Leveraging SUE Data for Utility Safety on Light Rail Transit Projects

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Salt lake City

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Principal Engineer
Utility Mapping Services, Inc.
Discussion Topics

• SUE Process Fundamentals
• Analytical Tools
  • Conflict Matrix, BIM & 3D CAD
• Prime Control - *Empowering the Contractor*
• Geodetic Tools
  • Machine Control, GPS Integrated Locators
  • Cloud Based Repository & Integrated Maps
• Stakeholder Personnel Qualifications
What is Subsurface Utility Engineering (SUE)?

- It’s the utility’s responsibility
- It’s too expensive
- It’s a “Potholing” Service
- It’s something anyone can do!
- It’s a Survey Service
- It’s a Locate Service
What is Subsurface Utility Engineering (SUE)?

No – It is a Non-Trivial and Essential Engineering Process

1. Identify, Characterize, Map and Document Utilities (CI/ASCE 38)
2. Coordinate the Inclusion of All Utilities Within Design and Construction of a Civil Project
3. Hold Paramount Public Welfare
Qualifications require integration of professional specialties.

**Subsurface Utility Engineering**

- **Surveysing / CADD**
- **GIS/Data Management**
- **Utility System Distribution Analysis & Design**
- **Health & Safety**
- **Utility Coordination**
- **Conflict Resolution Engineering & Construction**
- **Discrete Daylighting**
- **Geophysics**

"Utility System Distribution Analysis & Design" is connected to "GIS/Data Management," "Utility System Distribution Analysis & Design" is connected to "Utility Coordination," and "Conflict Resolution Engineering & Construction" is connected to "Discrete Daylighting."
Industry Standard
CI/ASCE 38-02 (The Standard)
SUE (The Engineering Process)
SUE Data Example: Before and After Data Mapped Per CI/ASCE 38-02

CI/ASCE 38-02 data included in bid package.
## SUE Work Scope

<table>
<thead>
<tr>
<th>SUE Work Scope Items</th>
<th>Corresponding Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data acquisition</td>
<td>CI/ASCE-38</td>
</tr>
<tr>
<td>2. Conflict identification</td>
<td>SHRP R15A Conflict Matrices</td>
</tr>
<tr>
<td>3. Utility Workshops</td>
<td>FHWA <em>Avoiding Utility Relocations</em></td>
</tr>
<tr>
<td>4. Engineer Resolutions</td>
<td>(DTFH61-01-C-00024)</td>
</tr>
<tr>
<td>5. Utility Agreements</td>
<td>...</td>
</tr>
<tr>
<td>6. Construction PS&amp;E</td>
<td>...</td>
</tr>
<tr>
<td>7. Construction Bidding, Management,</td>
<td>...</td>
</tr>
<tr>
<td>Oversight</td>
<td></td>
</tr>
<tr>
<td>8. As-Built Data</td>
<td>Proposed U.S. Standard</td>
</tr>
</tbody>
</table>
Conflict Management

• Shifts Utility Conflict Identification & Resolution to Preliminary Design Stages

• Creates an Environment for Pro-Active Management and Planning
  – Standardized Data
  – Systematic Procedures
  – Sufficient Time for Stakeholders to Develop Resolutions in a Controlled Manner
SUE Impact On Construction

– Reduces Relocation Costs
– Streamlines Construction
– Reduces Damage During Construction
– Reduces Contractor Change Orders (Unforeseen Surprises)
– Reduces Contractor Contingencies in Bids
– Optimizes Utilization of Public Right of Way
Problem: Utility relocation work cannot be advanced due to significant grade changes.

- Advanced utility work not feasible
Project Plan View

18” Drainage

30” Water

Conflict?
How deep is the water pipe?

30" Water
Analytical Tools – 3D CADD

Clash detection of utilities and drainage using *ProjectWise Navigator.*
Analytical Tools - BIM

Rendering of infrastructure model including roadway, bridge overpass, electrical utilities, and water utilities, with survey data provided by Wigan Council, a government agency in the UK. Designed in AutoCAD® Civil 3D® software. Rendered in Autodesk® 3ds Max® Design software.
Geodetic Tools – Machine Control
Geodetic Tools – GPS Integrated Locators

Map Views are particularly valuable during data collection, to validate the position of the incoming points compared to already mapped utilities, or the as-built positions. Auto-logging based on either time or distance intervals, coupled with auto-tolerancing of the merged utility offset and GNSS positions, provide a very efficient mechanism for collecting line data. After the measurement session, Trimble Access supports field editing of the dataset, or alternatively, a simple upload of the data to the company’s servers.

Version 1.1

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Geodetic Tools – Emerging Cloud Based Repository & Real-time GPS Navigation
Prime Control

*Empowering the Contractor*

- Utilities are included within project development (work is value engineered by designer, prime contractor)
- Transfers responsibilities to prime contractor (reducing utility related delay claims resulting from third party failures to perform)
- Decreases project risk (e.g., damage, health and safety, schedule, public and commerce disruption, project budget)
- Contractor has a tighter bid (utility unknowns are largely eliminated, less contingency required)
- Project schedule is optimized
- Utility work is optimized
- Contractor can quickly work deals with utilities by offering betterment opportunities, joint construction work, etc. (State statutes may prevent DOT’s from cutting such deals.)
## Example of Prime Control

### $53M Design-Build Project

<table>
<thead>
<tr>
<th>Initial Anticipated Utility Relocation Cost</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td>Telephone Duct Relocate</td>
<td>$1.0 Million</td>
</tr>
<tr>
<td>Additional Utility Relocations</td>
<td>$1.4 Million</td>
</tr>
<tr>
<td>Total</td>
<td>$2.4 Million</td>
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</tbody>
</table>

### Actual

- SUE Data Collection and Management Costs: $200,000
- Required the Contractor to bid utilities as part of proposal
- Utility Relocation Line Item: $630,000
- Contract provided 60% contractor / 40% DOT split
- on Bid vs. Actual Utility relocation savings
- **Contractor designed around the majority of utilities**
- Actual Relocation Costs: $480,000
- Contractor Split: $90,000
- Total Utility Relocation Costs w/SUE: $770,000
- **Total cost savings**: $1,630,000
Understanding the Issues

Final Result:

The RIGHT Transportation Design...

The RIGHT Utility Process...

The RIGHT Utility Design...

STILL PROBLEMS!

Drew Markewicz
TRB AFB70 Jan 2012
To Bridge the Gap.....

Transportation Project

Subsurface Utility Engineering

Utility Technical Discipline Void

Successful Project

Utilities within Project Limits

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To Bridge the Gap.....

Address the Utility Technical Discipline void

• Must Understand BOTH Agency and Utility Needs
• Be Knowledgeable in BOTH Agency and Utility Company Policies, Procedures, & Requirements
• Have "Cross Discipline” Design Experience in BOTH Transportation & Utilities
• Experienced in Identifying, Prioritizing, & Mitigating Risks for BOTH Transportation & Utilities

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To Bridge the Gap.....

Address the Utility Technical Discipline void

• Have a Design understanding of ....
  ...road & railways, drainage, structures, traffic, ROW, etc.

• Experience in resolving Utility Field Construction Issues

• Ability to perform Constructability Reviews involving BOTH Transportation & Utilities

• Understand Construction Staging & Sequencing constraints for BOTH Transportation & Utilities

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To Bridge the Gap.....
Address the Utility Technical Discipline void

• Ability to Establish Relationships, based on Mutual Understanding & Trust

• Ability to Recognize Time & Cost Innovative Utility Solutions

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Example of installing offset manholes to maintain access to an existing 84" storm main left in place below a light rail.
Columbia River Project in Vancouver, Washington

50024: LRT | ELINPUD524 Conflict
0 Accepted Resolutions | 0 Resolutions | 0 Messages | Unresolved

Features in Conflict

<table>
<thead>
<tr>
<th>Feature ID</th>
<th>Description</th>
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<tbody>
<tr>
<td>LRT</td>
<td>TriMet</td>
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<tr>
<td>ELINPUD524</td>
<td>Clark County PUD</td>
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</table>

<table>
<thead>
<tr>
<th>Conflict Number</th>
<th>Resolve By Date</th>
<th>Alignment</th>
<th>Features in Conflict</th>
<th>Description</th>
<th>Created by</th>
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<tbody>
<tr>
<td>50023</td>
<td></td>
<td>Washington Street</td>
<td>LRT</td>
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<td>Light Rail Transit: Rail Section</td>
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Light Rail Typical Section

MULTI-DIRECTION LIGHT RAIL CROSS-SECTION

Original 5ft+ Depth Along Alignment

Option A
1.5ft Slab

Option B
2ft Thickened Slab
“Captain, sensors indicate an oil pipeline of probable Romulan origin is in conflict with our new light rail alignment. However, I’ve instructed the computer to develop a reinforced rail span system that allows the pipeline to remain in place without engaging the Romulans.”
We appreciate your time.

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