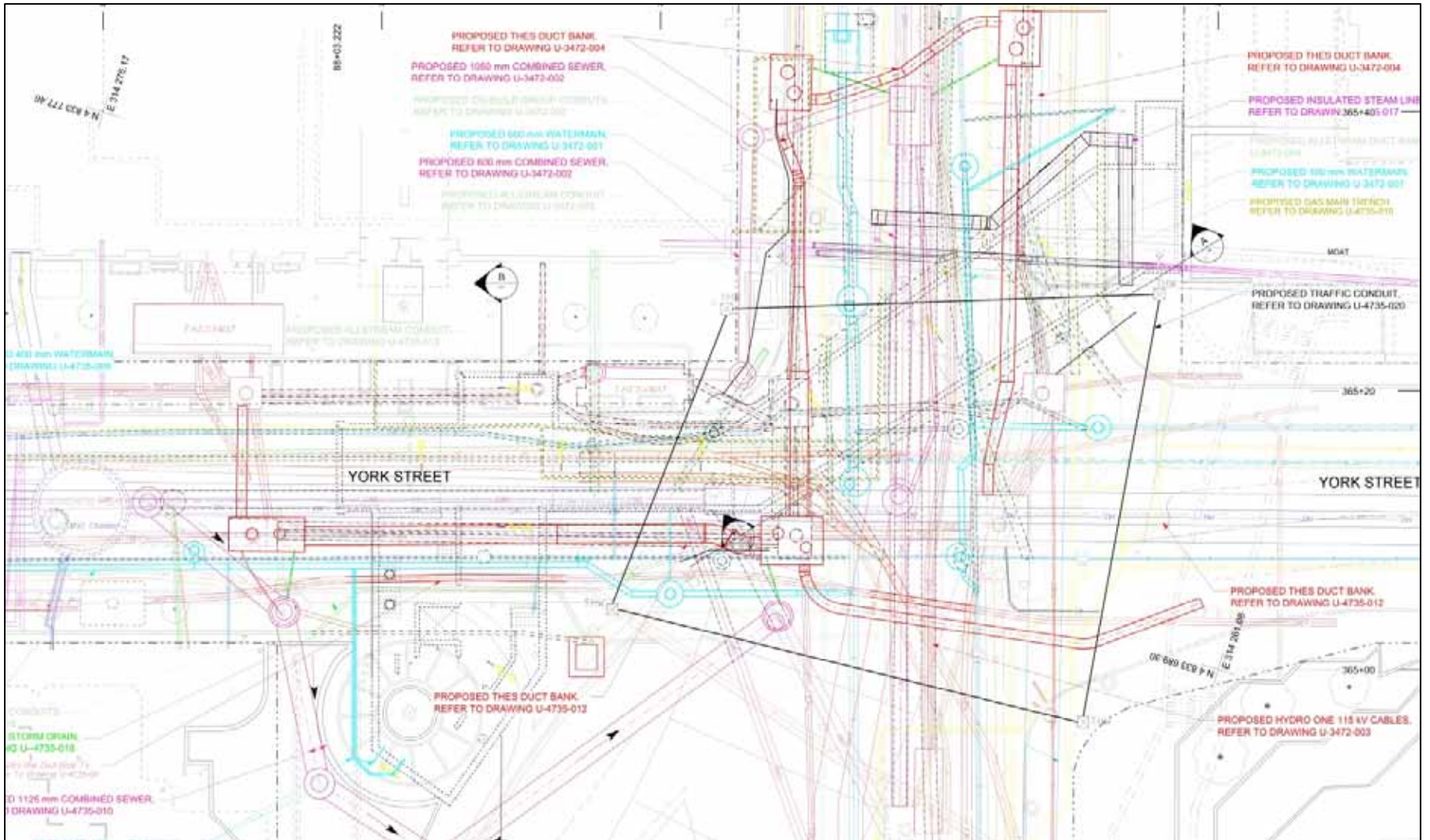
Case Studies

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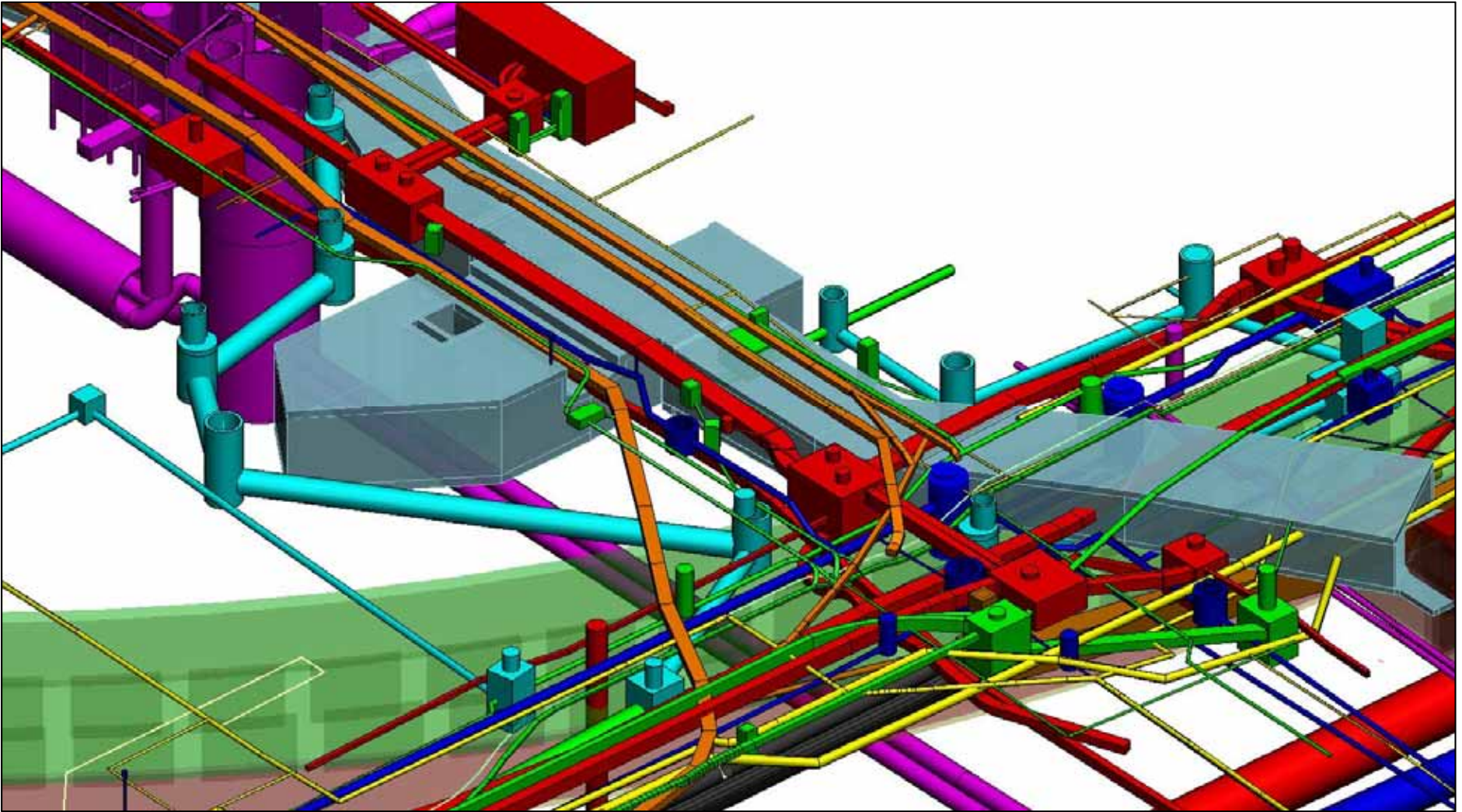




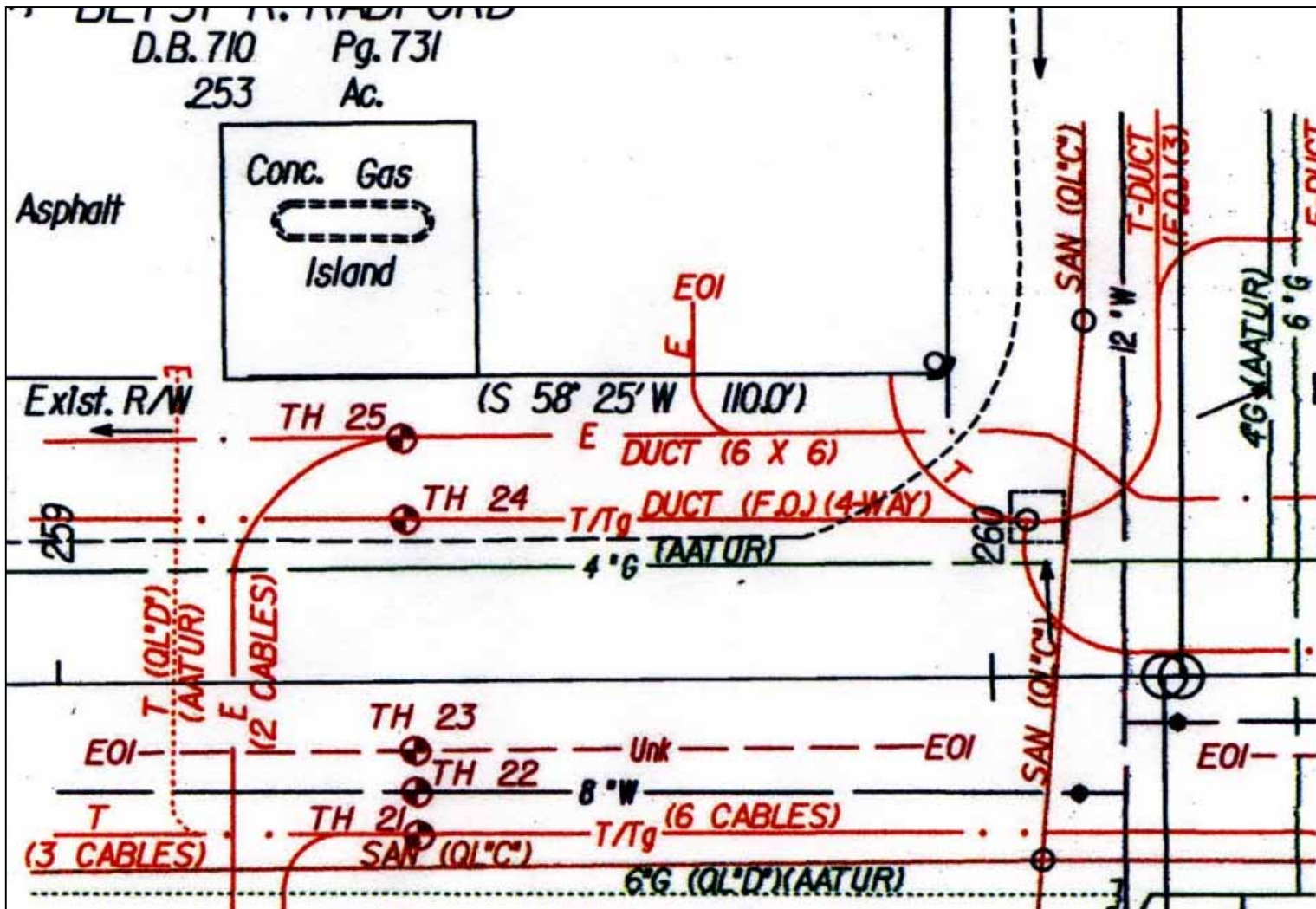
Traditional 2D Plan View



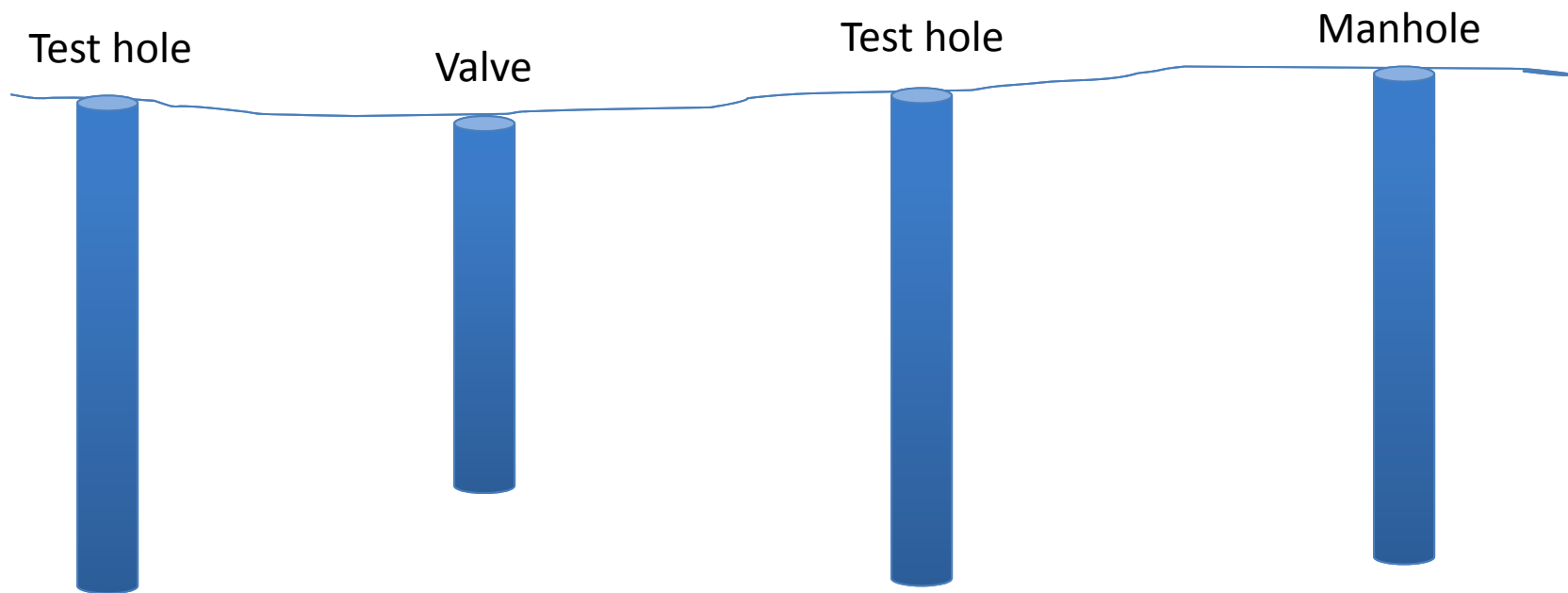
3D Model Including Utilities



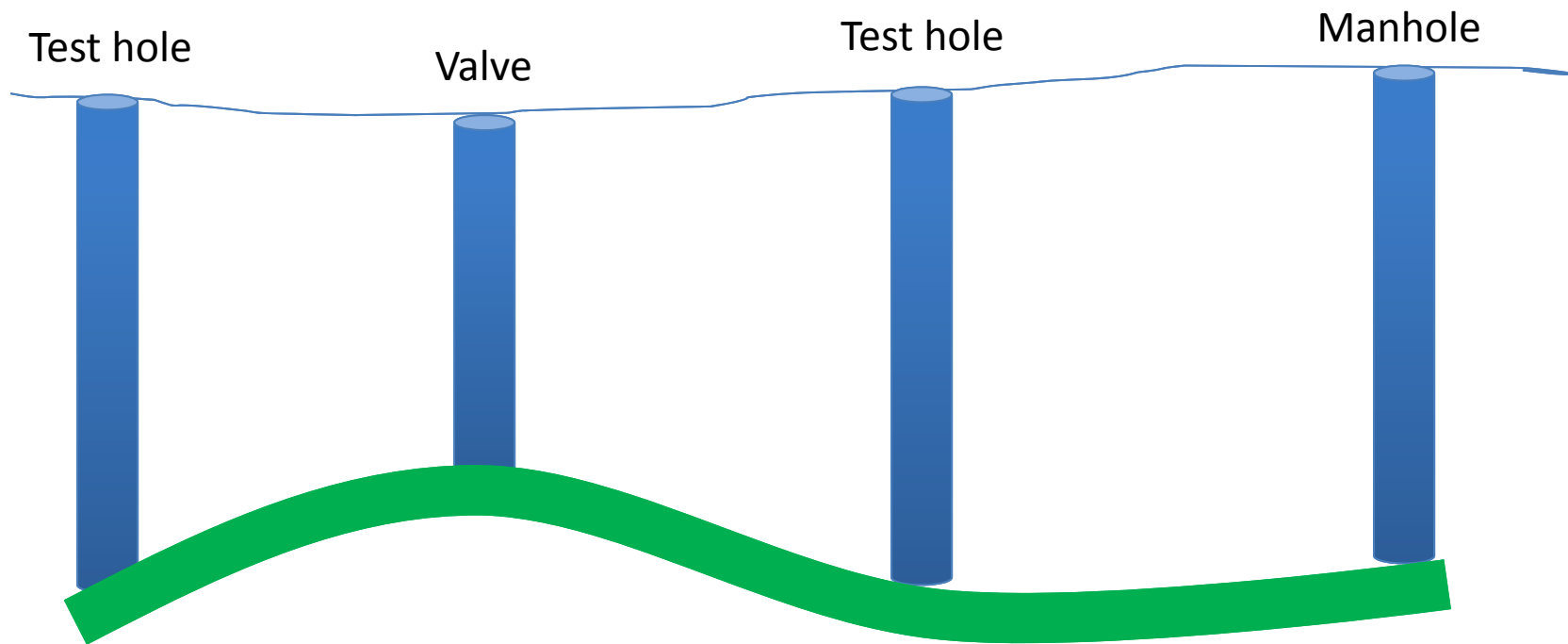
QLB and QLA Utility Investigation



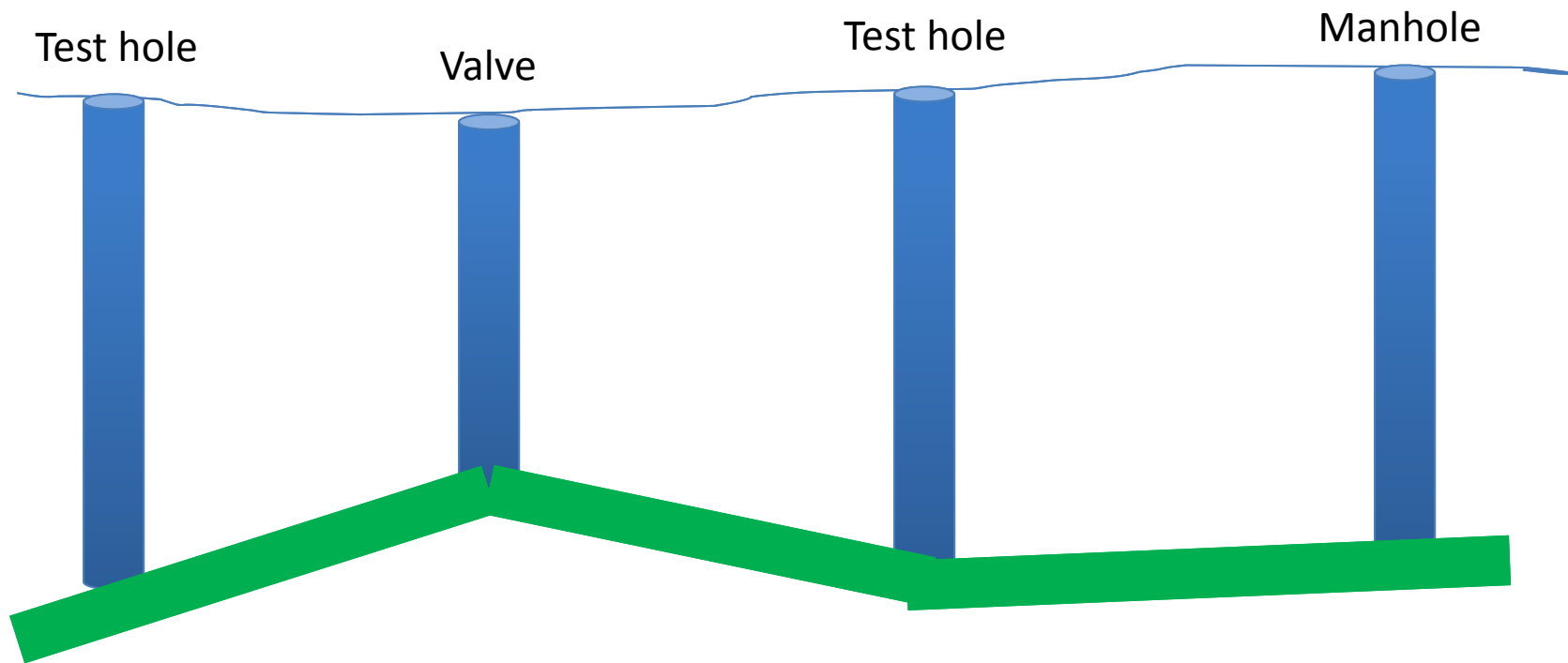
Locations with QLA Data



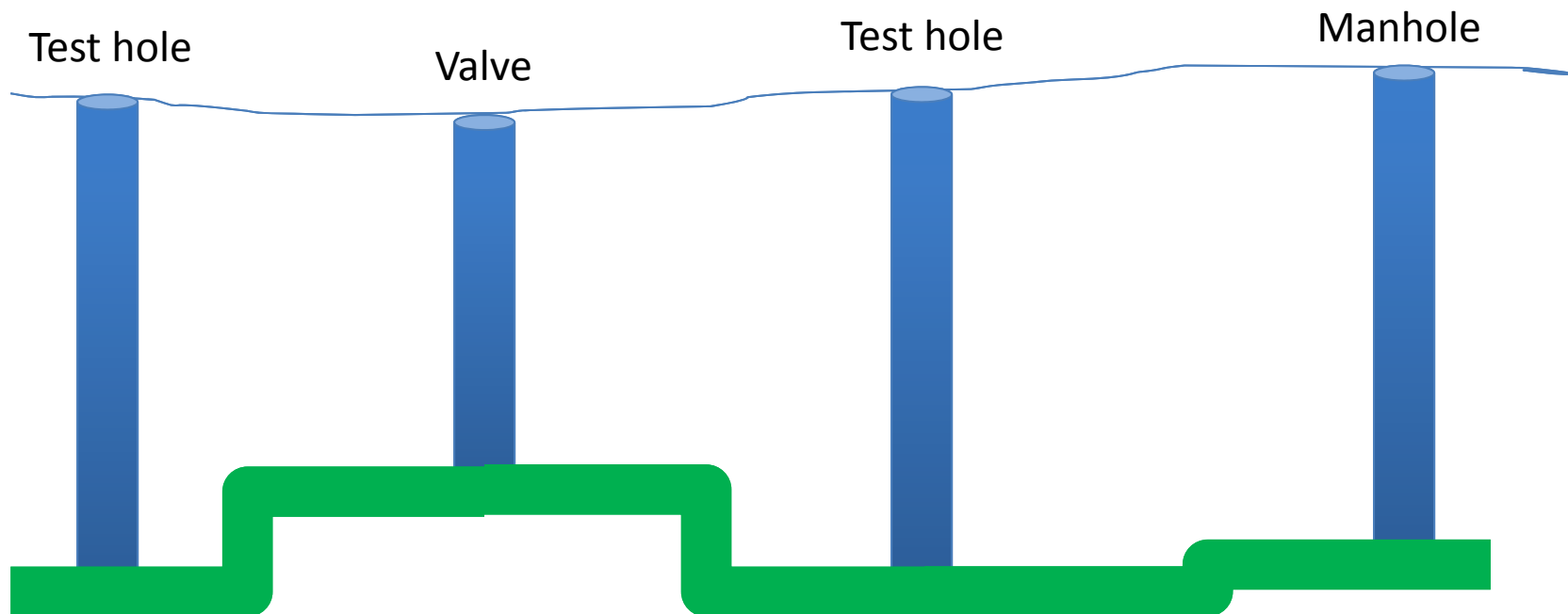
Assumed Curved Pipe Alignment



Assumed Straight Pipe Alignment



Assumed Horizontal Interpolation



GPR and EMI Arrays

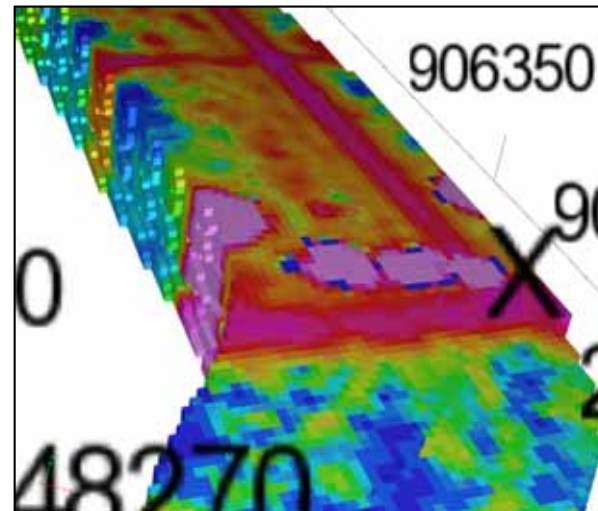
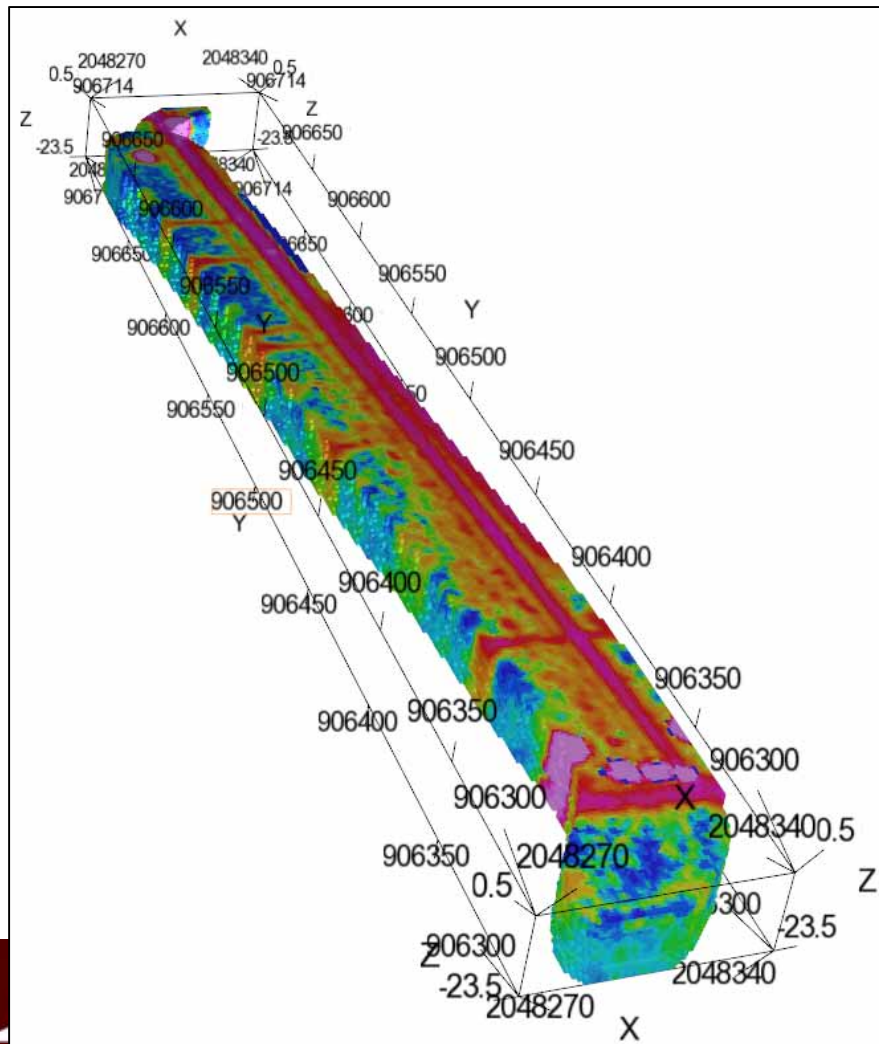
GPR array



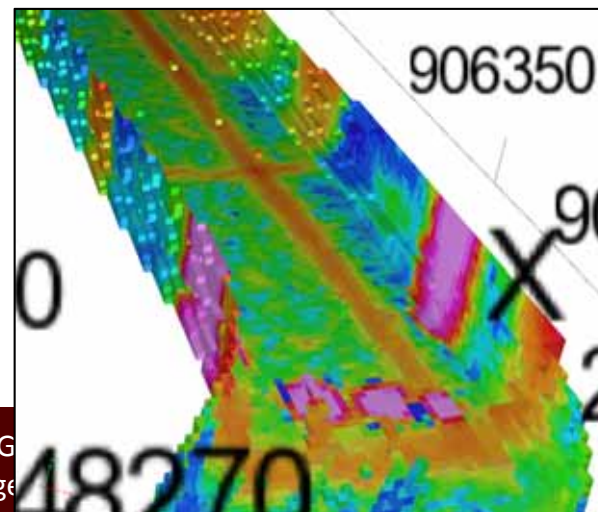
EMI array



3D Imagery – EMI Array



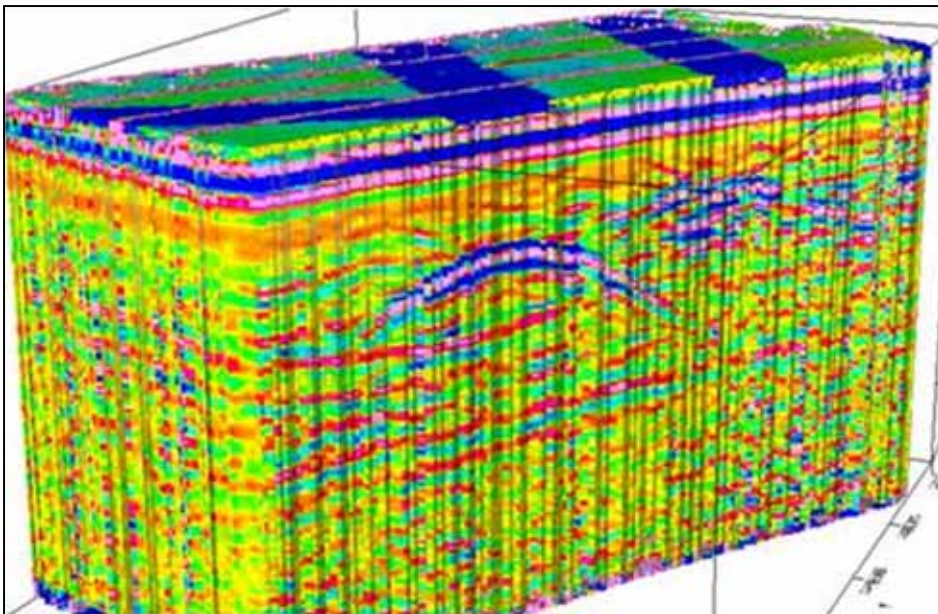
Zoomed-in
view, all
levels
shown



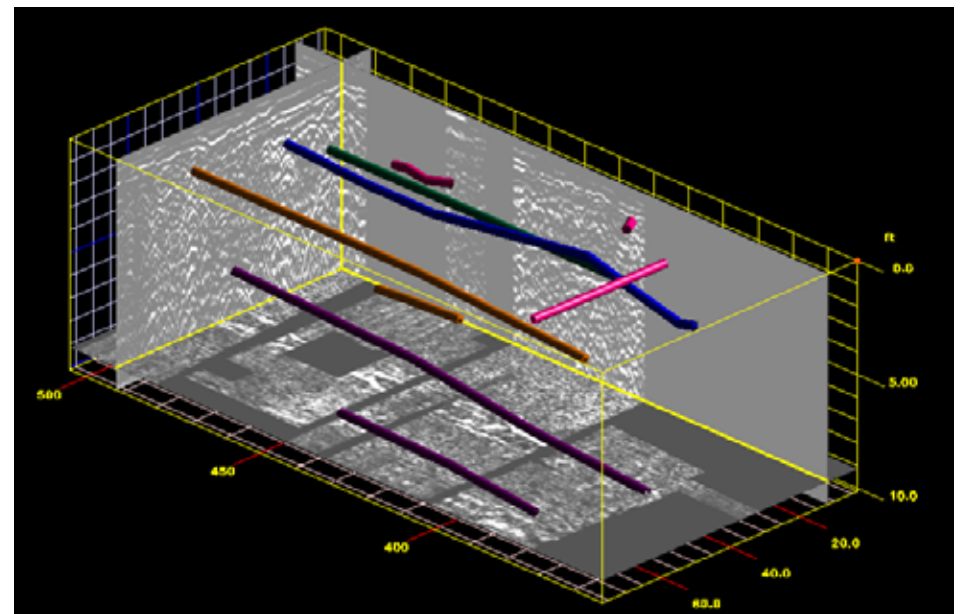
Zoomed-in
view, with
one level
hidden

3D Imagery – GPR Array

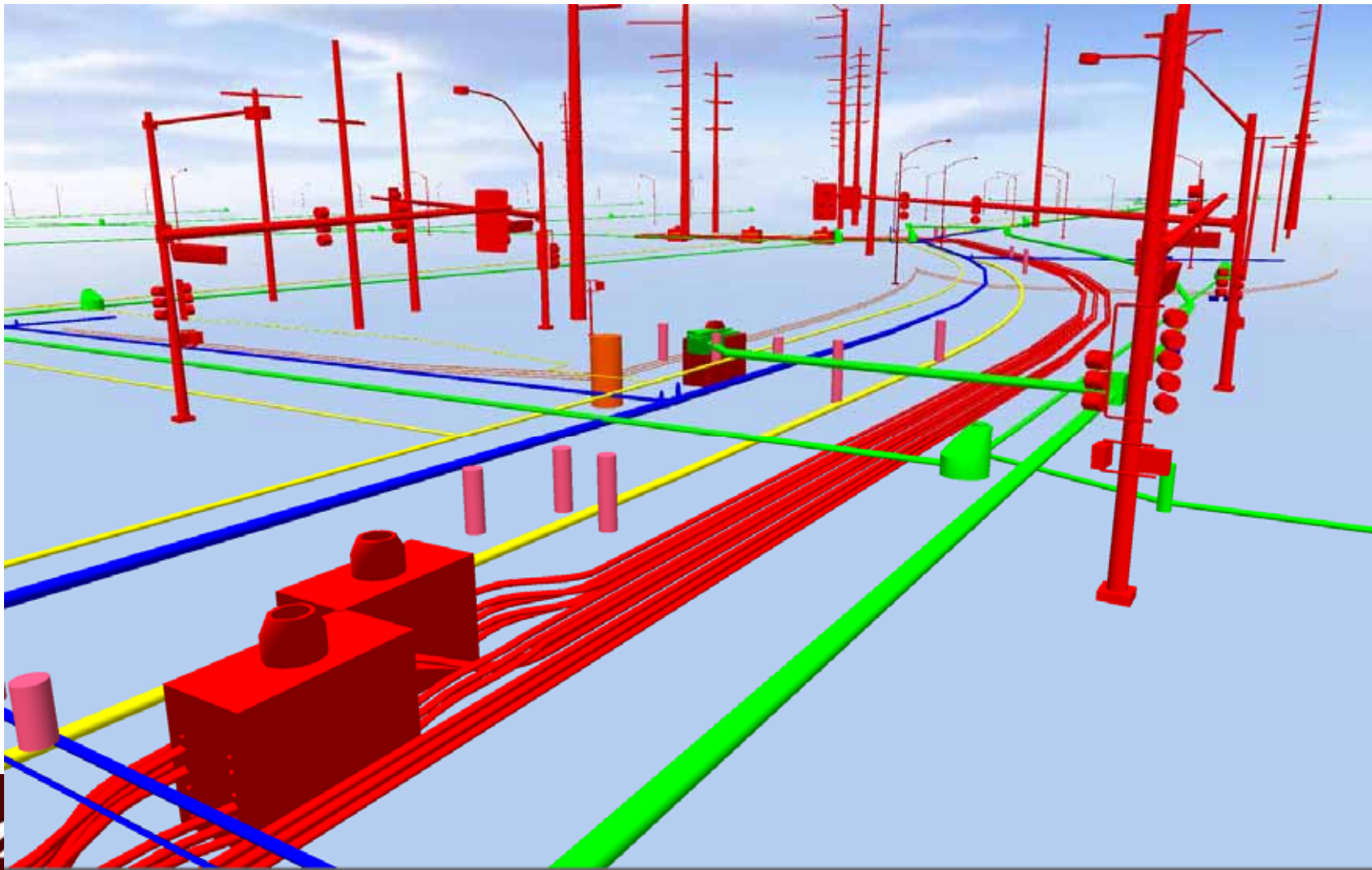
3D imagery



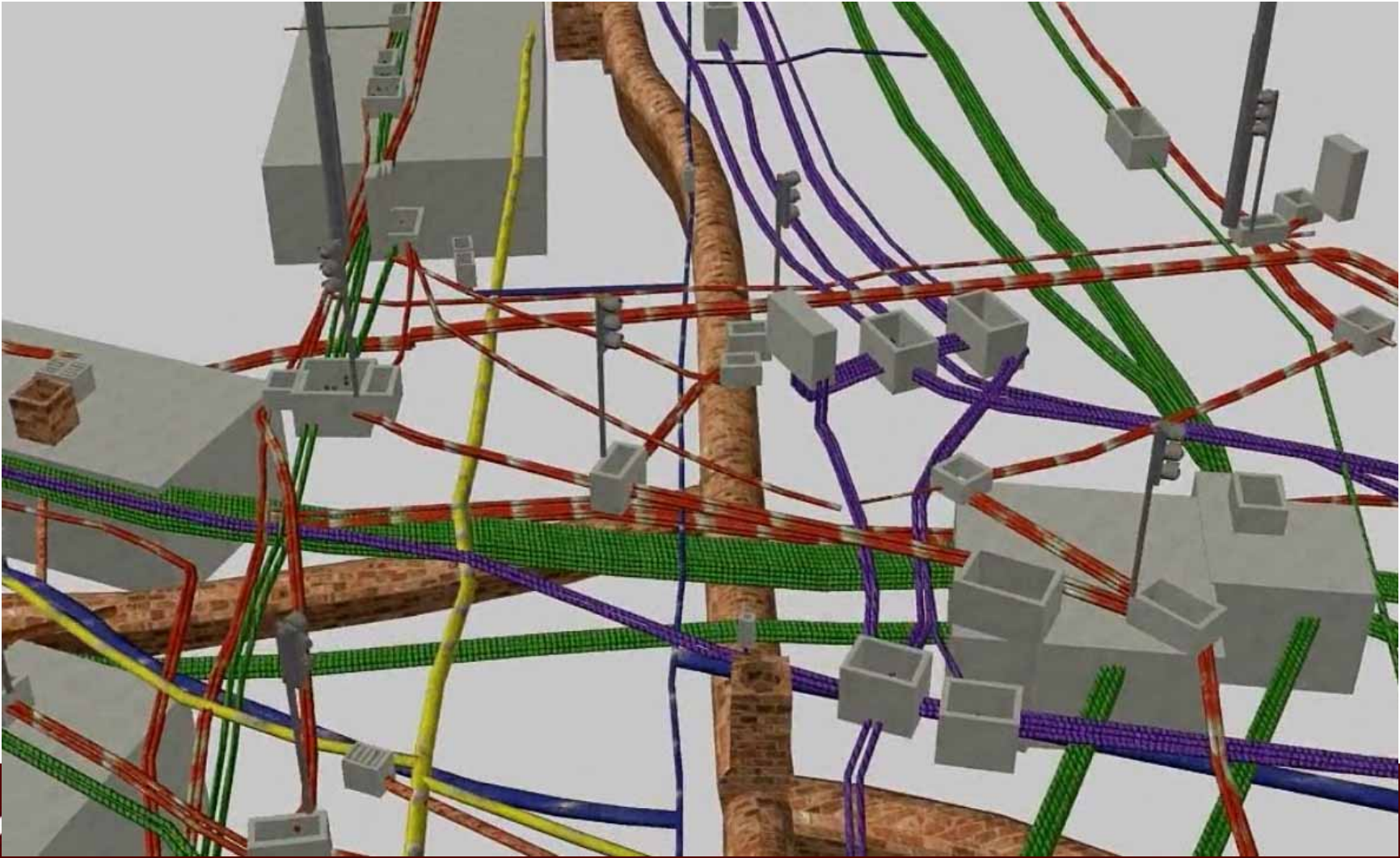
Interpreted pipe locations



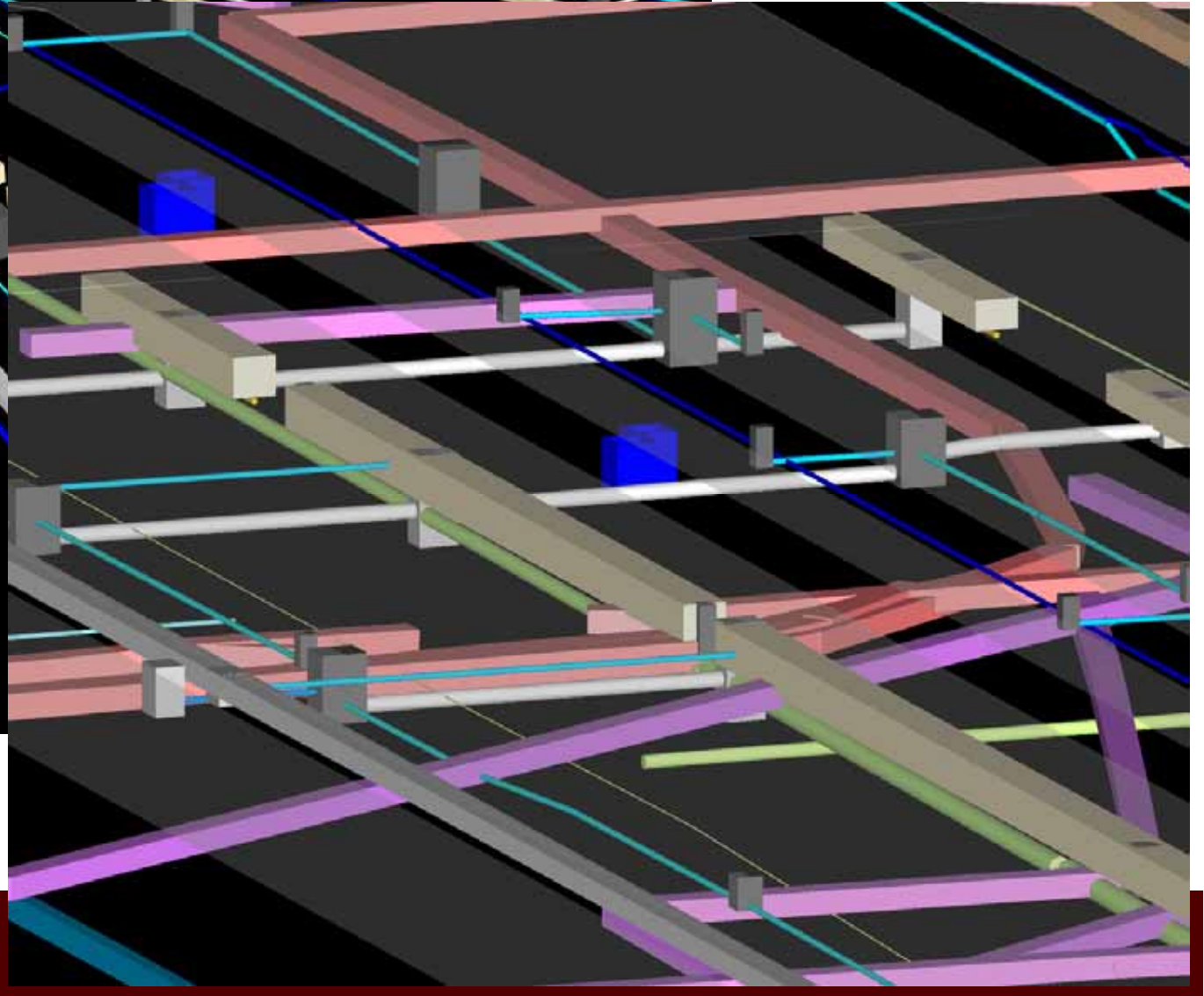
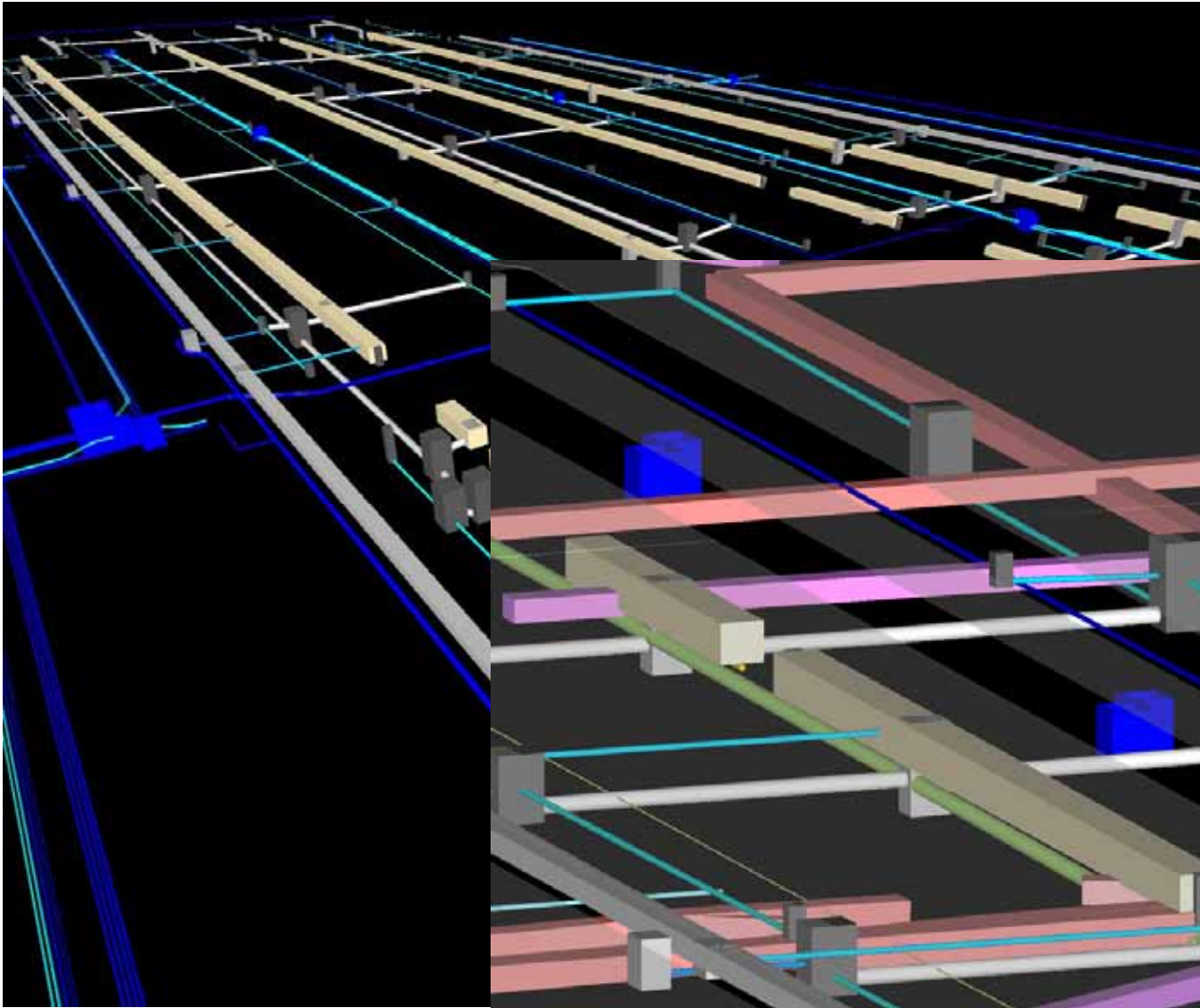
3D Model of Existing Facilities



3D Utility Visualization – Ireland



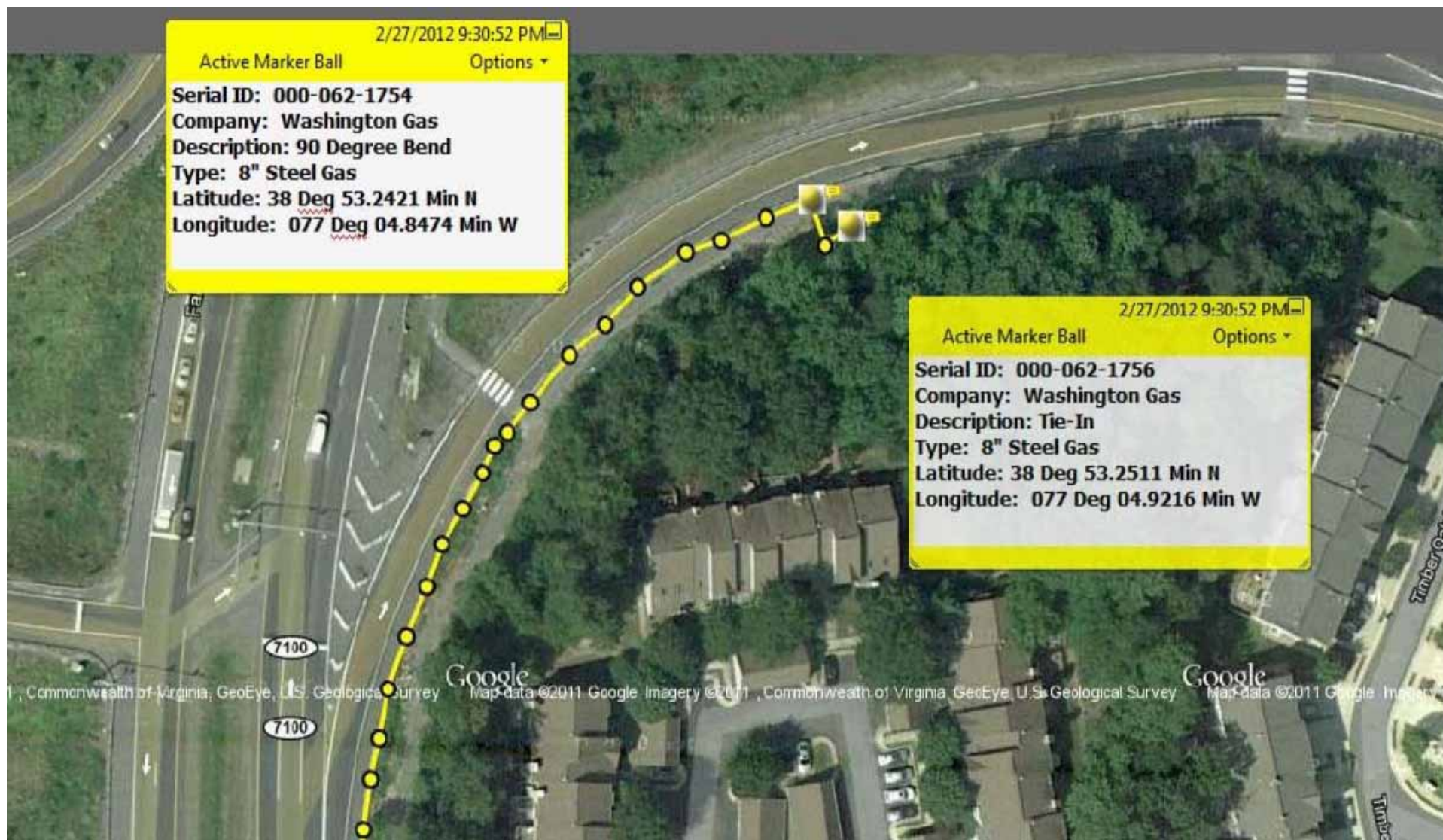


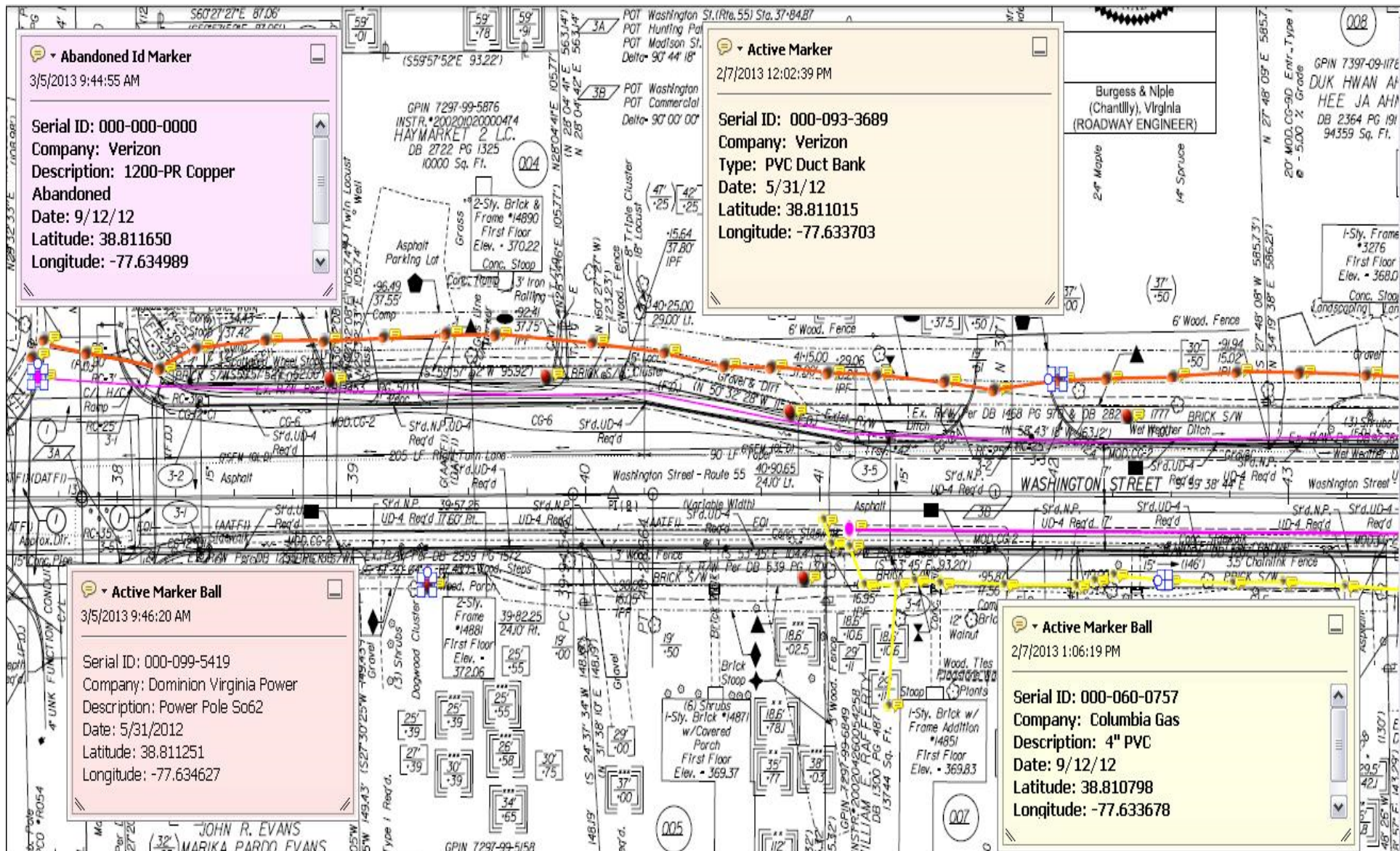


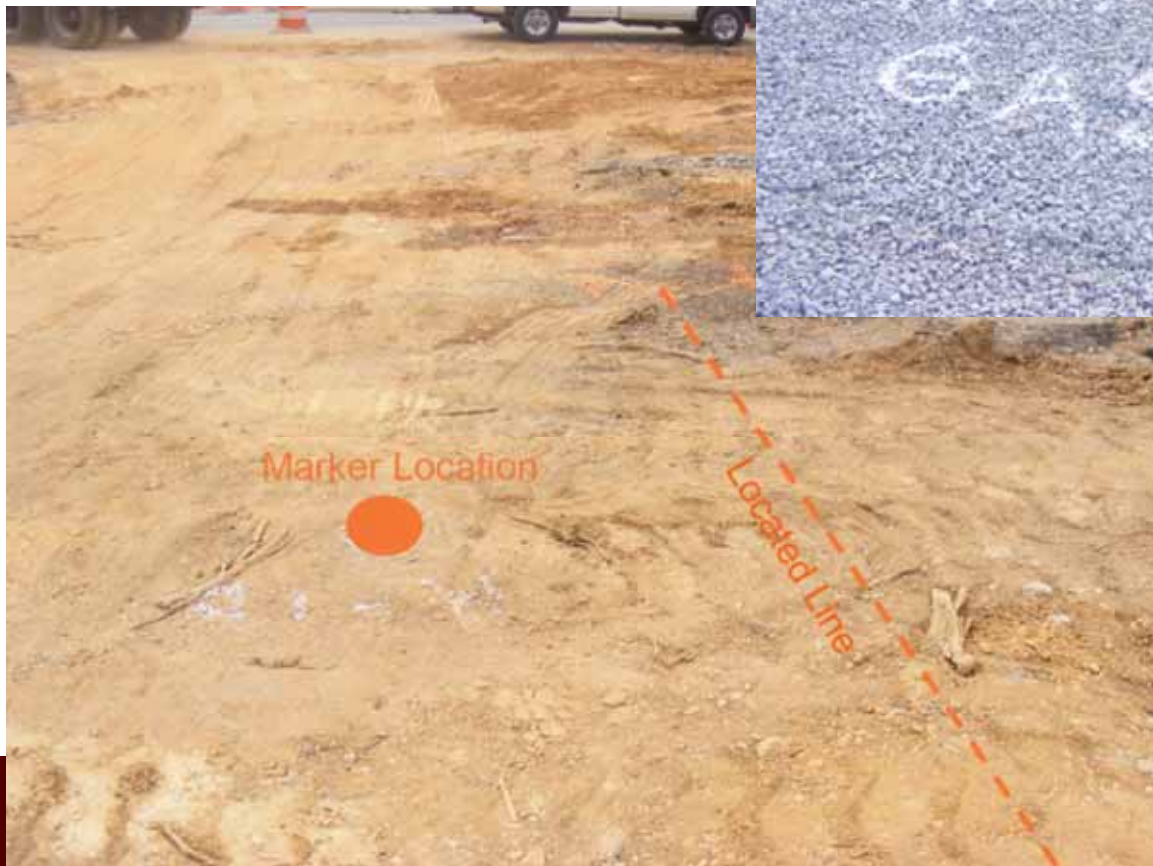
Virginia – VDOT

- RFID marker implementation:
 - Mainly at VDOT's Northern Virginia District
 - 40% of construction projects at VDOT
 - Some at Fredericksburg District
 - Purpose:
 - Damage prevention
 - Evolved to support utility asset inventory and management
 - Motivation:
 - Changes to utility installations after initial QLB investigation
 - Changes to VDOT's own underground installations









Virginia – VDOT

- Average installation cost:
 - \$16.22/marker
 - \$0.65/foot of utility marked (1 RFID marker every 25 feet)
- Impact on utility installation cost:
 - 24-inch water main: \$145/foot (cost increase: 0.45%)
 - 12-inch pipe: \$60/foot (cost increase: 1.1%)
 - 4-inch pipe: \$40/foot (cost increase: 1.6%)

Thank You!

- Cesar Quiroga
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