Subsurface Utility Engineering

Heather Howe
ODOT State Utility And Railroad Liaison

Chris Pucci
Construction Automation Surveyor

Bend, OR
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What is Subsurface Utility Engineering?

Simply put it is an Engineering Processes that attempts to manage risk with respect to:

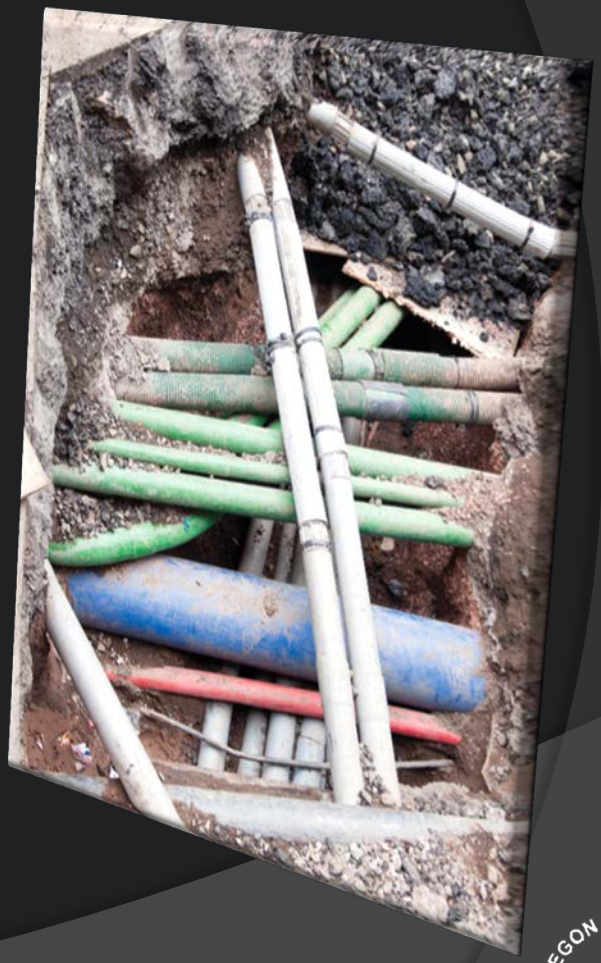
- Utility Coordination
- Utility Mapping in accordance with ASCE Quality Levels
- Utility relocation design and cost estimates
- Utility relocations and adjustments
- Communication of utility data to design staff

Subsurface Utilities are a Key Piece to 3D Everything

Collaborating with Utility companies to Collect 3D Utility Information

Benefits Include

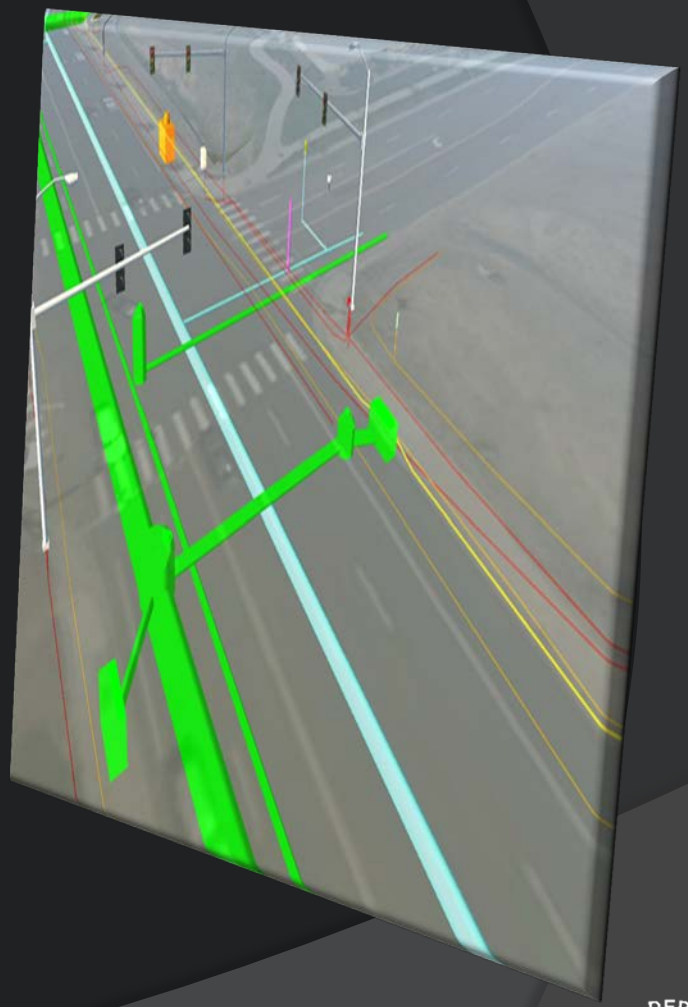
- Construction Safety
- Conflict Reduction
- Time Savings
- Cost Savings



Risks related to Subsurface Utilities

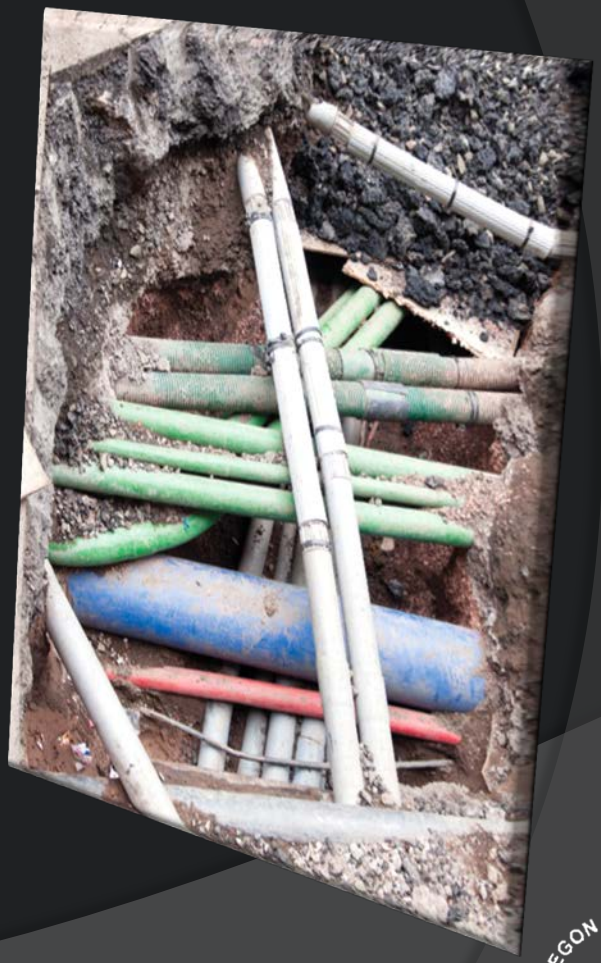
Subsurface Utilities and their related structures:

- Create risks to the project
- Inaccurate, incomplete, and/or out-of-date information on the existence and location of existing utilities
- Reduces the engineers', owners' and contractors' abilities to make informed decisions regarding the project's impact on existing utilities.



Risks related to Subsurface Utilities

- Project Delays
- Damage to utilities
- Safety of public/workers
- Redesign Costs
- Higher bids
- Change Orders
- Construction Claims
- Detours for traveling public
- Negative publicity



Oregon SUE – Huge Step Forward

February 2, 2015
SUE Memorandum
from Department of Justice
to Oregon Department of Transportation

ELLEN F. ROSENBLUM
Attorney General

FREDERICK M. BOSS
Deputy Attorney General

DEPARTMENT OF JUSTICE
GENERAL COUNSEL DIVISION

MEMORANDUM

RECEIVED
FEB 05 2015
BY: Julie Rayburn

DATE: February 2, 2015

TO: Tom Lauer, Technical Services Manager
Ranvir Singh, Chief of Surveys, Geometronics Manager
Oregon Department of Transportation

FROM: Lucinda D. Jackson, Senior Assistant Attorney General
Government Services Section

SUBJECT: Use of Highway Funds for Subsurface Utility Engineering (SUE)
DOJ File No. 734040-GG1157-14

Designing a highway project, including surveying above and below the ground, is also an important aspect of constructing, reconstructing and improving highways. Highway Funds are appropriately used for surveying above ground features and for the surface location of underground utilities. The use of Highway Funds for new technology, such as SUE, that provides a better, more accurate way to survey below the ground for utilities should be treated no differently. As a result, I conclude that Highway Funds can be used for SUE.

activities of ODOT regarding the relocation of utility facilities were component parts of the reconstruction and improvements of the roads in question by ODOT.

Designing a highway project, including surveying above and below the ground, is also an important aspect of constructing, reconstructing and improving highways. Highway Funds are appropriately used for surveying above ground features and for the surface location of underground utilities. The use of Highway Funds for new technology, such as SUE, that provides a better, more accurate way to survey below the ground for utilities should be treated no differently. As a result, I conclude that Highway Funds can be used for SUE.

Please let me know if you have any further questions.

[2] Previously, this office provided comprehensive guidance on the constitutional use of Highway Funds in a letter to Grace Crunican, ODOT Director, dated January 31, 2001.

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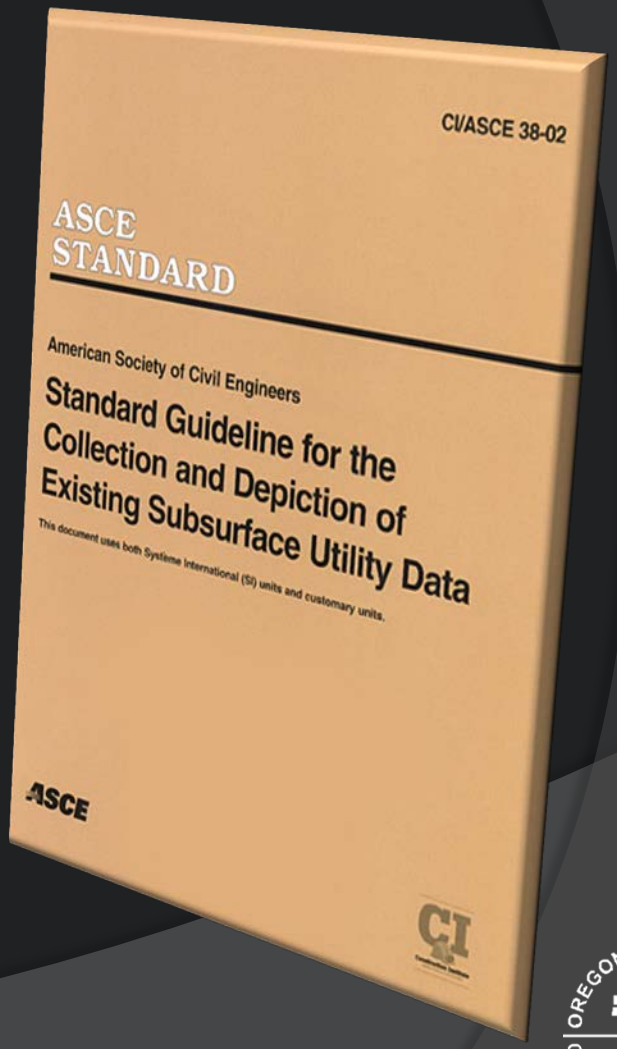
Utility Mapping in accordance with ASCE Quality Levels

The American Society of Civil Engineers developed a National Consensus Standard, CI/ASCE 38-02, titled "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data".

Currently used in contracts to aid in definition of an engineer's standard of care and level of responsibility. Updated document planned for release this year.



Utility Mapping ASCE Quality Levels

Quality Level D (QL-D)

Existing Utility Records

- Information obtained from review of known utility records and documentation of verbal accounts and/or one-call markings.
- Purpose is assessment of the major active utilities and approximate locations referenced to the known plan documents.

Utility Mapping ASCE Quality Levels

Quality Level C (QL-C)

Survey of Visible Features

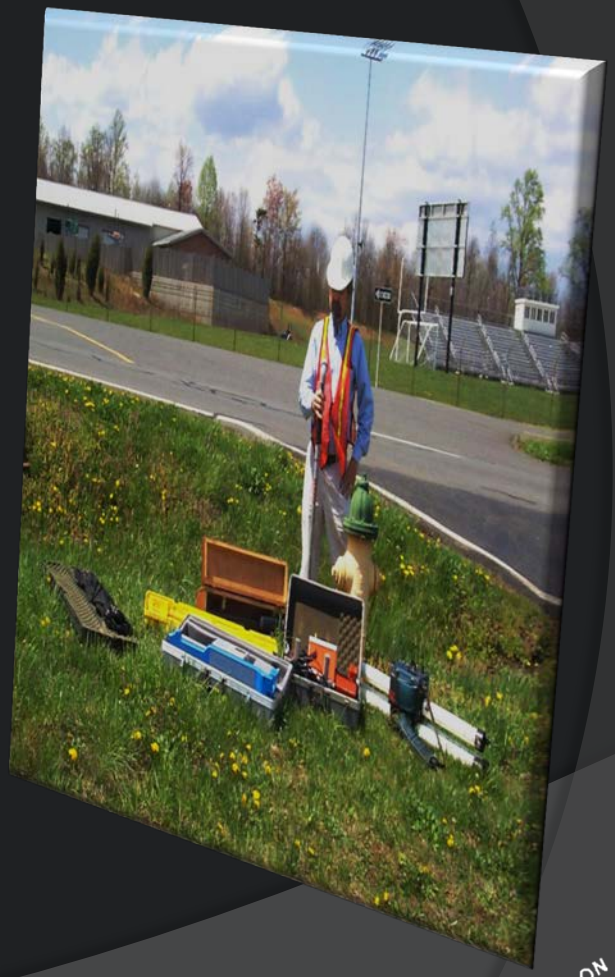
- Coupled with QL-D information by adding surveyed surface features such as utility poles, junction boxes fire hydrants, valves, risers, and manholes.
- Purpose: Develop the approximate horizontal positions of underground utilities.

Utility Mapping ASCE Quality Levels

Quality Level B (QL-B)

Utility Designating

- Geophysical systems are designed to evaluate existing and approximate horizontal locations of underground utilities.
- Geophysically located utility precision may be influenced by equipment limitations, external EM sources (power plants), geology, and operator experience.



Utility Mapping ASCE Quality Levels

Quality Level B (QL-B)

Designating Method & Equipment

- Select method
  - Inductive – induces current along utility
  - Conductive – directly connects to utility
- Select equipment
  - Single or multi-frequency electromagnetic units
  - Sonde or sonic methods
  - Magnetics
  - GPR

Utility Mapping ASCE Quality Levels

Quality Level B (QL-B)

Designating QC & QA

- QL-B results provides imprecise horizontal and vertical data.
- Survey data plotted with QL-D and QL-C data set.
- Builds on QL-D and QL-C.
- Field data checked against QL-D records and QL-C surveys.
- A unified data and plan set developed.
- Precision remains an issue.

Utility Mapping ASCE Quality Levels

Quality Level B (QL-B)

GPR - Ground Penetrating Radar

Utility Mapping ASCE Quality Levels

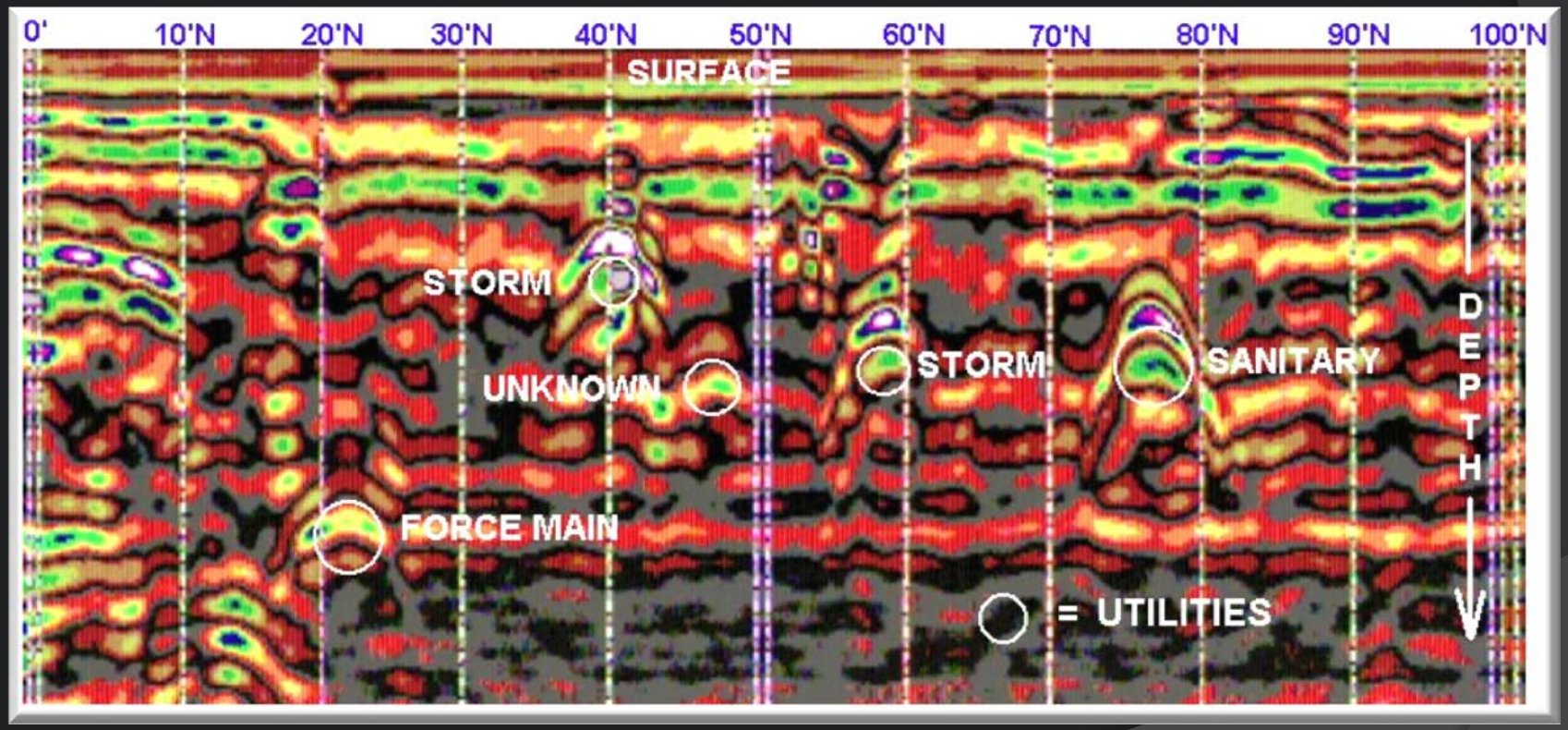
Quality Level B (QL-B)

TDEMI – Time Delay Electromagnetic Induction

Utility Mapping ASCE Quality Levels

Quality Level B (QL-B)

GPR – Data Interpretation



Utility Mapping ASCE Quality Levels

Quality Level A (QL-A)

Utility Locating

- Subsurface utility data obtained via exposure at specific points followed by survey.
- Precise and accurate horizontal and vertical data are surveyed and recorded.
- Provides utility type, size, material, and other characteristics

Utility Mapping ASCE Quality Levels

Quality Level A (QL-A)

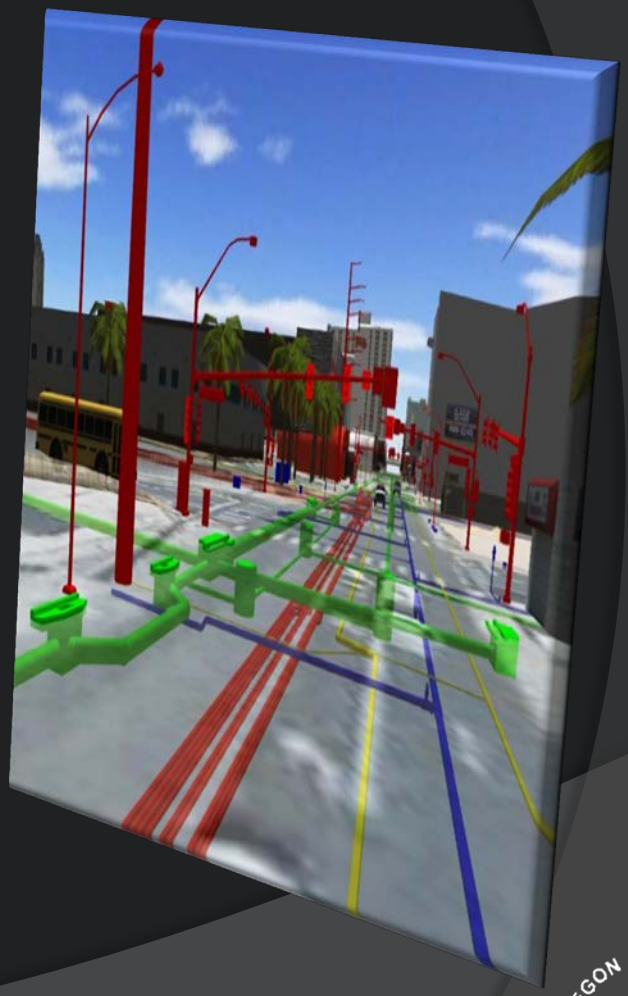
Utility Locating – During Construction

Utility Mapping ASCE Quality Levels

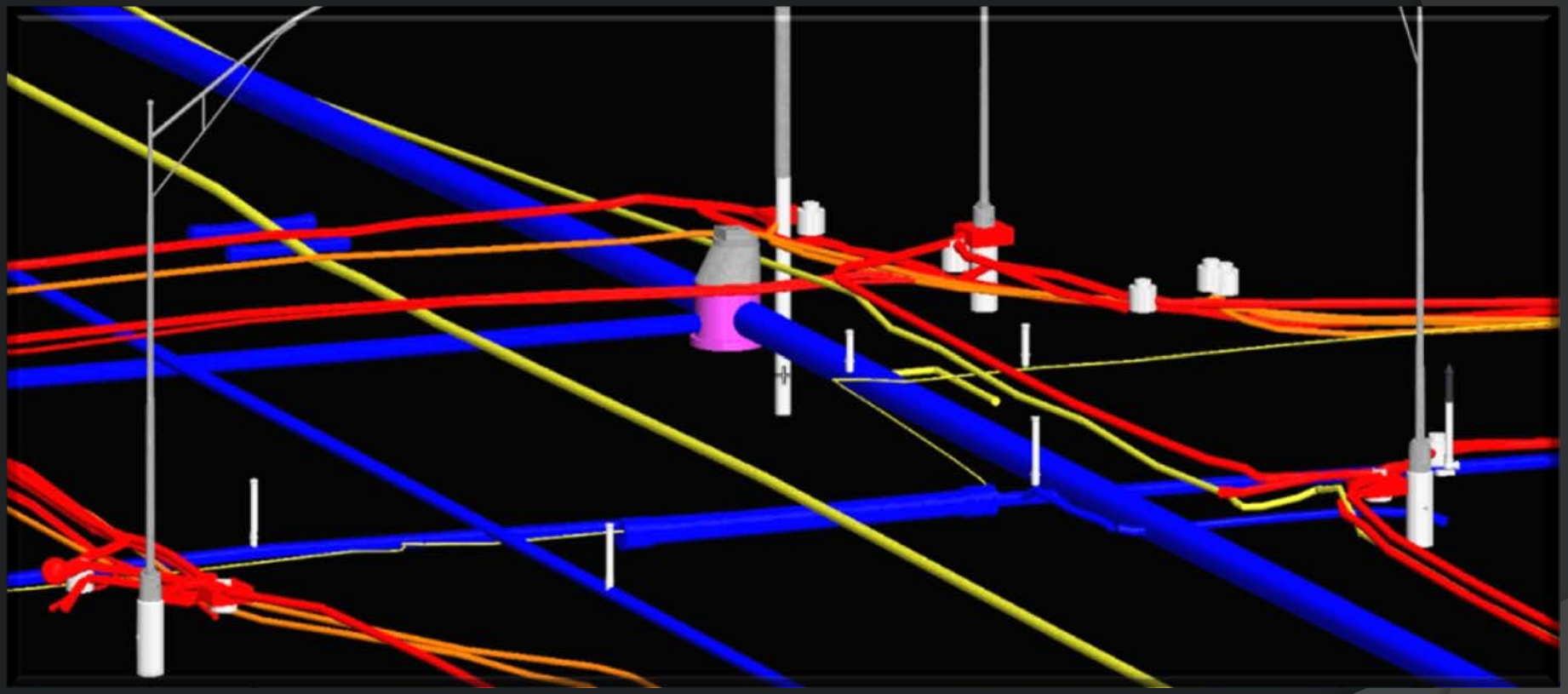
Quality Level A (QL-A)

Utility Data Model

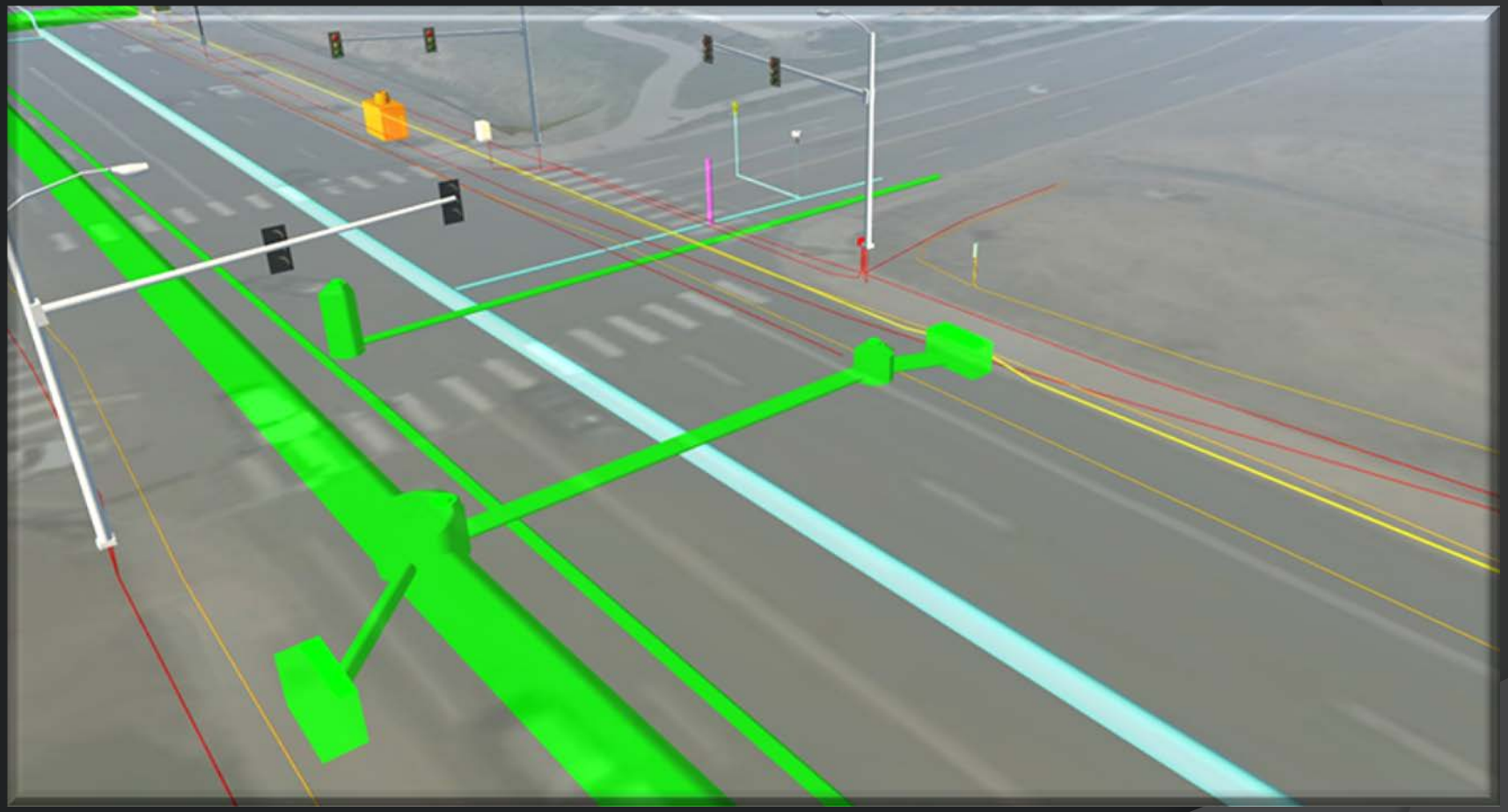
- QL-A information is highly precise and accurate.
- Survey tolerances are typically ½ - inch vertically and to project survey standards horizontally.
- QL-A data may be portrayed as 3-D point clouds; whereas, QL-B, QL-C, and QL-D horizontal data are line segments.



3D Utility Models



3D Utility Models



Utility Conflict Matrix

From the 3D Model, Conflicts are Identified and tracked through a Utility Conflict Matrix

Project Owner:
Project No. :
Project Description:
Highway or Route:

Utility Conflict Matrix Developed/Revised By:
Date:
Reviewed By:
Date:

Note: Refer to subsheet for utility conflict cost analysis.

Utility Owner and/or Contact Name	Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description	Start Station	Start Offset	End Station	End Offset	Utility Investigation Level Needed	Test Hole	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status

Advantages in Design

- With more complete information we can:
  - Avoid Utility conflicts entirely
    - Drainage design and location
    - Structure design and location
  - Manage relocation with greater efficiency
    - Avoid other utilities during relocation
    - Move once

Results

- **Make Informed Design Decisions**
  - Designers require accurate utility information, including constructability of multi-phase projects.
- **Avoid Using Unreliable Underground Utility information**
  - Avoid uncertainty and second guessing where a utility may be located.
- **Avoid Costly Conflicts / Utility Relocations**
  - By knowing the exact location of the underground utilities, costly conflicts and utility relocations may be avoided.
- **Savings and Safety**
  - Inaccurate information can result in costly conflicts, utility damage, construction delays, service disruptions, redesign claims, and even injuries and loss of life.

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Thank you!

Questions?

Heather Howe
ODOT State Utility and Railroad Liaison
Heather.C.Howe@odot.state.or.us
503-986-3658

Chris Pucci
ODOT Construction Automation Surveyor
Christopher.Pucci@odot.state.or.us
503-986-3542