Utility Locating Technologies (R01B)
2019 TRB Update

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• Product Overview – “Utility Bundle”
  • 3D Utility Location Data Repository (R01A)
  • Identifying and Managing Utility Conflicts (R15B)
  • Utility Locating Technologies (R01B)

Round 6: Proof of Concept ($150K each agency)
Round 7: Lead Adopter ($100K each agency)
Implementation Assistance Program (IAP) States:

Virginia
Ohio
Arkansas
Oregon
California*
Montana*
Utility Locating Technologies (R01B) – Technologies Selected

- MCGPR for 3D
- TDEMI for 2D
Technologies Developed*

Advanced Geophysical Hardware*

• Multi-Channel Ground Penetrating Radar (MCGPR)
• Time-Domain Electromagnetic Induction (TDEMI)

Advanced Software*

• Software for processing, interpretation and visualization of MCGPR in 3D, and TDEMI data in 2D (plan-view)

* Commercially Available and Proven Technologies
‘General’ Implementation Plan:

1) **Training** → on-site: classroom *and* field / instrument demonstrations
2) **Planning** → Site / Project Selection
3) **Implementation** → Active DOT project for deployment of technologies (*for design needs*)
4) **Reporting** → DOT Reports (project) and AASHTO SHRP2 Report-outs
For Each Method:
- Basic Theory
- Limitations
- Complications
- Variations
- Applications
- Why it works for utility mapping
- When it won’t work for utility mapping
- Requirements for effective use
- Final Products – What are the deliverables
Field Demonstrations/Projects

IDS Stream-EM System

3D-Radar System
DXG
MCGPR: IDS STREAM EM

• GPR solution towed by a vehicle (speed > 10mph).
• Data collection in longitudinal direction (without the need of moving the array in the transversal directions) but detection of utilities and connections.
• High productivity
• High modular structure
• High detection capability
• Avoid blocking the road traffic
• Exploit the same advanced processing feature of RIS MF Hi-Mod
• Possibility of different kind of towing frames
The GRED HD software comes with a 3D graphic interface, and advanced software features making it an advanced and complete tool for post processing Ground Penetrating Radar data. The software is able to show:

- Tomography (time slices),
- Radar scans parallel to the acquisition direction,
- Virtual Radar scans orthogonal to the acquisition direction
- 3D view.
MCGPR: GRED Output (.avi file)
DXG-Series multi-channel antenna arrays

- 200 MHz - 3.0 GHz frequency range
- All elements have uniform size and frequency response
- Simultaneous recording on two receiver antennas
- 7.5 cm antenna element spacing
- Multi-offset and automatic CMP-recording
- Built-in GPS for time stamp and coarse positioning
MCGPR: 3D-Radar

3D Radar Theory Of Operation

Principle of Operation

3D-RADAR DX/DXG-Series
Multi-Channel Ground
Coupled Antenna
3D Radar Theory Of Operation

Step-frequency waveform

- Frequency: 3.0 GHz
- Frequency step: 30 MHz
- Dwell Time
- N frequencies

Scan Time (Integration Time)
Time-Domain Electromagnetic Induction (TDEMI)
TDEMI Multi-Coil EM61’s

Specifications

MEASURED QUANTITIES
Four time gates of secondary response in mV

EM SOURCE
Air-cored coil, 1 x 0.5 m size

CURRENT WAVEFORM
Unipolar rectangular current with 25% duty cycle

EM SENSORS
1. Main: Air-cored coil, 1 x 0.5 m in size, coincident with EM source
2. Focusing: Air-cored coil, 1 x 0.5 m in size, 30 cm above main coil

DYNAMIC RANGE
18 bits

OUTPUT MONITORS
Color active matrix TFT-LCD 240x360 pixels, and audio tone

DATA STORAGE
512 MB internal disk; SD and CF slots, user accessible

DATA OUTPUT
RS232 - serial port, Bluetooth

POWER SOURCE
12 V rechargeable battery for 4 h continuous operation

OPERATING TEMPERATURE
-30°C to +60°C

OPERATING WEIGHTS & DIMENSIONS
41 kg trailer mode;
100 x 50 x 5 cm (bottom),
100 x 50 x 2 cm (top)
TDEMI for Utilities
R01B Example Project Sites

Montana DOT – Custer Avenue
Montana DOT – Custer Avenue

2:12am – Data Collection at Night-time
R01B Example Project Sites

Oregon DOT – SR8
TDEMI Line Path Map

Same Utility line detected with MCGPR (top image) and TDEMI (image left)
Sample Output Images

MCGPR 2D Rendering of 3D Volume
Making ‘sense’ of it all!

SUE + MCGPR + TDEMI = Best Possible Solution (!?!)
**Report results not for distribution**
Lessons Learned

- Coordination is Key – many participants … and the Public
- Work at night for TDEMI (vehicles cause interference with data)
- MCGPR – won’t work on concrete with rebar and/or clayey soil sub-grade
- Traffic controls are critical
- ~8 hrs of field effort ~80,000 line feet of data (15 mi) per shift
- 1 night of data yield weeks of analysis / reporting
- A method matrix is being compiled for these R01B technologies to compare field, office, and reporting time.
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**GoSHRP2 website**
www fhwa dot gov/goSHRP2
- Product details
- Information about SHRP2 implementation phases

**SHRP2 Utility Bundle website**
http://shrp2.transportation.org/Pages/UtilityRelatedProducts.aspx
Implementation Information for AASHTO members