

Safety starts with (SUE) Subsurface Utility Engineering

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Safety Minute

Damage prevention is a shared responsibility

- > Engineering and SUE are the first steps of Damage Prevention



Project Challenges for Major Infrastructure Projects

Are Utilities one of the major risks to the budget / schedule / safety / success of your projects?

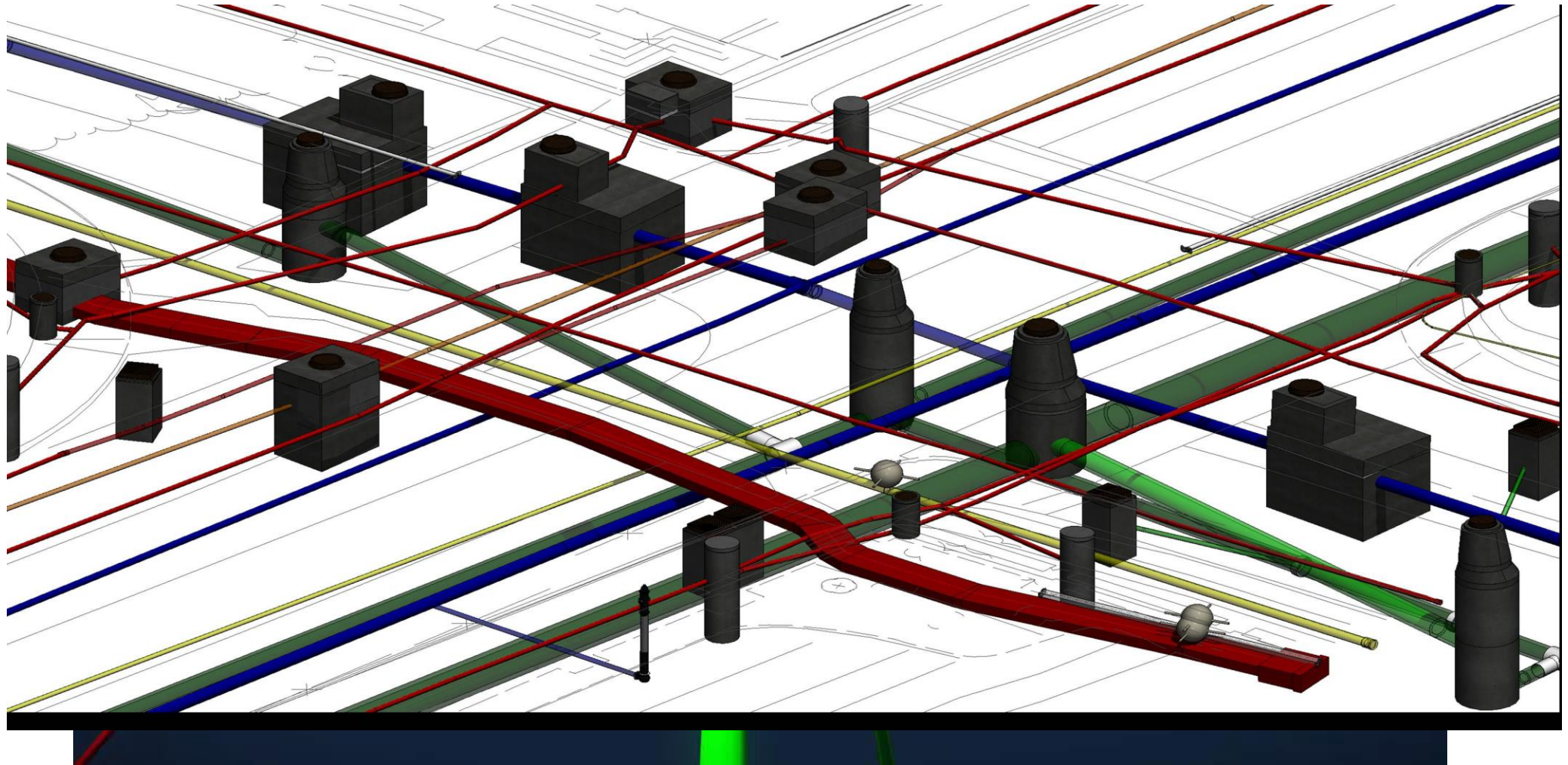


An example of same area changing over years



2011
2010

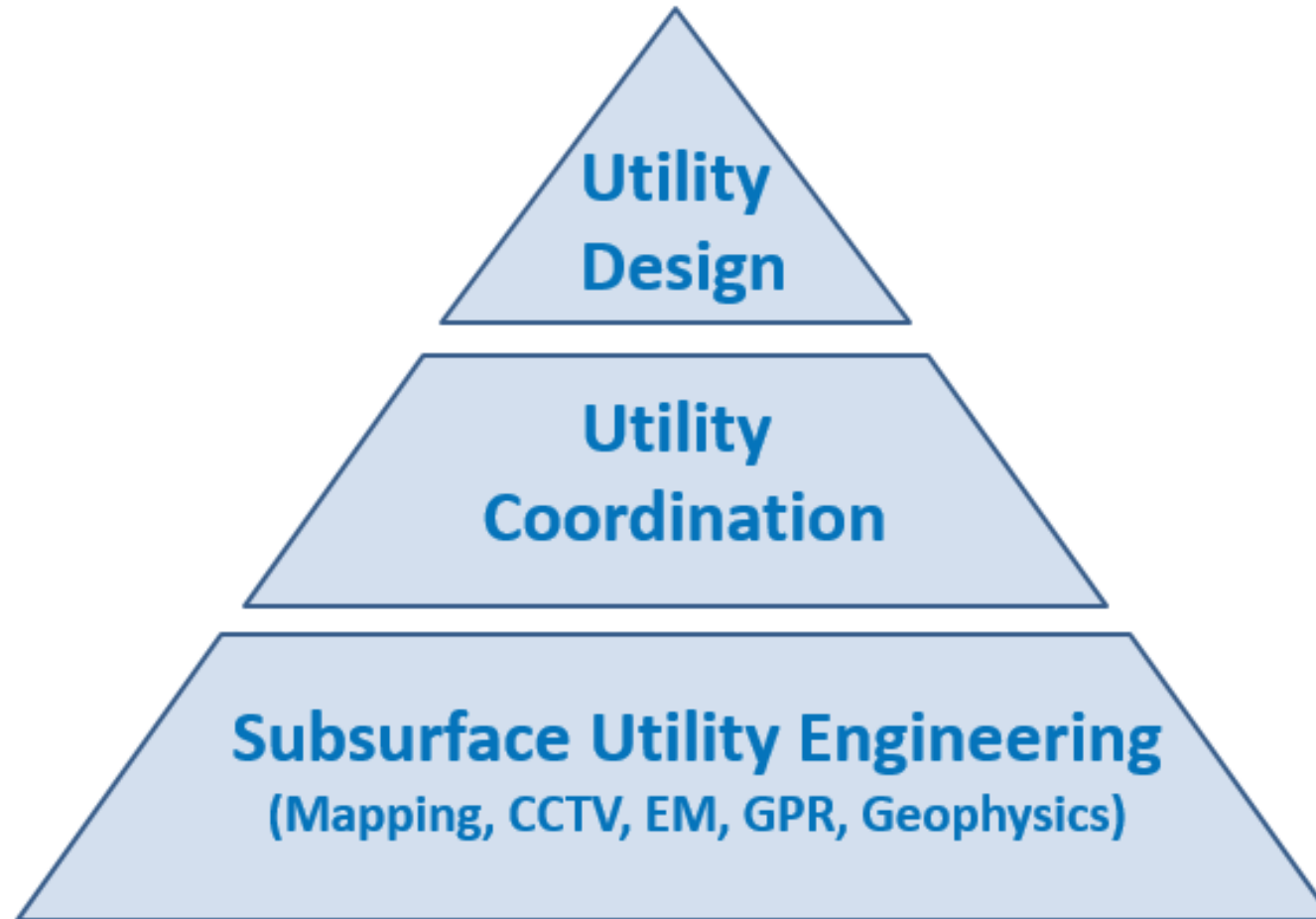
I want to design based on this! how do I get here?



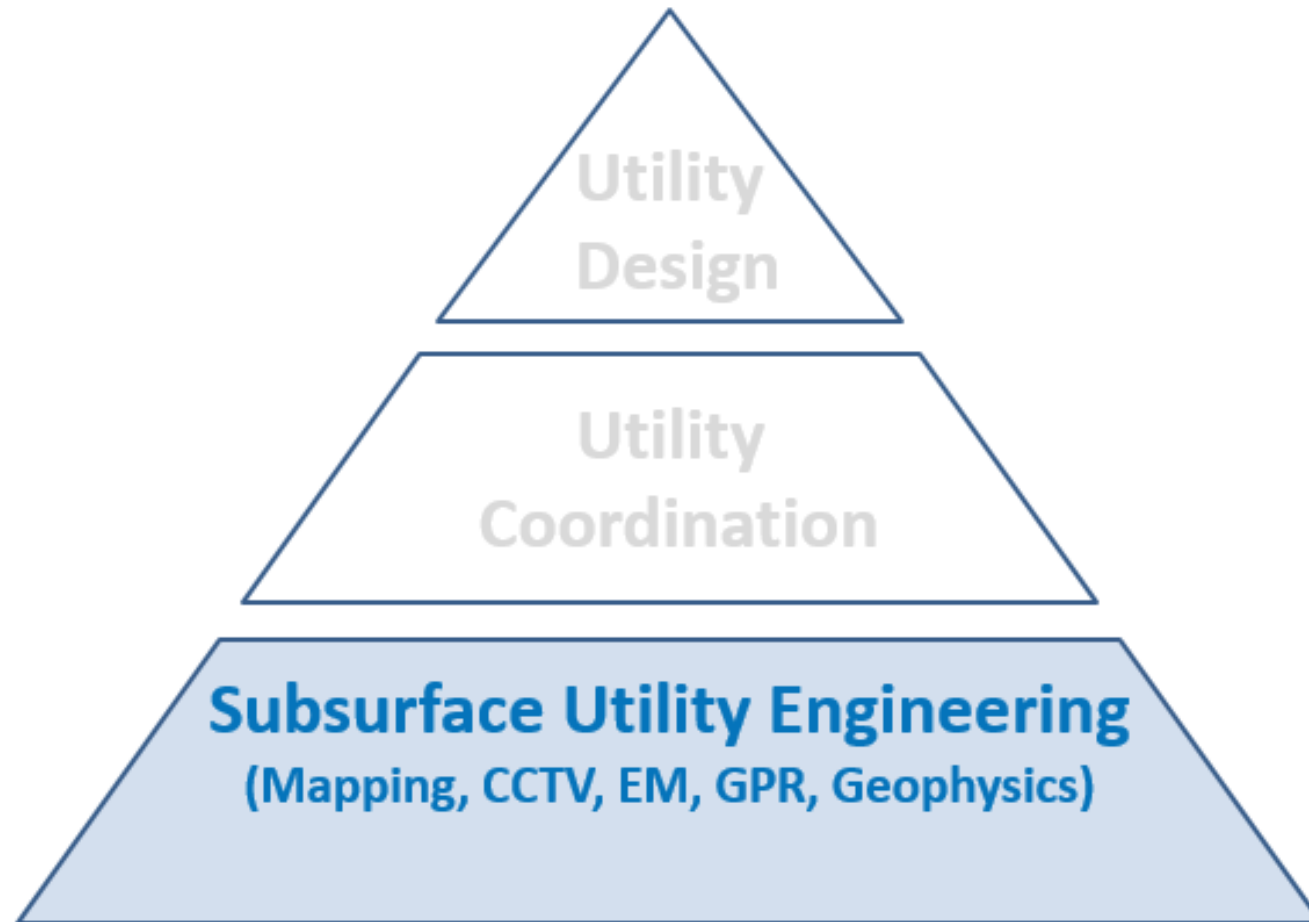
Agenda

1. Managing Utility Risks – Pyramid
2. Subsurface Utility Engineering
 - ASCE 38-02 Standard
 - Technologies
 - Deliverables
3. Call To Action

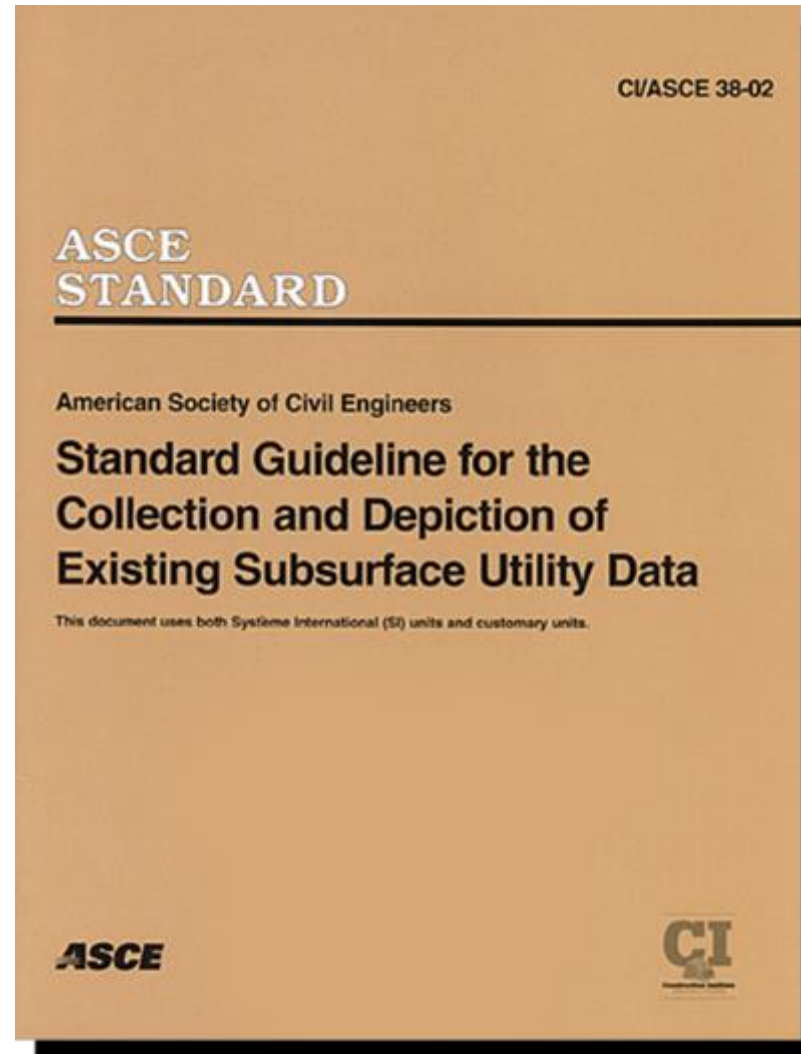
Managing Utility Risk – Utility Engineering



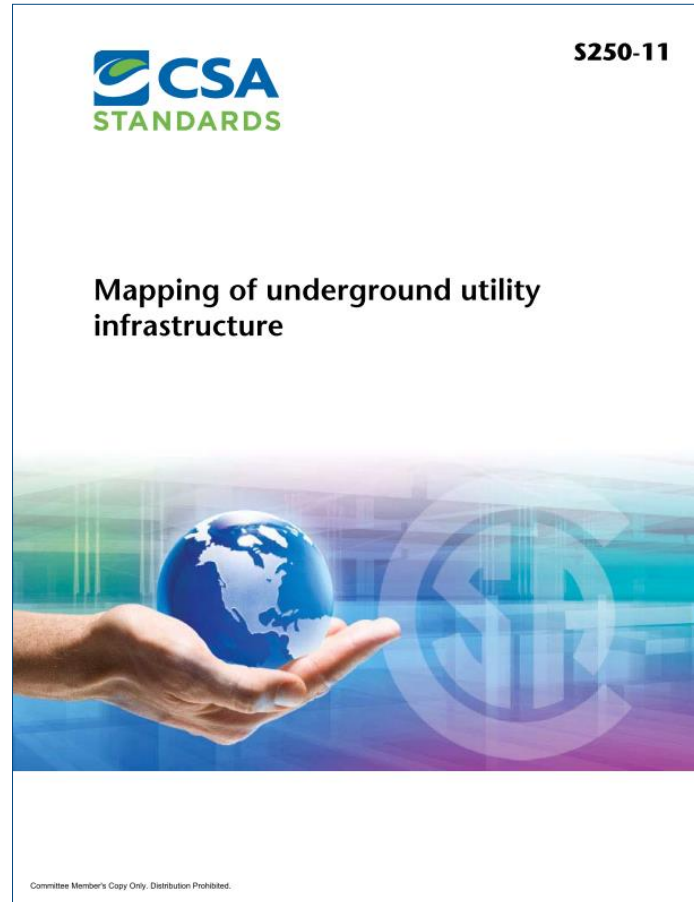
SUE – Subsurface Utility Engineering



Standards – ASCE 38-02



Canadian As Built Standard



CSA S250

SUE Quality Levels

Level A



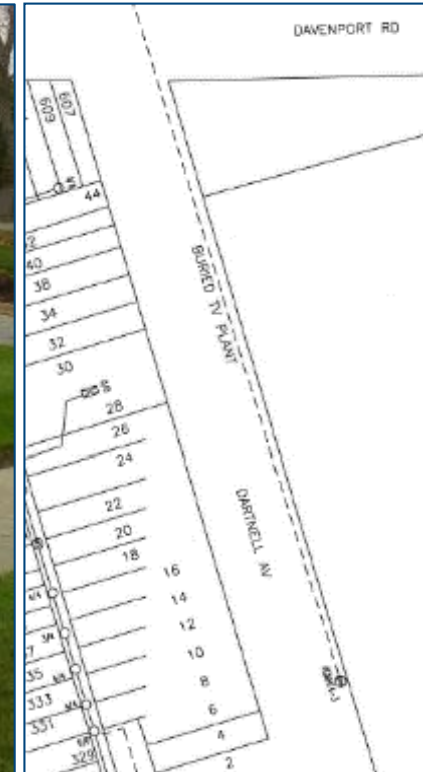
Level B



Level C



Level D



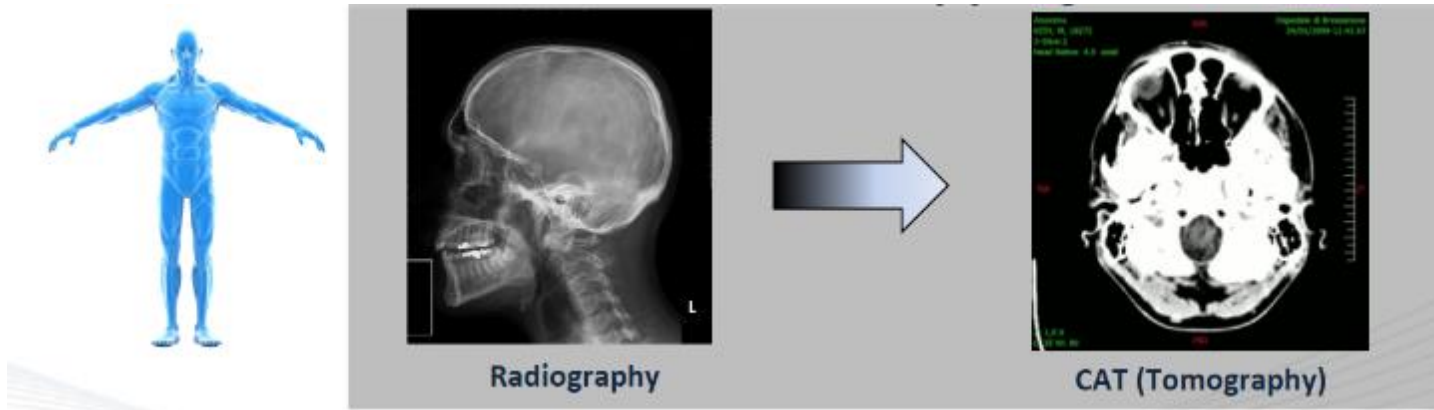
Most Certain

Least Certain

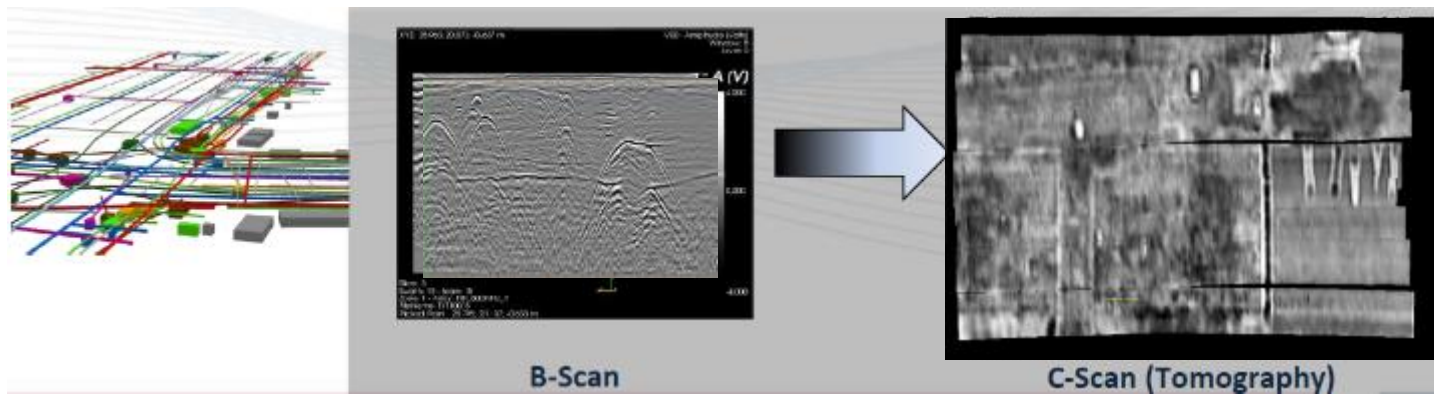
New Technologies - Multi-Channel GPR



Multi-Channel GPR



From detection to mapping...



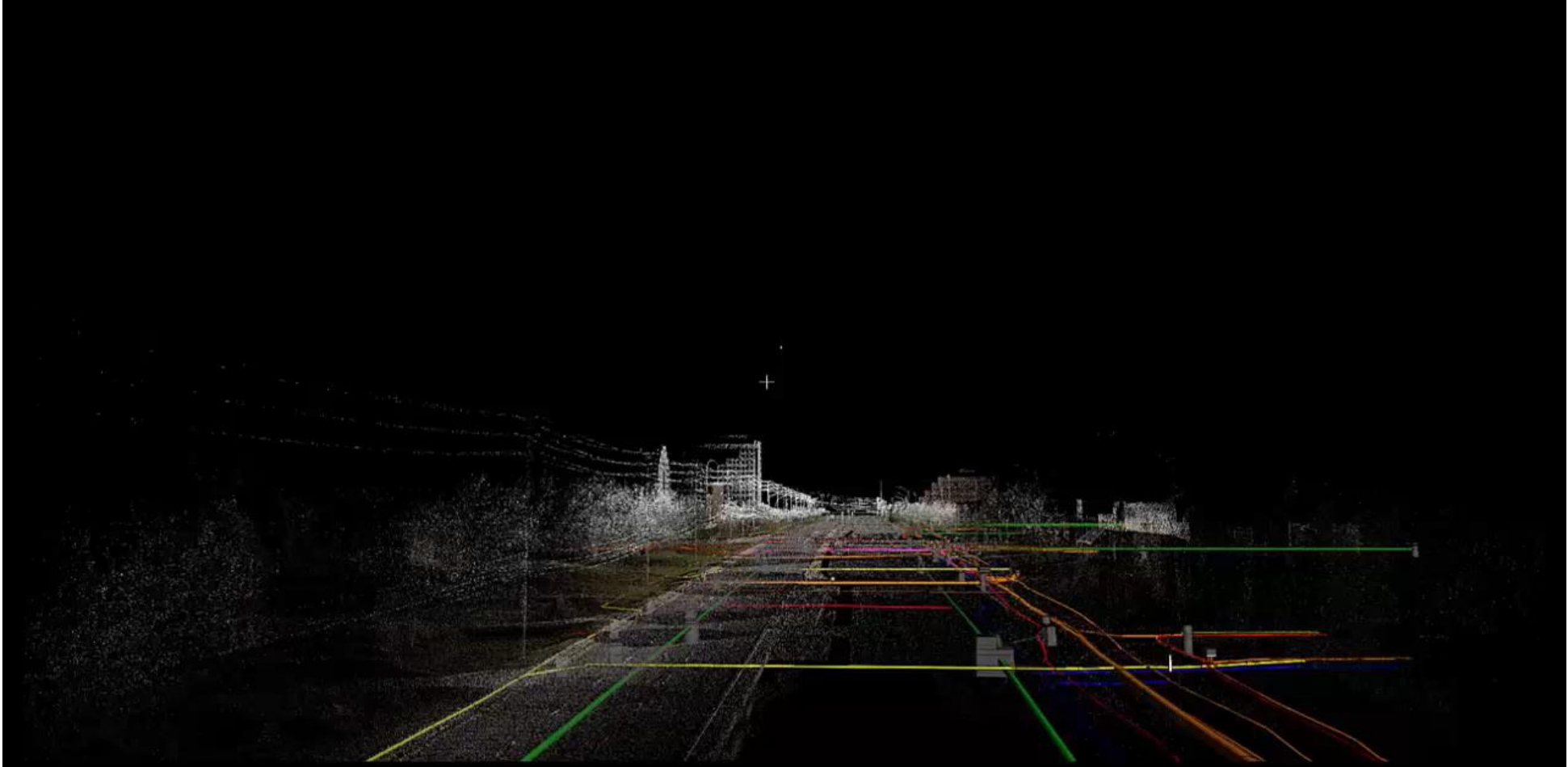
Multi-Channel GPR



Results - MCGPR



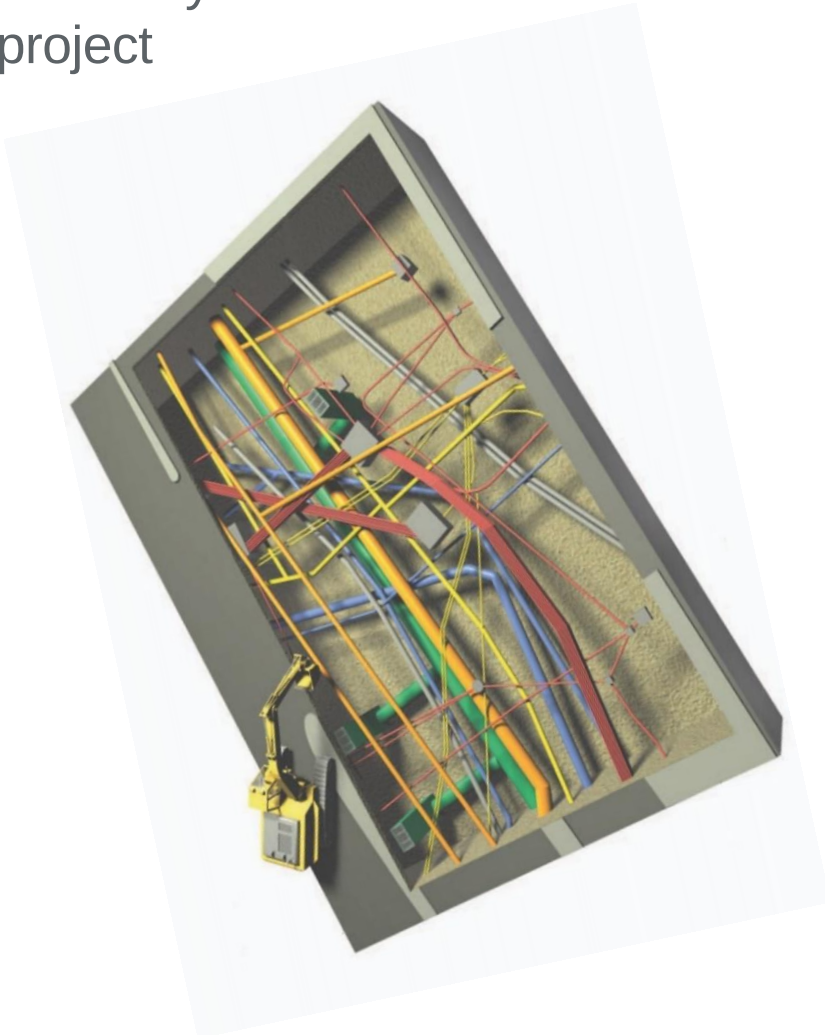
3D Model



Utilities Create Risks on Projects

NYC 1971

Broadway Subway Station
Tie-Back project





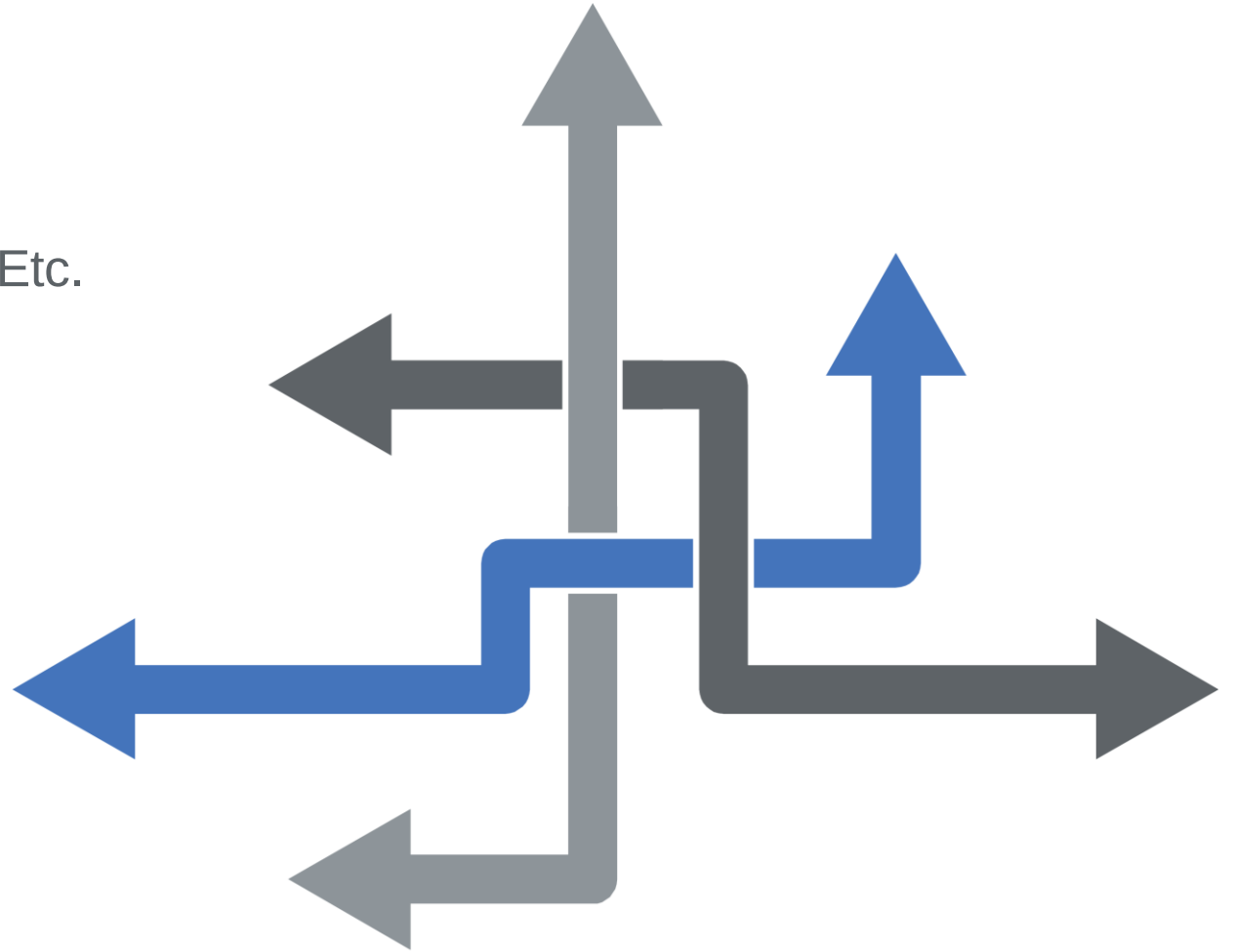
Underground Uncertainties

Utilities

- > Known
- > Unknown
- > Thrust Blocks, Tie-backs, Sheeting Piles, Etc.

Geotechnical Data

- > Paving and Substrate Thickness
- > Presence of rebar
- > Voids
- > Construction rubble / Debris
- > Depth to water table



What Happens with Underground Uncertainties?

- > Nothing, If You're Lucky
- > Most Likely to Some Degree...
 - Project Delays
 - Cost Overruns
 - Change Orders
 - Accidental Environmental Releases
 - Higher Bids for Construction
 - Damages to Property
 - Injury or worse to people
 - Bad Press



Ways to Reduce Uncertainties

- > Thorough Utility Site Investigations
 - Records or One-Call
 - Topography / Visual / Geomorphology
 - Test Holes / Bores
 - Geophysics / Remote Sensing
- > Professional Judgment



Ways to Manage Remaining Uncertainties

- > Risk-Based Data Presentation
- > Reports
- > Planning and Design Considerations
- > Conflict Analysis
- > Keeping Data Current on Long-Duration Projects
- > Project As-Built Standardization
- > Professional Judgment



Last Century Engineering Practices

- > Use Records to guide locations for Test Holes / Pot Holes
- > Problems with records:
 - Never made
 - Incorrect and incomplete
 - Site repurposing / abandonment
 - Lost
- > Results in:
 - Holes with no data
 - Data where no holes



Benefiting from Practice and Research: Where We Should Be Today with Utilities

- > Map Them Early in the Project
- > Map them Using ASCE Standard 38 (Risk-based Process and Visualization)
- > Only Dig Test Holes Where Necessary
- > Only Use 3D where Necessary for Complicated and Congested Design Areas
- > Keep the Data Current During Project Development if there are Utility Changes or Additions in Project Area
- > Use a Utility Conflict Matrix to Assist in Design Decisions
- > Keep an accurate utility composite database for future projects, maintenance, and operational support

Where Should We Be Today – with Utilities

- > Map them Using ASCE Standard 38 (Risk-based Process and Visualization)
- > Attempt to Achieve Utility Quality Level B within Project Limits (find and trace and survey known and unknown utilities through geophysics)
- > Where geophysics can't image a suspected utility of record show it at Utility Quality Level C or D
- > Get Utility Quality Level A data where necessary (Vacuumed test hole and surveyed data)

Purpose of the ASCE 38 & CSA S250

- > To assist owners and engineers in developing an unambiguous comprehensive scope of work concerning collecting and depicting utility information on documents
- > To standardize how utilities are portrayed on documents
- > And most importantly, to standardize an attribute for utility information that indicates its reliability and relative uncertainty (utility quality level attribute).

Lessons Learned- for Safety sake

- > If utilities are shown on a plan drawing, check to see if it's ASCE 38 compliant
 - If so, remember the uncertainty associated with the quality levels
 - If not, you must assume all utilities are highly uncertain and there may be significant unknowns
- > When there are one-call marks, check them against the plans and resolve discrepancies / assume you must address both One-Call marks and utilities shown on plans

Sample Project Oil Terminal

Survey partner on sample project Steaphan MacAulay VP Transportation & Infrastructure Global
Raymac Surveys

Sample Project – Oil Terminal



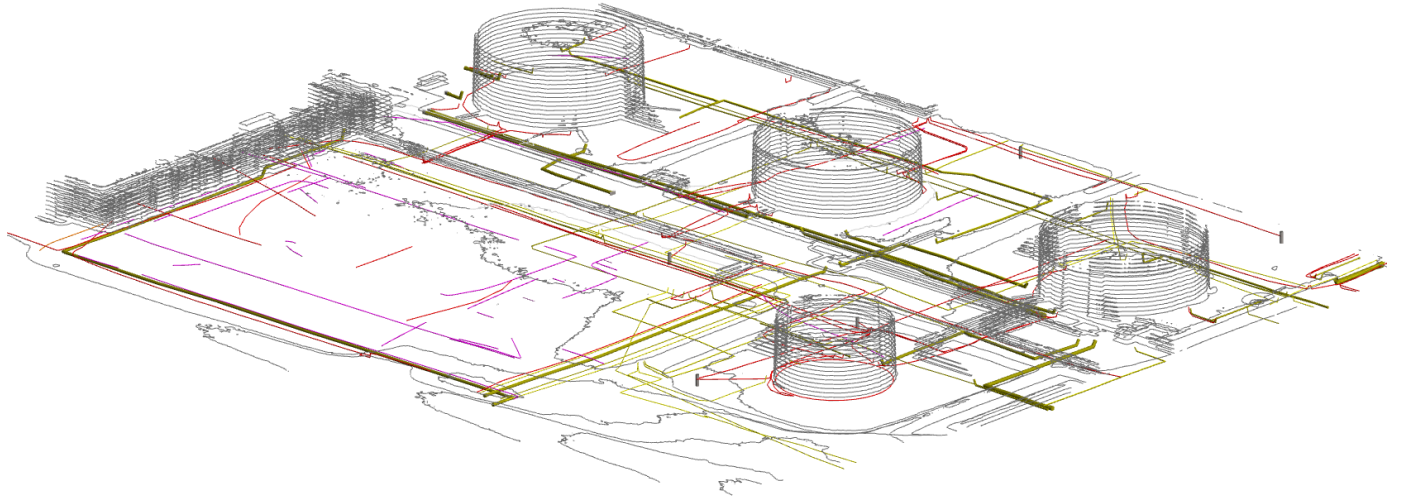
Sample Terminal – Deliverables

Report
Subsurface Utility Engineering Services

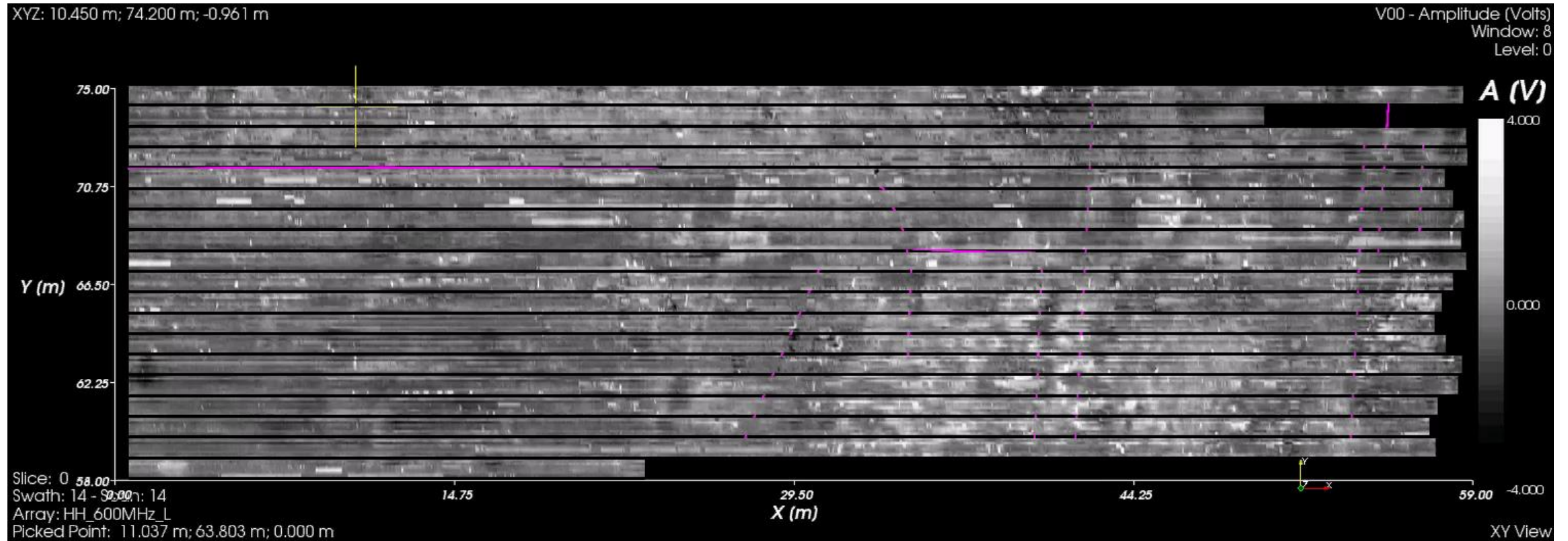
Project #61001338



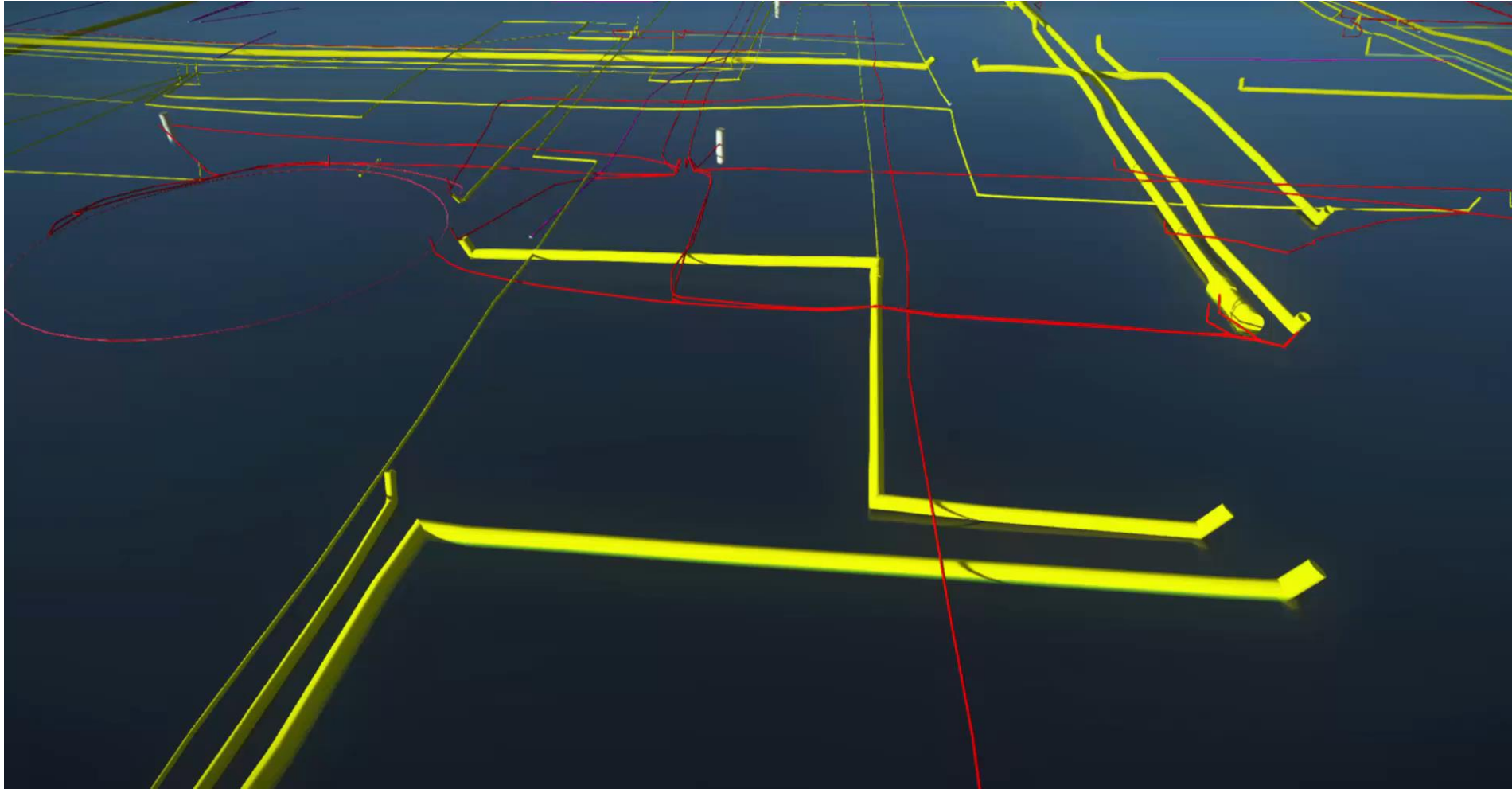
Report Date: December 12, 2018



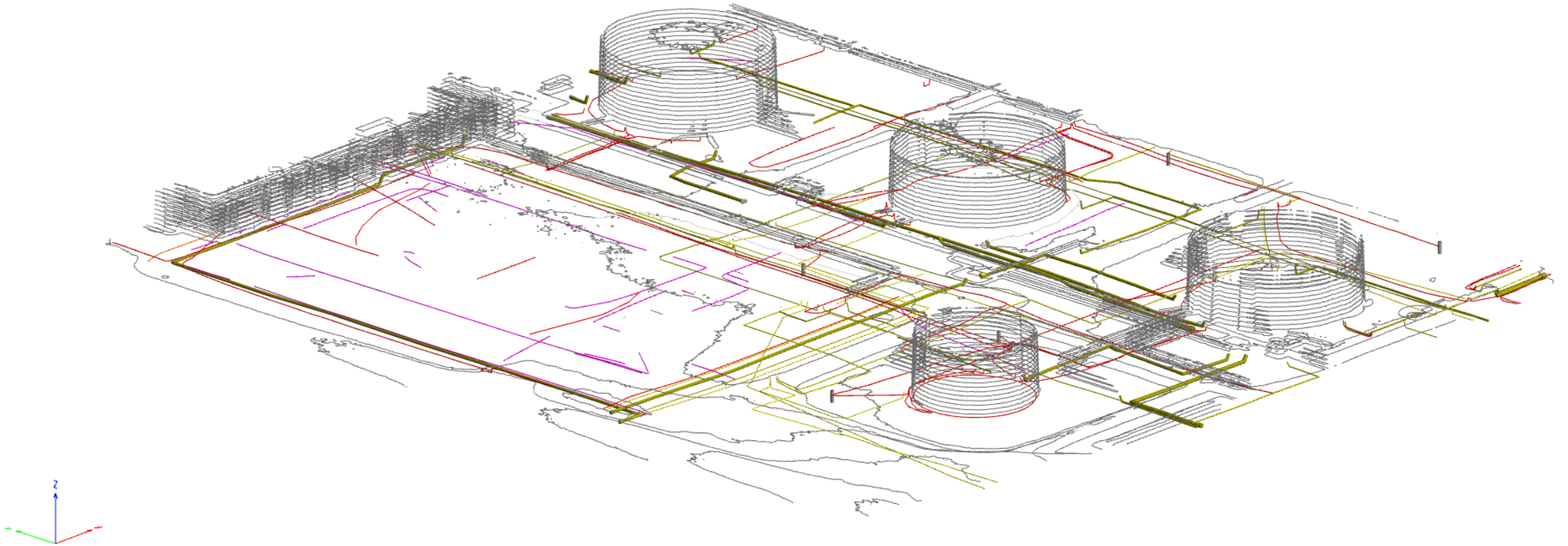
Sample Oil Terminal – MCGR Results



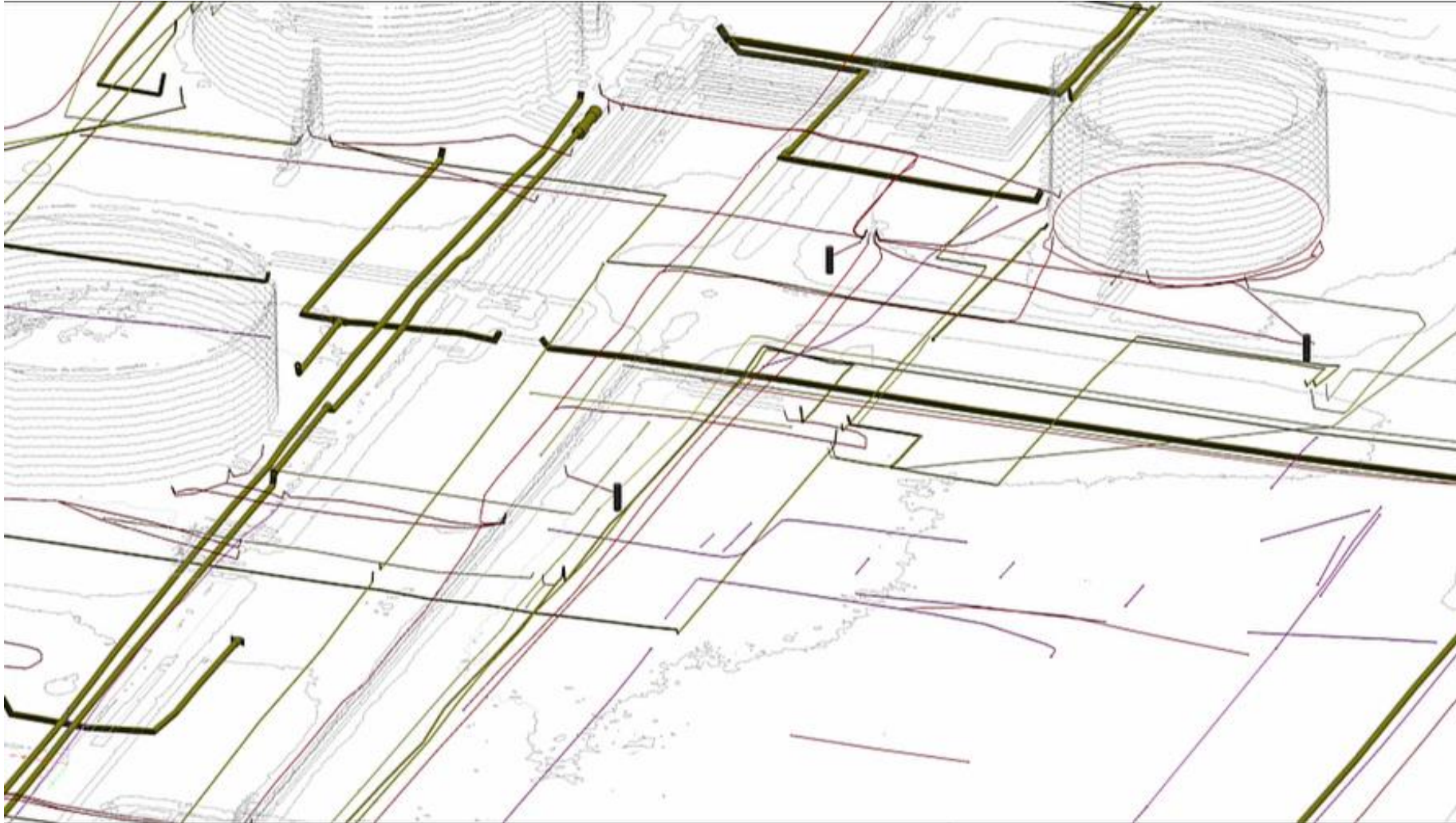
Sample Oil Terminal – 3D Model



Sample Oil Terminal – 3D PDF



Sample Oil Terminal – 3D PDF



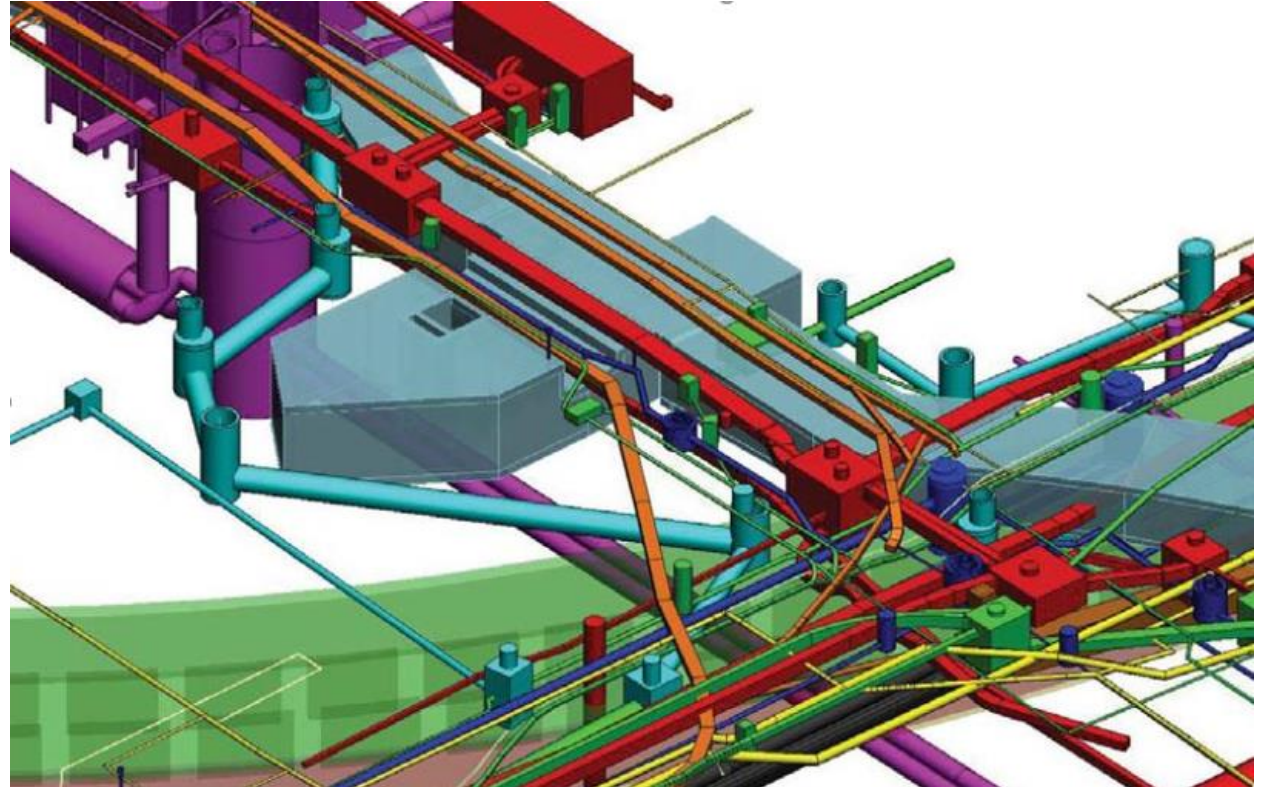
Why use SUE?

SUE provides designers, engineers and utility coordinators with valuable information during the design stage, utilizing recognized standards and best practices.

- > Clearly define conflicts and relocations
- > Reduces re-design costs
- > Reduces project costs
- > Reduces project delays
- > Improves project safety
- > SUE reduces clients' overall **RISK**

Call to Action

- > Build ASCE 38 and SUE into your Project Design Processes/Manuals
- > Develop ASCE 38 / SUE Language into RFP's
- > Identify the importance of Utility Impacts on Projects and invest accordingly.
- > Reduction of uncertainty assists in safety.





UESI Alberta-BC Chapter Initial Meeting

April 5, 2019 | Edmonton, Alberta



Thank you



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