Committee on Right of Way, Utilities and Outdoor Advertising Control 2019 Annual Meeting

Chattanooga, Tennessee
April 28–May 2, 2019
Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs

Montana Department of Transportation

Why is Utility data Important to MDT?

MDT’s Experience with R01B Technologies
Why is Utility data Important to MDT?

- Affect the delivery of approximately $300M in projects annually
- Certification to FHWA
- Statute and MDT Policy requirements - 75%+ reimbursement

60-4-403. Relocation -- costs. (1) Except as provided in subsections (2) and (3), 75% of all costs of relocation, dismantling, and removal must be paid by the department as a cost of federal-aid systems construction.
Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs

Drawing parallels from MDT's Processes

Why is Utility data Important to MDT?

- 30%
- 60%
- 90%

Typical Design Project – 100 to 200 activities!

Affect the delivery of approximately $300M in projects annually
Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs
Drawing parallels from MDT's Processes
Available Data Sources - Yesterday

*Subsurface Utility Engineering (SUE)*:

**Phase I SUE** – Qualified consultant using non-invasive techniques to obtain data

**Phase II SUE** – Vacuum Excavation

- 30% Design
- Design Utility Conflicts Review

**Preliminary Utility Conflicts Review**
- Research
- Ut. Co. As-builts
- One-call
- Surveyed features

*Phase I SUE*
- Research
- Ut. Co. As-builts
- One-call
- Surveyed features

*Phase II SUE*
- Ut. Co. CADD records

*Additional Phase II SUE*

- 60% Design
- Utility Plans

- 90% Design
- Construction

- Relocation

Research
Ut. Co. As-builts
One-call
Surveyed features

*Phase I SUE*
*Phase II SUE*
Ut. Co. CADD records

Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs
Drawing parallels from MDT's Processes
Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs

Available Data Sources - Tomorrow

- 30% Design
  - Design Utility Conflcts Review
  - Preliminary Utility Conflcts Review
  - Available Data Sources - Tomorrow
    - MCGPR
    - TDEMI
    - SPAR300
    - ULDR
    - LiDAR
    - Research
    - Ut. Co. As-builts
    - One-call
    - Surveyed features
    - Phase I SUE

- 60% Design
  - Utility Plans
  - MCGPR
  - TDEMI
  - SPAR300
  - ULDR
  - LiDAR
  - Research
  - Ut. Co. As-builts
  - One-call
  - Surveyed features
  - Phase I SUE

- 90% Design
  - Utility Agreements
  - Relocation
  - Construction
  - MCGPR
  - TDEMI
  - SPAR300
  - ULDR
  - LiDAR
  - Research
  - Ut. Co. As-builts
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  - Phase I SUE
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  - Ut. Co. CADD records
  - Additional Phase II SUE
Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs
Drawing parallels from MDT’s Processes

Available Data Sources

MCGPR
TDEMI
SPAR300

ULDR
LiDAR
Research
Ut. Co. As-builts
One-call
Surveyed features
Phase I SUE
Phase II SUE
Ut. Co. CADD records

GOAL – Minimize Data Rediscovery

30% Design
60% Design
90% Design Relocation

Construction

Preliminary Utility Conflicts Review
Design Conflicts Review
Utility Agreements

Surveyed features
One-call
Phase I SUE
Phase II SUE
Ut. Co. As-builts
Ut. Co. CADD records

MCGPR
TDEMI
SPAR300
ULDR
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Research
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30%
60%
90%

Minimize Data Rediscovery
Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs
Drawing parallels from MDT's Processes

Available Data Sources

- **30% Design**
  - Design
  - Preliminary Utility Conflicts Review
  - MCGPR
  - TDEMI
  - SPAR300

- **60% Design**
  - Design
  - Utility Agreements
  - MCGPR
  - TDEMI
  - SPAR300
  - ULDR
    - LiDAR
    - Research
    - Ut. Co. As-buils
t    - One-call
    - Surveyed features
    - Phase I SUE
    - Ut. Co. CADD records

- **90% Design Relocation**
  - Construction
  - MCGPR
  - TDEMI
  - SPAR300
  - ULDR
    - LiDAR
    - Research
    - Ut. Co. As-buils
    - One-call
    - Surveyed features
    - Phase I SUE
    - Phase II SUE
    - Ut. Co. CADD records
    - Additional Phase II SUE

**GOAL – Minimize Data Rediscovery**
The Permitting Life-Cycle for Highway and Non-Highway Projects

Utility Coordination

Utility Permitting Coordination (Non-Hwy Project)

Approved Utility Permits

Relocation Installation

or

Construction
The Permitting Life-Cycle for Highway and Non-Highway Projects

Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTS

The Permitting Life-Cycle for Highway and Non-Highway Projects
The Permitting Life-Cycle for Highway and Non-Highway Projects

- **Utility Permitting Coordination (Non-Hwy Project)**
  - RETAIN AS-BUILT SURVEY IN ULDR
    - (Condition of Permit Approval)
  - **Utility Coordination (Hwy Project)**
    - Construction
    - Retention or Installation

- **Approved Utility Permits**

- **Available Data Sources**
  - 30% Design
  - 60% Design
  - 90% Design
  - Relocation
  - Construction

- **GOAL - Minimize Data Rediscovery**
  - MCGPR
  - TDEMI
  - SPAR300
  - ULDR
  - LiDAR
  - Research
  - Ut. Co. As-builtons
  - One-call
  - Surveyed features
  - Phase I SUE
  - Phase II SUE
  - Ut. Co. CADD records
  - Additional Phase II SUE
Locating Technologies (R01B), Feasibility of Mapping & Marking Underground Utilities By DOTs
Drawing parallels from MDT’s Processes

Available Data Sources

30% Design
Custer Avenue

60% Design
Utility Agreements

90% Design
Construction

Relocation

Design Conflicts Review

Preliminary Utility Conflicts Review

MCGPR
TDEMI
SPAR300
ULDR
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GOAL – Minimize Data Rediscovery
• 1.6 Mile Reconstruction Project with major utility and right-of-way constraints
• $6M in potential impacts to Yellowstone Pipeline if not avoided
• “OT” Phase: Alignment/Grade, Typical Section, Intersection control not yet determined
• Data from R01B technologies and other SUE methods used to aid in determination
Custer Avenue

**MCGPR**
- IDS GeoRadar Stream C 600 megahertz MCGPR
- 34 antennas in two polarizations
- Survey-grade RTK GPS
- 3D

**TDEMI**
- Multiple-coil Geonics EM61 Mk2
- Three-coil machine-towed array
- Survey-grade RTK GPS
- 2D only
Custer Avenue

RESULTS

- 78 New Point Features
- 64 Linear anomalies not associated with Phase I
  - 18% of detected Phase I linear features
- Captured known metallic pipes such as Yellowstone Pipeline
- Signal loops and comm lines, paved over lids and valves

TDEMI
- Multiple-coil Geonics EM61 Mk2
- Three-coil machine-towed array
- Survey-grade RTK GPS
- 2D only
RESULTS

- 2 New Point Features
- 68 Linear Anomalies not associated with Phase I
  - 19% of detected Phase I linear features
- Captured several pipes and cables not otherwise detected
- Pavement and distress cracks
<table>
<thead>
<tr>
<th>Test Hole Elevation</th>
<th>Offset</th>
<th>Nearest Observation</th>
<th>Pipe &amp; Cable Locator</th>
<th>Spar Elevation Standard Deviations and QLs</th>
<th>Spar Offsets and Nearest Point</th>
<th>MGPR Elevation &amp; Offsets</th>
<th>TDEM Located?</th>
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<tr>
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<td>Vertical 1.181/C&lt;sup&gt;3&lt;/sup&gt;</td>
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<td>0.8</td>
<td>3882.44</td>
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<td>1</td>
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<td>1.5</td>
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<td>Vertical -0.18 Horizontal 0.1 Nearest 16.3</td>
<td>3858.48 0.695 Horizontal 0.1</td>
</tr>
</tbody>
</table>

1 - Spar QLA = +/- 4"
2 - Spar QLB = +/- 8"
3 - Spar QLC = +/- 1.7"
4 - Spar QLD = +/- 3.3'
5 - Spar QLE = +/- 6.6'

*N/A (TDEM & MGPR) = not surveyed or unable to survey
Custer Avenue MCGPR
Figure 4: MCGPR profile showing apparent utility bored beneath Custer Avenue, just west of National Avenue. This alignment was among many revealed with MCGPR, but not identified in the Phase 1 SUE.
Custer Avenue MCGPR
Custer Avenue
Custer Avenue TDEMI
Custer Avenue

TDEMI
3D Model of Utilities - Custer Avenue
Helena, MT