Utility Engineering Best Practices Using ASCE 38

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SAM Family of Companies
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Ever have a utility problem?
Underground Utilities

- 50+ million miles of underground utilities exist in the U.S.
- Existing utilities are at varied depths, in varied soils, made of different materials, are varied sizes and have varied access.
- More utilities are being installed daily, deeper and with less detectable materials.
- No one entity in control; hodgepodge of laws, policies, attitudes
Underground Utilities

- Oil/Gas Pipeline
- Water
- Sanitary Sewer
- Storm Drain (normally not considered a utility)
- Telephone
- Fiber Optic Cable
- Electric Transmission
- Electric Distribution
- Gas Distribution
- Cable TV
- ITS Systems
- Traffic Control
- Others
It’s Easy If You Can See The Lines
How do people map utilities?

• Record Data
  • Incorrect, Missing, Never Made

• One Call/ Private Locating Contractors
  • Incorrectly Marked, Do Not Participate, Abandoned Utilities Not Marked

• Exploratory Potholing
  • Nothing In The Hole, Where Does It Go Between Holes?

• Survey What You Can See
  • How Does It Connect Below Ground?
National Standard

D, C, B, A

Least Accurate → Most Accurate
ASCE Standard 38-02 Quality Level “D”

- As-Built records
- Utility system drawings
- One-Call Marks
- Oral recollections
ASCE Quality Level D – “Record Research”
ASCE Standard 38-02 Quality Level “C”

Surveying visible, above ground, surface features such as:

- Valves
- Fire hydrants
- Pull boxes
- Manholes
- Telephone pedestals

Reconciled to ASCE Quality Level D records
ASCE Standard 38-02 Quality Level “B”

Surface geophysical methods to designate, or mark, the approximate horizontal position of subsurface utilities, with subsequent survey, professional judgment, and depiction.
Surface Geophysical Equipment

- Electromagnetic Methods
- Rodders & Sondes
- Elastic Wave/Acoustic
- CCTV
- Laser Scanning (LiDAR)
- Ground Penetrating Radar (GPR)
- Advanced Geophysics
  - Multi channel GPR (STREAM)
  - EM 31/61
One Call vs. Quality Level B

> Designator: Possesses or at least has requested all available utility owners’ records
> Locator: Possess only those records for the utility owner for which he/she is under contract
> Designator: Finds and marks all utilities capable of being found
> Locator: Only marks some utilities – doesn’t have advantage of seeing all parts of the puzzle. For instance, abandoned utilities, unknown utilities, multiple non-encased wires, etc. cause identification confusion
> Designator: Has many pieces of equipment on-site or readily available
> Locator: Has limited equipment available
> Designator: Maps a large area, allowing better familiarization with utilities at a site
> Locator: Usually only responsible for a very small area, making it difficult to see the large picture
> Designator: Has a realistic time frame for finding and marking utilities
> Locator: Is under severe time constraints for getting utilities marked
What happens when you are only marking one specific Utility?

Because the telephone line can carry a frequency better than the water, the water locator’s equipment can “bleed off” onto the telephone line without the locator knowing since they are only locating a single line and the signal they have is good. The water locator may not have any idea a buried telephone line is in the area.
Does GPR Work?
Missouri GPR Soil Suitability
Ground Penetrating Radar (GPR)

- NAS R-01: Using only GPR would be considered negligent in most cases
- FDOT: 45% of utilities imaged with GPR (great soils)
ASCE Standard 38-02
Quality Level “A” Locating (Test Hole)

Using non-destructive excavating equipment at critical points to determine the *precise* horizontal and vertical position, type, size, condition, material and other characteristics of underground utilities.
### Quality Level “A” Documentation

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<th>Test Hole #</th>
<th>Utility Type</th>
<th>Utility Material</th>
<th>Utility Size (Diam.)</th>
<th>Approx Station</th>
<th>Northing</th>
<th>Easting</th>
<th>Elevation of Hub Placed for Survey</th>
<th>Manual Depth (Top)</th>
<th>Elevation at top of utility</th>
<th>Cross Sectional View</th>
<th>Utility Direction</th>
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Desired Project Utility Investigation Process
(for “horizontal” projects requiring the design services of a civil engineer)
Project Risk
With and Without ASCE 38

TOTAL RISK
Without ASCE 38

TOTAL ENGINEERING RISK POOL

DEFINED QUALITY LEVEL

Design Engineer

Utility Engineer

ALLOCATION OF RISK WITHIN ENGINEERING POOL

RISK ELIMINATED

Without SUE With SUE

TOTAL ENGINEERING RISK POOL
Section 7.0 Relative Costs and Benefits

> Cost/Benefit Studies:
  – Purdue University- $4.62 saved per $1 spent
  – University of Toronto- $3.41
  – Penn State- $22.21

> Biggest Savings:
  – Relocations avoided
  – Fewer delay claims

> Best Practice:
  – FHWA
  – AASHTO
  – FAA
  – 39 State DOT’s
  – State Law in Colorado and Pennsylvania
NOTE:
1. PRIOR TO REMOVALS, CONTRACTOR AND ENGINEER SHALL MARK TRACES TO BE PROTECTED.
2. LIMITS SHOWN FOR REMOVAL OF CONCRETE PAVEMENT ARE APPROXIMATE, SHALL BE VERIFIED BY THE ENGINEER.
BURIED CABLE
CENTURY LINE RECORDS SHOW A LINE AS
DEPICTED IN THE DRAWING AS FO(0) AT QUALITY
LEVEL D. FIELD INVESTIGATIONS WITH PIPE AND
CABLE LOCATORS AND GROUND PENETRATING RADAR
FOUND NO GEOPHYSICAL EVIDENCE OF THIS LINE.
NO SURFACE EVIDENCE WAS FOUND.

UNKNOWN LINE FOUND WITH VM810 PIPE AND CABLE LOCATOR
AND GROUND PENETRATING RADAR.
NO SURFACE EVIDENCE EXISTS.
LINE APPEARS TO RUN UNDERNEATH WATER MAIN.

COPPER
ABANDONED LINE
OUT STREET LIGHT ELECTRIC LINE EXPOSED

LEADER: THE UTILITY INFORMATION SHOWN ON THESE
DRAWINGS IS IN ACCORDANCE WITH CRAD 214SD 38402
3D Utility Models
Questions?

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