Outlining Technology, Procedures and Research in USA

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Utility Issues Getting More Attention

- 11 - 20 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, 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 (e.g. FAA & airports are both major utility owners but often do not share data; state DOTs say big problem is that municipalities do not share utility permit installation data)
How do we typically manage the risks of existing utilities on projects?

Do nothing
High Risk

Do everything
Low Risk

COST

# of Projects

Do nothing

Do everything

Subsurface Utility Engineering

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Subsurface Utility Engineering

Designating
(Pipe and cable locators)

Locating
(Test Holes)

THEN (1985)

Subsurface Utility Engineering

A Professional Service

Collection & Depiction

QL D – Records Research
QL C – Surveyed Features
QL B – Designating
QL A – Locating

Today

Graphics Courtesy of TBE
Pictures Courtesy of So-Deep
Subsurface Utility Engineering

A Professional Service

Collection & Depiction
- QL D – Records Research
- QL C – Surveyed Features
- QL B – Designating
- QL A – Locating

- Utility Coordination
  - Conflict Analysis
  - Conflict Resolution

- Gravity Systems
  - Gravity Systems
  - Rims & Inverts, CCTV, Sondes, Designating & Locating

- Overhead
  - Poles, Lines, Pole Counts, Inventories

- Manhole Detailing
- Profiles Development

- Modern mapping tools
  - GPR, "3D" Imaging, other new tools

- Construction Observation & Certified Record Drawings
- GIS Database Population
- Damage prevention

Today

Projects with no perceived risk

Minimum Government Standards

One-Call during construction
OSHA Excavation Statutes

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Projects thought to have some risk

Sketchy design plans
Utilities, if shown on plans, plotted from minimal office effort
Contractor calls One-call
Contractor potholes utilities marked by utility owners
Contractor modifies design in field
Based upon one-call marks and pothole results

Projects with minimal design may not meet “The Standard Of Care”

• Standard of care is the degree of prudence and caution required of an individual who is under a duty of care
• Engineers and surveyors are under a higher duty of care than an average person
• Measured by peers practices, national industry standards, protecting the public safety
**Median** practice

Utilities plotted from available records
Utilities in conflict potholed, Design modified if necessary
Contractor calls One-call
Contractor potholes utilities marked by utility owners
Contractor modifies design in field, Based upon one-call marks and pothole results

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Increasing levels of risk management for Projects thought to have more risk

Utilities plotted from available records
Designer calls One-Call or Contract Locator
Locator marks surveyed and plotted by designer
Design advanced to 60% or so
Utilities in conflict potholed, Design modified if necessary

Contractor calls One-call
Contractor potholes utilities marked by utility owners
Contractor modifies design in field, based upon one-call marks and pothole results

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• Outlines specific steps for the engineer / surveyor to take that result in increasingly better utility mapping.

• Utilities as mapped are shown according to their “Utility Quality Level” which allows all parties to make better risk decisions.

• Use of Utility Quality Levels protects engineers and surveyors

• Requires all utility mapping to be performed under the direct responsible charge of a registered professional, experienced in utility issues, surface geophysics, survey, and CAD

• Increasing usage across the country is increasing its importance in cases where standard of care is an issue.
The total risk for the engineering pool decreases as quality level increases,
While within the engineering pool,
The risks shift towards the subsurface utility engineer as quality levels trend towards QLA data.

What’s Missing?

- Improved Geophysics to see utilities in the ground
- Better Data Management
  - Improved access to authorized parties
  - More timely data
  - Better ways to display and make data useful
- National Utility Data Standards
- Keeping Data Current
  - Better Installation Records
  - Comprehensive Permit management
Imminent Updates to ASCE 38

- GIS deliverables formatting
- Depth data for other than QLA
- Value Studies
- 3-D imaging geophysics

Future Updates to ASCE 38

- Attribute and Metadata specifics
- Certified Record Drawing requirements
  - 3-D deliverable examples
- Merging of Sensor data to utility databases
ASCE Standards

- Committee of 12 to 50 members
- Must be balanced between “Users,” “Producers,” and “General Interest – Regulatory”
- Consensus vs. Mandatory
- Committee Balloting / Public Balloting Procedures
- Updates every 5 years

- Can be “licensed” to other countries for their individual modifications (Australia has done this with ASCE 38-02, Canada interested)
- Dr. Nicole Metje added to 38-02 committee as GB Liaison
- 38-02 was the result of approx 10 years of outreach efforts before committee formed

MOST RECENT COST STUDY

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2007 Penn State Study for PENNDOT

Looked at:
- Utility relocation costs
- Utility damage costs
- Emergency restoration costs
- Traffic delay costs
- Business impact costs
- User service costs
- Environmental impact costs
- Information gathering costs (i.e. not using QLs)
- Legal & Litigation Costs
- Efficient design costs

10 randomly selected projects

Savings of $22.21 for every $1 spent in upgrading to QL B and QL A as opposed to projects using only QL D or QL C.

Total cost of obtaining QL A / QL B was 0.6 % of project costs.

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Phase I   Electronic White Line

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Phase I   Electronic White Line

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Phase I Metrics – Polygon Size

• Collection of GPS points of the field locate through the use of a GPS enabled locating instrument

• Overlay the GPS points on VUPS’ ortho-photography / land-base. (produced through Sentinel USA)

• Archive the electronic manifest within VUPS’ ticket history

Phase II Electronic Manifest

• Collection of GPS points of the field locate through the use of a GPS enabled locating instrument

• Overlay the GPS points on VUPS’ ortho-photography / land-base. (produced through Sentinel USA)

• Archive the electronic manifest within VUPS’ ticket history
Phase II  Electronic Manifest

Current manifest record

- Allow excavator access to view the document for a “birds eye” view of excavation site
- Location documentation
- Transmit the GPS locate data to individual utilities for a verification of maps and records
- Path to Phase III
Phase 3

Objective

- Develop and demonstrate a GPS-based excavation monitoring system

- Phase 3A - Protect against excavators that do not utilize the one-call center or accidently leave the valid ticket area

- Phase 3B - Protect against excavator encroachment

Phase 3A

- GPS Excavation Monitoring
  - Low cost, low accuracy
  - Commercially available
  - Additional benefits

- Portal
  - Central data repository
  - Monitoring software to detect excavation activity that is occurring outside of a valid one-call ticket
Phase 3A

> Digging Trigger
  – How does the system know when digging is occurring?
  – Retrofit Sensors
    > Motion or pressure sensors
    > Diagnostics
  – Next Generation Equipment

Phase 3A

> Pilot Project
  – Fall 2009
  – Soliciting participation from excavators
  – Selecting equipment types
Phase 3B

- GPS grade control system
  - High accuracy, high cost
  - Commercially available
  - Additional benefits
- Real-Time Portal
  - Monitoring software to warn excavator of imminent encroachment
  - Low and high cost options
- GPS-Enabled Locator
  - High accuracy GPS

Other Research

- See-ahead GPR on Directional Drilling equipment
- Utility Conflict Matrix
- Multi-Sensor Locating Unit
- GPS / GIS data repositories
- Elastic wave plastic pipe detection
- Keyhole technology
- RFID
What Does the Future Hold?

Islands of Technology

- Design/Estimating
- Construction
- Maintenance/Operations
- Records/Mapping
Central Repository for Utility Data

- Capture project data (SUE)
- Keep project data current during project (GPS)
- Develop mechanism to capture new data between projects (permitting)
- Project owners use data for future projects
- Utility owners use data for asset management
- Excavators use data for future damage prevention

J.H. Anspach Consulting Northwest Forum on Trenchless Technology

Central Repository