Lessons Learned on Major Infrastructure Projects

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Infrastructure Projects + Utilities = Risk
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- What the Conceptual Design Report said.
  - Minor Utility Relocations will be required, total Project Budget $14M.

- What was NOT done!
  - SUE was not completed within the EA process…
  - An experienced Utility Coordinator was not used on the project…
Infrastructure Projects + Utilities = Risk

- Water
- Sewer
- Telecom
- Gas
- Electrical
Infrastructure Projects + Utilities = Risk

• Results
  – Original estimate within the EA was ~$14M
  – Utility impacts increase cost to ~$105M ++

• What could they have done?
  – Early SUE and UC would have provided better budget and schedule certainty.
What have we learned?

• Raise the Profile and Importance on Utility Engineering
  • UESI
• Follow Industry Best Practices
  • TAC Guideline
  • ASCE 38-02
• Utilize Technology
  • Multi-Channel GPR
  • LIDAR
  • 3D Modeling
• Sample Project
  • Hamilton LRT
Utility Engineering

- Raise the Profile and Importance of Utility Engineering on Infrastructure Projects
  - SUE Professionals
  - UC Professionals
  - Survey Professionals
Guideline for the Coordination of Utility Relocations

ASCE Standard

Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

Mapping of underground utility infrastructure
TAC Guideline

Presents a High Level Process for Utility Coordination on Infrastructure Projects

Being adopted by Agencies as a basis for their specific UC Guidelines

Currently being updated to outline the process for UC on PPP projects.
Subsurface Utility Engineering

A specialty practice of civil engineering that investigates and depicts existing underground utilities through the collection and analysis of records, visual, geophysical, and/or exposure methods and assigns achieved Utility Quality Levels to Utility Segments based upon the integration of all the analyzed data with professional judgment at a defined point in time. SUE has evolved as a subset of Utility Engineering.
ASCE 38 Updates

- Definition of SUE
- Quality Level C
- Quality Level B
  - Designating Precision
  - Measuring, Documenting and Depicting Depths
- Quality Level A
- Measuring, Documenting and Depicting Vaults
- Inclusion of a Utility Report
Utilize Technology

Leverage Existing Proven Technologies

Take Advantage of New Technologies
- Multi-Channel GPR
- 3D Utility Models
- LIDAR
Multi-Channel GPR

STREAM EM

STREAM C
Multi-Channel GPR

STREAM Units
- Multi-Channel ground penetrating radar
- 40 separate channels
- double polarized (VV and HH) antennas
- dual 200 and 600 MHz antennas
- Data is spatially tied to survey coordinates
Multi-Channel GPR

From Detection to Mapping

Radiography → CAT (Tomography)

B-Scan → C-Scan (Tomography)
Multi-Channel GPR
Multi-Channel GPR
3D Utility Models
3D Utility Models
LIDAR
Sample Project - HaLRT
Sample Project - HaLRT

- ~13 kms
- Centre Alignment
- 17 At Grade Stops
- 1 Grade separation
- 1 Operations Maintenance and Storage Facility (OMSF)
- 3 Bridges over controlled access highways
Sample Project - HaLRT

- Followed TAC Guideline
- Completed a SUE Investigation following ASCE 38-02
- PSOS written to include use of CSA S250 for As-builts and Enabling Works
- STREAM EM / C Utilized
- 3D Model of Utilities Created
- LIDAR attempted
Sample Project - HaLRT
Sample Project - HaLRT
Sample Project - HaLRT
Sample Project - HaLRT

- Integrating LIDAR data with 3D Utility Model
- Challenges of tying LIDAR to project Survey Control.
Time to Take Action!

- Raise the Profile and Importance on Utility Engineering
  - UESI
- Follow Industry Best Practices
  - TAC Guideline
  - ASCE 38-02
- Utilize Technology
  - Multi-Channel GPR
  - 3D Modeling
  - LIDAR
THANK-YOU!

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