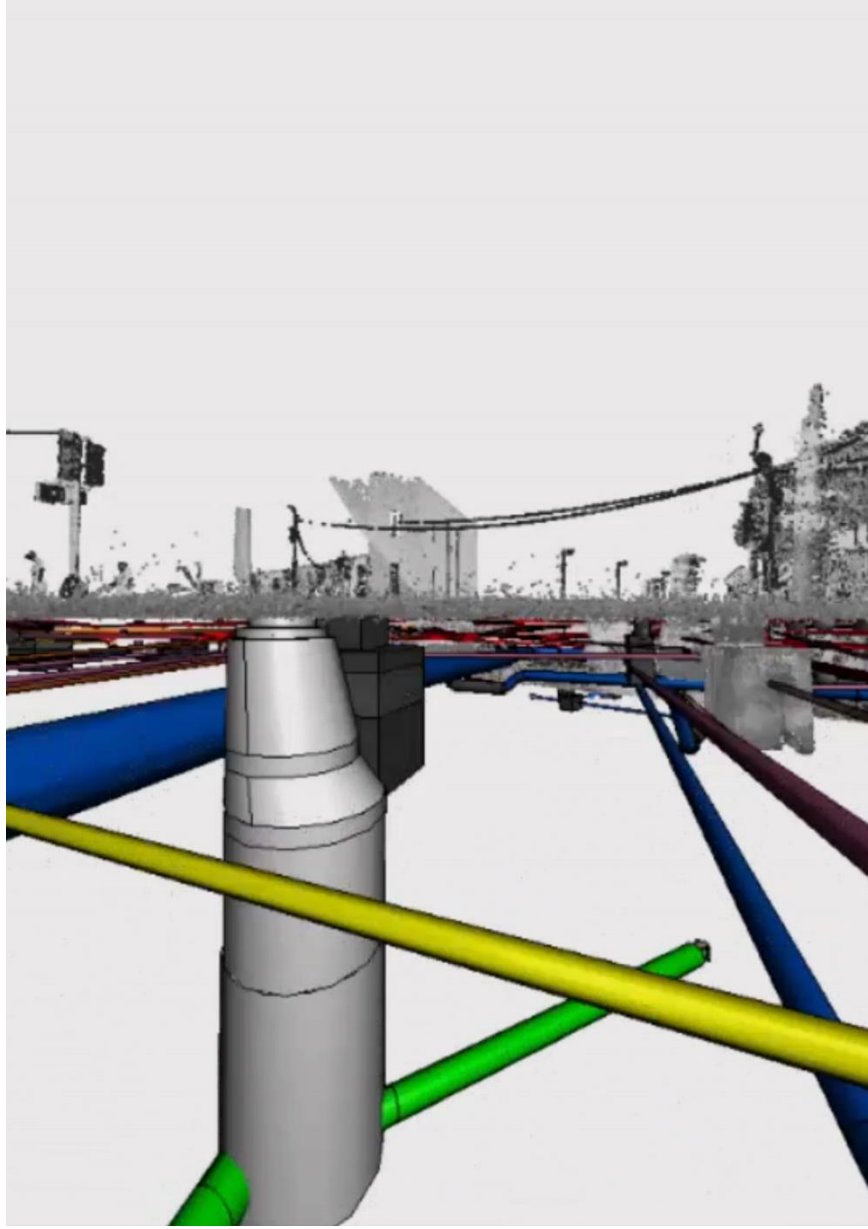
Utilities 101: Advancements in Subsurface Utility Engineering and Survey



Michael Picha, PLS / Branch Manager

Presented to: CITY ENGINEERS ASSOCIATION OF MINNESOTA

Engineering Our Cities' Futures

January 26, 2022

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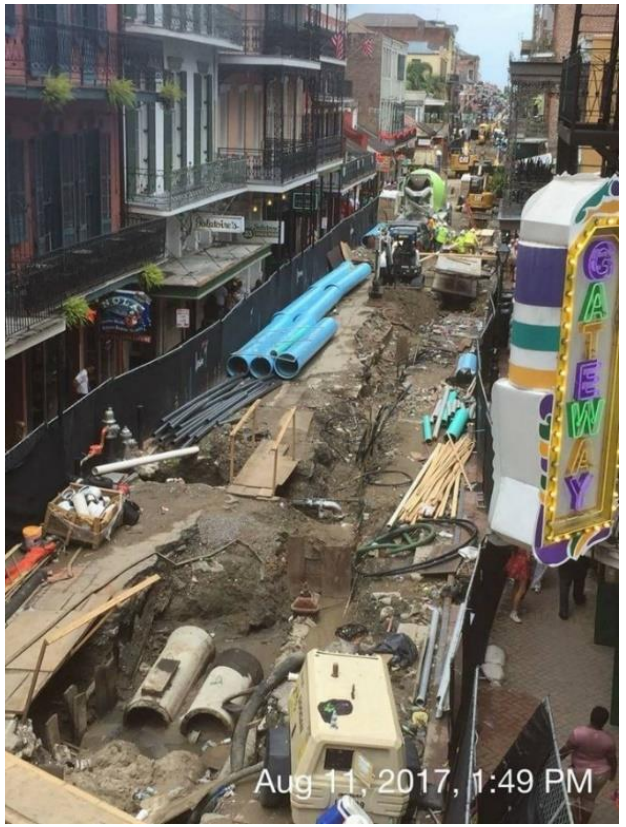
Subsurface Utility Engineering in review

U.S. Department of Transportation
Federal Highway Administration

- **1982** – Traditional ways not working, SUE developed
- **1985** – First statewide SUE contract with Virginia Department of Transportation
- **1986** – First statewide UC contract with Virginia Department of Transportation
- **1991** – FHWA began promoting SUE
- **2002** – Standard ASCE 38-02 was adopted by American Society of Civil Engineers
- **2018** – 38+ State DOTs using Statewide\District-Wide\Region-Wide UES Services
- **2022** – Anticipating the release of Standard ASCE 38-22



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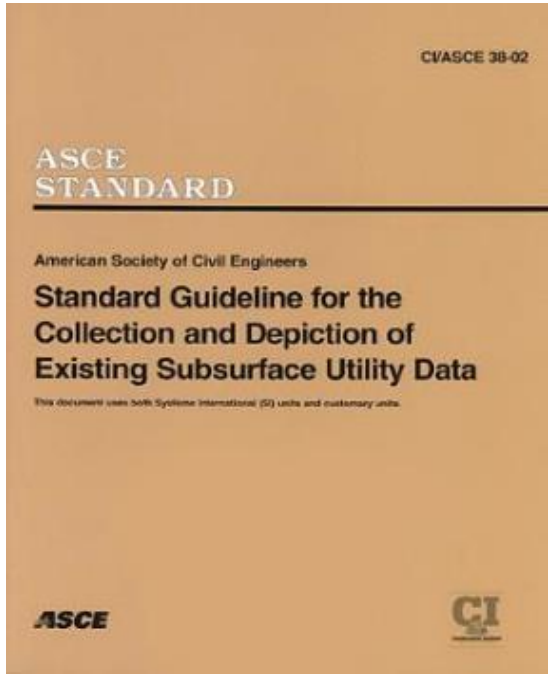
ASCE Standard 38-02

The American Society of Civil Engineers (ASCE) has developed a National Consensus Standard, CI/ASCE 38-02, titled “Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data”. This National Consensus Standard (NCS) is used by courts and lawyers, along with contractual instruments, to assist in both defining a professional’s standard of care and level of responsibility.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS



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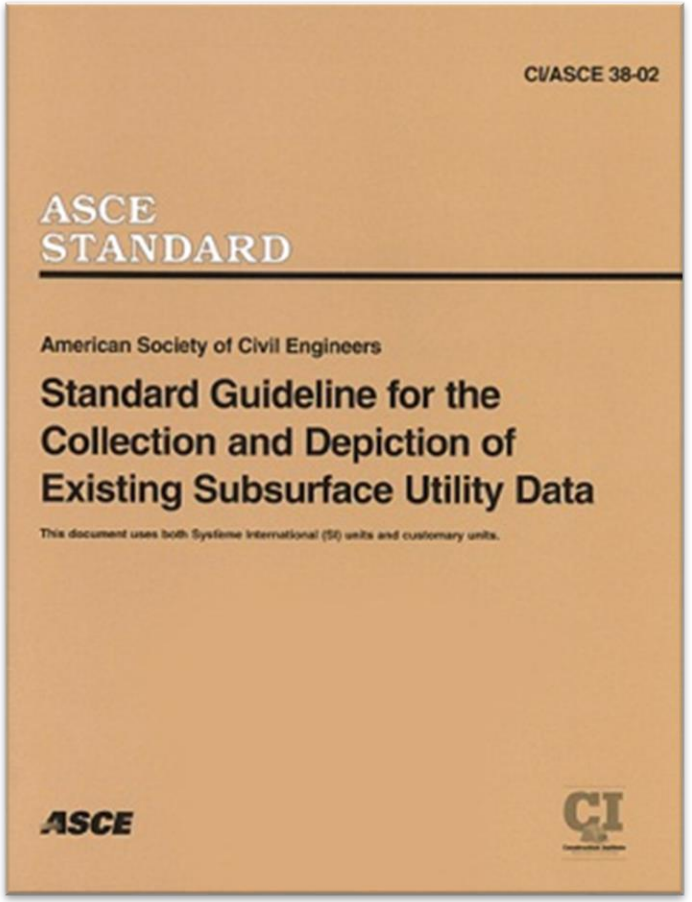
ASCE Standard 38-02

- *“The intent of this standard guideline is to present a system of classifying the quality of data associated with existing subsurface utilities.”*

  ASCE 38-02

- *“Such a classification will allow the project owner, engineer, constructor, and utility owner to develop strategies to **reduce risk** by improving the reliability of information on existing subsurface utilities in a defined manner.”*

  ASCE 38-02



What is Subsurface Utility Engineering?

ASCE Standard 38-02: Quality Levels

Quality Level D

Quality Level C

Quality Level B

Quality Level A

Least Certain → **Most Certain**

Subsurface Utility Engineering is an interpretive science; therefore, a skilled team with knowledge of construction history & years of experience sets us apart.

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Definitions (from ASCE 38-02)

Utility Quality Level:

- A professional opinion of the quality and reliability of utility information. Such reliability is determined by the means and methods of the professional.
  - These levels are cumulative
  - Each QL is defined in the Standard

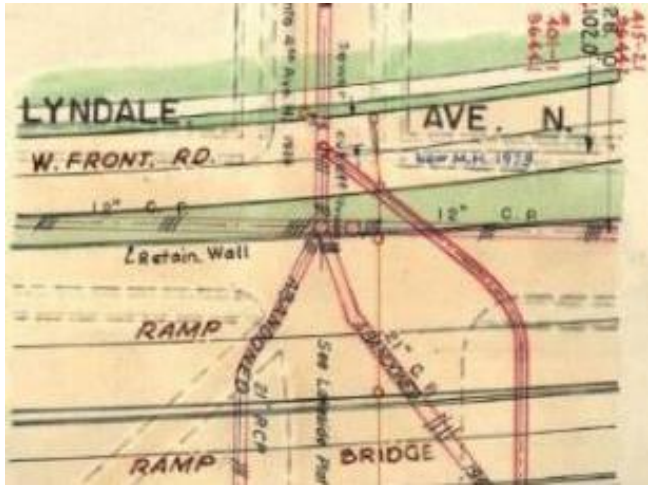


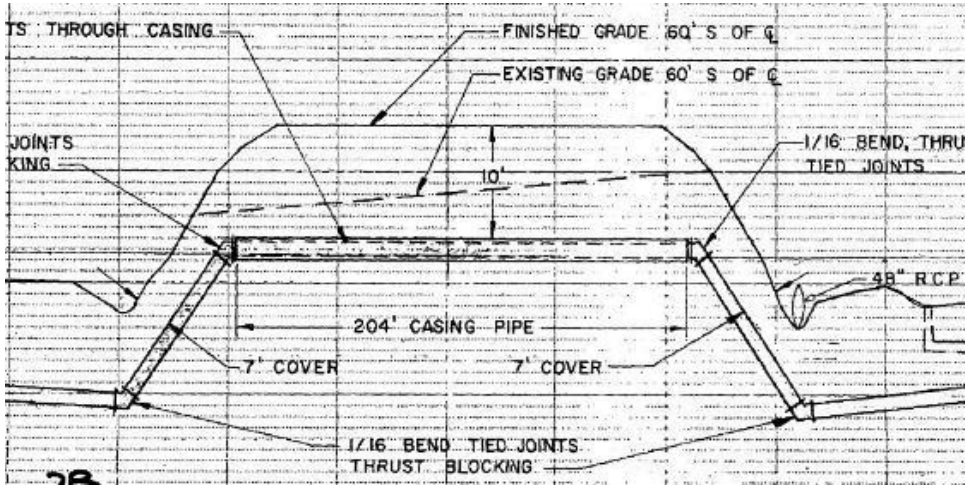


ASCE Quality Level D (QL-D)

Existing Utility Records

- Information derived from existing records or oral recollections. It is assigned when there is no other data other than records.
  - Record Drawings
  - As-built records
  - GIS Data
  - Field Notes
  - DOT / City Records
  - Circuit Diagrams
  - Mtgs. w/ Staff
  - Land Owner
  - Valve Guides





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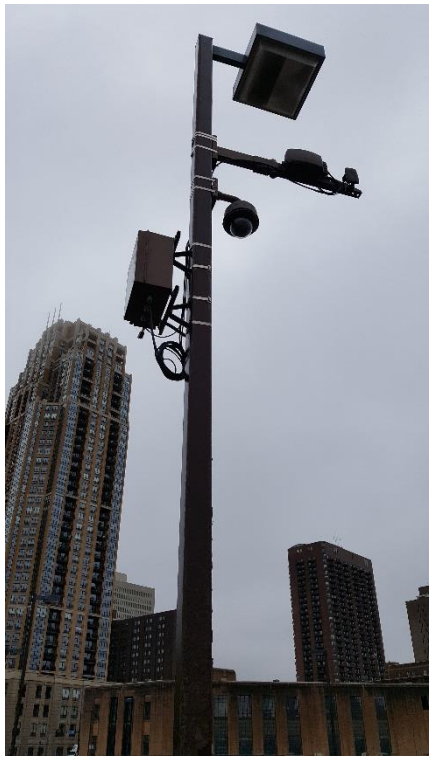
ASCE Standard 38-02 - Quality Level “C”

Topographic Survey

- Use of above ground surface features to indicate subsurface alignment, such as:
  - Valves
  - Fire hydrants
  - Power Poles
  - Manholes
  - Telephone pedestals
- Verified to ASCE Quality Level D records



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ASCE Quality Level B (QL-B)- Designating

Designating: The process of using a geophysical method or methods to interpret the presence of a subsurface utility and to mark its approximate horizontal position (its designation) on the ground surface.

ASCE Quality Level B (QL-B)- Designating

Determining the existence and approximate horizontal position of subsurface utilities.

Radio Frequency Pipe and Cable Locators

Radio Frequency Pipe & Cable Locaters

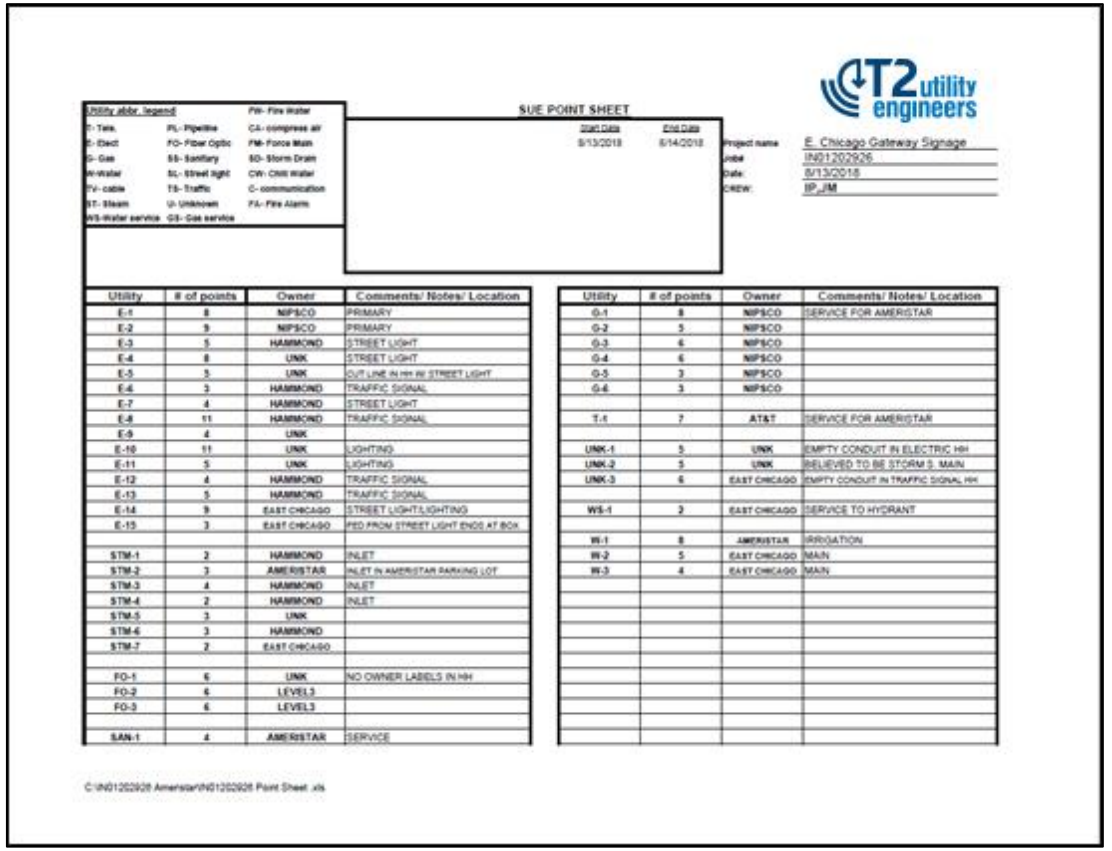
Single channel Cable Locator

Single / Multi channel GPR

ASCE Standard 38-02 - Quality Level “B”

Utility Point Sheet and Sketch

- This sheet references any paint marks that are identified by geophysical methods
- Periodically placed marks over the utility identifies line position, critical bends, beginning and end of target lines.
- This process ensures that each paint mark has been captured when compared to the survey file and report.
- It’s important to have this systematic plan in place to ensure thorough recording of our findings.



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SUE POINT SHEET

Utility abbr. legend		
T- Tele.	PL- Pipeline	FW- Fire Water
E- Elect	FO- Fiber Optic	CA- compress air
G- Gas	SS- Sanitary	SD- Storm Drain
W-Water	SL- Street light	CW- Chill Water
TV- cable	TS- Traffic	C- communication
ST- Steam	U- Unknown	FA- Fire Alarm
WS-Water service	GS- Gas service	

Start Date: 8/13/2018 End Date: 8/14/2018

Project name: E. Chicago Gateway Signage
Job#: IN01202926
Date: 8/13/2018
CREW: IP, JM

Utility	# of points	Owner	Comments/ Notes/ Location
E-1	8	NIPSCO	PRIMARY
E-2	9	NIPSCO	PRIMARY
E-3	5	HAMMOND	STREET LIGHT
E-4	8	UNK	STREET LIGHT
E-5	5	UNK	CUT LINE IN HH W/ STREET LIGHT
E-6	3	HAMMOND	TRAFFIC SIGNAL
E-7	4	HAMMOND	STREET LIGHT
E-8	11	HAMMOND	TRAFFIC SIGNAL
E-9	4	UNK	
E-10	11	UNK	LIGHTING
E-11	5	UNK	LIGHTING
E-12	4	HAMMOND	TRAFFIC SIGNAL
E-13	5	HAMMOND	TRAFFIC SIGNAL
E-14	9	EAST CHICAGO	STREET LIGHTS LIGHTING
E-15	3	EAST CHICAGO	FED FROM STREET LIGHT ENDS AT BOX
STM-1	2	HAMMOND	INLET
STM-2	3	AMERISTAR	INLET IN AMERISTAR PARKING LOT
STM-3	4	HAMMOND	INLET
STM-4	2	HAMMOND	INLET
STM-5	3	UNK	
STM-6	3	HAMMOND	
STM-7	2	EAST CHICAGO	
FO-1	6	UNK	NO OWNER LABELS IN HH
FO-2	6	LEVEL3	
FO-3	6	LEVEL3	
SAN-1	4	AMERISTAR	SERVICE

Utility	# of points	Owner	Comments/ Notes/ Location
G-1	8	NIPSCO	SERVICE FOR AMERISTAR
G-2	5	NIPSCO	
G-3	6	NIPSCO	
G-4	6	NIPSCO	
G-5	3	NIPSCO	
G-6	3	NIPSCO	
T-1	7	AT&T	SERVICE FOR AMERISTAR
UNK-1	5	UNK	EMPTY CONDUIT IN ELECTRIC HH
UNK-2	5	UNK	BELIEVED TO BE STORM S. MAIN
UNK-3	6	EAST CHICAGO	EMPTY CONDUIT IN TRAFFIC SIGNAL HH
WS-1	3	EAST CHICAGO	SERVICE TO HYDRANT
W-1	8	AMERISTAR	IRRIGATION
W-2	5	EAST CHICAGO	MAIN
W-3	4	EAST CHICAGO	MAIN

C:\IN01202926 Ameristar\IN01202926 Point Sheet .xls

Part of our QA/QC process for QLB.

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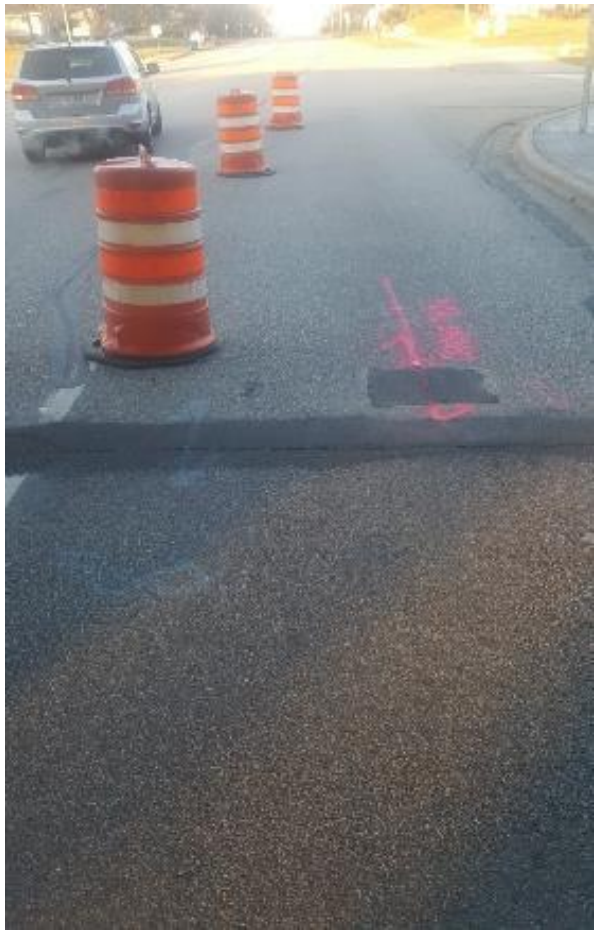
Differences between One-Call marks and Quality Level-B?

- One-Call designed as a risk based system used for excavation
- The information received has no guarantee of accuracy
- One-Call locator has a single utility focus / limited time
- Rely on utility records with minimal detail
- Do not perform utility sweeps
- Do not locate private utilities
- No point sheet or sketch for accuracy
- Survey of one-call paint marks is not QL-B
- Utility data records research, interpretations, and designation not performed under the responsible charge of a registered professional.



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ASCE Quality Level A (QL-A) Locating

Utility Locating

- Precise location by actual exposure
- Minimally intrusive excavation method: *A method of excavation that minimizes the potential for damage to a structure being uncovered.*
- Survey grade accuracy
- Supported by QL-D, QL-C, and QL-B

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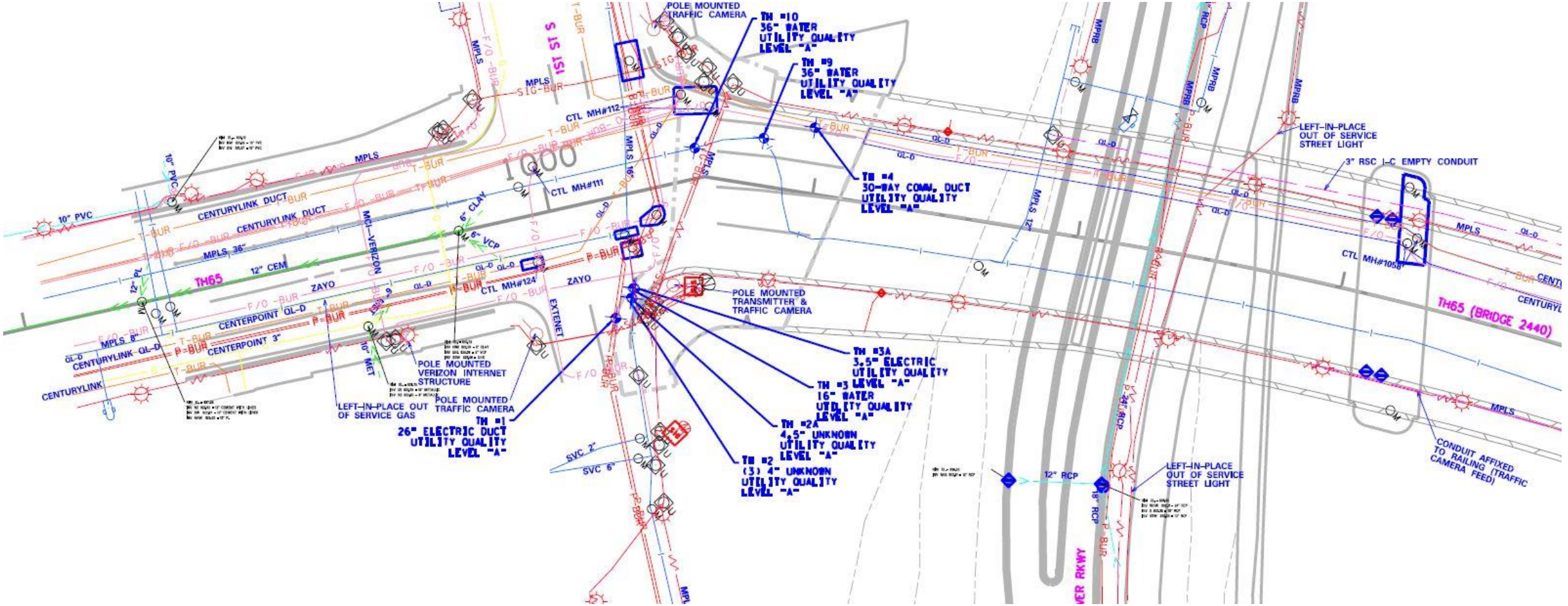
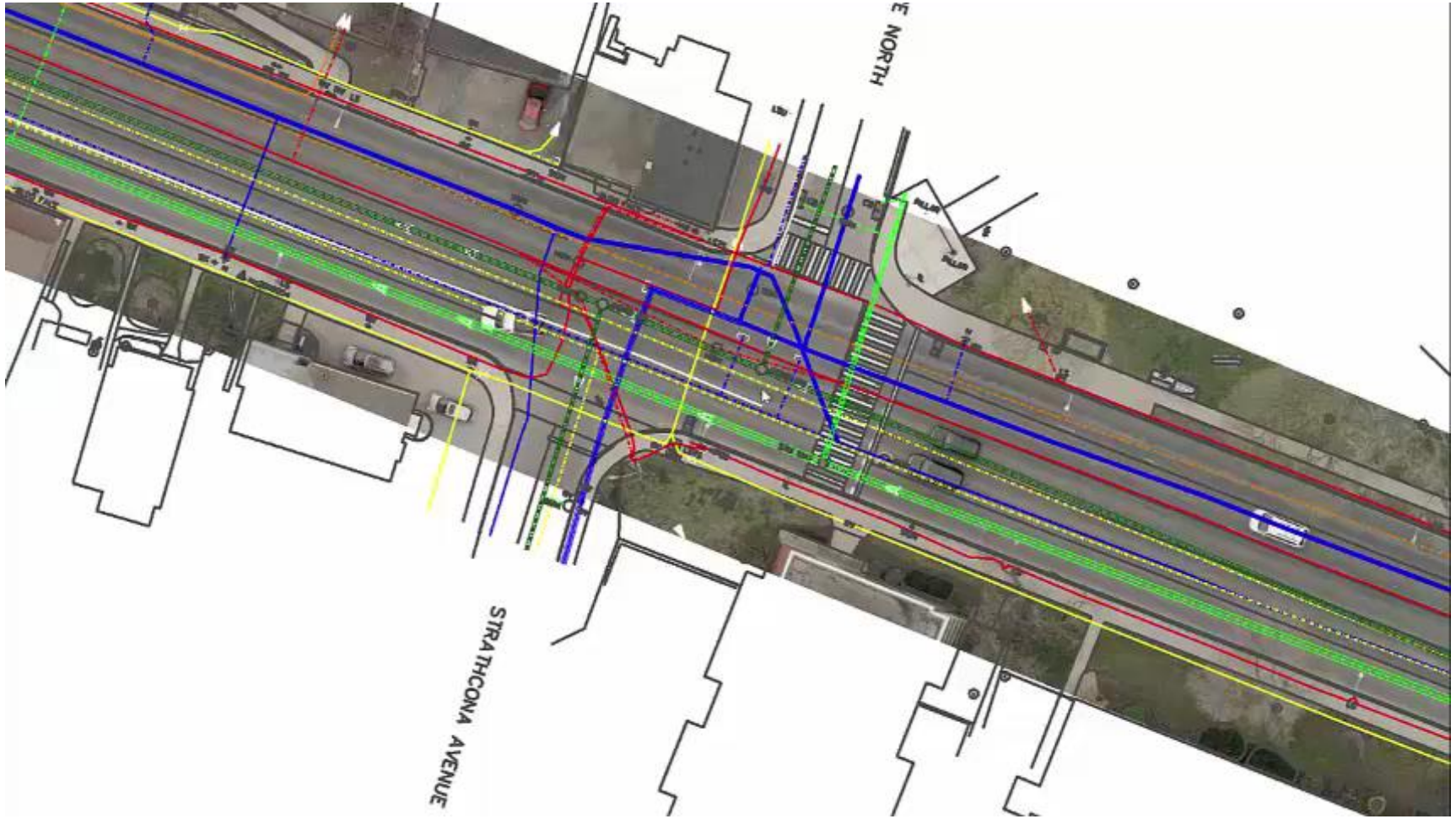
ASCE Quality Level - A SUE Deliverable



Looking to the Future - Advanced Geophysics



3D Multi-channel GPR Results

Single-channel GPR

3D Multi-channel GPR
Field Collection

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3D SUE Modeling

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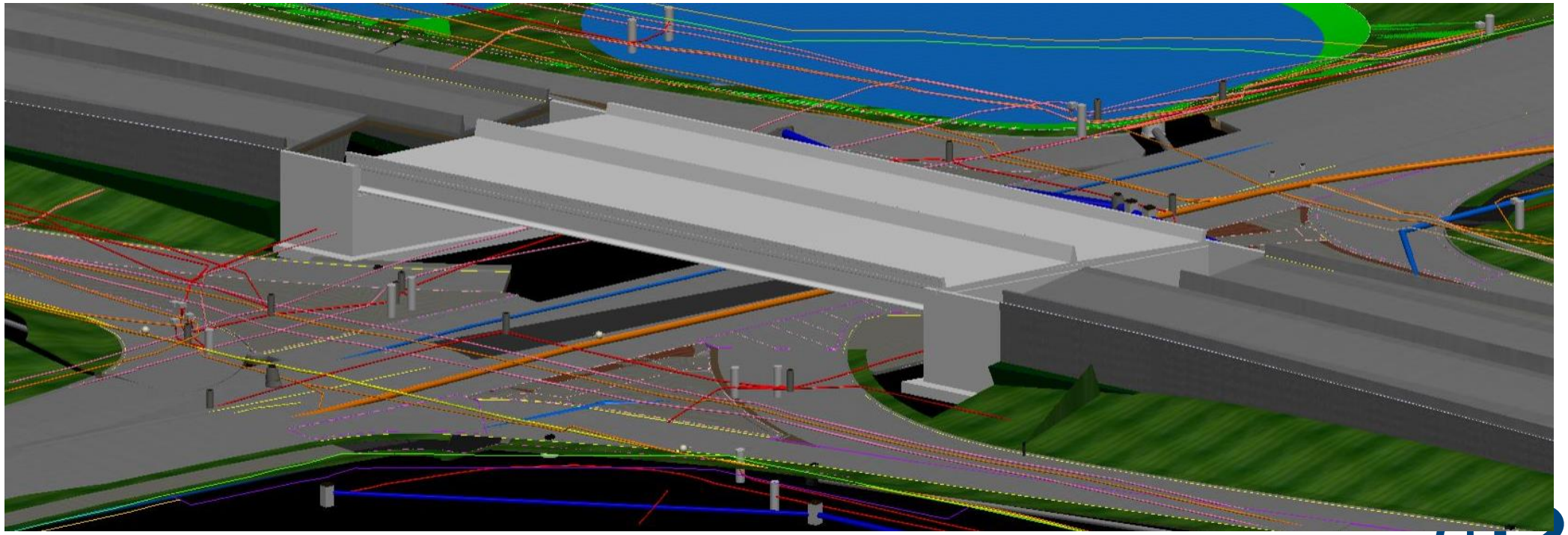
Time To **Take Action**

- Utility Corridors will continue to get more congested.
- The Importance of Accurate Reliable Information will increase as will the use of 3D Models.
- Experienced Utility Coordinators will become increasingly important roles on design projects.



What is a 3D Model

2D SUE Drawing

- Horizontal alignment (i.e. flat).
- Depths (inverts, test holes) are typically notes on the drawing or reports.

3D Model

- Creates a 3D representation of the buried underground infrastructure.
- Depth is added to the SUE Drawing based on physical measurements, assumed depths and records.
- 3D Model is a blend of:
  - verified data points (x,y,z)
  - alignments with assumed depths (x,y)
  - assumed elements
- Assumptions will need to be stated in the project scope document.
  - Technical Memo

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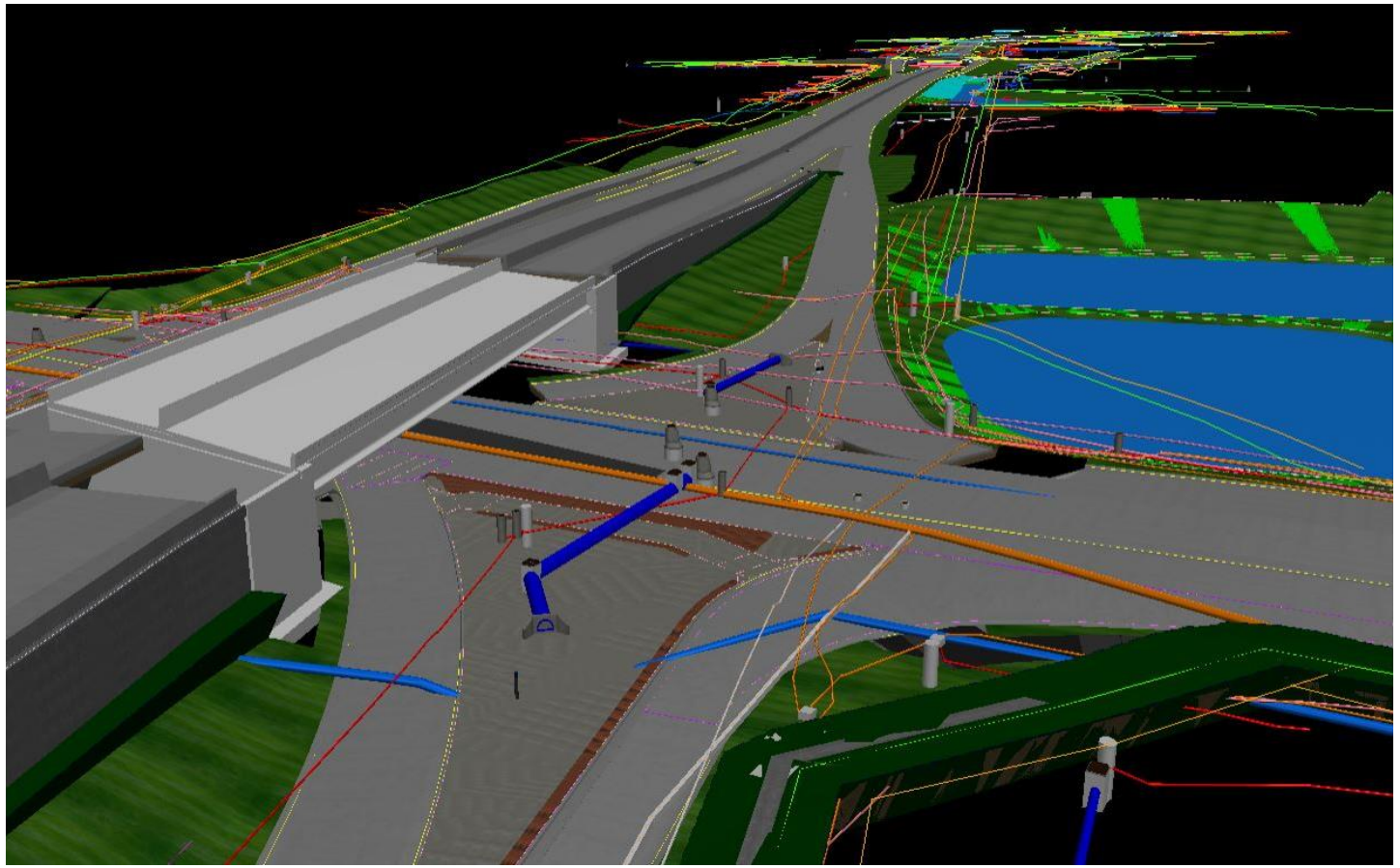
What Clients Benefit from 3D Model

- 3D Model projects have typically been created for larger linear projects developed for transportation.
- Engineering design for projects being completed using 3D.
- Utility Cross Sections, Profiles, Constructability, Shoring Design, Man Hole, Utility Connections, Utility Design and Plan Delivery.
- Ease of conflict identification.
- Accessibility – Online viewer
- “Beauty of 3D, comfortable user interface to consume it. Historically unable to do so easily.” Clients are finding it much more intuitive.



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Thank You

There are more difficult things to deal with on the job than utilities!

Additional Information

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