SUE for Municipalities
Who are you?

- Consultant
- DOT
- Municipality
- Utility
- Contractor
Do you use SUE?

- Yes, on every project.
- Yes, on some projects.
- No.
- I don’t know what SUE is.
- I’m just here for the PDH’s.
What is SUE?
What SUE is NOT

- Pipe and cable locator
- Vacuum or hydro excavation truck
- One Call marks – surveyed or not surveyed
- The “E” does not stand for exploration
What SUE is

- ASCE 38-22: Standard Guideline for Investigating and Documenting Existing Utilities

“The specialty practice of civil engineering’s Utility Engineering branch that includes the investigation, analysis, judgment, and documentation of existing Utility networks.”
Why SUE?

• From *Subsurface Utility Engineering for Municipalities*:

  “SUE is concerned with developing a full understanding of all the utility infrastructure in the project area to anticipate issues and engineer solutions during project development as designs are conceived and laid out. This proactive, predictive approach safeguards workers and utility infrastructure; moreover, it sustains essential services for dependent businesses, government agencies, and consumers during project delivery.”
Why use SUE?

• Poor or no data provided by utility companies
• Records are old, outdated, lost, or never existed
• Utility records are often incomplete and inaccurate
• Not all utilities are marked through a One Call system
• No search for unrecorded or abandoned facilities
• No responsibility for missing or erroneous marks
• Marks on the ground rarely convey facility attributes
• Responses to a ticket can be a phone call or record drawing in lieu of marks
• Field locators providing data and marks are not related to those recording, depicting, and interpreting the data
Why use SUE?

- DESIGN IS COMPLETED WITHOUT CONSIDERATION OF ACCURACY OF UTILITY INFORMATION
- UNRELIABLE UTILITY DATA IS CARRIED FORWARD FROM PRELIMINARY DESIGN TO FINAL DESIGN TO CONSTRUCTION
- CONTRACTOR IS THEN REQUIRED TO BID THE PROJECT BASED OFF OF OLD AND INACCURATE UTILITY INFORMATION
Benefits of SUE

- Unexpected conflicts and are eliminated
- Allows for discussions with utility stakeholders during verification plans
- Provides horizontally accurate information about existing utility infrastructure
- Contractors have more control over project sites
- Unnecessary relocations are avoided
- Allows for more efficient designs that avoid, minimize, and mitigate utility conflicts
- Project safety is enhanced
- Contractor bids are reduced when risk is reduced
But we...get records

- Utility records are often incomplete and inaccurate and therefore unreliable
But we...use One Call...it’s free

The old adage “You get what you pay for”
But we...use One Call...it’s free

- Lack of liability and accuracy
- One Call is there to protect the excavator, not for design
- Unmarked utilities
- Locators mark everything they “find”, even if it doesn’t make sense
- Locators may mark utilities even if they don’t get a signal but “the maps say its here”
- Not even considered QLD
- Public locators do not locate private utilities
Relying only on One Call

One call marks showed the water line outside the area of bridge construction, seemingly out of conflict.
Relying only on One Call

- Water line determined to be in direct conflict with proposed bridge replacement
Price is what you pay, value is what you get.

Warren Buffett
The Value of SUE

• Knowledge…
  • You know who is in your right of way
  • You know what they own in your right of way
  • You know where they are in your right of way

• Accurate information

• Minimize surprises
  • A sweep of the entire area is done
  • Finds facilities that public locates may not find

• Design has more accurate information to design from
  • Reduces re-design due to inaccurate utility information

• Costly utility relocations may be avoided
• Contractors work from more accurate information*
Utility Levels

“The value assigned by the Professional, a of Utility Segment or subsurface Utility Feature that identifies the relative (nonquantifiable) uncertainty of a Utility Segment’s or subsurface Utility Feature’s existence and actual location to that of its documented location.”

-ASCE 38-22
Utility Quality Levels: QL-D

• Records Research
• “Value assigned to a Utility Segment or Utility Feature not visible at the ground surface whose estimated position is judged through:
  • Utility records
  • Information from others
  • Visual clues such as pavement cuts, obvious trenches, or existence of service.”

• This is the most uncertain of the quality levels.
• Unreliable
• Information may include: owner, type of facility, size, material
Utility Quality Levels: QL-C

- "Value assigned to a Utility Segment not visible at the ground surface whose estimated position is judged through correlating Utility records or similar evidence to Utility Features, visible aboveground and/or underground.

  - Utility Anchor Points are tied to a project survey datum with an accuracy of 0.2 feet horizontal.

- Survey of the above ground utility infrastructure such as manholes, valve boxes, posts, and other related features and correlating this data with the QLD information.

- May be useful on rural projects where utilities are not prevalent or not too expensive to repair or relocate.
Utility Quality Levels: QL-B

• “Designating”
• “Value assigned to a Utility Segment or subsurface Utility Feature whose existence and horizontal position is based on Geophysical Methods combined with professional judgement and whose location is tied to the Project Survey Datum.”
Utility Quality Levels: QL-B

- The following conditions must be met:
  - Use of Geophysical Methods
  - Geophysical signal was judged to be reliable
  - Interpreted position judged based on the use of geophysical science, design and installation practices, records, visual features, and site conditions
  - Source Designation is tied to the Project Survey Datum with an accuracy of 0.2 feet horizontally

NOTE: Some electromagnetic equipment provide depth readings, but the horizontal locations (x,y) of the utilities are the only data provided that is professionally certifiable at this stage.
Utility Quality Levels: QL-A

• “Locating”

• “Value assigned to that portion (x-, y-, and z-geometry) of a Utility Segment or subsurface Utility Feature that is directly exposed and measured and whose location and dimensions are tied to the Project Survey Datum.”

• Accuracies:
  • Horizontal – 0.2 feet for the measurements of the outside limits of the feature or segment
  • Vertical – 0.1 feet

• Commonly referred to as “test holes” or “potholes”
  • “Test Holes” indicates the a precise and professional effort

• While highly accurate, it is only accurate at that specific point.
Project Development Process

Planning/Scoping
0-10%

Survey & Stage 1 Plans
10%-30%

PFC
30%-60%

Stage 3
60%-90%

Tracings
100%

Construction

Establish Risk:
- Early Coordination Meeting
- Verification of Existing Facilities
- Maps/GIS/Utility Information

Mitigating Risk:
- Establish conflicts
- Revise design if possible
- Collaborate mitigation measures

Damage Prevention:
- Survey data provided to Contractor
- As-built data & plans for relocated facilities

Initial Notice
Verification Plans
Conflict Analysis
Work Plans/Relocations/Construction

QL-D & QL-C
QL-B
QL-A
Utility Relocations/Construction
Consider doing SUE in two phases:
- Designating (QL-B) during survey
- Locating (QL-A) during conflict analysis/Stage 2 plan development

Allows for discussions with utility stakeholders during verification plans to:
- Confirm findings
- Evaluate & mitigate risk
- Begin design with a better understanding of utility facilities

QL-A after PFC – before Stage 2

QL-A after Stage 3 is too late
- Design is mostly complete
- Work plans are likely complete
- Not enough time for SUE provider to get the information before tracings
Project Example

- Thank you to InfraMap Corp for the use of this project example.
What to Look for in a SUE Provider

- General Qualifications
  - Registered Professional Engineer and/or Land Surveyor
  - Professional Liability insurance ($1M)
  - Sufficient resources to meet the project needs
  - Documented QA/QC plan
What to Look for in a SUE Provider

• EXAMPLES OF PROFESSIONAL JUDGEMENT EXERCISED IN QA/QC UTILITY PLAN REVIEW:
  ▪ Evaluate all available utility data (records, designating, aerial)
  ▪ Are all utilities accounted for?
  ▪ If a watermain was not located, how are residents getting water? (wells, etc.)
  ▪ If a gas main was not located, how are businesses getting heat? (electric or propane)
  ▪ If no sewer system, is there evidence of septic?
  ▪ Inconclusive and Competing records
  ▪ Unknown utilities
Scope of Work

• What are the expected ASCE 38 Quality Levels?
  • Will the utility coordinator provide the records research? (QL-D)
  • If the designer has conducted the survey, will that survey data be available to the SUE consultant? (QL-C)
  • Will geophysical techniques be used and tied to survey control to determine the horizontal location of subsurface utilities? (QL-B)
    • This yields precise horizontal location within survey grade accuracies
  • Will excavation and visual observation of the facility be required? (QL-A)
    • This yields precise horizontal and vertical location of the facility at this point.
    • This provides visual confirmation of size, material, condition, etc of the facility
Scope of Work

• Should the work include mapping of overhead and/or above ground utility features?
• Will estimated Z values be provided? Are those values are based on
  • Approximate based on geophysical methods?
  • Measured from valves and/or handholes?
  • Inspection of a manhole and vault including detailed diagrams?
  • Assumed depths based on records and/or UAP’s?
• What geophysical methodologies are anticipated to be used?
• Will the deliverable include a Utility Report?
• What is the needed or anticipated schedule?
<table>
<thead>
<tr>
<th>Deliverable</th>
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</thead>
<tbody>
<tr>
<td>Stamped and sealed plans</td>
</tr>
<tr>
<td>2D of underground and/or overhead utilities</td>
</tr>
<tr>
<td>2D with annotated depths</td>
</tr>
<tr>
<td>2D with elevations provided at specific QL-A points</td>
</tr>
<tr>
<td>CAD files using linestyles depicting quality levels</td>
</tr>
<tr>
<td>Utility attribute data and meta data</td>
</tr>
<tr>
<td>Test hole data forms</td>
</tr>
<tr>
<td>Utility report</td>
</tr>
<tr>
<td>3D deliverable as requested</td>
</tr>
</tbody>
</table>
• Thank you to CDOT for the use of this SUE plan deliverable example.
Deliverable – Utility Report

Provides a summary of the project

- Project start and end dates
- Project limits
- Geophysical methodologies utilized
- Survey datum and methodologies utilized
- Utility findings including utilities not anticipated to be in the area
- Utility discrepancies and unknown utilities
- Discusses any areas unable to be investigated and why
- Any anomalies during the investigation

Provides recommendations for unverified information

- May include additional geophysical methods
- May include doing test holes

Includes any assumptions or exclusions

Discusses engineering judgements made in QL determination

Signed & Sealed by a Professional
Deliverable – Utility Report

- Test hole data sheets
  - Test hole number correlates to plan sheet
  - Location of test hole
  - Utility being located vs. utility found
  - Material and size of utility
  - Condition
  - Material surrounding utility
  - Depth of utility
  - Pictures of the utility, site surrounding test hole, measured depth

Thank you to InfraMap Corp for the use of this project example.
Fee Schedule

- Hourly items:
  - Records research (QL-D)
  - Targeting Only (marking utilities for survey)
  - Designating – targeting + survey (QL-B + QL-C)
  - Test Holes (QL-A)
  - Plan Development
  - 3D Modeling
  - Project management
  - QC/QA
  - Traffic Control
Fee Schedule

**Day Rates for field work**
Should include everything involved in the project
QL-C, QL-B
Survey
Travel – per diem & hotel
Mileage

**Unit Rate for field work**
Linear Foot for targeting and designating
Per Test Hole
CDOT Case Study

Example project - CDOT Corridor projects**

- I-70 through Downtown Denver
  - SUE required as a part of the design process
  - Utilized as-built mapping throughout the project
  - Merged as-built data with legacy data during construction
- I-225 – similar in size and scope
  - Utilized only legacy (811) data

Utility Damages During Construction

- Legacy Data Only – 147 strikes
- Merging of as-built data, Legacy data, and SUE information – 3 strikes

**Background provided by and used with permission from CDOT
### CDOT Case Study

| Natural Gas | $245,494 = A * B * F | Natural Gas | 467 = B * E * F |
| Telecom | $251,971 | Telecom | 159 |
| Electric | $72,550 | Electric | 28 |
| Cable | $43,887 | Cable | 38 |
| Water/Sewer | $29,561 | Water/Sewer | 9 |
| Fiber | $180,000 | Fiber | 33 |

**Total Direct Measurable Costs Avoided:** $823,463  
**Total CO2 t saved:** 735

<table>
<thead>
<tr>
<th>Downtime costs per incident (estimated avg):</th>
<th>Low Estimate</th>
<th>Mid Estimate</th>
<th>High Estimate</th>
</tr>
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<tbody>
<tr>
<td>Labor reallocation</td>
<td>$5,000</td>
<td>$27,500</td>
<td>$50,000</td>
</tr>
<tr>
<td>Overtime</td>
<td>$10,000</td>
<td>$55,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Machinery downtime</td>
<td>$5,000</td>
<td>$27,500</td>
<td>$50,000</td>
</tr>
<tr>
<td>Injury / Loss of life</td>
<td>$7,500</td>
<td>$38,472</td>
<td>$69,444</td>
</tr>
</tbody>
</table>

**Total strikes avoided:** 144  
**Total Indirect Estimated Costs Avoided:** $3,960,000

**Total Estimated Savings:** $4,783,463  
$22,203,463  
$39,623,463

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- **Background provided by and used with permission from CDOT**

On a $1 bill project, this would represent 2.2% of savings using the mid-point estimate.
SUE is just one component of minimizing utility impacts.
WHEN A UTILITY COORDINATOR BECOMES A SUE PROVIDER

Meet with the design consultant to better understand the project

- Scope of project
- Schedule of project

Understand where the existing utility information came from

- 811 locates
- Utility records
- Prior designating
<table>
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<th>WHEN A UTILITY COORDINATOR BECOMES A SUE PROVIDER</th>
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</table>

- **Review the conflict analysis or matrix**
  - Drainage conflicts
  - Subgrade conflicts
  - Grading conflicts
  - Constructability conflicts

- **Make recommendations for test hole locations**
  - Outside pavement
  - Outside wheel tracks when in pavement
  - Outside of sidewalk/paths
WHEN A UTILITY COORDINATOR BECOMES A SUE PROVIDER

What permits will be required?
- Local permit
- General contractor registration
- Railroad permit

Any environmental concerns?
- Wetlands
- Environmentally sensitive areas
- Archaeological areas

Any property owner or right-of-way issues?
- Access to site
- Slopes, steep grades
- Guardrails
- Heavy brush
WHEN A UTILITY COORDINATOR BECOMES A SUE PROVIDER

- Survey control
- Utility records, if they have them
- Topo survey in CAD
- Defined project limits
- Utility owners & contact information
- Full plan set
- Geotech report
- Conflict matrix
## WHEN A UTILITY COORDINATOR BECOMES A SUE PROVIDER

<table>
<thead>
<tr>
<th>Evaluate</th>
<th>Complete</th>
<th>Determine</th>
<th>Accommodate</th>
<th>Communicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate preliminary design for potential conflicts with existing utilities</td>
<td>Complete a conflict matrix</td>
<td>Determine test hole locations and coordinate with SUE professional</td>
<td>Review test hole data and revise design as needed to accommodate utilities in place whenever feasible</td>
<td>Communicate SUE data to the Contractor – on plan sheets or as an attachment to the bid package</td>
</tr>
</tbody>
</table>
Why Use Sue?

Unknowns lead to damages

Damages lead to loss of time, money, and possibly life
Why Use Sue?

Reduce Unknowns → Reduce Risk → Reduce Damages & Delays

The more predictable and precise the information during design... ...the less risk there is during construction.
Thank You

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