


SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

SHRP2 Utility Solutions Peer Exchange and Retrospective Workshop

Washington, DC

July 16-17, 2019

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO




SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Welcome and Introductions

Julie Johnston, FHWA

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
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Peer Exchange Agenda

Welcome, Introductions & Opening Remarks	Pam Hutton, AASHTO Julie Johnston, FHWA
PEER EXCHANGE Utility Conflict Management Standardization (R15B focused)	Alana Spendlove, Utah DOT Chuck Ferguson, Delaware DOT
BREAK	
PEER EXCHANGE Transitioning Utility Data Repository from 2D- to 3D-design and construction workflows (R01A focused)	Nick Lefke, Michigan DOT Chris Pucci, Oregon DOT
LUNCH	
PEER EXCHANGE – Coordination for successful application of utility locating technologies (R01B focused)	Bill Owen, Caltrans Gabe Priebe, Montana DOT
BREAK	
PEER EXCHANGE Equipment and IT Resources: Challenges and Successes	David Otte, Kentucky DOT Michael Tavani, Pennsylvania DOT
BREAK	
PEER EXCHANGE Leadership Buy-in: Procurement and Process Changes	Texas DOT Mark Turner, Caltrans by phone
Adjourn, Optional Group Dinner at 6:00 (TBD)	

Retrospective Workshop Agenda

Recap of Day 1
Product Panels
BREAK
SHRP2 Program Wide Discussion
Breakout Report Out (if necessary)
BREAK
Utilities Products Retrospective Discussion (may split into breakout groups per product)
Breakout Report Out (if necessary)
LUNCH
Future and Next Steps Discussion
Breakout Report Out (if necessary)
Break
Strategic Roadmap Forward
Report Out and Wrap Up

Focus Areas

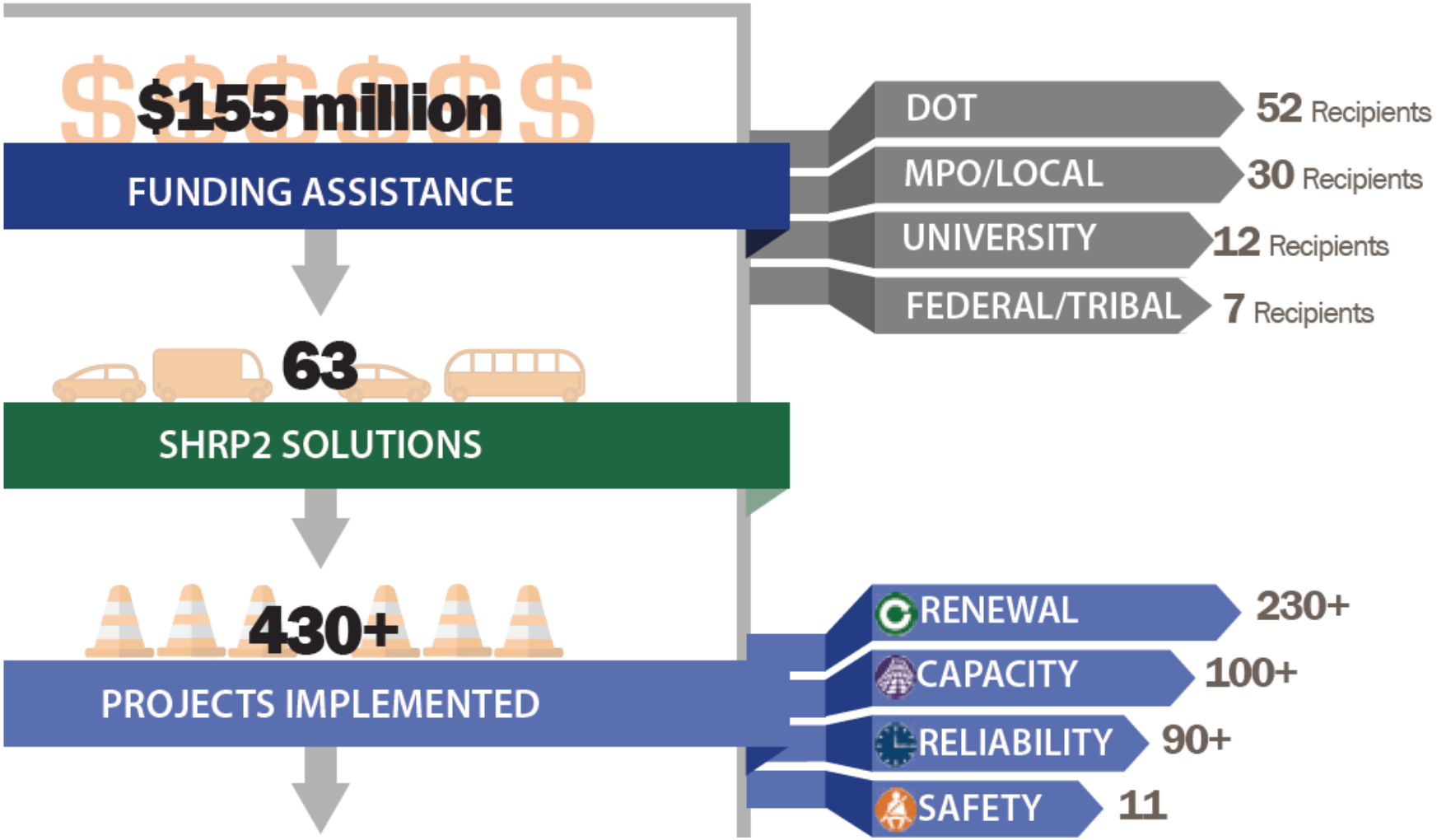
Safety: fostering safer driving through analysis of driver, roadway, and vehicle factors in crashes, near crashes, and ordinary driving

Reliability: reducing congestion and creating more predictable travel times through better operations

Capacity: planning and designing a highway system that offers minimum disruption and meets the environmental and economic needs of the community

Renewal: rapid maintenance and repair of the deteriorating infrastructure using already-available resources, innovations, and technologies

SHRP2 Implementation:
INNOVATE . IMPLEMENT. IMPROVE.



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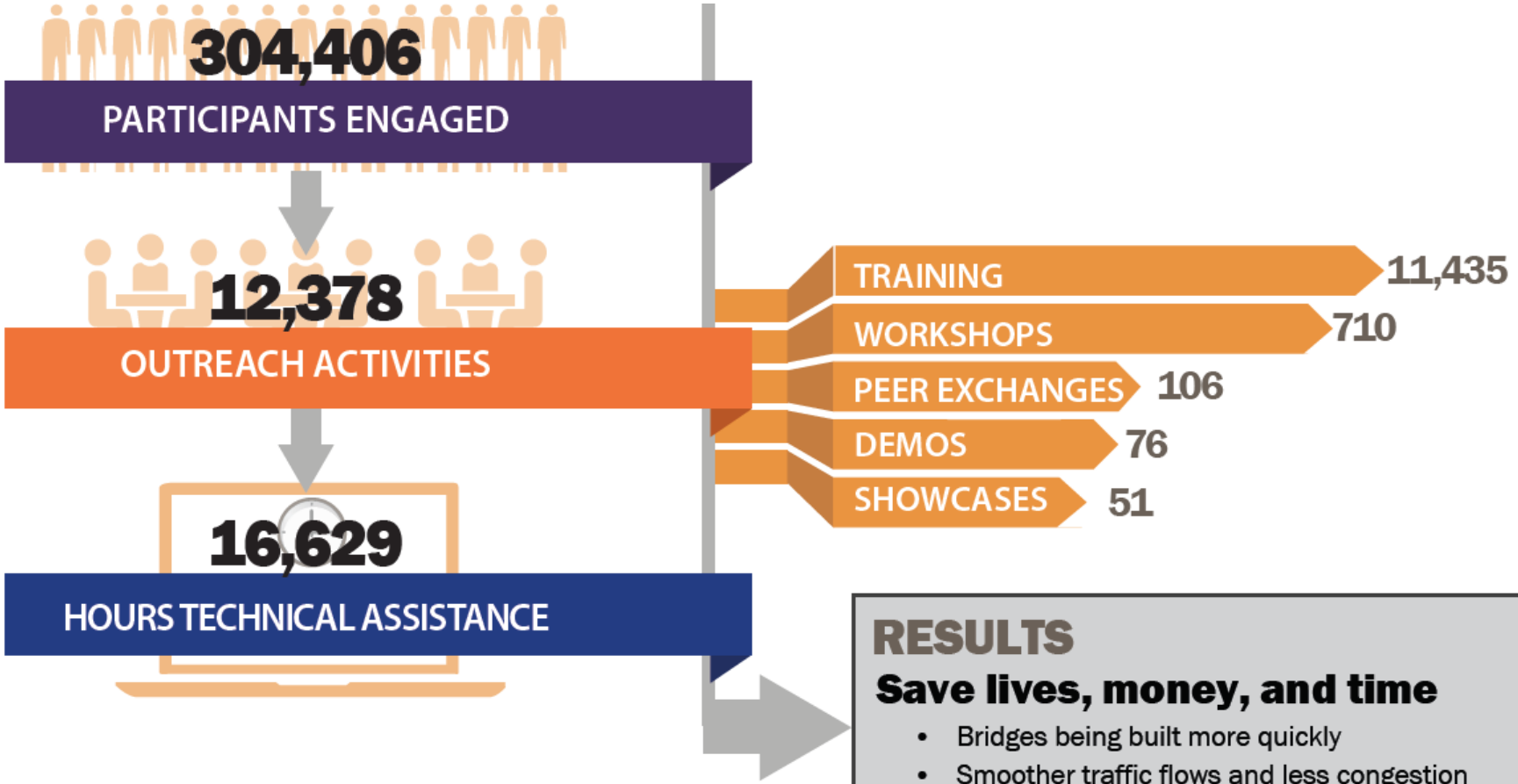

RESULTS

Save lives, money, and time

- Bridges being built more quickly
- Smoother traffic flows and less congestion
- Reduced construction costs
- Safer roadways
- Smarter environmental reviews

SHRP2 Utility Products

- **3D Utility Location Data Repository R01A**
- **Utility Location Technologies R01B**
- **Identifying and Managing Utility Conflicts R15B**

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

SHRP2 FHWA Overview

Julie Johnston, FHWA

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SHRP2 SOLUTIONS
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PEER EXCHANGE Utility Conflict Management Standardization (R15B focused)

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Alana Spendlove, Utah DOT
Live Web Site Demonstration

UCM IMPLEMENTATION IN DELAWARE: LESSONS LEARNED

DEBORAH KUKULICH–DELDOT UTILITIES COORDINATOR

CHUCK FERGUSON – DELDOT UTILITIES COORDINATOR

SHRP2 UTILITY PEER EXCHANGE AND WORKSHOP

JULY 16-17, 2019

Delaware Department of Transportation

THOUGHTS GOING INTO GRANT

OBJECTIVES:

- FOCUS ON CUSTOMIZED UTILITY CONFLICT MATRIX FOR DELDOT POJECT/PLAN DEVELOPMENT PROCESS
- DEVELOP MATRIX USERS GUIDE
- DEVELOP AND PROVIDE TRAINING
- IMPLEMENT MATRIX AS INTEGRAL TOOL IN THE PROJECT DEVELOPMENT PROCESS

THOUGHTS GOING INTO GRANT

BENEFITS:

- EASY TO USE WORKBOOK SPREADSHEET FORMAT
- PROVIDES STANDARDIZED METHOD AND FORM FOR TRACKING UTILITY CONFLCITS AND RESOLUTIONS
- CREATES A RECORD OF UTILITY CONFLICT INVESTIGATION AND COORDINATION EFFORTS
- KEEPS ALL STAKEHOLDERS ON THE SAME PAGE
- OVERALL ***LESS*** WORK BY AVOIDING LAST MINUTES ISSUES AND CONSTRUCTION CONFLICTS

THOUGHTS GOING INTO GRANT

DRAWBACKS:

- STAFF ***IMPRESSION*** THAT USE OF THE UCM CREATES ***MORE*** WORK

PROGRESS

- UCM WORKBOOK IS FINALIZED
  - ✓UCM MATRIX WORKSHEET
  - ✓COST ESTIMATE ANALYSIS WORKSHEET
  - ✓USER GUIDE WORKSHEET
  - ✓FIELD AND COLUMN DESCRIPTIONS WORKSHEET
  - ✓DROP-DOWN LISTS WORKSHEET
- USER GUIDE COMPLETE AND INCLUDED AS A WORKSHEET IN THE UCM WORKBOOK

PROGRESS

- STARTED PROCESS TO IMPLEMENT UCM AND UTILITY CONFLICT MANAGEMENT CONCEPTS INTO INTERNAL DESIGN POLICY AND PROCESS DOCUMENTS
- DEVELOPING STAKEHOLDER TRAINING
- INVESTIGATING DEVELOPING SUBSURFACE UTILITY DESIGN AND ANALYSIS (SUDA) SOFTWARE FOR INCORPORATION INTO DELDOT DESIGN PROCESS
- POTENTIALLY LINK SUDA OUTPUT TO UCM

LESSONS LEARNED

- START AT THE TOP TO GET BUY-IN
  - THE UCM IS NOW ON THE DELDOT DESIGN RESOURCE CENTER https://deldot.gov/Business/drc/index.shtml
  - THE UCM IS NOW A CHECK–OFF ITEM ON THE “Construction Plan Submission Checklist for Division of Transportation Solutions Projects” https://deldot.gov/Business/drc/pdfs/projectmanagement/plan_submission_checklist.pdf?043019
- SHARE MATRIX WITH CONSTRUCTION PERSONNEL, EVEN IF INFORMALLY

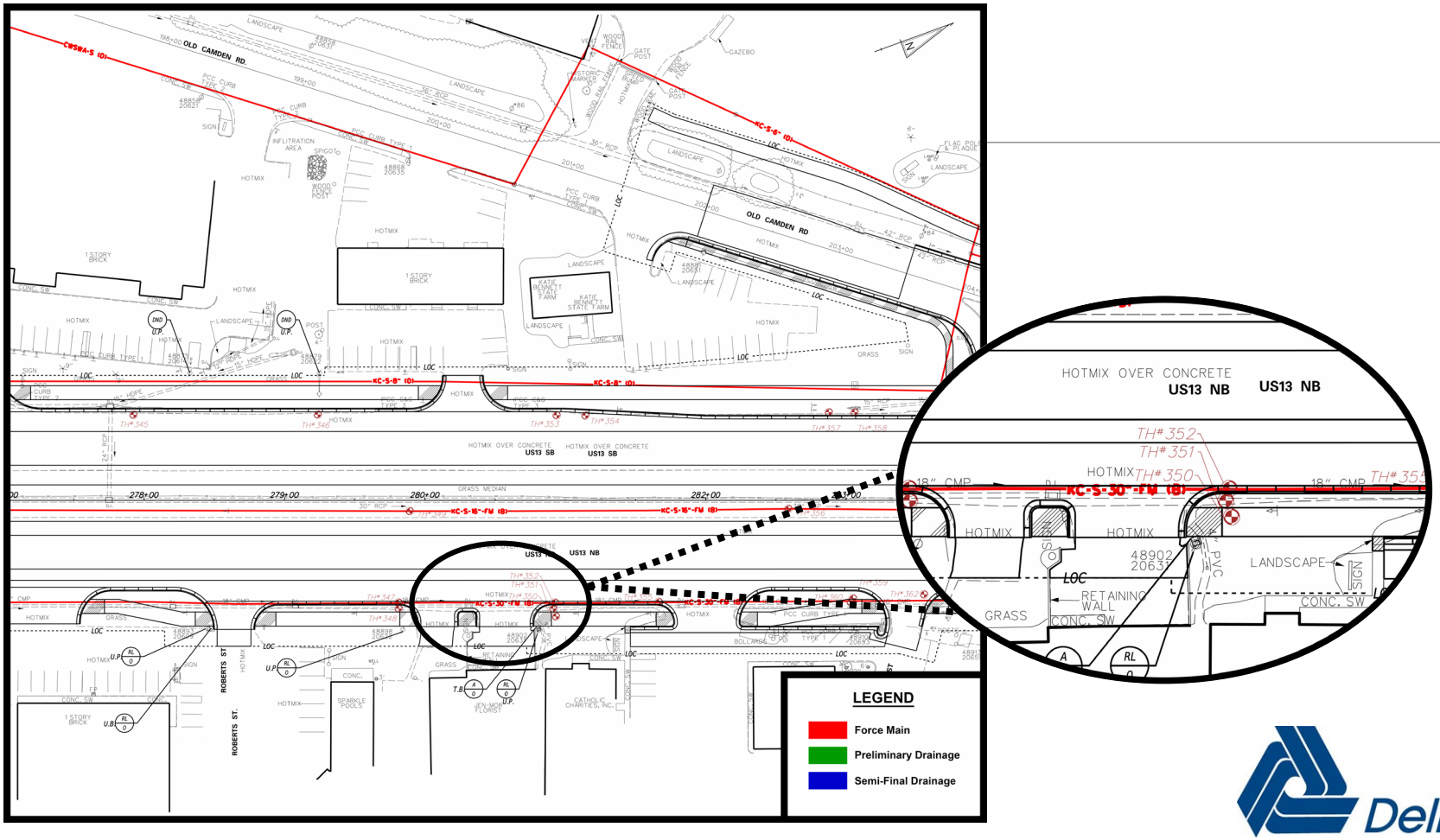
LESSONS LEARNED

- IDENTIFY THE HISTORIC ISSUES THAT THE UCM IS ADDRESSING
- KEEP THINGS SIMPLE…FOCUS ON THE SMALL TASKS TO KEEP MOMENTUM GOING AND EXPAND FROM THERE
- INCLUDE ALL STAKEHOLDERS IN DEVELOPMENT PROCESS
- SOLIDIFY USE BY ADDING INTO POLICY AND PROCESS

CASE STUDY - T201500202 - US13, LOCHMEATH WAY TO PUNCHEON RUN

- HEP, T201500202- KC US13 Lochmeath Way to Puncheon Run Connector – widen US13 from a four-lane divided highway to a six-lane divided highway with intersection improvements and a multi-modal path (northbound and southbound) from Lochmeath Way to Puncheon Run Connector.
- PROJECTED PROJECT LENGTH – 3 MILES
- PROJECTED ENGENEERS ESTIMATE – $76.3 M
- PROJECT DESIGNATION LENGTH – 120,000 LF+
- NUMBER OF TEST HOLES – 450 COMPLETE – 50 ADDITIONAL REQUESTED

DelDOT


OLD CAMDEN RD.
OLD CAMDEN RD
ROBERTS ST.
ROBERTS ST
HOTMIX OVER CONCRETE
US13 SB
US13 NB
LOC
GRASS MEDIAN
278+00
279+00
280+00
282+00
LEGEND
Force Main
Preliminary Drainage
Semi-Final Drainage

HOTMIX OVER CONCRETE
US13 NB
US13 NB
TH# 352
TH# 351
TH# 350
HOTMIX
18" CMP
KC-S-30"-FW (B)
HOTMIX
HOTMIX
LOC
RETAINING WALL
GRASS
CONC. SW
LANDSCAPE
SIGN
CONC. SW
48902
20631
PVC

DelDOT

DelDOT Utility Conflict Matrix

Contract Number: T201500202
Project Title: HEP, KC, US13, Lochmeath Way to Puncheon Run Connector
County - MR # - Name: Kent 24 South DuPont Highway
Project Development Stage: Semi-Final

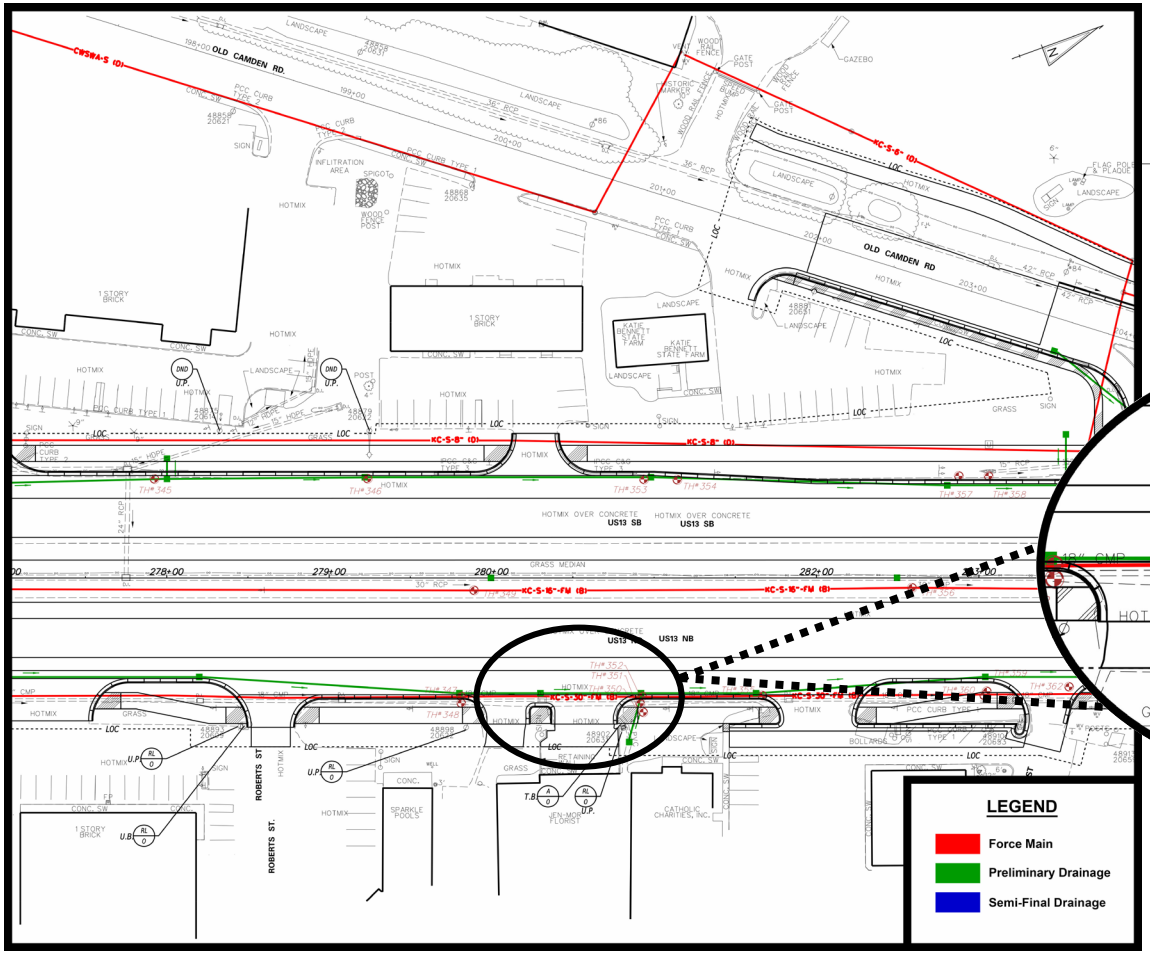
Section: Project Development South I
Project Manager: John Gaines, PE
Project Designer: N/A
Project Consultant: Century Engineering, Inc.

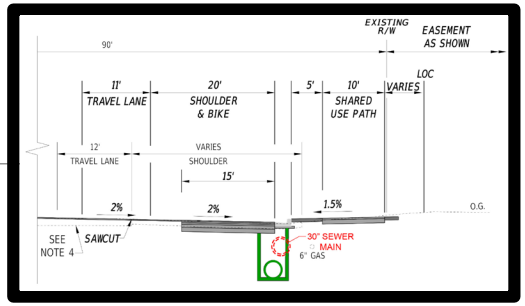
Preliminary UCM Developed Dy - Date: Kendall L. Robinson 9/27/2017
Reviewed By - Date: Jill Frey, PE 4/30/2018
Semi-Final UCM Updated By - Date:
Reviewed By - Date:
Final UCM Updated By - Date:
Reviewed By - Date:

Note: refer to subsheet for utility conflict cost analysis.

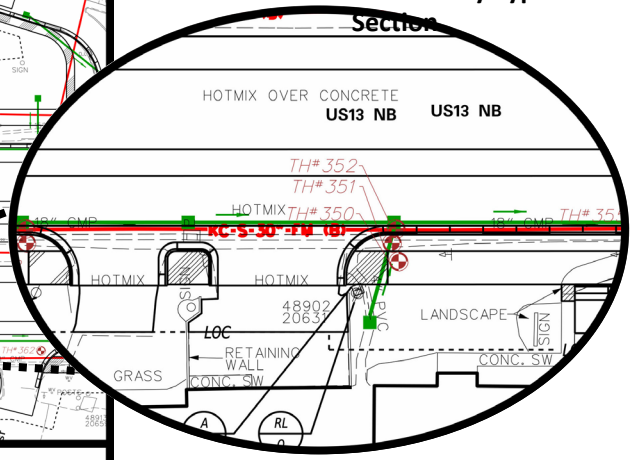
Utility Owner	Conflict ID	Drawing or Sheet No.	Conflict Status	Utility Type	Size and/or Material	Current Utility Investigation Level	Utility Conflict Description	Start Station	Start Offset	End Station	End Offset	Required Utility Investigation Level	Test Hole Number	Utility Top and Bottom	Conflict Top and Bottom	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status
Verizon	346	CP-26	Potential	Communications (UG)	1" direct bury cable	QLB - Designation	DI 1129 - 48x48	259+50	57.75 L	283+00	0	QLA - Test holes						
Kent County	347	CP-26	Potential	Sanitary Sewer	30" concrete force main	QLB - Designation	DI 1024 - 48X48	278+50	73.6 R	283+00	72.25 R	QLA - Test holes						
Eastern Shore Natural Gas	348	CP-26	Potential	Gas- Transmission	8" metal	QLB - Designation	DI 1026 - 48X48	158+00	81 R	295+10	0	QLA - Test holes						
Kent County	349	CP-26	Potential	Sanitary Sewer	16" metal force main	QLB - Designation	DI 1067 - 48X48	158+00	MEDIAN	293+25	0	QLA - Test holes						
Verizon	350	CP-26	Potential	Communications (UG)	1" direct bury cable	QLB - Designation	P 1026 - 30" RCP	278+50	80.7 R	283+00	82.3 R	QLA - Test holes						
Eastern Shore Natural Gas	351	CP-26	Potential	Gas- Transmission	8" metal	QLB - Designation	P 1026 - 30" RCP	158+00	81 R	295+10	0	QLA - Test holes						
Kent County	352	CP-26	Potential	Sanitary Sewer	30" concrete force main	QLB - Designation	P 1026 - 30" RCP	278+50	73.6 R	283+00	72.25 R	QLA - Test holes						
Verizon	353	CP-26	Potential	Communications (UG)	1" direct bury cable	QLB - Designation	DI 1130 - 48X48	259+50	57.75 L	283+00	0	QLA - Test holes						
Verizon	354	CP-27	Potential	Communications (UG)	1" cable	QLB - Designation	P 1130 - 30" RCP	259+50	57.75 L	283+00	0	QLA - Test holes						
Kent County	355	CP-27	Potential	Sanitary Sewer	30" concrete force amin	QLB - Designation	DI 1027 48X48	278+50	73.6 R	283+00	72.25 R	QLA - Test holes						
Kent County	356	CP-27	Potential	Sanitary Sewer	16" metal force main	QLB - Designation	DI 1068 48X48	158+00	MEDIAN	295+10	0	QLA - Test holes						
Verizon	357	CP-27	Potential	Communications (UG)	1" cable	QLB - Designation	DI 1131 48X48	259+50	57.75 L	283+00	0	QLA - Test holes						
Verizon	358	CP-27	Potential	Communications (UG)	1" cable	QLB - Designation	P 1131 - 30" RCP					QLA - Test holes						
Verizon	359	CP-27	Potential	Communications (UG)	1.5" direct bury cable	QLB - Designation	DI 1028 - 48X48					QLA - Test holes						
Kent County	360	CP-27	Potential	Storm Sewer	30" concrete force main	QLB - Designation	DI 1028 - 48X48	278+50	73.6 R	283+00	72.25 R	QLA - Test holes						

Key:
[List of acronyms used in the utility conflict matrix]





Preliminary Typical Section



COST TO RELOCATE KENT COUNTY SEWER MAINS

- FOR RELOCATIONS OWNED BY MUNICIPALITY [17 Del. C. §143 (b)] **If required by reason of the construction, reconstruction, relocation, repair, or maintenance of a public highway, the Department of Transportation shall, at its sole expense, make any necessary alteration or relocation of the facilities owned and/or operated by a public utility of a municipality or of any governmental body or political subdivision of the State.**
- ENGINEERS ESTIMATE - $2.5M TO RELOCATE A PORTION OF THE 30” FORCE SANITARY SEWER MAIN
- ENGINEERS ESTIMATE - $1.5M TO RELOCATE 16” FORCE SANITARY SEWER MAIN (TWO SPOT LOCATIONS)
- TOTAL COST TO DELDOT TO RELOCATE KENT COUNTY SEWER SYSTEM- $4 M

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Reviewed By - Date: Jill Frey, PE 4/18/2019
Final UCM Updated By - Date:
Reviewed By - Date:

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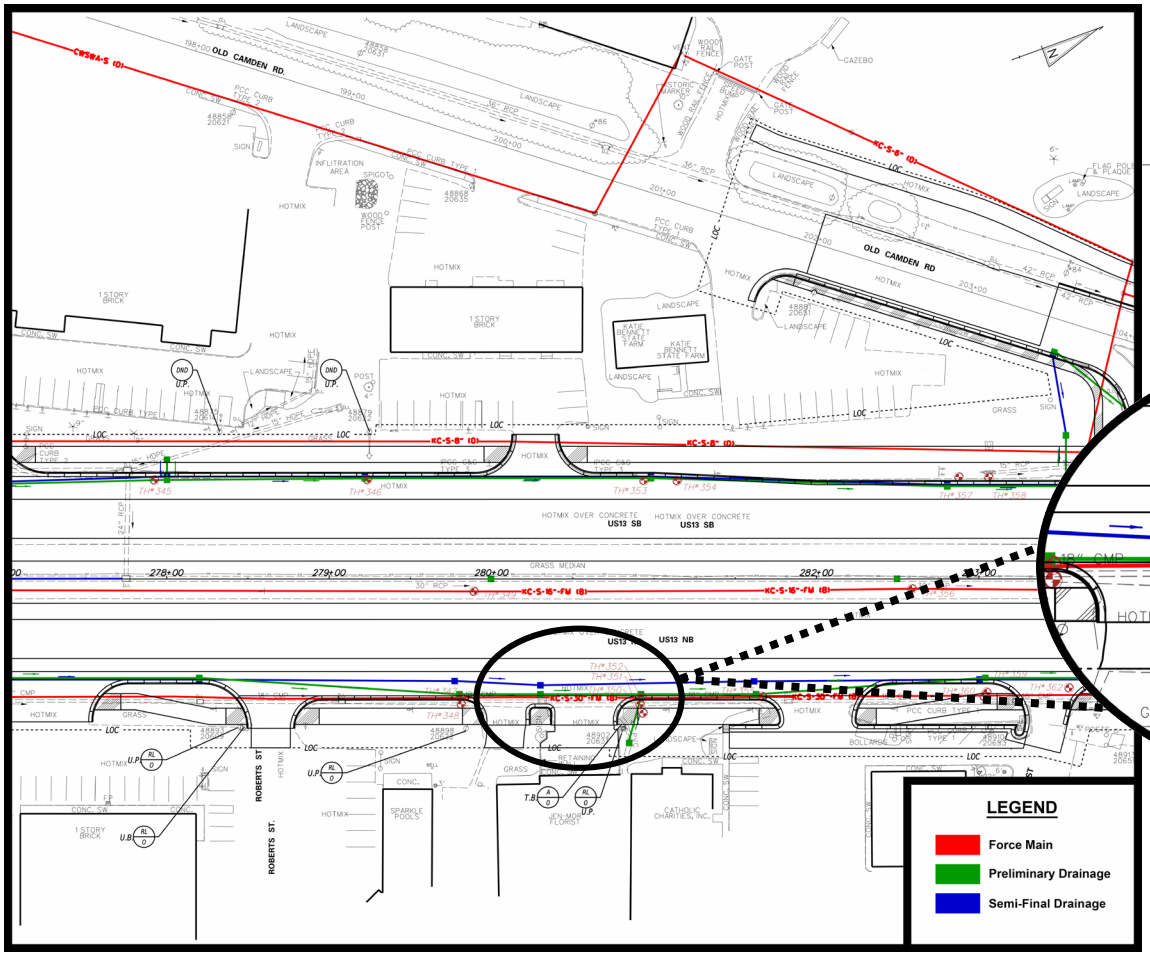
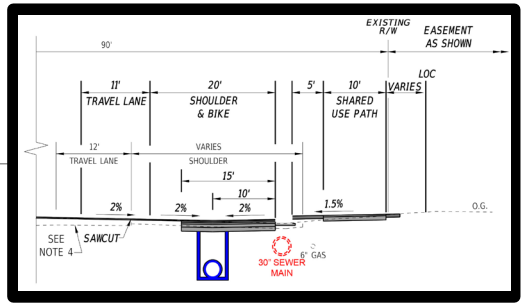
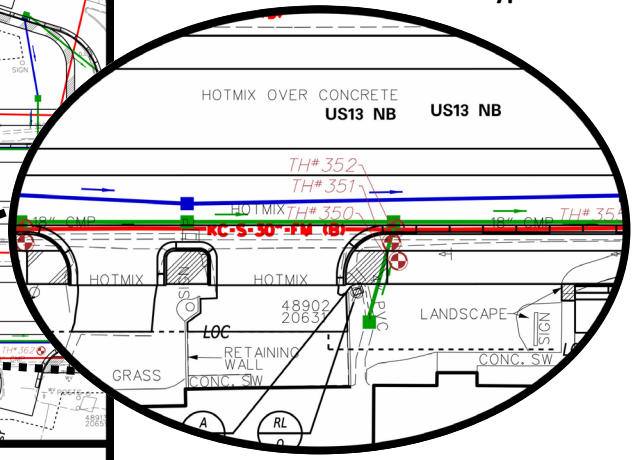
Verizon	346	CP-26	Actual	Communications (UG)	1" direct bury cable	QLA - Test holes	P 728 - 24" RCP	259+50	57.75 L	283+00	0		346	27.02		Relocate utility		Utility owner informed of conflict
Kent County	347	CP-26	Actual	Sanitary Sewer	30" concrete force main	QLA - Test holes	DI 659 - 48X48	278+50	73.6 R	283+00	72.25 R		347	25.68 22.85		Redesign drainage system		Utility conflict resolved
Eastern Shore Natural Gas	348	CP-26	Actual	Gas- Transmission	8" metal	QLA - Test holes	DI 659 - 48X48	158+00	81 R	295+10	0		348	24.44 23.69		Relocate utility	7/15/2019	Conflict resolution strategy selected
Kent County	349	CP-26	No Conflict	Sanitary Sewer	16" metal force main	QLA - Test holes	DI 631 - 48X48	158+00	MEDIAN	293+25	0		349	24.51 23.01		No conficit		
Verizon	350	CP-26	No Conflict	Communications (UG)	1" direct bury cable	QLA - Test holes	P658 - 30" RCP	278+50	80.7 R	283+00	82.3 R		350	24.38		Relocate utility		Utility owner informed of conflict
Eastern Shore Natural Gas	351	CP-26	Actual	Gas- Transmission	8" metal	QLA - Test holes	P658 - 30" RCP	158+00	81 R	295+10	0		351	23.20 22.45		Relocate utility	7/15/2019	Conflict resolution strategy selected
Kent County	352	CP-26	No Conflict	Sanitary Sewer	30" concrete force main	QLA - Test holes	P 658 - 30" RCP	278+50	73.6 R	283+00	72.25 R		352	24.52 21.69		Redesign drainage system		Utility conflict resolved
Verizon	353	CP-26	Actual	Communications (UG)	1" direct bury cable	QLA - Test holes	DI 728 - 48X48	259+00	57.75 L	283+00	0		353	24.81		Relocate utility		Utility owner informed of conflict
Verizon	354	CP-27	Actual	Communications (UG)	1" cable	QLA - Test holes	P 729 - 24" RCP	259+00	57.75 L	283+00	0		354	24.33		Relocate utility		Utility owner informed of conflict
Kent County	355	CP-27	No Conflict	Sanitary Sewer	30" concrete force amin	QLA - Test holes	DI 660 - 48X48	278+50	73.6 R	283+00	72.25 R		355	24.51 21.68		Redesign drainage system		Utility conflict resolved
Kent County	356	CP-27	No Conflict	Sanitary Sewer	16" metal force main	QLA - Test holes	DI 632 - 48X48	158+00	MEDIAN	295+10	0		356	21.02 19.52		No conficit		
Verizon	357	CP-27	Actual	Communications (UG)	1" cable	QLA - Test holes	DI 729 - 48X48	259+00	57.75 L	283+00	0		357	22.05		Relocate utility		Utility owner informed of conflict
Verizon	358	CP-27	Potential	Communications (UG)	1" cable	QLA - Test holes	P 730 - 24" RCP						358	21.40	18.12 15.62			Utility owner informed of conflict
Verizon	359	CP-27	Actual	Communications (UG)	1" direct bury cable	QLA - Test holes	DI 661 - 48x48						359	21.26	26.57 16.03	Relocate utility		Utility owner informed of conflict
Kent County	360	CP-27	No Conflict	Sanitary Sewer	30" concrete force main	QLA - Test holes	DI 661 - 48x48	278+50	73.6 R	283+00	72.25 R		360	22.00		No conficit		

Key:
[List of acronyms used in the utility conflict matrix]





Semi-Final Typical Section



FUTURE ITEMS

- IDENTIFY SERVICE CONNECTIONS AS PART OF COORDINATION PROCESS
- ENSURE SUBSURFACE UTILITY ENGINEERING (SUE) INFO IS REVIEWED FOR ACCURACY
- DEVELOP A TEAM TO SPECIFICALLY OVERSEE UTILITY FIELD WORK, DOCUMENT (AS-BUILT) RELOCATIONS, AND UPDATE UCM
- MAKE SURE COMPANIES UPDATE RECORDS SO PROPERLY MARKED IN RESPONSE TO ONE CALL (811)

CONTACT INFO

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chuck.ferguson@delaware.gov
PHONE: (302) 760-2345

DelDOT

Utility Conflict Management Standardization (R15B focused)

Describe and discuss challenges and successes of implementation including:

- Development and dissemination of a standard utility conflict list template;
- Use of the template for information exchange purposes and documentation using the spreadsheet file or a database;
- Use of dedicated layers or levels to display utility conflict locations in the project design software environment;
- Conducting utility conflict analysis at project delivery milestones;
- Any other challenges and/or successes?

BREAK

15 Minutes

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

PEER EXCHANGE Transitioning Utility Data Repository from 2D- to 3D-design and construction workflows (R01A focused)

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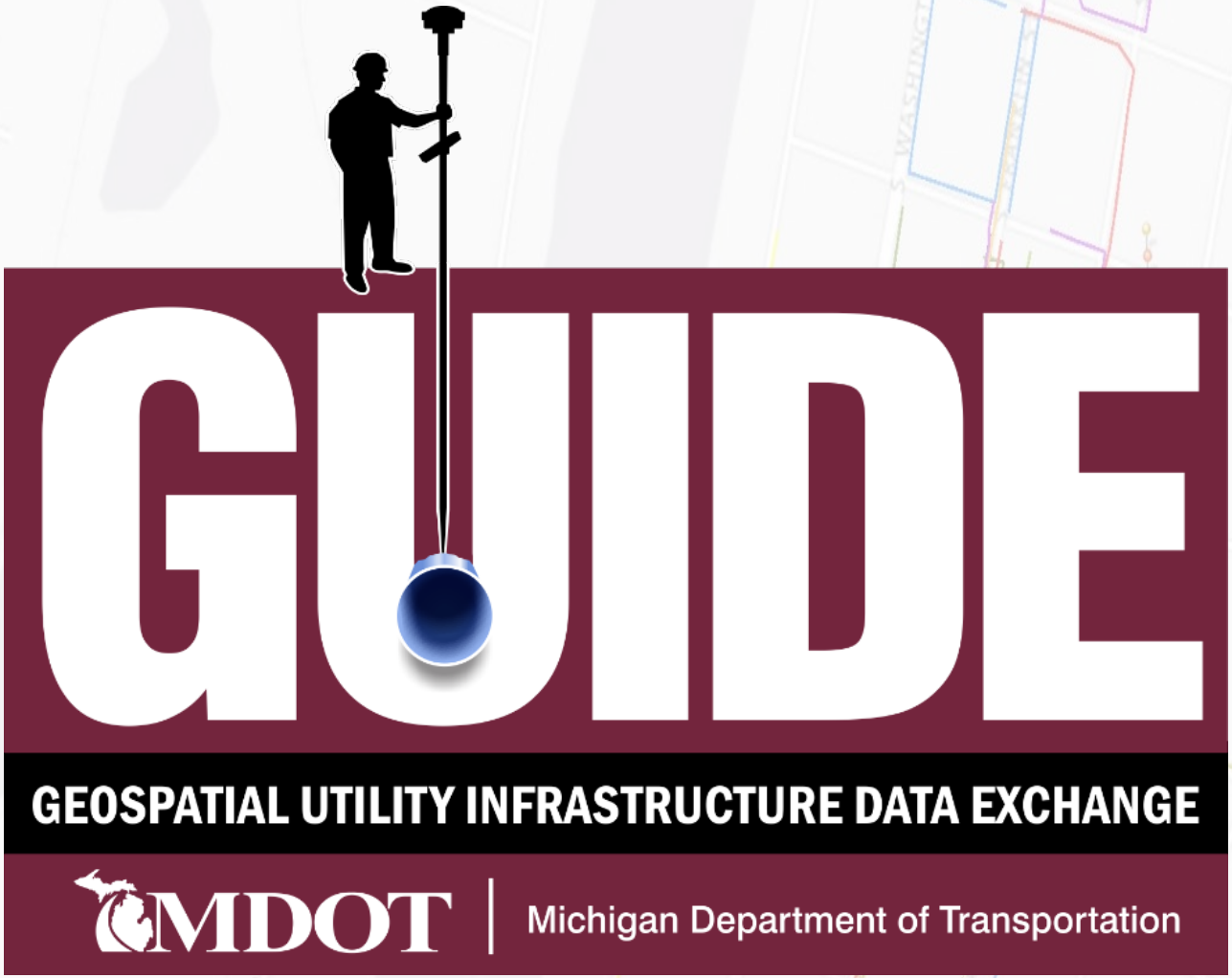
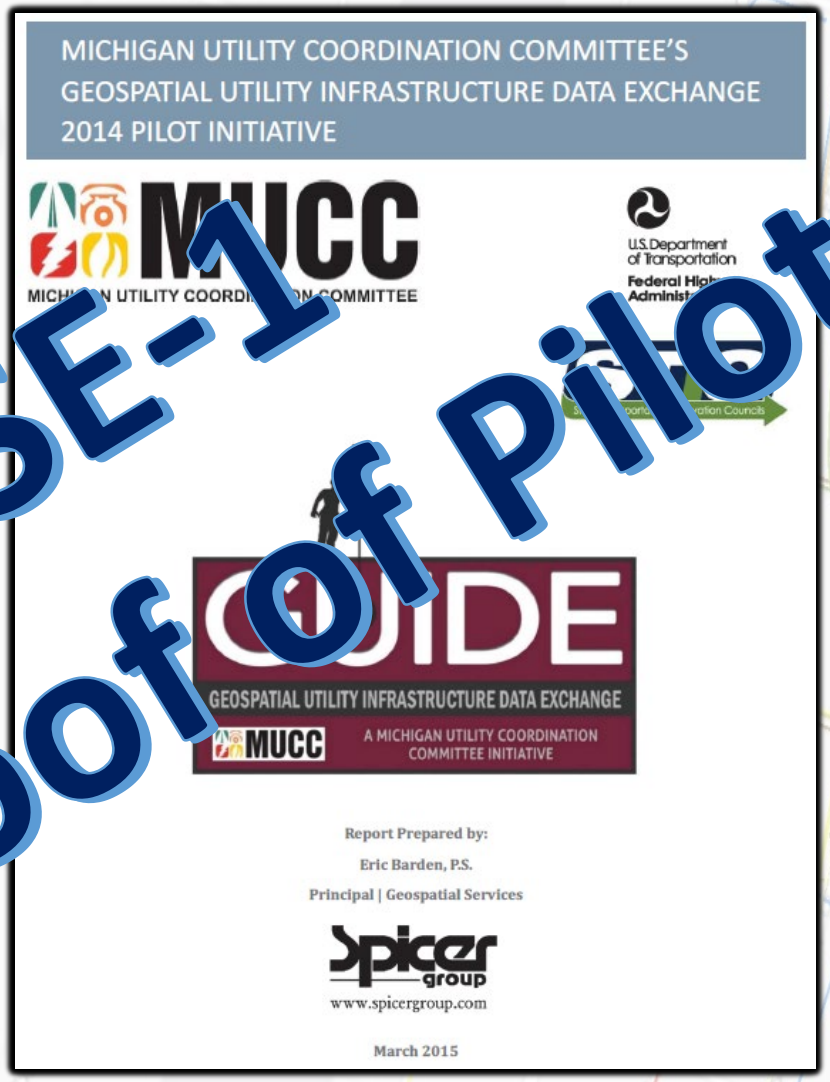
July 16-17, 2019

SHRP2 Implementation Assistance Program, Round 7, Utility Bundle

- **3D Utility Location Data Repository (R01A)**
- Utility Locating Technologies (R01B)
- Identifying and Managing Utility Conflicts (R15B)


GUIDE
GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
MDOT
Michigan Department of Transportation



PHASE-1 Proof of Pilot

MUCC

MICHIGAN UTILITY COORDINATION COMMITTEE

at&t

Consumers Energy
Count on Us

DTE Energy

MISS DIG System, Inc.
811
www.missdig.org 1-800-482-7171

mita
Michigan Infrastructure & Transportation Association

MDOT

Anticipated Benefits

- Efficiencies in project coordination
  - Better decision making
  - Improved communication
- Reduce utility conflicts during construction
- Develop accurate data on new utility infrastructure
- Reduce public impacts - user delay costs
- Improve safety - reduce impacts to high risk utilities

Pilot Outcomes

- Comprehensive Statewide Standards
- Development of Centralized Data Repository
- Stakeholder Buy-In
- Proof of Program
  - Statewide, More Utilities, Etc.

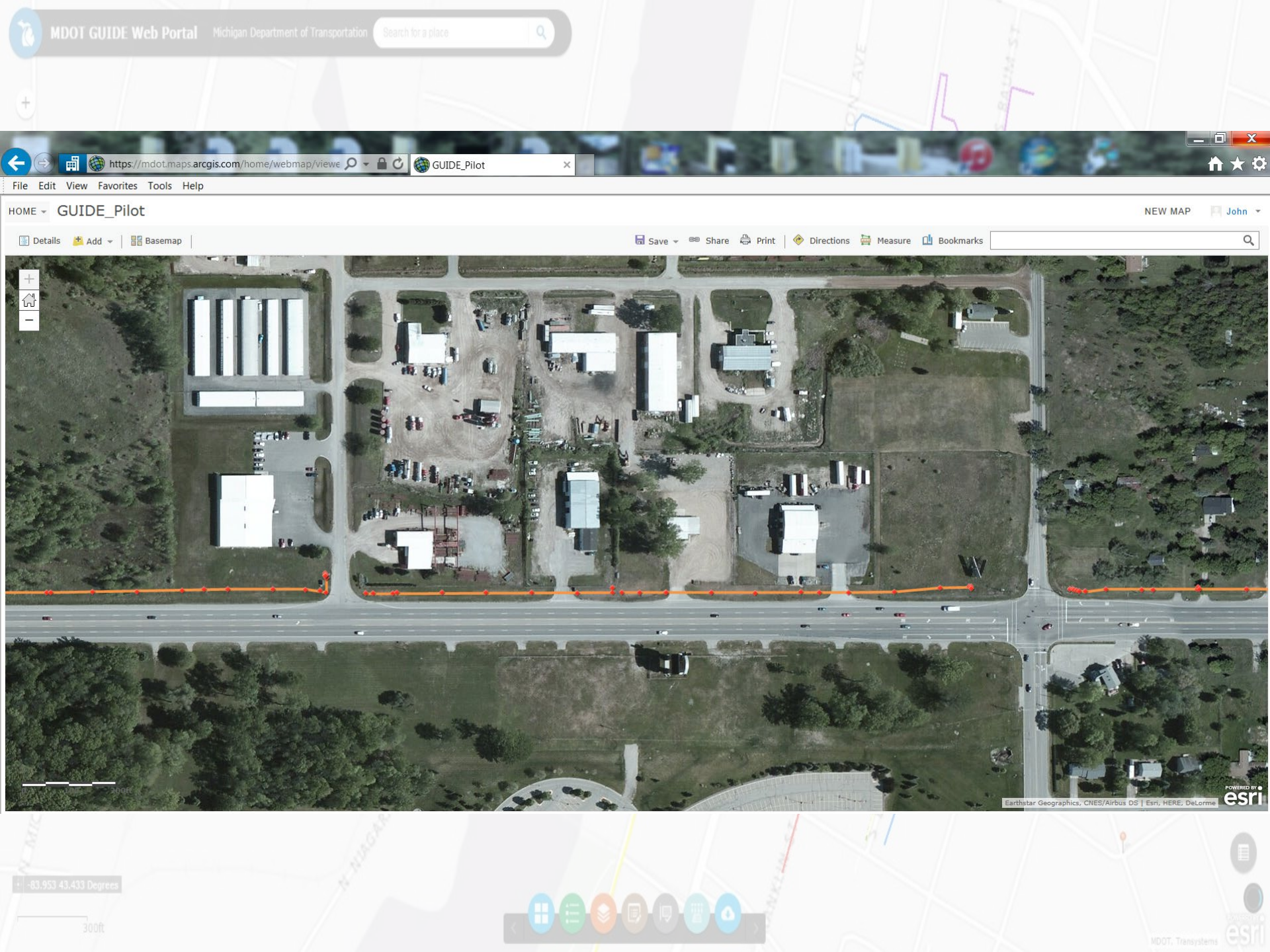
Consumers Energy
Count on Us

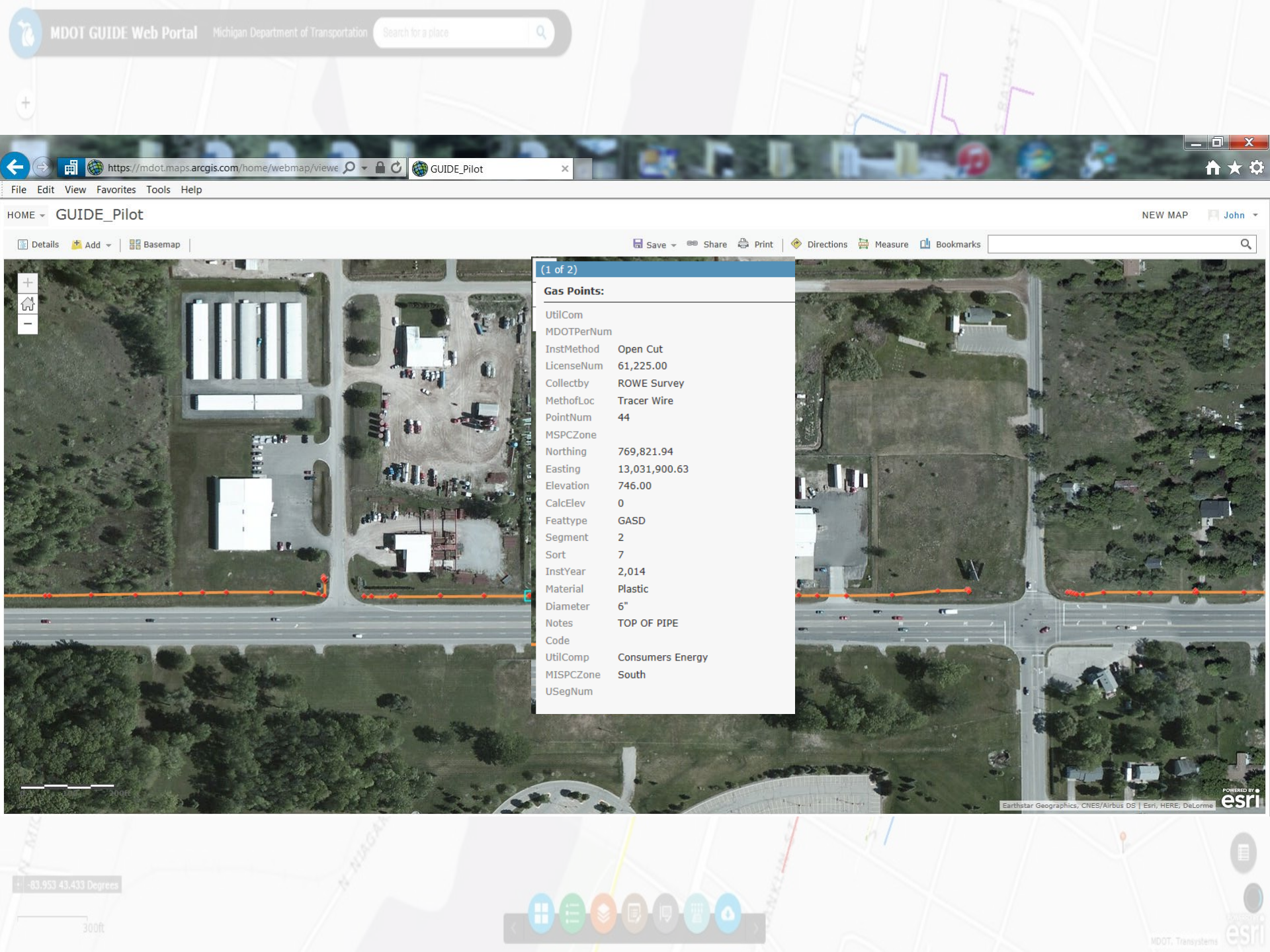
Consumers Energy
Count on Us

Consumers Energy
Count on Us

Consumers Energy

Count on Us


MDOT GUIDE Web Portal
Michigan Department of Transportation
Search for a place
https://mdot.maps.arcgis.com/home/webmap/viewe
GUIDE_Pilot
File Edit View Favorites Tools Help
HOME
GUIDE_Pilot
NEW MAP
John
Details
Add
Basemap
Save
Share
Print
Directions
Measure
Bookmarks
Earthstar Geographics, CNES/Airbus DS | Esri, HERE, DeLorme
POWERED BY esri
-83.953 43.433 Degrees
300ft


MDOT GUIDE Web Portal
Michigan Department of Transportation
Search for a place
https://mdot.maps.arcgis.com/home/webmap/viewe
GUIDE_Pilot
File Edit View Favorites Tools Help
HOME
GUIDE_Pilot
NEW MAP
John
Details
Add
Basemap
Save
Share
Print
Directions
Measure
Bookmarks
(1 of 2)
Gas Points:
UtilCom
MDOTPerNum
InstMethod Open Cut
LicenseNum 61,225.00
Collectby ROWE Survey
MethofLoc Tracer Wire
PointNum 44
MSPCZone
Northing 769,821.94
Easting 13,031,900.63
Elevation 746.00
CalcElev 0
Feattype GASD
Segment 2
Sort 7
InstYear 2,014
Material Plastic
Diameter 6"
Notes TOP OF PIPE
Code
UtilComp Consumers Energy
MISPCZone South
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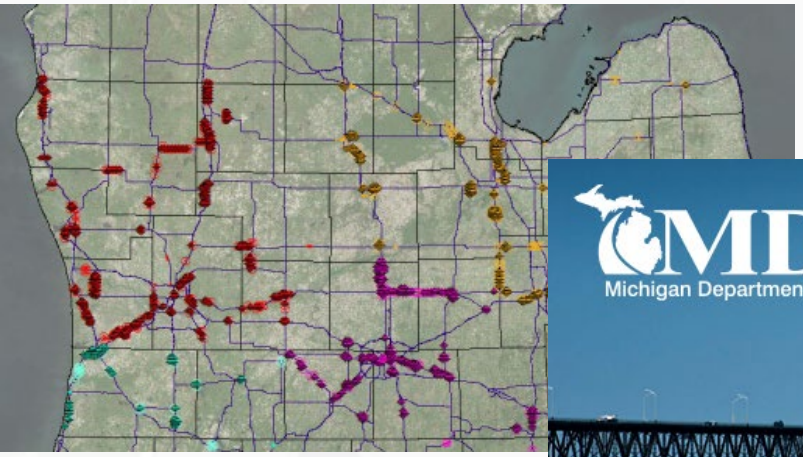
esri

Data Repository



PHASE-2 Procedural Manual & Standards Development

PHASE 2 - Objectives & Outcomes

- Comprehensive Procedural Manual and Accompanying Standards
- Guide Web Portal - Repository
- Data Collection App (Proposed Innovation)

Utilities Collected

Utility Type	Feature Code	Description of Utilities
Brine	BRNE	Brine transmission, distribution, service lines, and appurtenances within defined size parameter
Chilled Water	CHW	Chilled water transmission, distribution, service lines, and appurtenances within defined size parameter
Communication	COMM	All communication facilities, including fiber optic, copper, coaxial, including appurtenances within defined size parameter
Gas	GAS	Natural gas transmission, distribution, service lines, and appurtenances within defined size parameter
Electric	ELEC	Secondary electric or higher voltage
Pipe	PIPE	Pipeline facilities, including crude oil, refined oil, or all other types of oil pipeline transmission, distribution, service lines, and appurtenances within defined size parameter
Propane	PROP	Propane transmission, distribution and service lines, and appurtenances within defined size parameter
Sanitary Sewer	SANI	Sanitary sewer facilities including all mains, collection system, forcemains, services and leads, including appurtenances within defined size parameter. (Combined sewer is classified as sanitary sewer)
Steam	STEA	Steam transmission, distribution, service lines, and appurtenances within defined size parameter
Storm Sewer	STRM	Storm sewer facilities including all mains and collection system, including appurtenances within defined size parameter. (Excludes underdrain)
Water	WATR	Water transmission, distribution, service lines, and appurtenances within defined size parameter. (Excludes irrigations systems)
Other	OTHR	This designation can be used for those facilities not covered by the above feature codes, including but not limited to industrial facilities of all types and discovered utilities where the type of utility is unknown.

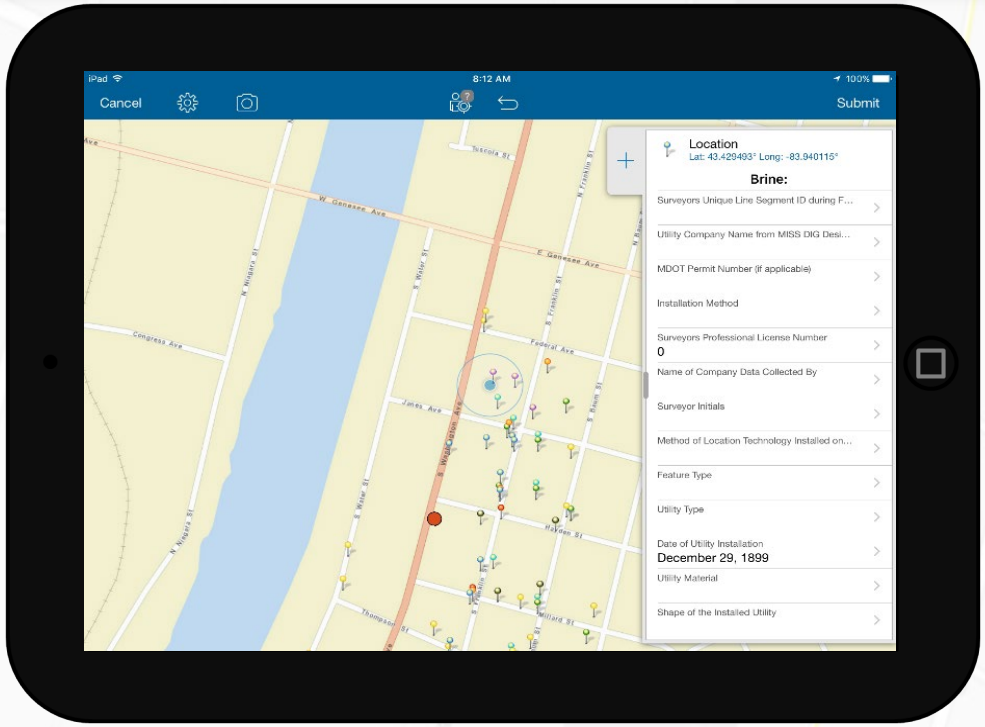
Field Name	Alias Name
OBJECTID	OBJECTID
SHAPE	SHAPE
AssetID	Unique Global Asset ID (auto generated)
SegID	Surveyors Unique Line Segment ID during Field coding
UtilComp	Utility Company Name from MISS DIG Design Ticket Database
MDOTPer	MDOT Permit Number (if applicable)
InstMeth	Installation Method
LicNum	Surveyors Professional License Number
CollecBy	Name of Company Data Collected By
SurvInit	Surveyor Initials
MethLoc	Method of Location Technology Installed on Utility

Field Name	Alias Name
FeaType	Feature Type
UtilType	Utility Type
InstDate	Date of Utility Installation
UtilMat	Utility Material
FacShape	Shape of the Installed Utility
UtilDia	Utility Diameter
ParaQT	Quantity of Same Size Utility Installed
Encas	Encasement (Yes or No)
SueQL	Equivalent SUE Quality Level
EncasMat	Encasement Material
EncasDia	Encasement Diameter
Notes	Any Special Notes
SHAPE_Length	SHAPE_Length

Data Formats – Industry Standard GIS Format

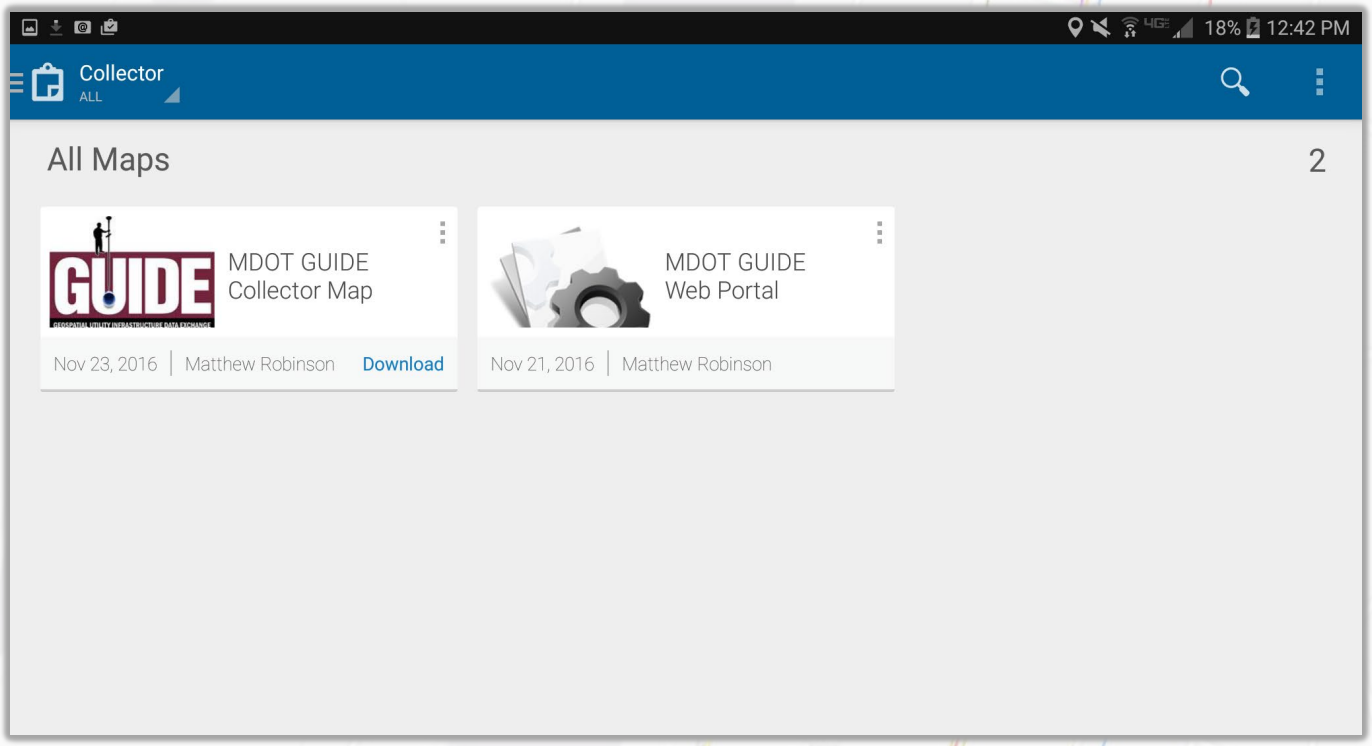
Simplified Data Collection

Utilizing Collector for ArcGIS



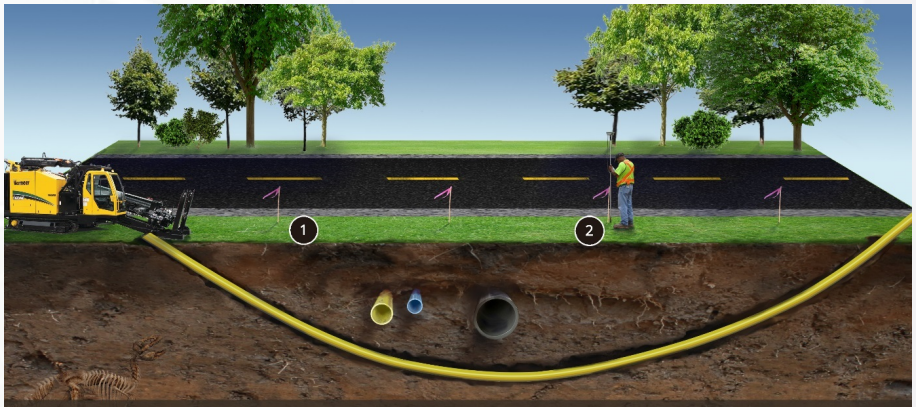
Windows 10

Connect to the GUIDE Collector Map



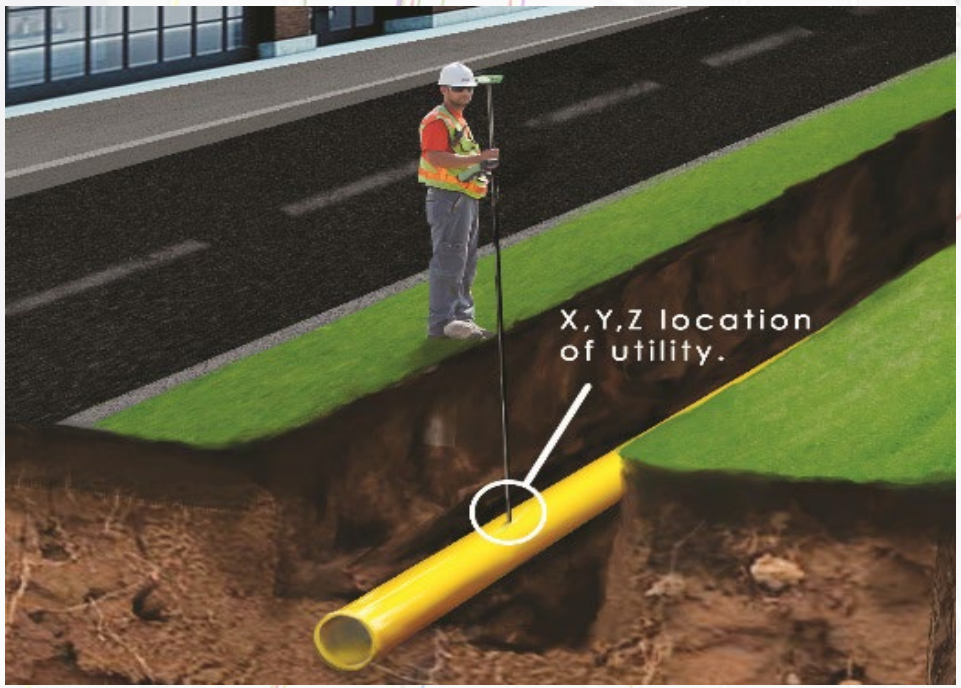
Surveyor Surveys each Utility Segment

Indirect Survey Measurement



1. Contractor marks the utility every 100 ft., or at changes in geometry during HDD operations. Depth from bore head is recorded on the stake.
2. Surveyor observes XYZ position and computes the elevation of the utility, based on depth reading marked on the stakes.

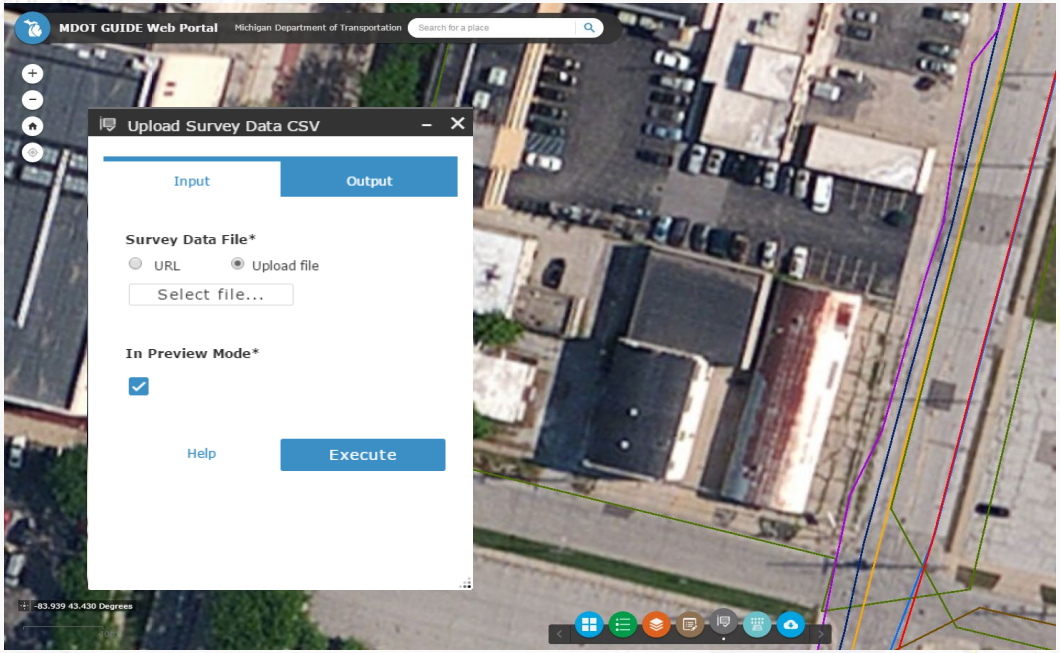
Direct Survey Measurement



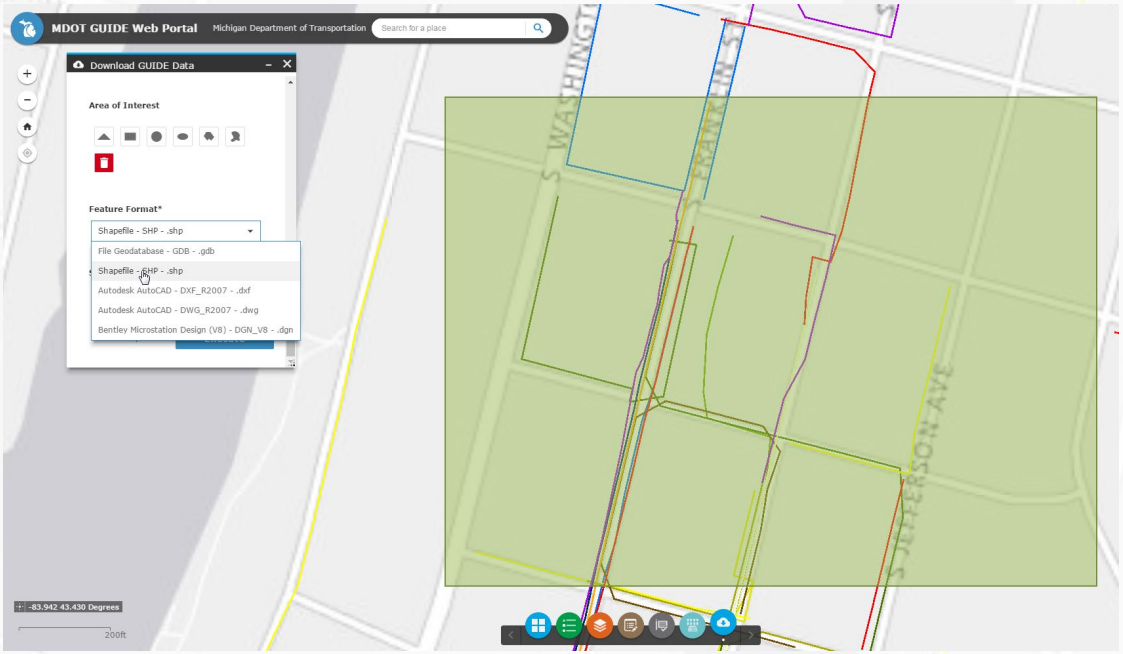
Surveyor Validates Collected Data and Creates CSV File

SegID	Northing	Easting	Elevation	FeaType	InstDate	SurvInit
BRNE1	703939.19	13237052.58	590.49	BRNE	20160411	ESB
BRNE1	703888.14	13237038.68	590.36	BRNE	20160411	ESB
BRNE1	703859.94	13237039.62	589.92	BRNE	20160411	ESB
BRNE1	703796.66	13237025.21	589.83	BRNE	20160411	ESB
BRNE1	703778.01	13237012.06	590.19	BRNE	20160411	ESB
BRNE1	703777.99	13237012.12	590.19	BRNE	20160411	ESB
BRNE1	703722.40	13237002.11	590.07	BRNE	20160411	ESB
BRNE1	703691.66	13236998.08	589.85	BRNE	20160411	ESB
BRNE2	703662.36	13236989.41	589.92	BRNE	20160411	ESB
BRNE2	703662.26	13236989.49	589.93	BRNE	20160411	ESB
BRNE2	703612.85	13236976.84	590.02	BRNE	20160411	ESB
BRNE2	703578.78	13236968.13	590.01	BRNE	20160411	ESB
BRNE2	703543.96	13236952.33	590.47	BRNE	20160411	ESB
BRNE2	703516.02	13236947.02	590.22	BRNE	20160411	ESB
BRNE2	703515.59	13236946.87	590.17	BRNE	20160411	ESB
BRNE2	703378.13	13236921.71	590.30	BRNE	20160411	ESB
BRNE2	703182.69	13236880.50	590.26	BRNE	20160411	ESB

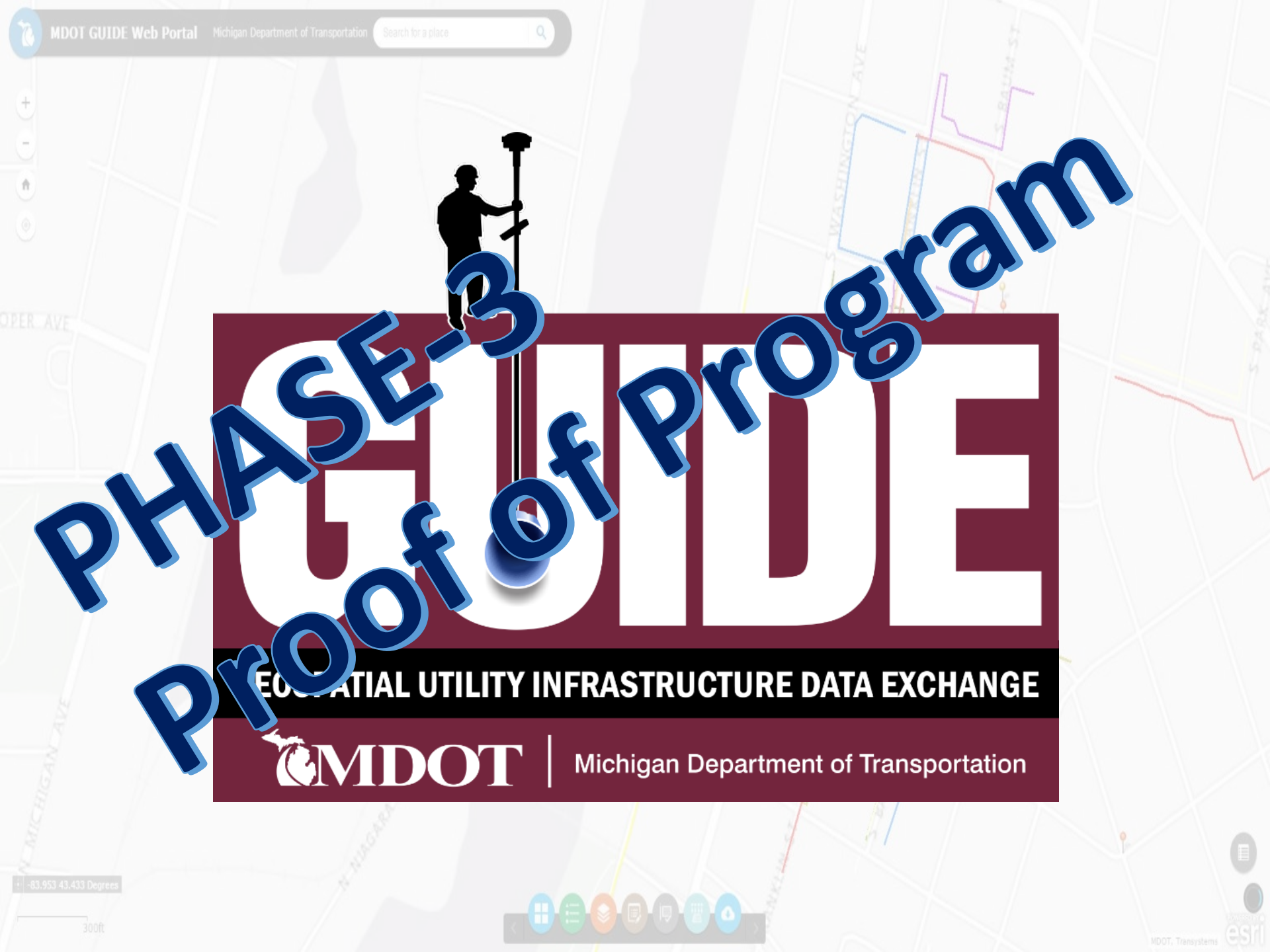
Upload Data to Web Portal



Download Data from GUIDE Portal



- Download by AOI
- 3D data in various formats
- Shapefiles
- Geodatabase
- DGN
- DWG/DXF


MDOT GUIDE Web Portal
Michigan Department of Transportation
Search for a place
PHASE-3
Proof of Program
GUIDE
ATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
MDOT
Michigan Department of Transportation

Consultants

Consultant 1

- Training
- General Support
- Revisions (Manual, Supporting Files, Collector App. Etc.)
- Quality Assurance

Consultant 2 Prein&Newhof

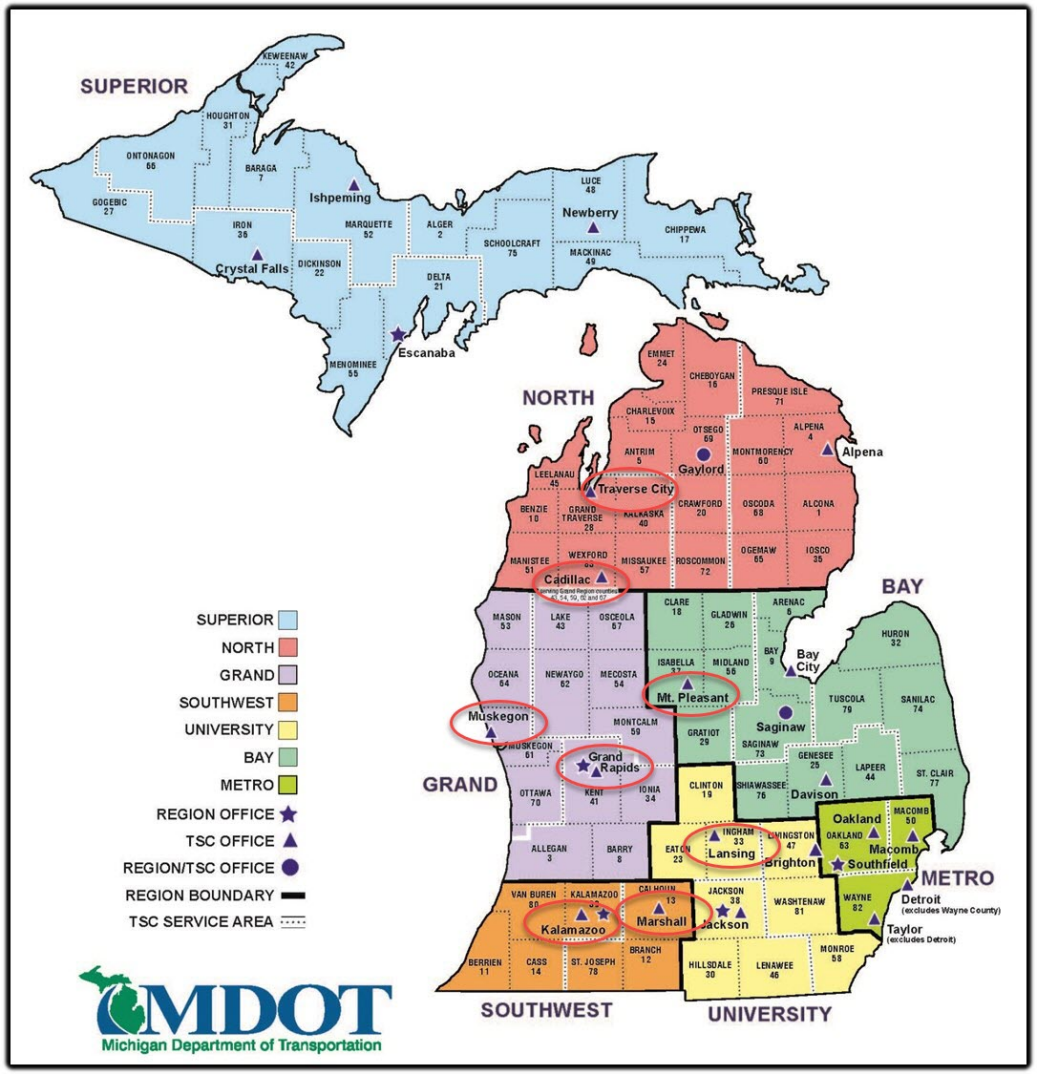
- Field Collection
- Process Validation
- Suggest Revisions
- Document “Proof of Program”

May 16, 2017 Kickoff Meeting

- Consultants & TSC Staff

Data Collection Focus Areas

- Kalamazoo
- Grand Rapids
- Cadillac



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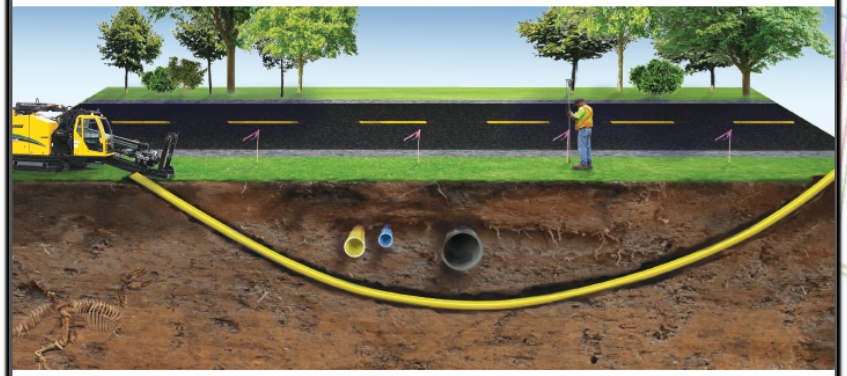
GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
MDOT Michigan Department of Transportation

SPECIAL CONDITIONS FOR UNDERGROUND UTILITY INSTALLATIONS



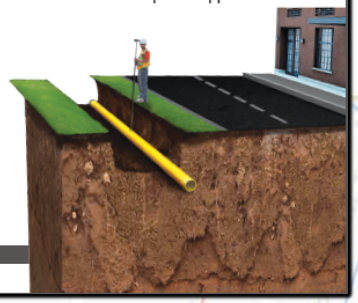
This permit has been selected to participate in the Michigan Department of Transportation's (MDOT) Geospatial Utility Infrastructure Data Exchange (GUIDE) proof of implementation initiative. GUIDE requires that the location of new underground utility installations be surveyed in X, Y and Z at the time of installation. In addition, various defined attributes will be recorded denoting the utility owner, size, type, etc. This data will be formatted and saved to MDOT's spatial database, where the data will be managed in a highly secure environment with controlled access.

MDOT Responsibilities:

- Educate permit applicant on GUIDE and share best practices for coordinating the data collection.
- Data collection will be completed by a MDOT Survey Consultant at no cost to the permit applicant.

Permit Applicant Responsibilities:

- Participate in a pre-construction meeting.
- Fully cooperate and coordinate the installation activities with MDOT and its survey consultant.
- Participate in a post construction meeting and/or survey.



Additional Details:

The permit applicant's name, permit details, construction photos and GUIDE data may be included in a final report documenting the GUIDE proof of implementation results.

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GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
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EARN 3.0 CEH
GUIDE Phase III Data Collection Process Training

Tuesday, May 23rd, 2017
9:00a.m.-12:00p.m.
Michigan Department of Transportation
Office of Aeronautics
2700 Port Lansing Road
Lansing, MI 48906-2160

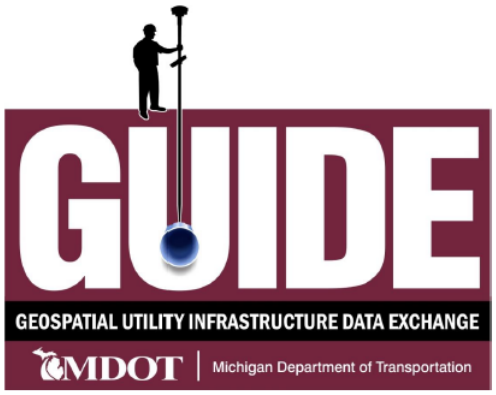
The Michigan Department of Transportation (MDOT) is undertaking phase III of its Geospatial Utility Infrastructure Data Exchange (GUIDE) initiative. Phase III involves field data collection and process validation of the January 2017 draft GUIDE Procedural Manual. The procedural manual defines the attributes and spatial accuracy in which permitted underground utility installations need to be collected, recorded and submitted for approval and storage. Industry representatives will participate in hands on training, walking them through the complete data collection process using Collector for ArcGIS and established surveying procedures.

Participants should come prepared with the following:
1. Laptop computer
2. Tablet device running Collector for ArcGIS (Android, Ios, or Windows10 only)

One set of user credentials will be provided for each participating organization. Credentials will allow each organization to connect to MDOT's spatial database engine through Collector for ArcGIS and the GUIDE web portal in order to contribute data to the proof of program phase.

Presented by:
Nick Lefke - Utility Coordination Specialist - MDOT
Mr. Lefke has statewide responsibilities overseeing the department's entire utility coordination program. He has been the GUIDE Project Manager since conception.

Eric Barden, PS – Spicer Group, Inc.
Mr. Barden is the principal in charge of Spicer Group's geospatial services group, and has been assisting MDOT in the development of the GUIDE standards and procedural manual.



Proof of Program - 2017 to 2019

SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

U.S. Department of Transportation
Federal Highway Administration

Prepared for

Michigan Department of Transportation

By

Prein&Newhof

June 2019

Proof of Program

Results:

- challenges coordinating data collection
  - responsibilities differ from procedures
- field data collection is the easy part
  - basic surveying line segments with defined attributes

Proof of Program

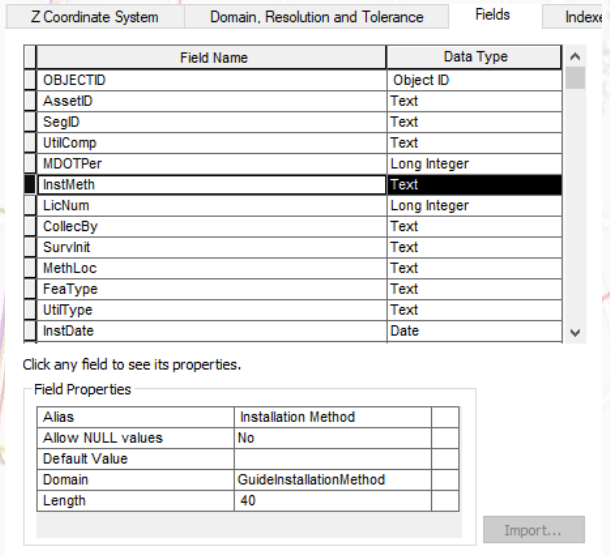
Results (continued):

- data collection modifications
  - Collector for ArcGIS application eliminated
    - Coordination proved onerous
    - Lack of internal programming support to make needed changes
    - Esri Shapefile is now the only accepted method for data uploads

Proof of Program

Results (continued):

- Moving forward…
  - MDOT provides a template defining field data collection
    - Dropdowns for attributes
  - Ensures data quality and consistency



Implementation Challenges

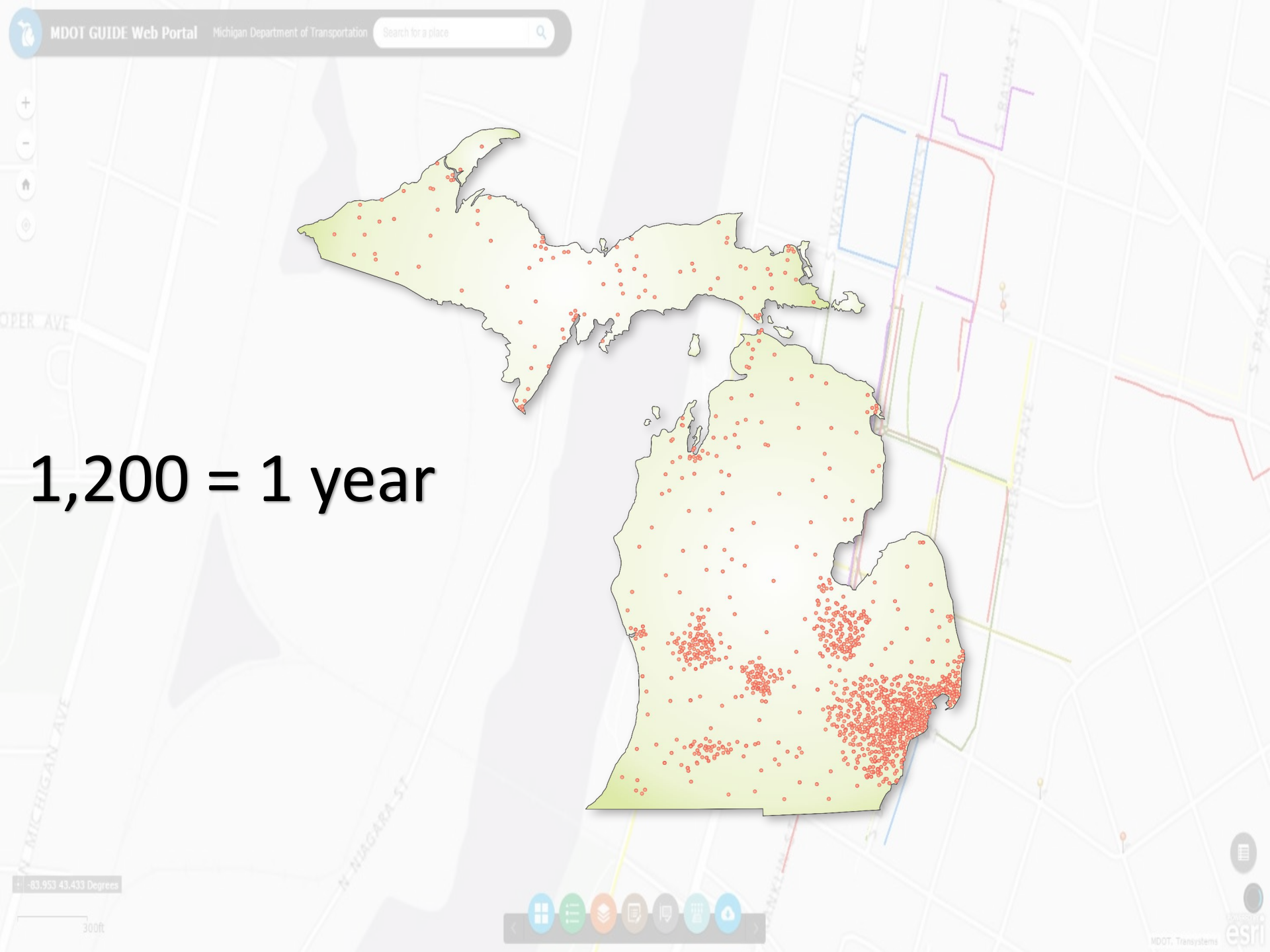
- Resources
- Utility Resistance
- Varying Standards
- Legal Considerations

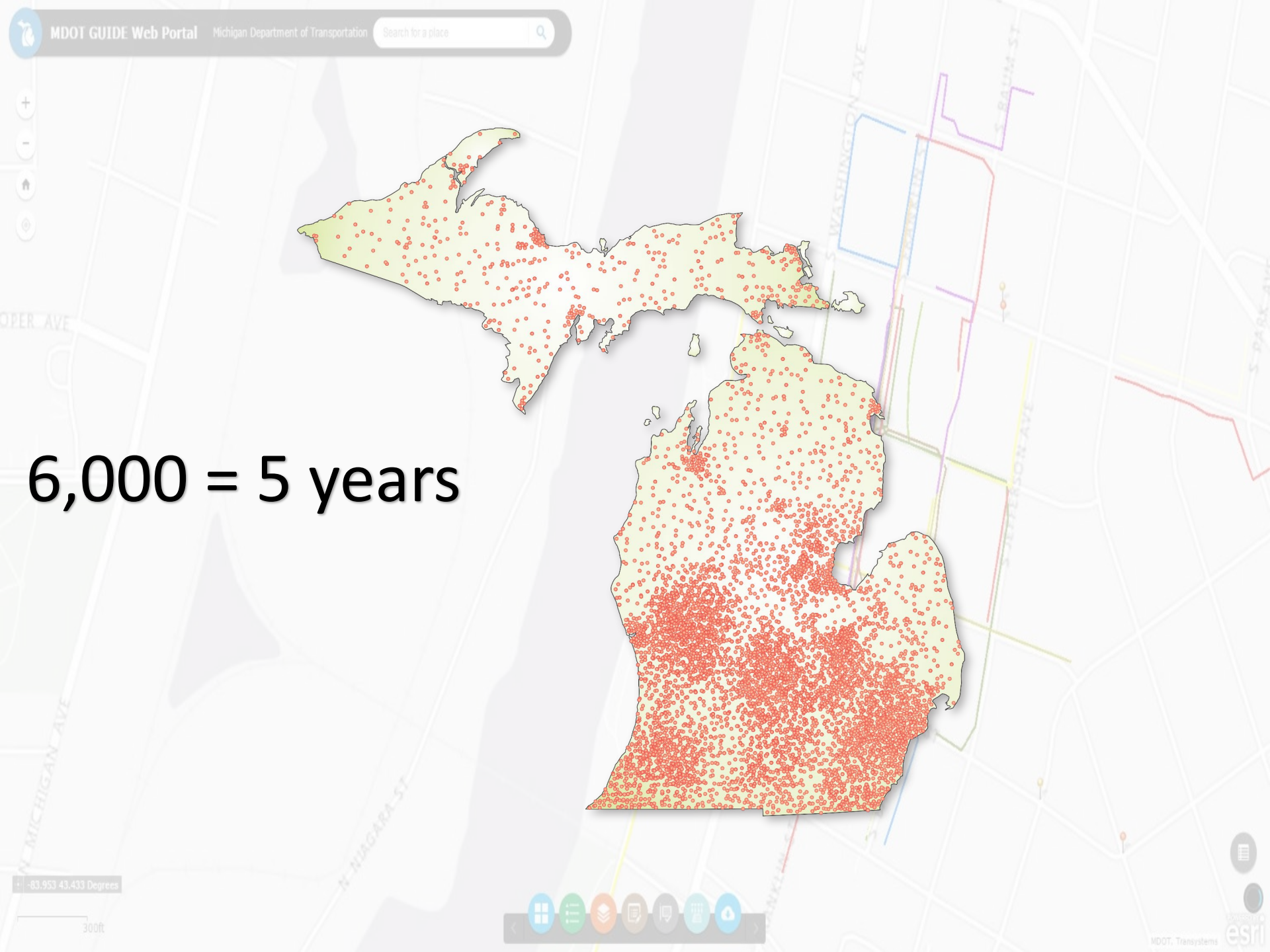
2013 Underground Utility Permits for **Utility Company** Applicants		
Utility	# of Permits	% of Total
Consumers Energy	114	10%
DTE Companies	101	9%
AT&T	322	29%
All Others	559	51%
TOTAL	1,096	100%

2013 Underground Utility Permits for **Governmental Agency** Applicants		
Utility Type	# of Permits	% of Total
Watermain	42	41%
Sanitary Sewer	34	33%
Storm Sewer	10	10%
Communication or Electric	16	16%
TOTAL	102	100%

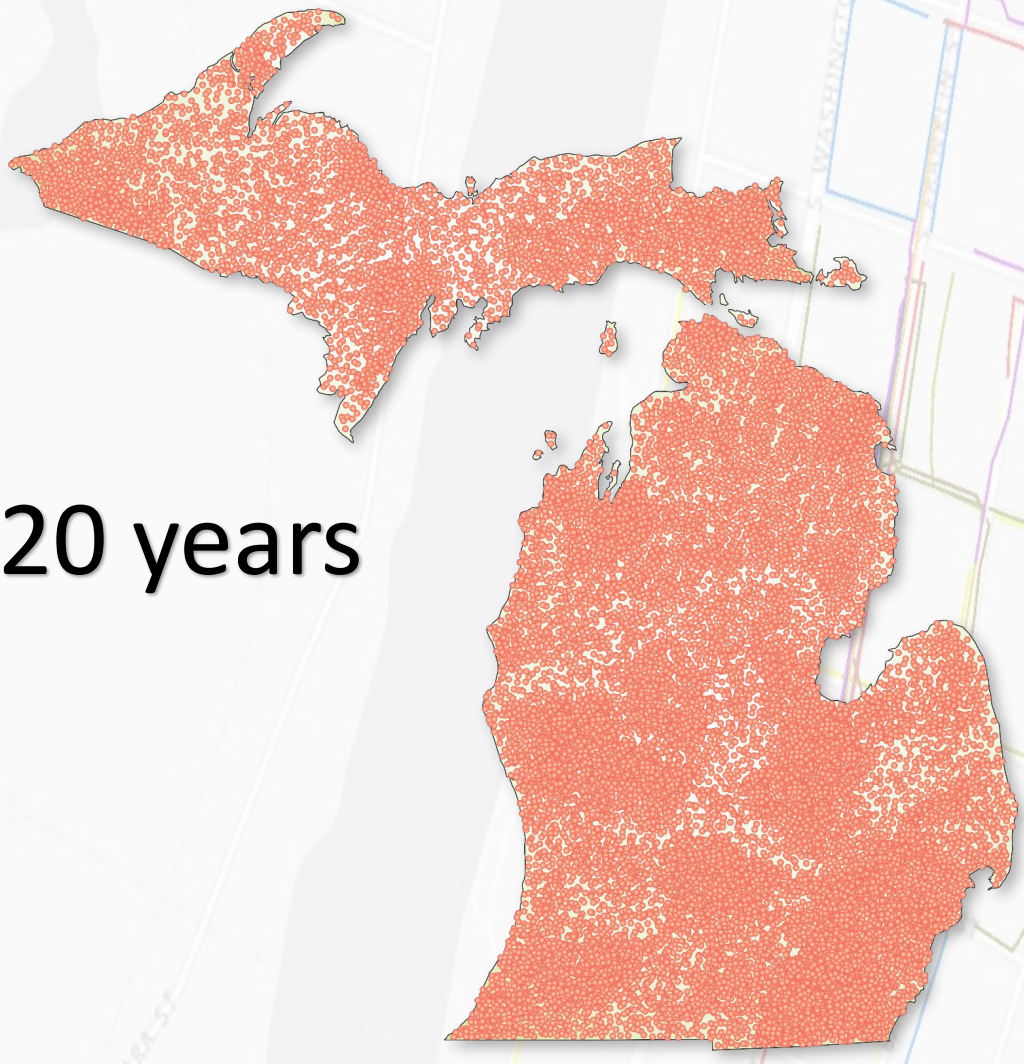
Combined TOTAL	**1,198 New Underground Permits**

1,198 New Underground Utility Permits Every Year


MDOT GUIDE Web Portal
Michigan Department of Transportation
Search for a place
1,200 = 1 year

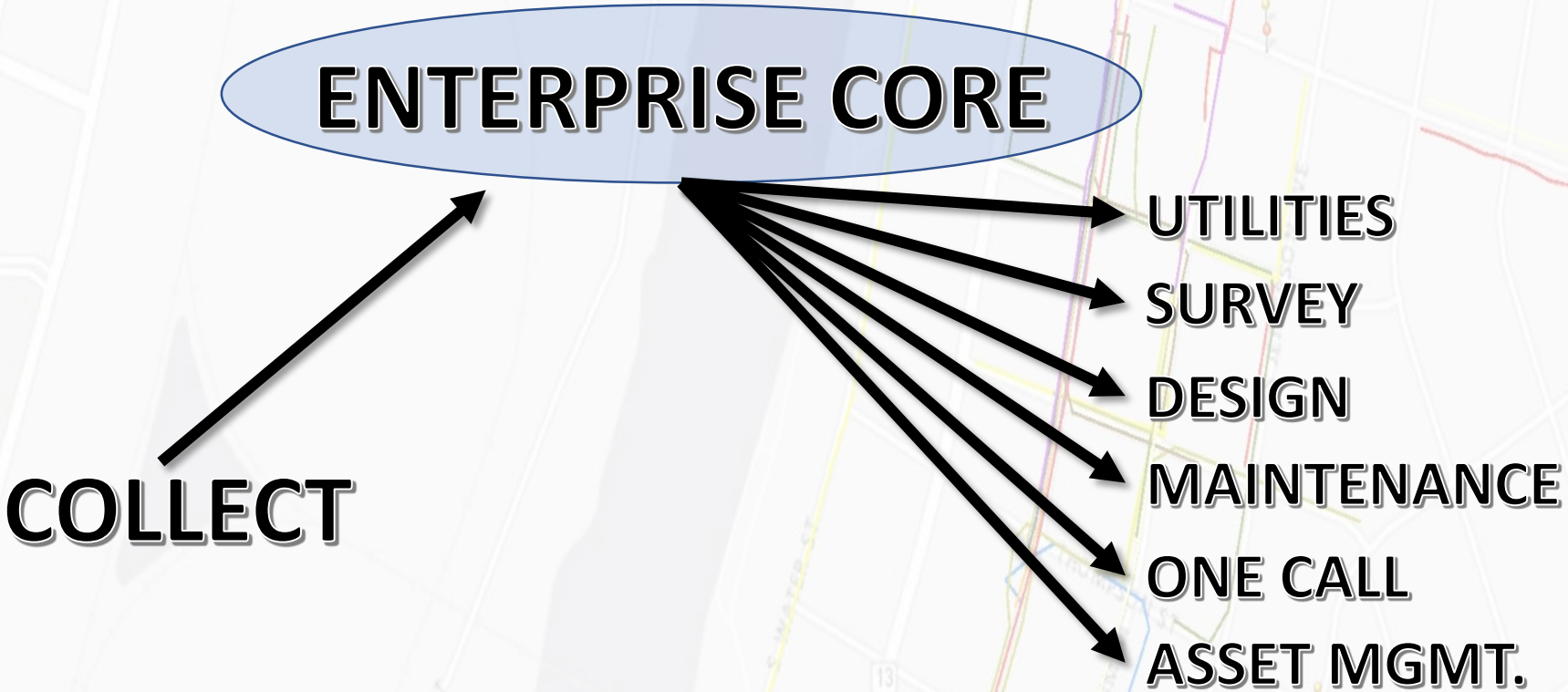

MDOT GUIDE Web Portal
Michigan Department of Transportation
Search for a place
6,000 = 5 years

12,000 = 10 years



24,000 = 20 years

Collect data once, collect it for everyone!



MICHIGAN UTILITY COORDINATION COMMITTEE'S
GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
2014 PILOT INITIATIVE

MUCC
MICHIGAN UTILITY COORDINATION COMMITTEE

U.S. Department of Transportation
Federal Highway Administration

STIC

GUIDE
GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
MUCC A MICHIGAN UTILITY COORDINATION COMMITTEE INITIATIVE

Report Prepared by:
Eric Barden, P.S.
Principal | Geospatial Services
Spicer group
www.spicergroup.com

March 2015

Geospatial Utility Infrastructure Data Exchange
Procedural Manual

U.S. Department of Transportation
Federal Highway Administration

GUIDE
GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
MDOT | Michigan Department of Transportation

Prepared by:
Eric Barden, P.S.

January 2017

Spicer group

GUIDE
GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
MDOT | Michigan Department of Transportation

Proof of Program - 2017 to 2019

SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

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Prein&Newhof

June 2019

Geospatial Utility Infrastructure Data Exchange
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GUIDE
GEOSPATIAL UTILITY INFRASTRUCTURE DATA EXCHANGE
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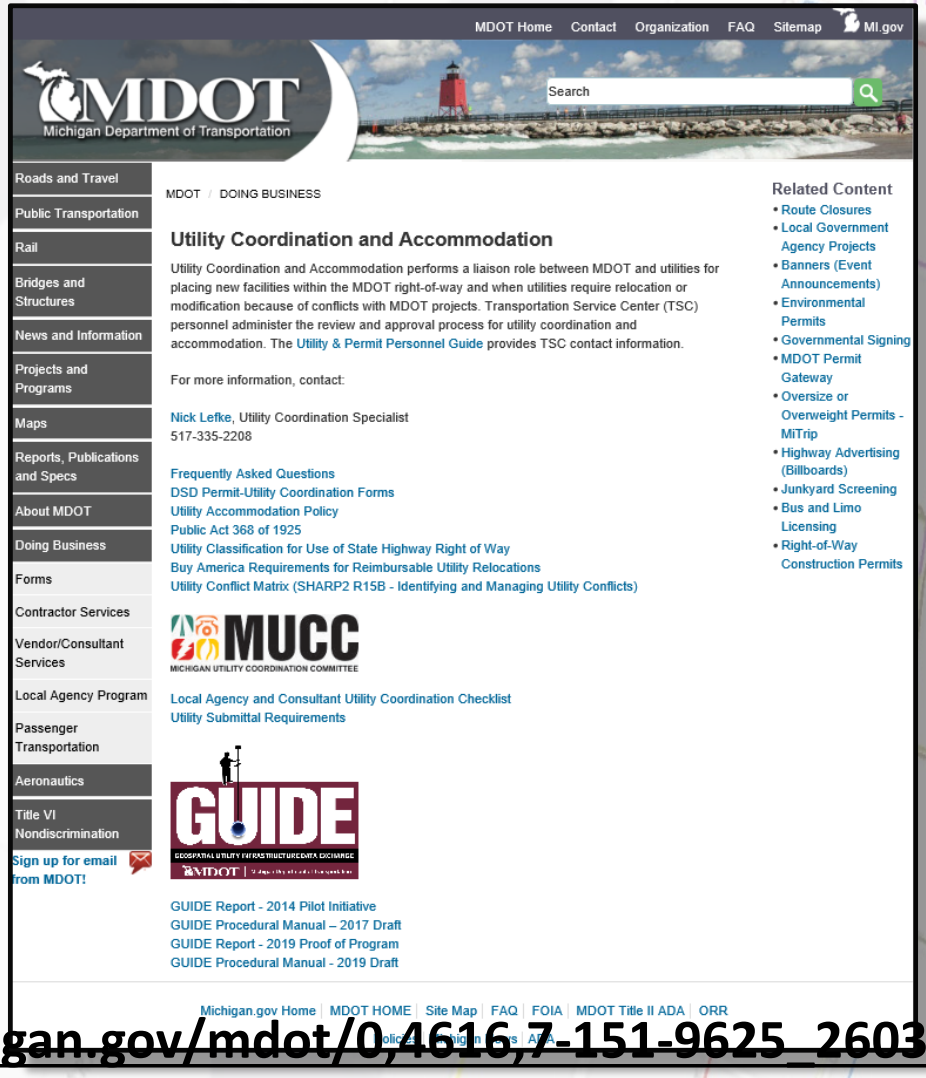
DRAFT
~~January 2017~~
Revised June 2019



https://www.michigan.gov/mdot/0,4616,7-151-9625_26039-182179--,00.html

Chris Pucci, Oregon DOT

Transitioning Utility Data Repository from 2D- to 3D-design and construction workflows (R01A focused)

Describe and discuss challenges and successes of implementation including:

- Utility investigation, timing, scope, quality, and completeness;
- Mapping and documentation of utility data on project files;
- Documentation of as-built conditions;
- Any other challenges and/or successes?

LUNCH BREAK

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

PEER EXCHANGE – Coordination for successful application of utility locating technologies (R01B focused)

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO




SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

Utility Locating Technologies (R01B)
Caltrans

William Owen

Peer Exchange
July 16-17, 2019

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

Introduction

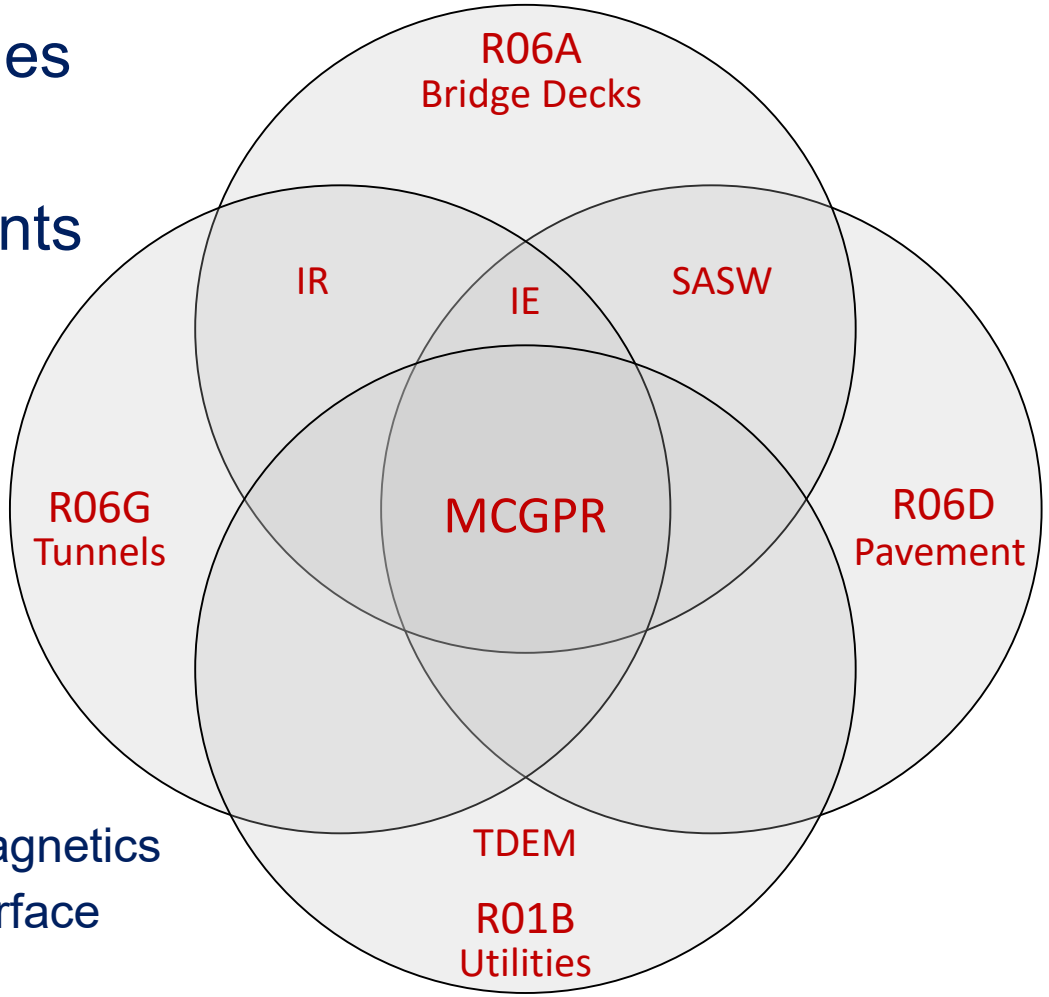
- How We Got Here
- History of GPR at Caltrans
- Caltrans GPR & EM Implementation (Under SHRP2)
- Results So Far
- Follow-Ups

History of Caltrans GPR

- 1998: PE IV and PE 1000
  - Utilities, NDT, Geotech
- 2000: Tow Cart
  - Pavements
- 2001: 2-½ D Applications
  - Void mapping
  - Pavement research
- 2006: 3-D Visualization
- 2008: Upgrades (PE Pro)
  - Improved tow cart, larger grids, high sample density
- 2009: Pavement Management
  - 58,000 Lane Miles (2009-2012)
- 2011: SUE
- 2015: Multichannel Radar
  - Product Demos (IDS, 3D Radar)
  - Bridge Deck Pilot (3D Radar)
  - SHRP2 Round 6 (R01B-SUE)
- 2016: SHRP2 Round 7
  - R06D (Pavement)
  - R06A/G (Bridge decks/Tunnels)
  - R01B (SUE)

SHRP2 Technology Overlap

- No single grant provides full funding
- Leverage multiple grants for technology acquisition



IE – Impact Echo
IR – Infrared (Thermal Imaging)
TDEM – Time Domain Electromagnetics
SASW – Spectral Analysis of Surface Waves
MCGPR – Multichannel GPR

SUE Economic Benefit

Cost	Expenditure on Typical Projects	Saving Rates	Savings on Overall Projects
Administrative Cost	20%	10%	2%
Engineering Cost	10%	5%	0.5%
Construction Cost	45%	5%	2.25%
Overrun Cost	15%	33%	5%
Utility Relocation Cost	10%	50%	5%
Total	100%	-	14.75%

(Stevens, 1993)

Return on Investment ($ saved/$ spent):

Purdue (*FHWA*, 2000):	4.62
Brown & McKim (*VADOT*, 2002):	7.00
Jeong et al. (*ASCE*, 2004):	12.23
Sinha et al. (*PennDOT*, 2007):	22.21

Caltrans SHRP2 Goals

- Validate GPR technology for diverse applications
- Bring high-speed GPR technology to Caltrans for utilities, pavements, bridge decks, tunnels
- Acquire TDEM technology for utilities
- Improve testing methodology and reporting
- Training and technology transfer
- Develop appropriate roles, responsibilities and business practices for collaboration

3D Radar/EM-61 Implementation

- Collaboration at State & National Level
  - Funding/Acquisition through FHWA/AASHTO
  - Design and Fabrication through CT-GS and CT-DOE
  - Installation and Testing through CT-DOE, CT-GS and UC Davis
- Implementation Challenges
  - Short Delivery Schedule
  - Dual Mounting System
  - Reliable Power Supply
  - I/O From Multiple Data Streams

GPR Van, Air-Launched Assembly

GPR Van, Ground-Coupled Assembly

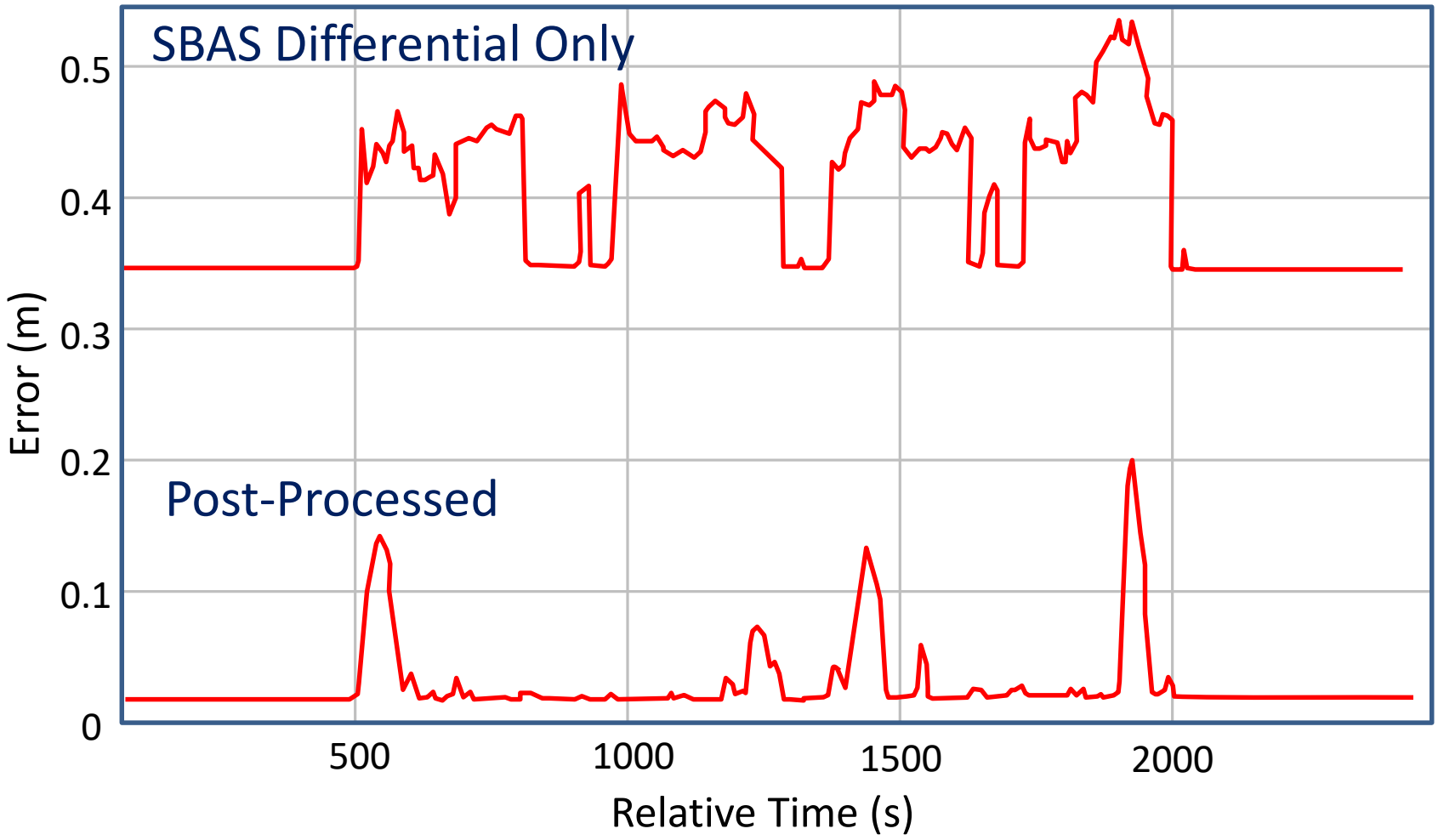
EM-61, Towed Assembly

POS LV - GNSS Aided Inertial Navigation

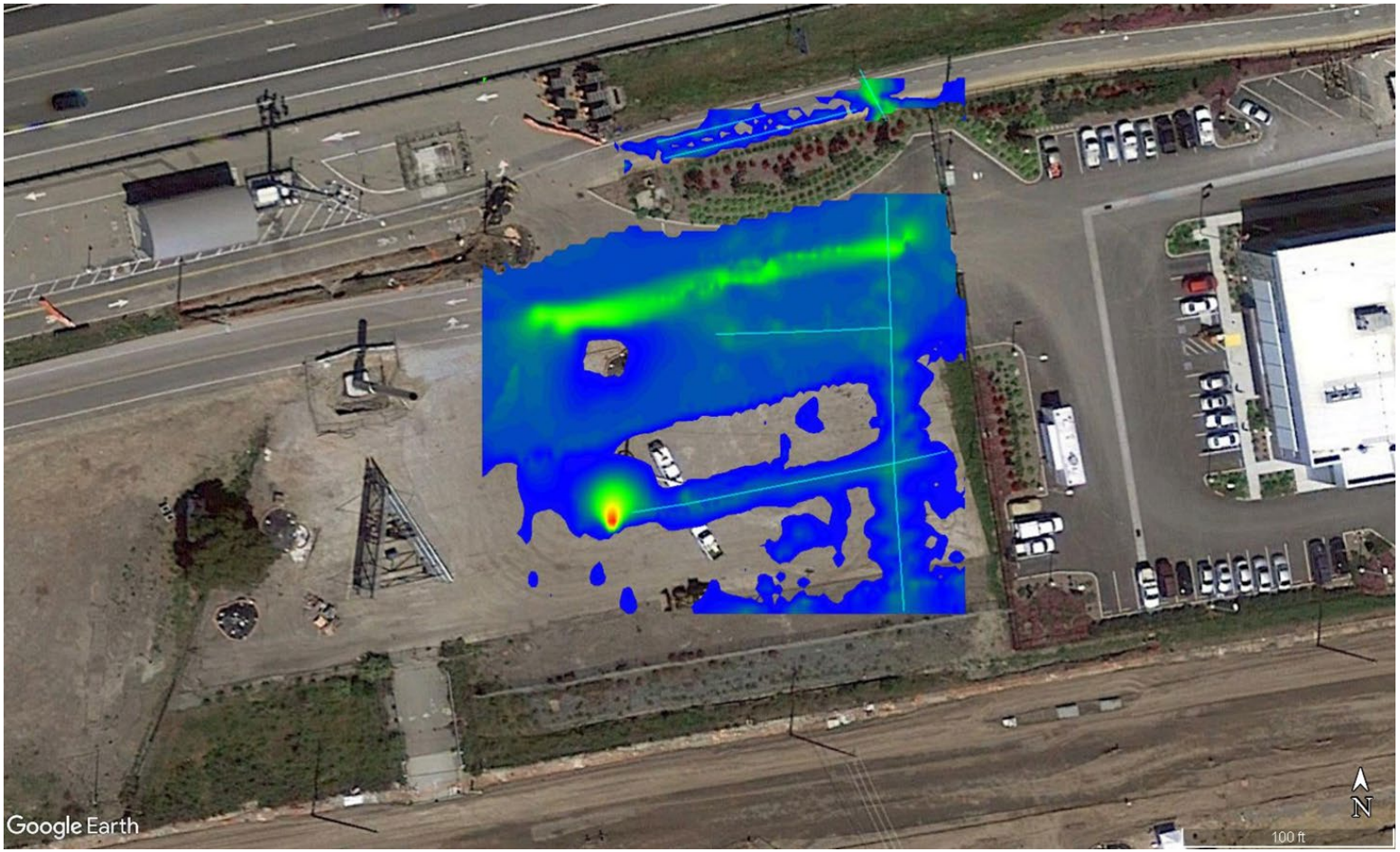
- Dual Antenna GNSS
  - ✓ position, attitude & heading
- Three-axis IMU
  - ✓ Accelerometer & gyroscope
  - ✓ 100 Hz output
- DMI Odometer
  - ✓ Up to 20,000 pulse/m
- Integrated processor
- PC interface
  - ✓ Real-time output
  - ✓ User parameter controls

https://www.applanix.com/img/gallery/pos_lv_imu_ant_dmi.png

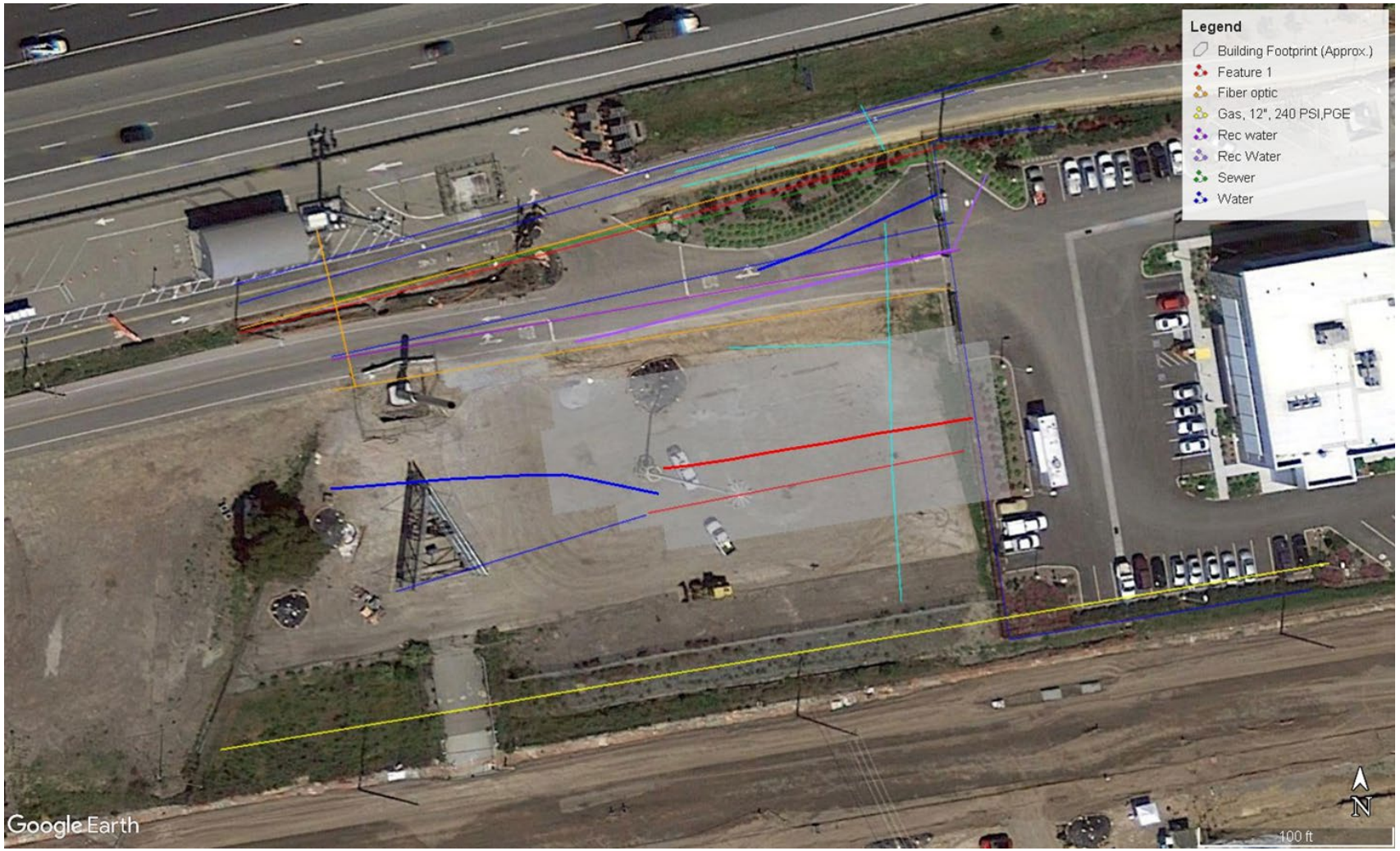
GNSS Post-Processing



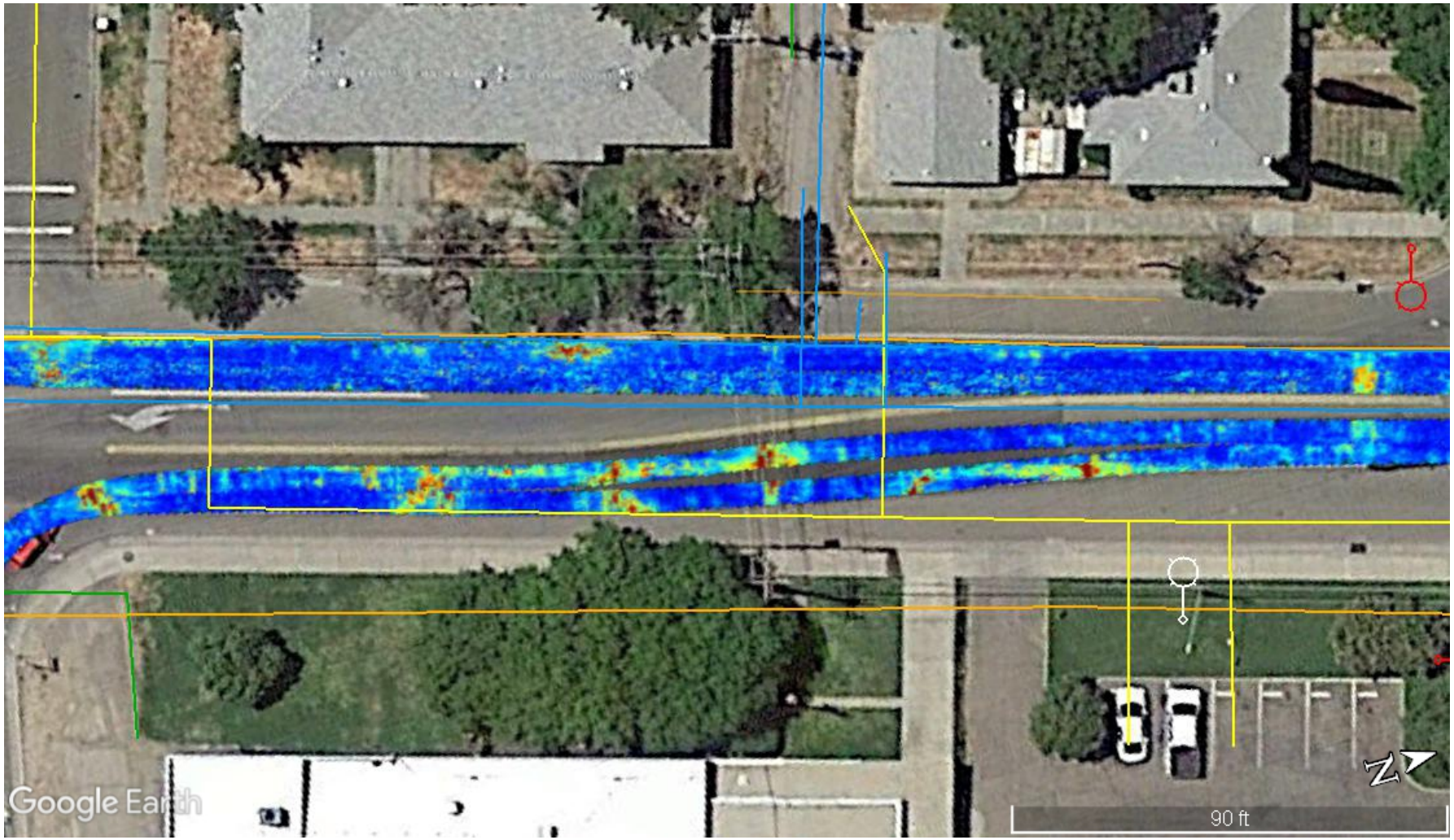
SFOBB Training Center: EM-61



SFOBB Training Center: QL-B,C,D



SR 20 @ Colusa: GPR

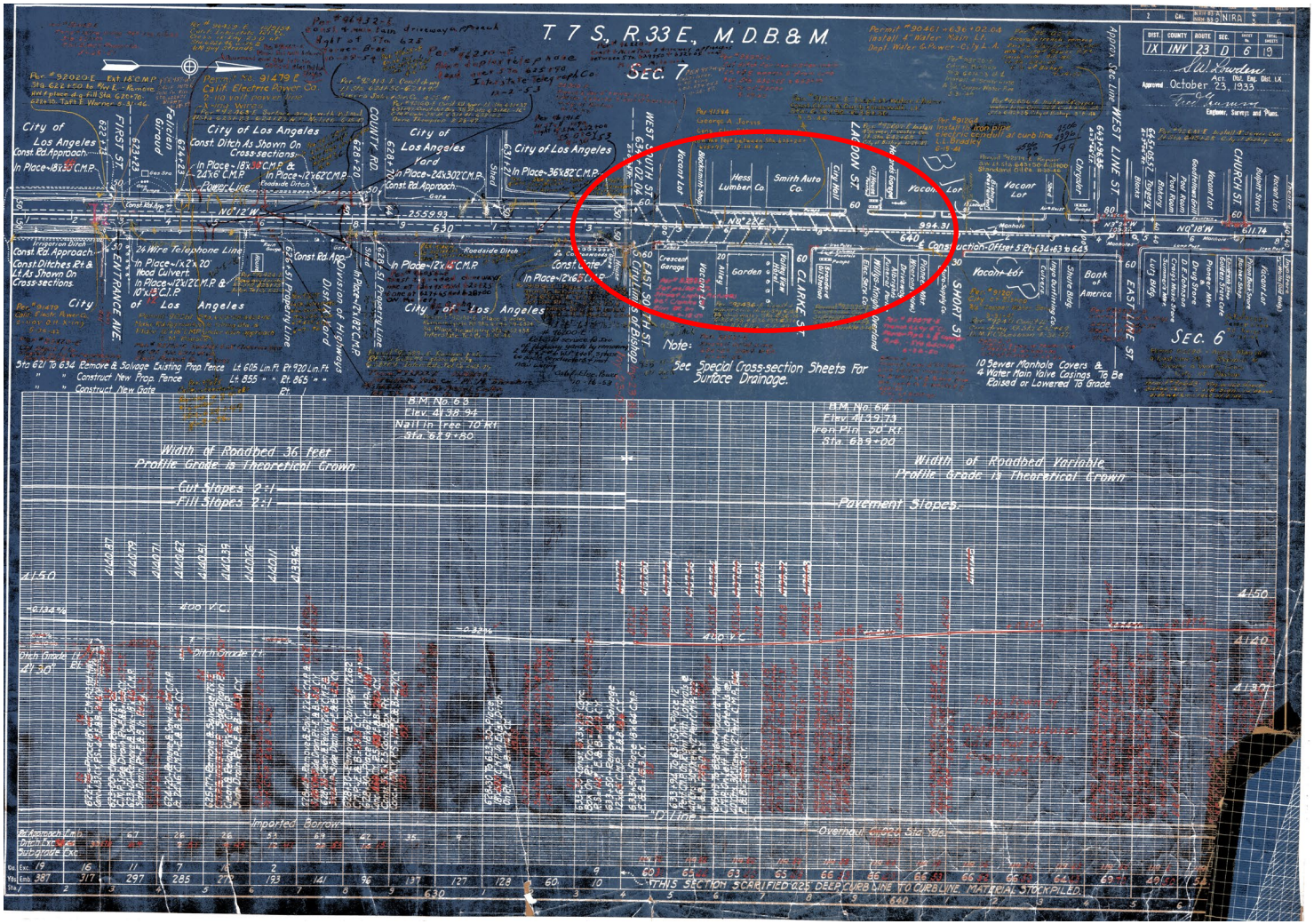


SR 20 @ Colusa: EM-61

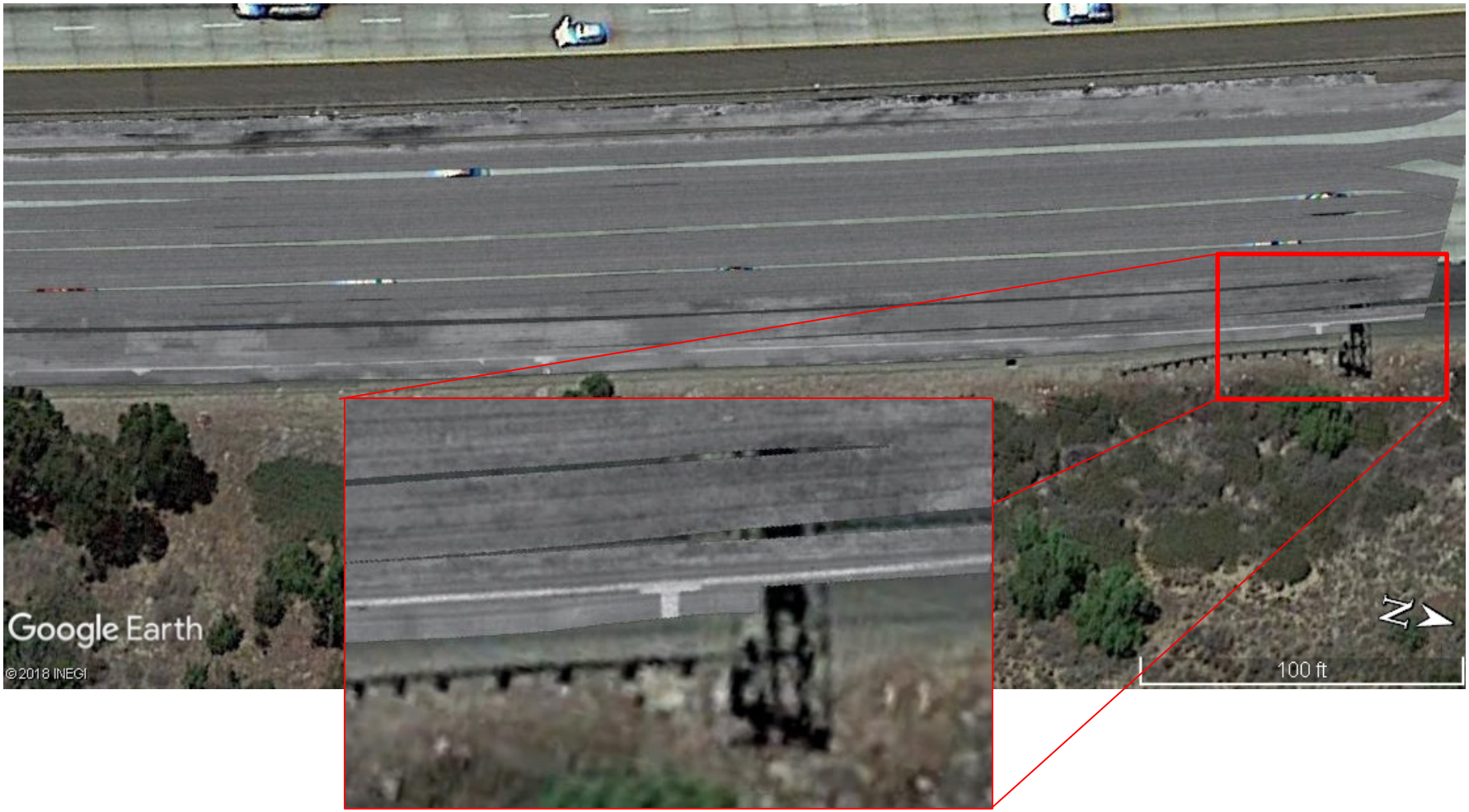
US 395 @ Bishop: GPR

US 395 @ Bishop: EM-61

US 395 @ Bishop: Drainage Plan (1933)



US 805 @ San Diego



Going Forward

- Process Improvement
  - ✓ QA/QC
  - ✓ Automation of data processing/analysis
- Integration with laser scanner and visual/thermal imaging systems
  - ✓ Full synthesis with existing systems
  - ✓ “One-Pass” acquisition
- Contract development to meet workload demand

In Summary

- Multichannel GPR arrays/towed EM-61 make large area surveys cost-effective
- Ultra-fast I/O = 3D GPR acquisition at near-highway speeds
- Real-Time 3D display improves quality control
- Improved post-processing software renders faster interpretation
- GNSS Aided Inertial Navigation = improved georeferencing
  - ✓ Post-processing refines GNSS solution to cm accuracy
- GPR ≠ primary QL-B technology
- Results validates technologies to improve QL-B subsurface utility designating for project design
- Contract services required to help meet SUE demand

Acknowledgements

- FHWA/AASHTO
- Olson Engineering/Collier Consulting (SME's)
- University of California, Davis
  - ✓ Advanced Highway Materials Research Center
- 3D Radar
- Applanix
- California Department of Transportation
  - ✓ Division of Equipment
  - ✓ Office of Land Surveys
  - ✓ Geophysics and Geology Branch

Gabe Priebe, Montana DOT

Coordination for successful application of utility locating technologies (R01B focused)

Describe and discuss challenges and successes of implementation, including:

- Engaging multiple DOT departments and their staff including Utility, Right of Way, Surveying, Engineering, Safety, Design;
- Investment and participation from service providers and contracting with qualified service providers willing and able to integrate standard SUE information;
- Technical training and information exchange with people covering operations, safety, right of way, surveying, design, and others;
- Information exchange between districts, other states;
- Any other challenges and/or successes?

BREAK

15 Minutes



SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

PEER EXCHANGE Equipment and IT Resources: Challenges and Successes

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

David Otte, Kentucky DOT

URMS
Utility Relocation Management System

Project Overview

Who: PennDOT project management
Contract developers

What: Project collaboration platform built to manage highway and bridge project utility involvement and utility conflicts.

When: Project start: Aug. 2016
Application Development started Nov. 2017
Release 1 – Feb. 2020
Release 2 – Jan. 2021
Release 3 – Sept. 2021

How Much: 4.1 Million

pennsylvania
DEPARTMENT OF TRANSPORTATION

Key Project Objectives

Increase Usership

- Intuitive
- Consolidate utility access - PennDOT Utility Portal access "One Stop Shop"
- Build value
- Accommodate Alternative Contracting Methods (ACMs)

Provide Tracking & Visibility

- Project Life-Cycle Tracking
- Due Dates for tasks
- Activity Log (AKA – Audit History)
- Process predictability

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DEPARTMENT OF TRANSPORTATION

Process, Policy and Cultural - Impacts

- **Align our process and policy with an "On Screen" approach…**
- **Stop thinking forms. Start thinking information…**
- **That's how we've always done it…**

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DEPARTMENT OF TRANSPORTATION

URMS - Utility Conflict Matrix – Database Approach

Conflict level documents

- Right-of-Way
- SUE Results
- Utility As-builts

Conflict level approvals used to drive other processes

- Compensable Real Property Interest
- Apply to reimbursement proration
- Test Hole permits

Conflict level risk assessment

- SUE needs
- Substitute R/W

Searchable UCM

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URMS UCM Demo

"Think this is bad? You should see the inside of my head."

https://urmsuat.penndot.gov/urms/common/home.xhtml

pennsylvania
DEPARTMENT OF TRANSPORTATION

Equipment and IT Resources: Challenges and Successes

Describe and discuss challenges and successes of implementation involving:

- IT resources
- Software
- Field equipment
- Utility detection technology
- Any other resources?

BREAK

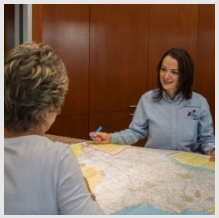
15 Minutes

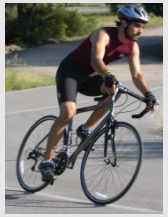
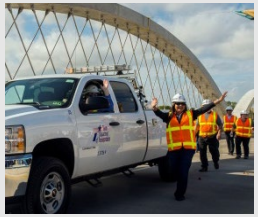
SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

PEER EXCHANGE Leadership Buy-in: Procurement and Process Changes

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO




SHRP2 R15B IN TEXAS: LEADERSHIP BUY-IN

Charon Williams, TxDOT Right of Way Division

Gregg Granato, TxDOT San Antonio District

Anna Pulido, TxDOT San Antonio District

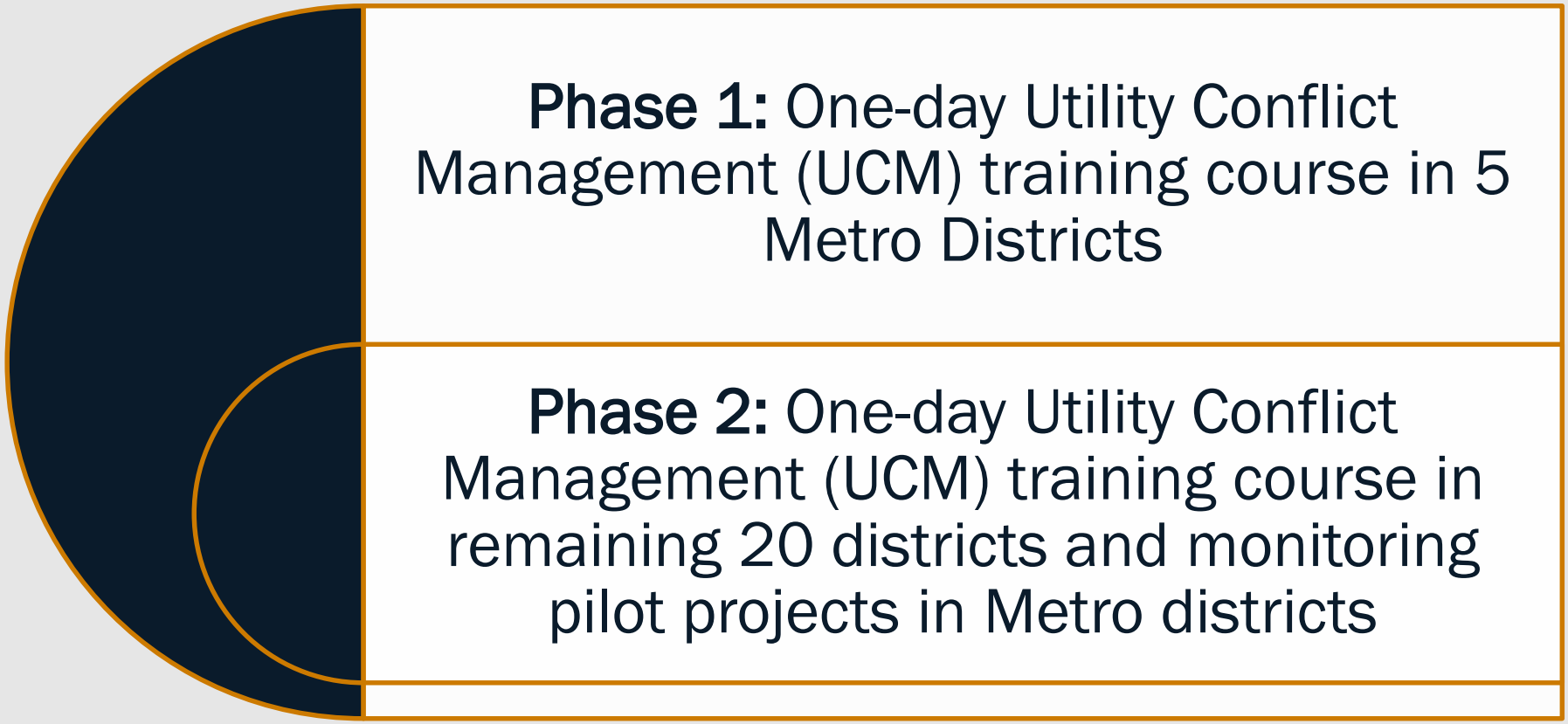
Utility Conflict Management – Leadership Buy-In

"Ready to Let" Memo (March 2016) – Chief Engineer

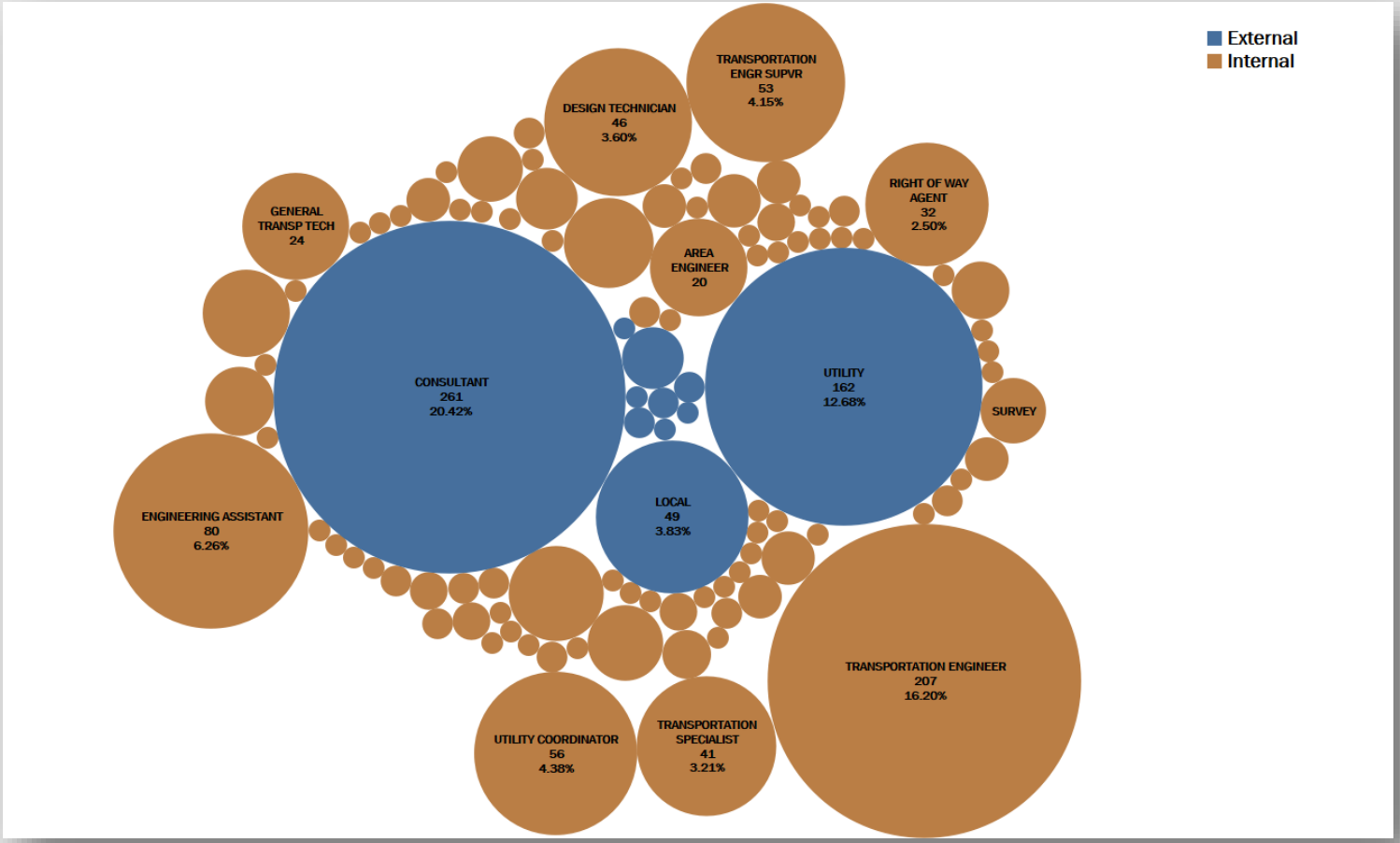
Delivering transportation improvements drives our business and will continue to be measured. It is essential that our performance standard for 'ready to let' projects be elevated and defined to ensure consistency in project letting preparation to meet our goal. Therefore, through detailed workshops attended by district and division offices the 'Ready to Let' definition as outlined below was developed and will be implemented on all construction projects effective immediately.

- *ENV cleared and ENV mitigation complete (cleared sufficiently to proceed into construction without delays)*
- *ENV permits secured (cleared sufficiently to proceed into construction without delays)*
- *ROW cleared (cleared sufficiently to proceed into construction without delays)*
- *100% PS&E (includes completed and approved schematic)*
- *Project agreements in place (includes local funding being received or an amount sufficiently received to proceed into construction without delays)*
- *Railroad coordination complete and agreement in place*
- *Utility agreements in place and relocations in progress (cleared sufficiently to proceed into construction without delays)*
- *The above and any other remaining issues to be cleared in < 3 months*

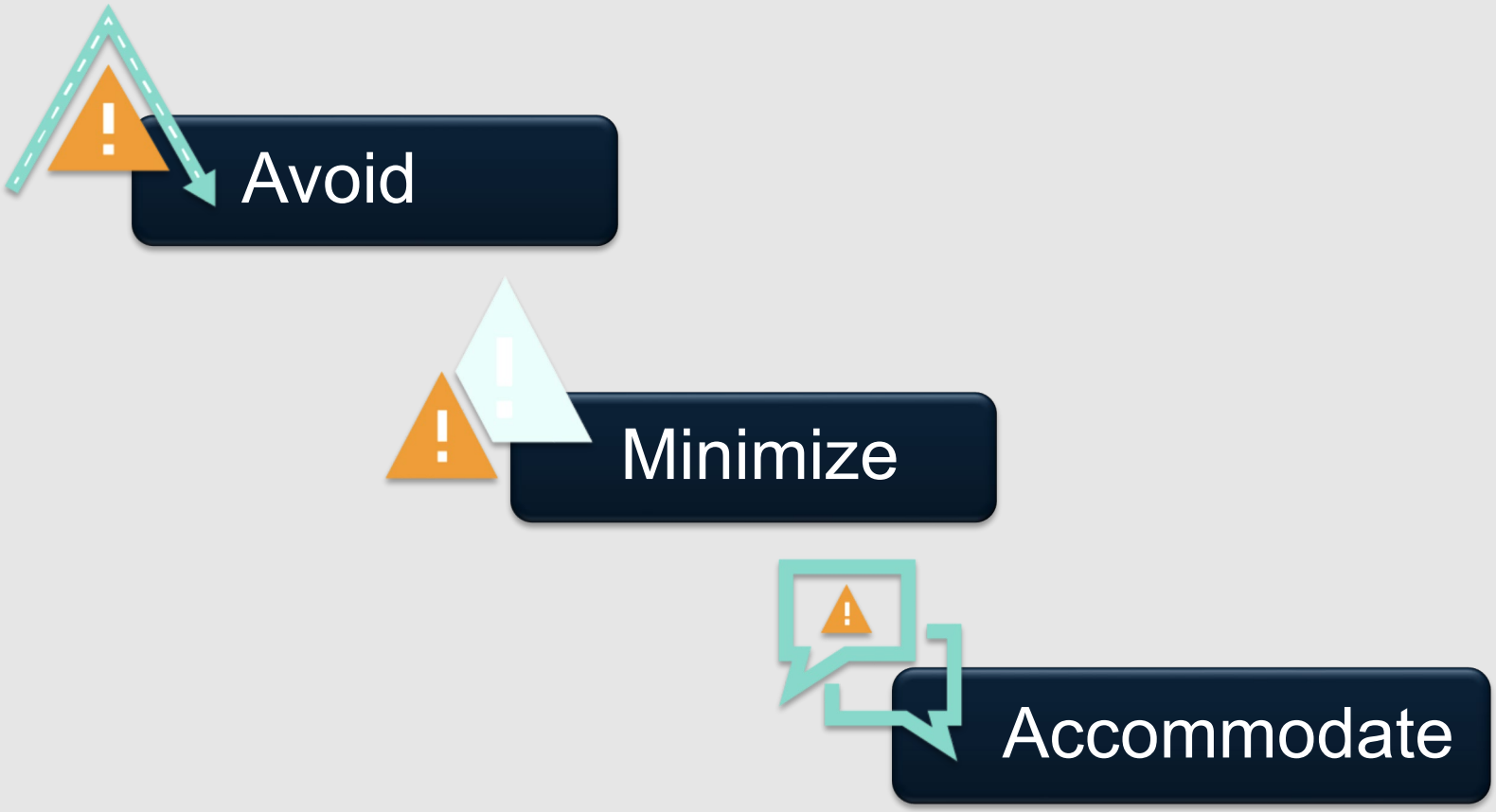
Utility Conflict Management Implementation



One-Day UCM Training Course – Participants by Title



Utility Conflict Management Emphasis



Utility Conflict Management Benefits – Results of Pilot

Efforts currently being tracked have indicated an estimated savings of nearly $10 million, and as many as 38 months in time savings – across 5 projects

District	Estimated Savings Identified ($M)	Identified Time Savings
Austin	$0.09	-
Dallas	$0.5	15 months
Fort Worth	$1.8	38 months
Houston	$2.9	-
San Antonio	$4.6	24 months

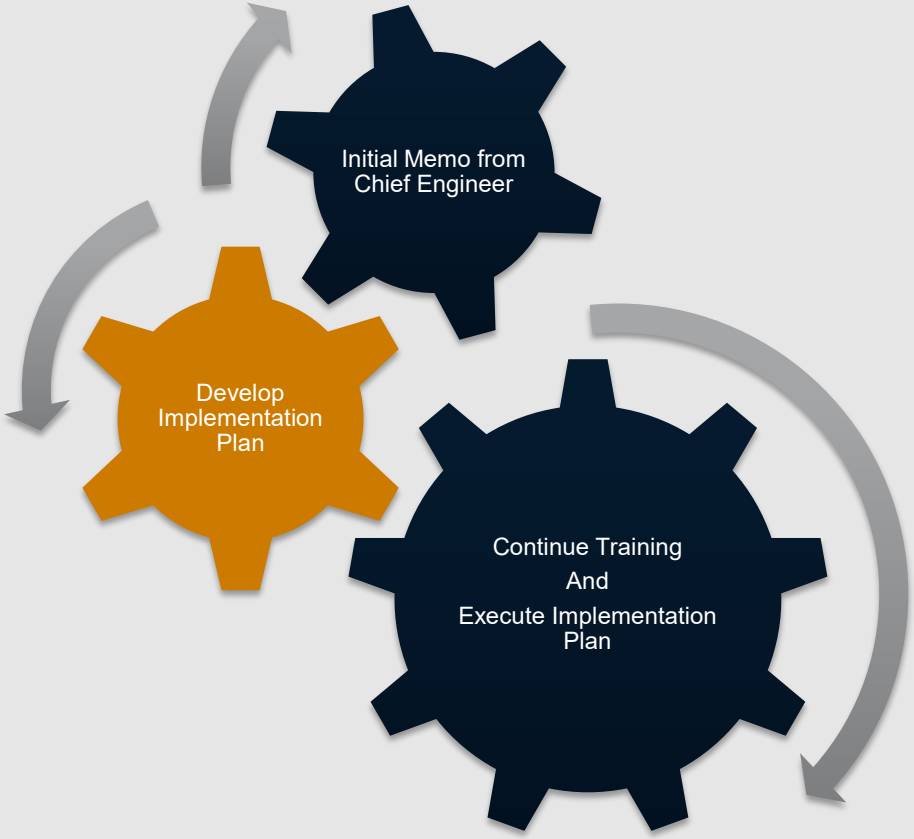
Utility Conflict Management Benefits – Other Districts

Identified additional benefits totaling $13 million from projects elsewhere in the state that started using the UCM approach

Utility Conflict Management Implementation

- TxDOT leadership team increased support for adoption of robust UCM principles throughout the state
  - Policy changes
  - Additional training courses and workshops
  - Increased industry partnering
  - Statewide implementation

Utility Conflict Management – Statewide Implementation



Utility Conflict Management Memo (October 2018) – Chief Engineer

One of our business process improvements to help us achieve "Ready to Let" success has been the implementation of Utility Conflict Management (UCM). This process is designed to reduce the time and cost associated with utility conflicts on a project. It starts by identifying utilities as early as possible during the project development phase. Once the utilities are identified a systematic process of tracking and communicating potential utility conflicts within the project development team is used to determine if the utility can be avoided in the project design, if the utility conflict can be minimized, or as a last resort, if the utility should be adjusted.

Several projects in Dallas, Ft. Worth, Houston and San Antonio were chosen in 2017 to pilot this process and their efforts, which are being tracked by ROW, FHWA and TTI. The results indicate an estimated savings of nearly $9 million, and as many as 38 months in time savings on these projects. The utility conflicts associated with these savings are those in which each district concluded that the use of the utility conflict management approach was responsible for the identification of an enhanced resolution alternative rather than what would have been the default strategy in years past. These successes will be discussed in more detail at the Utility Workshop scheduled on November 6 in Austin.

Utility Conflict Management Successes

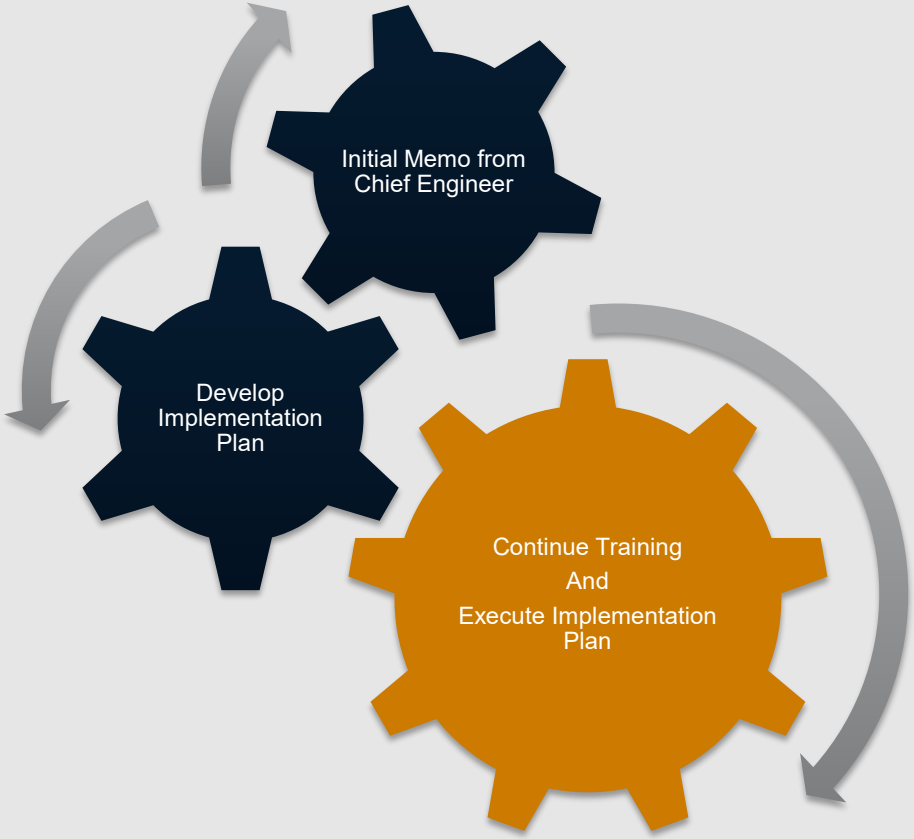
Utility Conflict Management Memo (October 2018) – Chief Engineer

Training to help districts implement the utility conflict management process has been developed by ROW in partnership with TTI. The course name in ELM is ROW100 and has been taught throughout the state since 2016. It is essential that you, your TP&D director, designers, utility coordinators, and project development teams attend this training so that these results can be replicated across our entire portfolio of projects.

Thank you for engaging in the Utility Conflict Management success for your district through this training and implementation of the best practices.

cc: Randy Hopmann, P.E.
Michael Lee, P.E.
Charon Williams, ROW

Utility Conflict Management – Statewide Implementation



Utility Conflict Management Implementation – Leadership Buy-In

Statewide implementation to begin in Fall ‘19

Utility Conflict Management Implementation – Leadership Buy-In

- Benefits of Leadership Buy-in
  - Culture Change
    - District Engineers, Directors, and other senior leaders are ***All In***
      - Stress importance of benefits: Cost and time savings
      - Support additional staff in utility coordination
    - Project Development Process Improvements
      - Early Utility Coordination and conflict identification
      - Avoid, minimize and accommodate
    - Improved Relationships with Utility Owners

Contact Information

- **Charon Williams**
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- **Gregg Granato**
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- **Anna Pulido**
  Utility Manager, San Antonio District, TxDOT
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Mark Turner, Caltrans

Leadership Buy-in: Procurement and Process Changes

Describe and discuss challenges and successes of implementation, including:

- Leadership buy in of product/processes;
- Establishing a champion of product/processes;
- Changing agency process and culture to adapt to new technologies;
- Adopting product into states processes and policies;
- Any other challenges and/or successes?

Optional Group Dinner

Rosa Mexicano

6:30

575 7th St. NW Washington, DC 20004

3 tables of 6

2 tables of 4



SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Welcome Back!

Wednesday, July 17, 2019

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO



SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Recap of Day 1 Peer Workshop

U.S. Department of Transportation
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SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Product Panels

SME Presentations

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Utility Location Technologies (R01B) Peer Exchange

June 17, 2019

Phil Sirles (SME)
Sr. Geophysicist
Collier Geophysics

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

Todays Outline

SHRP2 R01B Summary

- **2009-2019**
- **Goals**

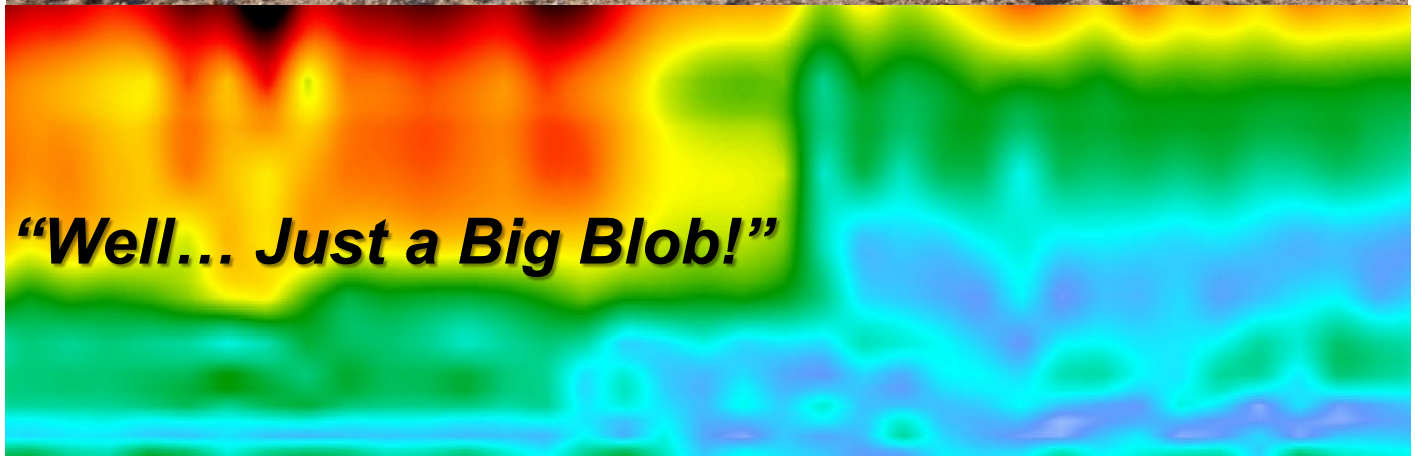
Technologies

- **MCGPR**
- **TDEMI**

Future Steps

Lasting Impression

In Summary

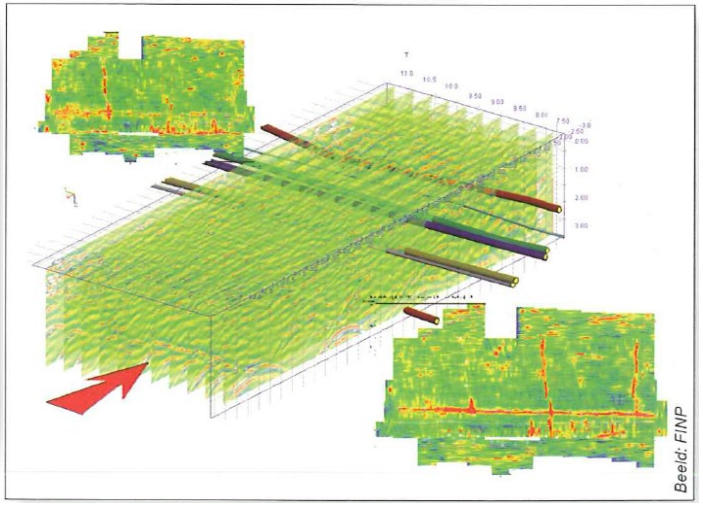


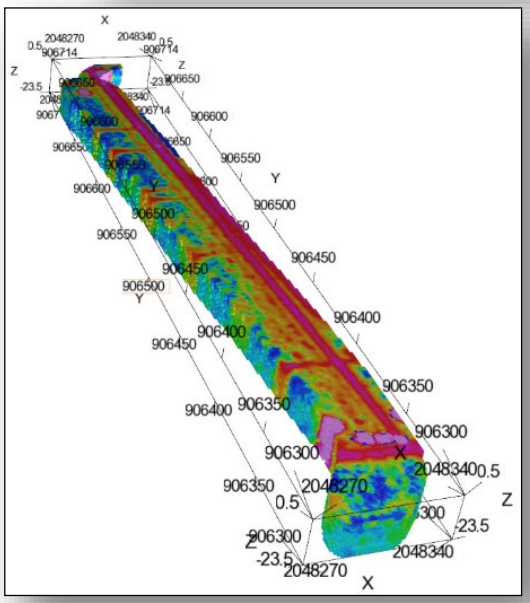
SHRP2 R01B Goals – From Research (2012)

Goal	Outcomes
1. **Educate industry and agencies** about benefits and limitations of subsurface utility engineering (SUE) investigation technologies, when it may be advantageous to incorporate multi-channel utility designation into business practices, and 2. How to **implement these systems**.	• Increased understanding of reliability of 3D data and quality levels. • Determination of depth and 3D data, which allows Quality Level B data to be identified earlier in the design process. • Multi-channel utility designation is accepted as another tool for facilitating subsurface utility investigations. • Implementation integrated with other SHRP2 utility products and coordinated with American Society of Civil Engineers' committees' standards for utilities.
3. **Establish standard processes** to incorporate SUE across agency departments.	• Scope the work needed for subsurface utility detection and provide data that can be used for measuring the performance of the outcomes.
4. Develop ability of agencies to incorporate SUE in total cost of facility ownership to **improve return on investment**.	• SUE integrated into agency asset management plans. • Proactively collected data on utility location as it is installed (using database developed under R01A).

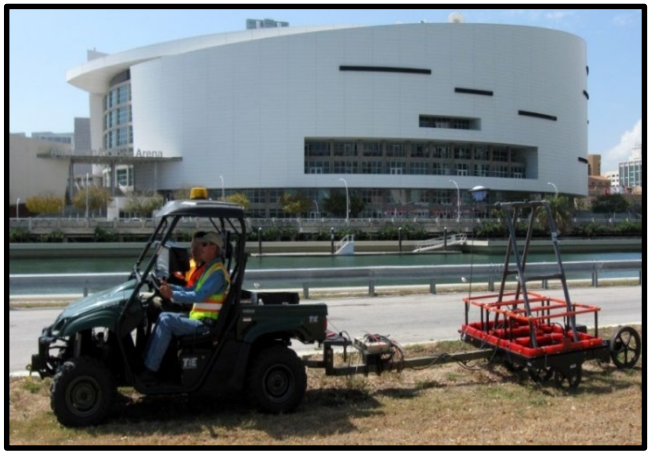
Utility Locating Technologies - R01B
2012 SHRP2 Methods Selected

→ *Commercially Available and Proven Technologies*





MCGPR and TDEMI for 3D Utility Location



SHRP2 Technologies Selected

Two "*Advanced Geophysical Technologies*" selected for SHRP2 IAP to *AUGMENT* the standard tool box for SUE Investigations!

Advanced Hardware

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

Advanced Software

- Software for processing, interpretation and visualization of MCGPR in 3D (X,Y,Z), and TDEMI data in 2D (X,Y)

SHRP2 Technologies Selected

Thanks to DOD Funding for R&D

*Advanced Hardware**

- Utilities – **Yes**
- Geology, Geotech, Mining, Archeology, ***and UXO/IED*** – ***No***

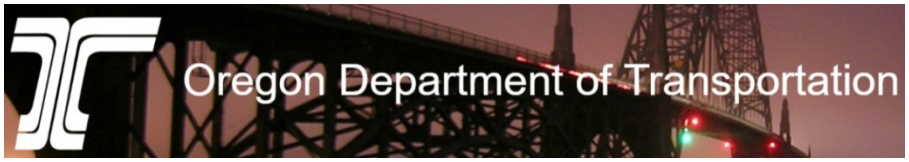
*Advanced Software**

- Heavy QA/QC for geophysical processing and interpretation (U.S. Army Corps)

R01B IAP States

Implementation Assistance Program (IAP) States:

Virginia*
Ohio
Arkansas
Oregon*
California*
Montana*



R01B Plan

Implementation Plan:

1) **Training** → on-site: classroom *and* field / instrument demonstrations
2) **Planning** → Project Selection / Procurement
3) **Implementation** → Active DOT design project for deployment of technologies (*part of SUE process*)
4) **Reporting** → DOT (project) Reports and AASHTO SHRP2 Report-outs

Training and Demonstrations

Making ‘sense’ of it all!

2D SUE & 3D MCGPR? Is it the best possible Solution?

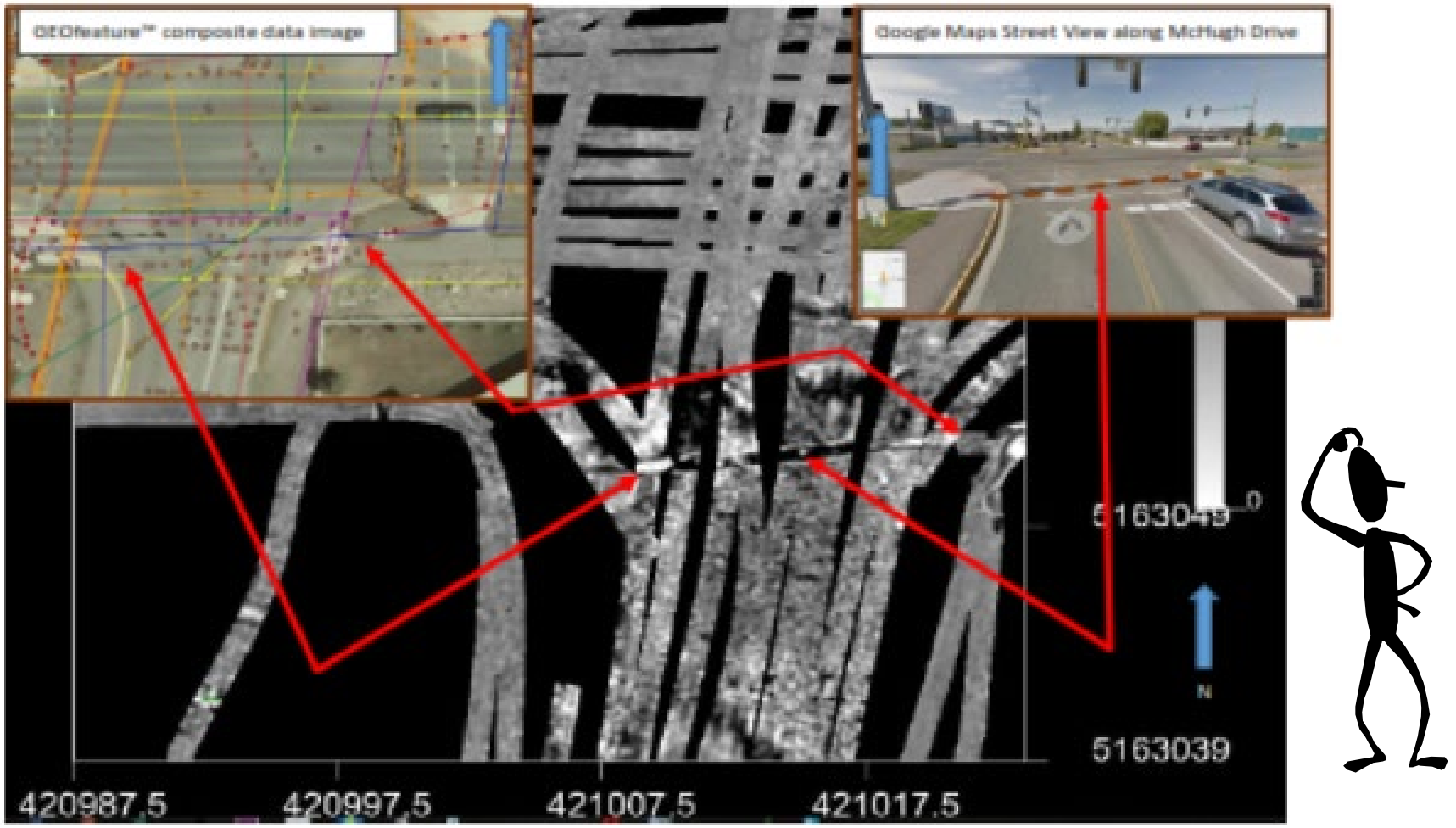
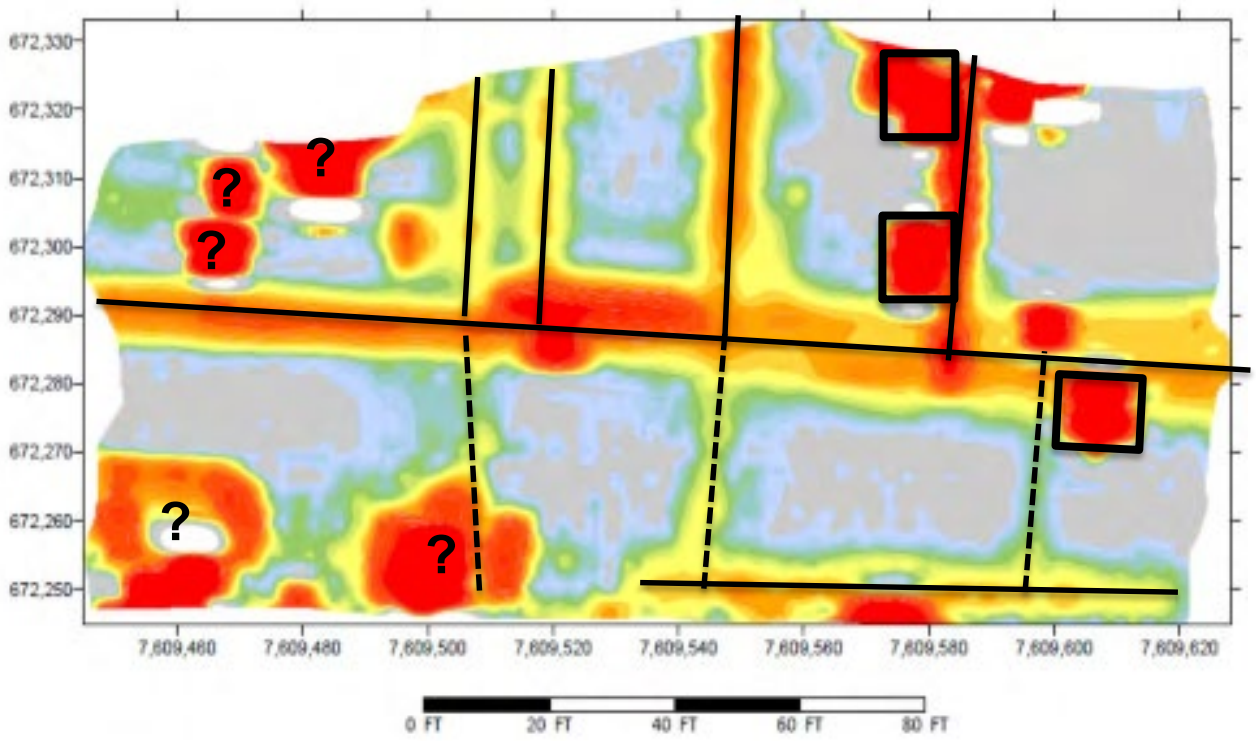
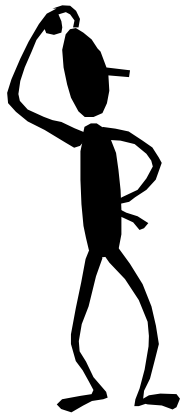


Image courtesy MDT & Utility Mapping Services, Inc.

Making ‘sense’ of it all!

2D SUE & 2D TDEMI? Is it the best possible Solution?





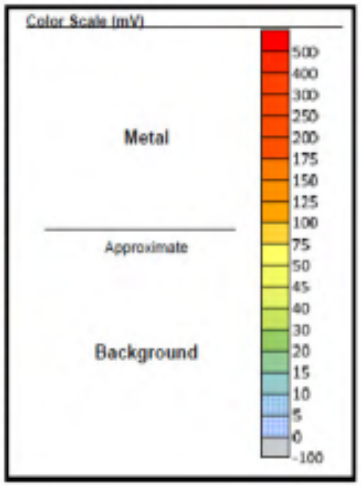


Image courtesy ODOT & Cardno

Making ‘sense’ of it all!

- **MCGPR & TDEMI** are reliable as another SUE QL-B tools
- **MCGPR** helps build 3D models, *with good site conditions*
- **TDEMI** is a metallic utility detector in any soil type
- **TDEMI** is a 2D digital mapping
- **TDEMI** does not discriminate **buried** and above-ground metallic objects (*i.e., vehicles)*

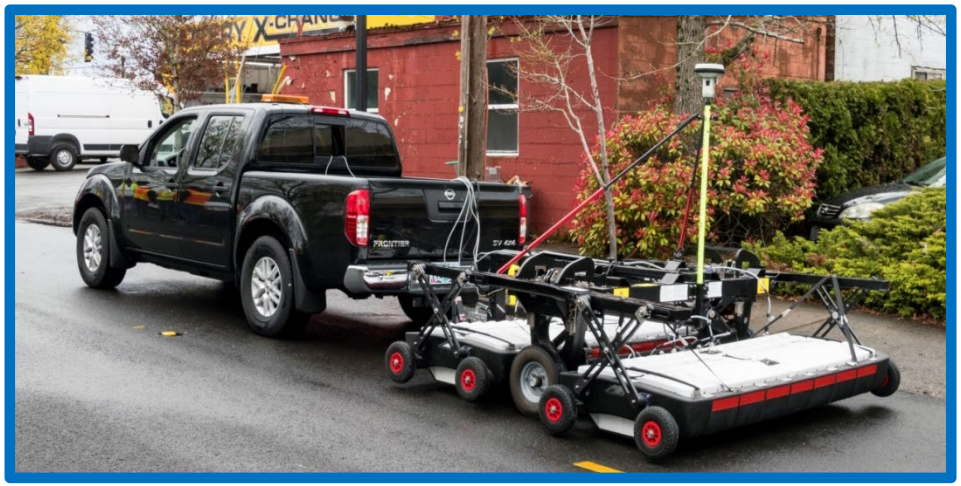
❖ **Integration *and* Interpretation with SUE information is key!**

2015 SHRP2 Goals – How did we do?

Goal	Outcomes
1. Educate industry and agencies about benefits and limitations of subsurface utility engineering (SUE) investigation technologies, when it may be advantageous to incorporate multi-channel utility designation into business practices, and **2. How to implement these systems.**	• **Increased understanding of reliability of 3D data and quality levels.** • **Determination of depth and 3D data, which allows Quality Level B data to be identified earlier in the design process.** • **Multi-channel utility designation is accepted as another tool for facilitating subsurface utility investigations.** • **Implementation integrated with other SHRP2 utility products and coordinated with American Society of Civil Engineers' committees' standards for utilities.**
3. Establish standard processes to incorporate SUE across agency departments.	• Scope the work needed for subsurface utility detection and provide data that can be used for measuring the performance of the outcomes.
4. Develop ability of agencies to incorporate SUE in total cost of facility ownership to improve return on investment.	• SUE integrated into agency asset management plans. • Proactively collected data on utility location as it is installed (using database developed under R01A).

Goal – Educate DOT's

Goal – Implement on Projects



MCGPR

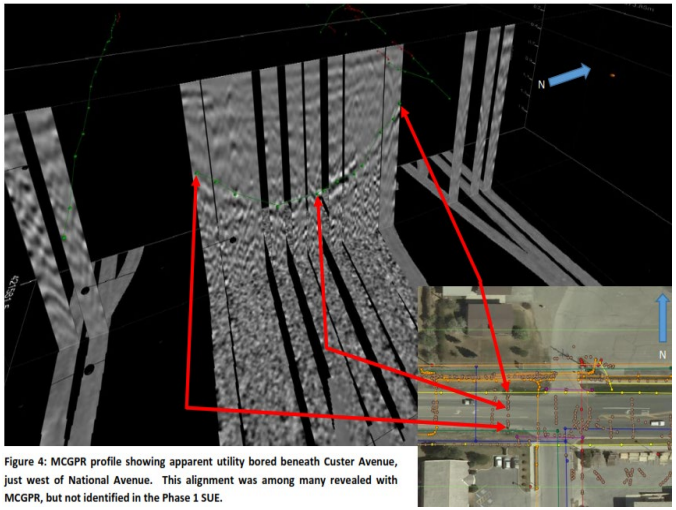
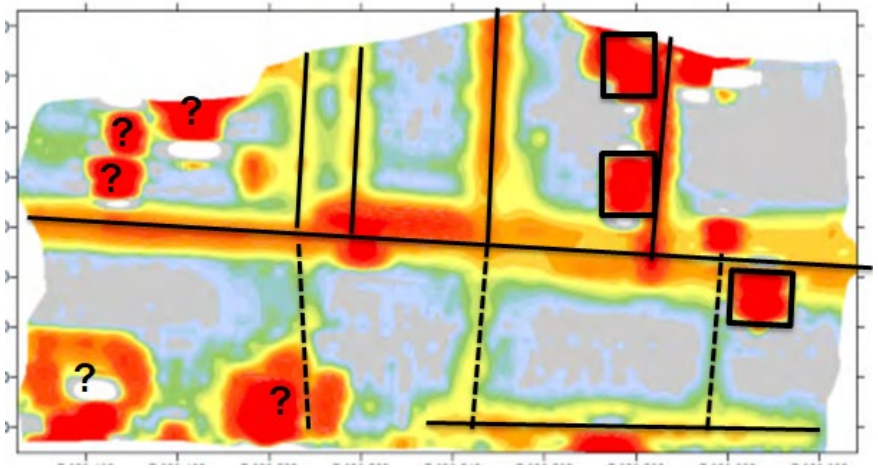
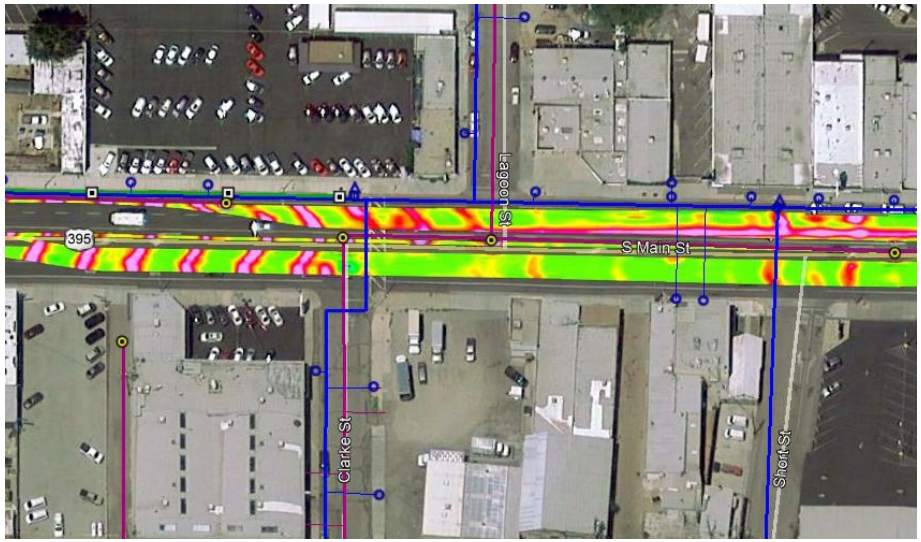


Figure 4: MCGPR profile showing apparent utility bored beneath Custer Avenue, just west of National Avenue. This alignment was among many revealed with MCGPR, but not identified in the Phase 1 SUE.

Goal – Implement on Projects



TDEMI ✓



Lessons Learned

- **Coordination and Planning are Key Elements**
  - Multiple Departments in the DOT
  - Contractor(s) for advanced geophysical technologies
  - Not all SUE providers are qualified for advanced geophysics
- **Consequences if 2D SUE and advanced methods are not reconciled and integrated carefully**
- **Understand site conditions p**
- **Good depth (Z) *estimates* fro**
- **One 'shift' of data collection**
- **Work at night for TDEMI** (*veh*

IAP Summary

- **VDOT** – Pleased MCGPR worked in 'clayey' soils
- **MTD** – Pleased Yellow Stone pipeline was detected
- **OR-DOT** – Pleased with ties between SUE and MCGPR/TDEMI and developed / matured their SUE statewide program

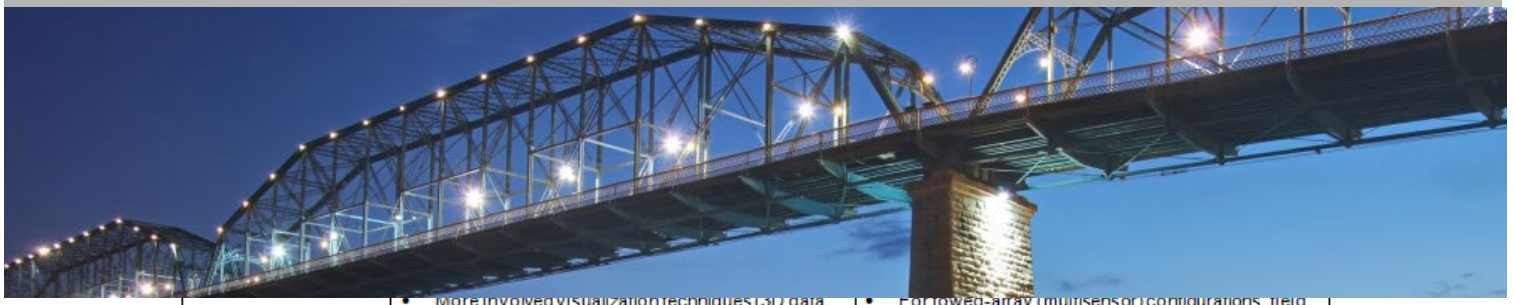
3. Establish standard processes to incorporate SUE across agency departments.		• Scope the work needed for subsurface utility detection and provide data that can be used for measuring the performance of the outcomes.

prepared as planned, and *contracting can take a long time*

- **Caltrans** – Created in-house ability; and, TDEMI primary method

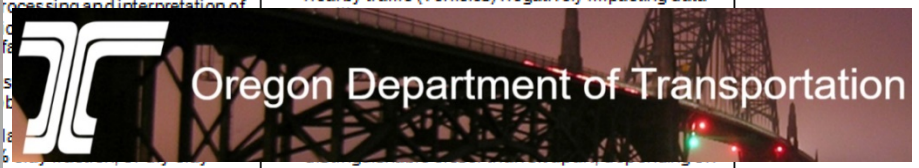
Method Strengths and Weaknesses

2019 AASHTO RUOC ANNUAL CONFERENCE
Chattanooga, Tennessee
April 28-May 2, 2019

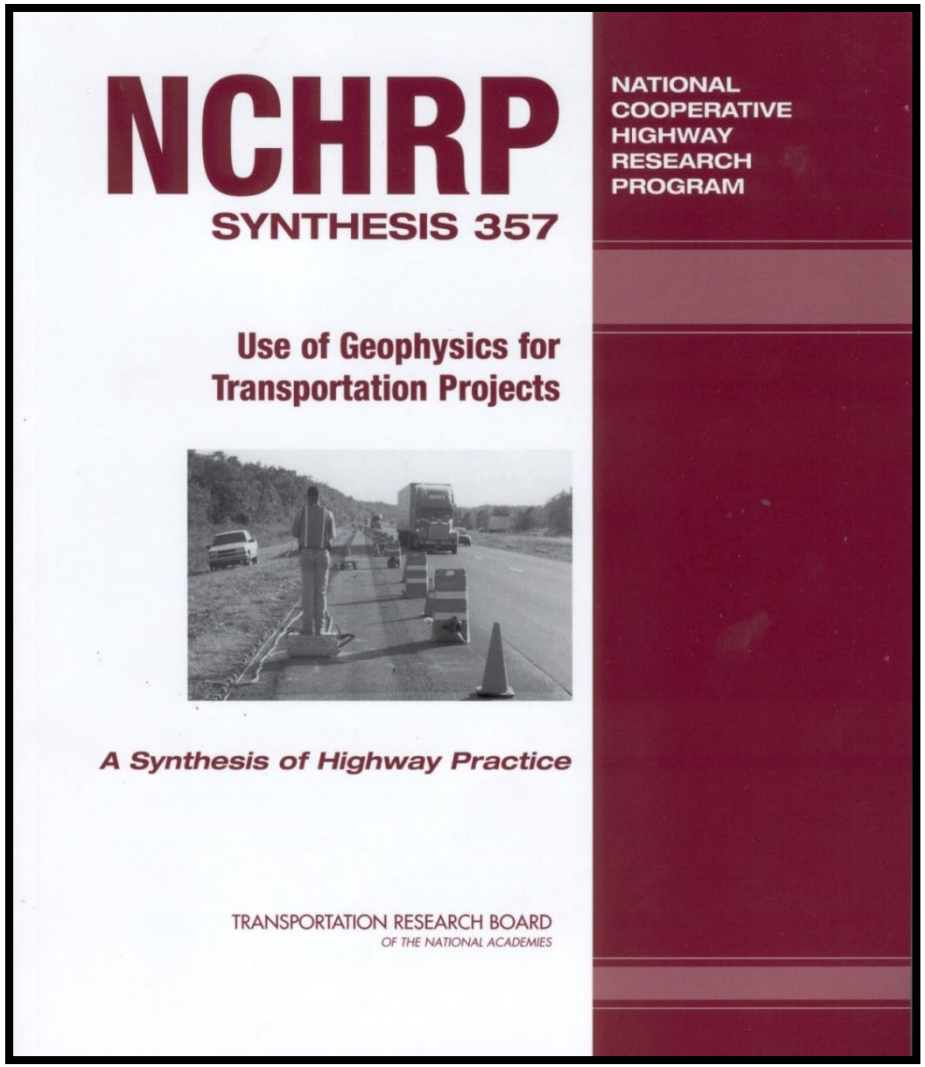


	MCGPR	TDEMI
	• Maps in 3D: X, Y, and Z; with survey-grade GPS integrated for positional accuracy	• Detects both ferrous and non-ferrous metallic utilities
	• More involved visualization techniques (3D data manipulation)	• For towed-array (multisensor) configurations, field operations must be conducted at night to avoid nearby traffic (vehicles) negatively impacting data
	• Depth of investigation is governed by soil type and water content • Road salts can impact data quality • Requirement that road base does not include mineralized materials such as iron slag • Best with unsaturated subsurface conditions • Data affected if surface is covered with ice	• burial depth and size of targets • Target depth information not available • Powerlines, parked or moving cars, dumpsters, fences, or other metallic objects within 15ft of survey area can result in poor quality data • Dense roadway rebar is problematic for target detection • Limited number of TDEMI manufactures for multisensor (towed) arrays

MDT



Future Steps



Sirles, 2006

NCHRP SYNTHESIS STUDY → TRB, FHWA & DOT's

Future Steps

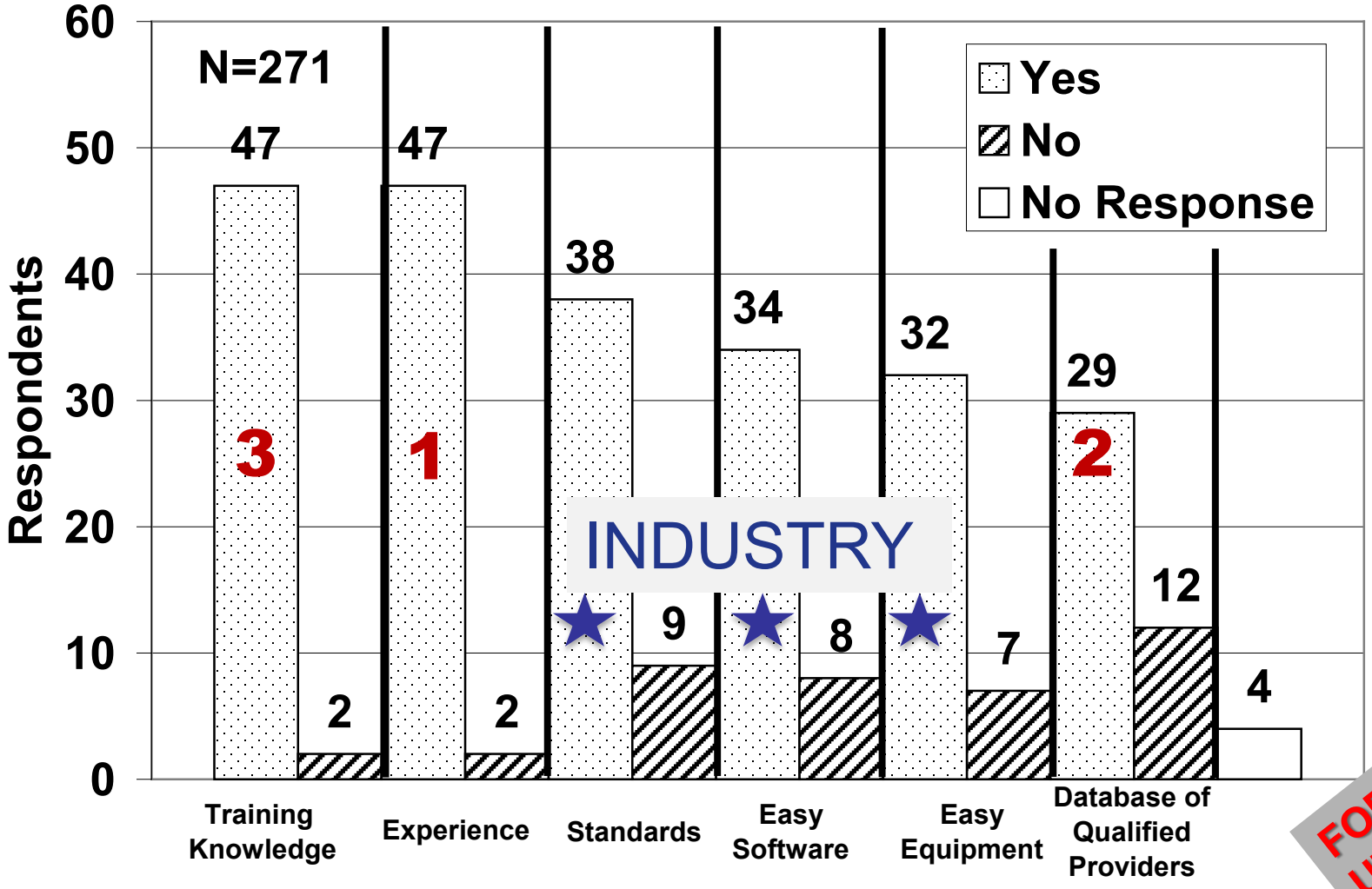


Figure 25. What would increase your level of comfort using geophysics?

Future Steps

Three Products → "*The Utility Bundle*"

- ***3D Utility Location Data Repository*** **(R01A)**
- ***Utility Locating Technologies*** **(R01B)**
- ***Identifying and Managing Utility Conflicts*** **(R15B)**

***Spend time learning how EACH product gives value to the DOT & Utility Owners for Product Delivery but…**

"not as independent products" – Mark Turner

Future Opportunity

1. Too early for <u>any</u> IAP state to provide performance metrics or insights to *'return-on-investment'* for use of Advanced Utility Locating Technologies.

2. The SHRP2 program should continue to help IAP states evaluate the effectiveness of their R01B effort. May take years to progress through construction.

4. Develop ability of agencies to incorporate SUE in total cost of facility ownership to improve return on investment.	• SUE integrated into agency asset management plans. • Proactively collected data on utility location as it is installed (using database developed under R01A).

R01B PROVIDED MULTIPLE "PILOT PROJECTS" TO TRACK!

R01B - Lasting Impression

<u>R01B</u>: It's all about reducing risk! Advanced Location Technologies help *"Optimize the next step… to QL-A"*

THANK YOU

For More Information

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- **Pam Hutton**, Program Manager, Operations, AASHTO
  phutton@aashto.org

- **Julie Johnston**, Utilities & Value Engineering PM, FHWA
  julie.johnston@dot.gov

Advanced* GPR Systems

impulse RADAR

3D Radar

The Ground is No Limit

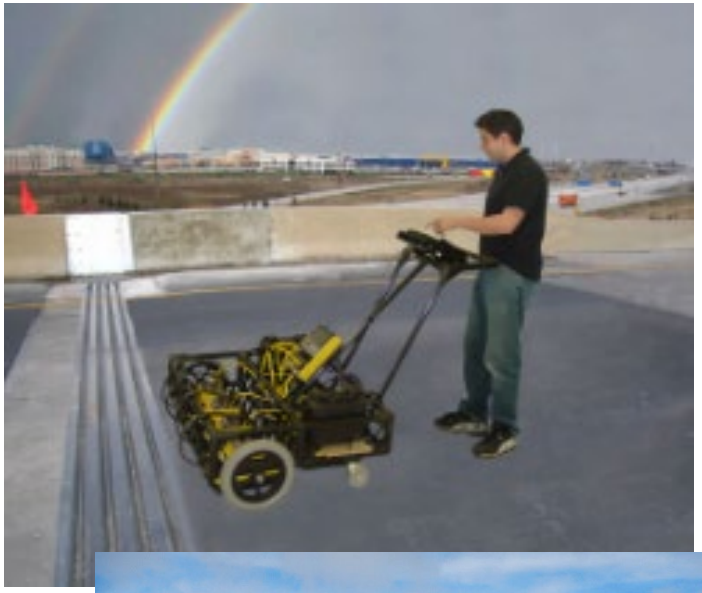
Sensors & Software

IDS GeoRadar

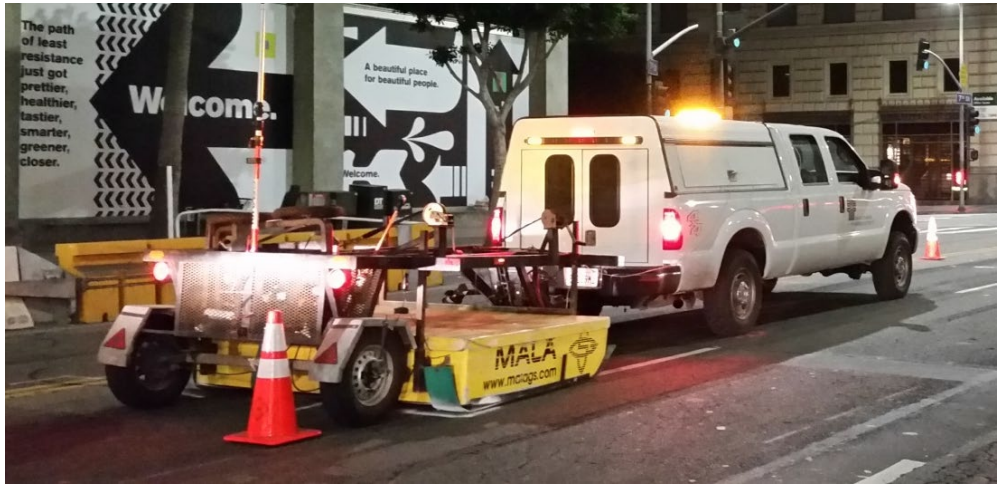
*Advanced is Multi-Channel / Multi-Frequency

MCGPR – "*Multi-Channel*" GPR

MCGPR – "*Multi-Channel*" GPR



MCGPR Towed Systems



TDEMI Multisensor Array: Geonics EM61-MK2

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 (bootom),
100 x 50 x 2 cm (top)

Advanced* TDEMI Systems

GEOEOD –
UltraTEM

Zonge International –
Dynamic NanoTEM

Ground Water, Inc. –
AgTEM

Geometrics –
Metal Mapper (z*)

**Advanced is Multi-Coil / Multi-Frequency*

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

SHRP2

Implementation Assistance Program

July 17, 2019

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

SHRP2 R01A, R01B, R15B Implementations

Round 3	Round 5	Round 6	Round 7
R15B: • Iowa • Kentucky • Michigan • New Hampshire • Oklahoma • South Dakota • Texas	R01A: • California • DC • Kentucky • Texas • Utah	R01B: • Arkansas • California • Ohio • Oregon R15B: • California • Delaware • Indiana • Maryland • Oregon • Utah	R01A: • Indiana • Michigan • Montana • Oregon • Pennsylvania • Washington R01B: • California • Indiana • Montana R15B: • Montana • Pennsylvania • South Carolina • Utah • Vermont • Washington

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Identifying and Managing Utility Conflicts (R15B)

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

Identifying and Managing Utility Conflicts (R15B)

SHRP2 R15B Tools

- Product 1: Compact, standalone utility conflict list
- Product 2: Utility conflict data model and database
- Product 3: One-day UCM training course

Identifying and Managing Utility Conflicts (R15B)

SHRP2 R15B Products

- Product 1: Compact, standalone utility conflict list

Utility Conflict Management (UCM) - Utility Conflict List

Project Owner: _____
Project No.: _____
Project Description: _____
Highway or Route: _____

Note: Use companion sheet to compare utility conflict resolution alternatives

Developed/Revised By: _____
Date: _____
Reviewed By: _____
Date: _____

Utility Owner and/or Contact Name	Utility Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description	Start Station	Start Offset	End Station	End Offset	Utility Investigation Level Needed	Test Hole No.	Recommended Action or Resolution	Estimated Resolution Date	Resolution Status

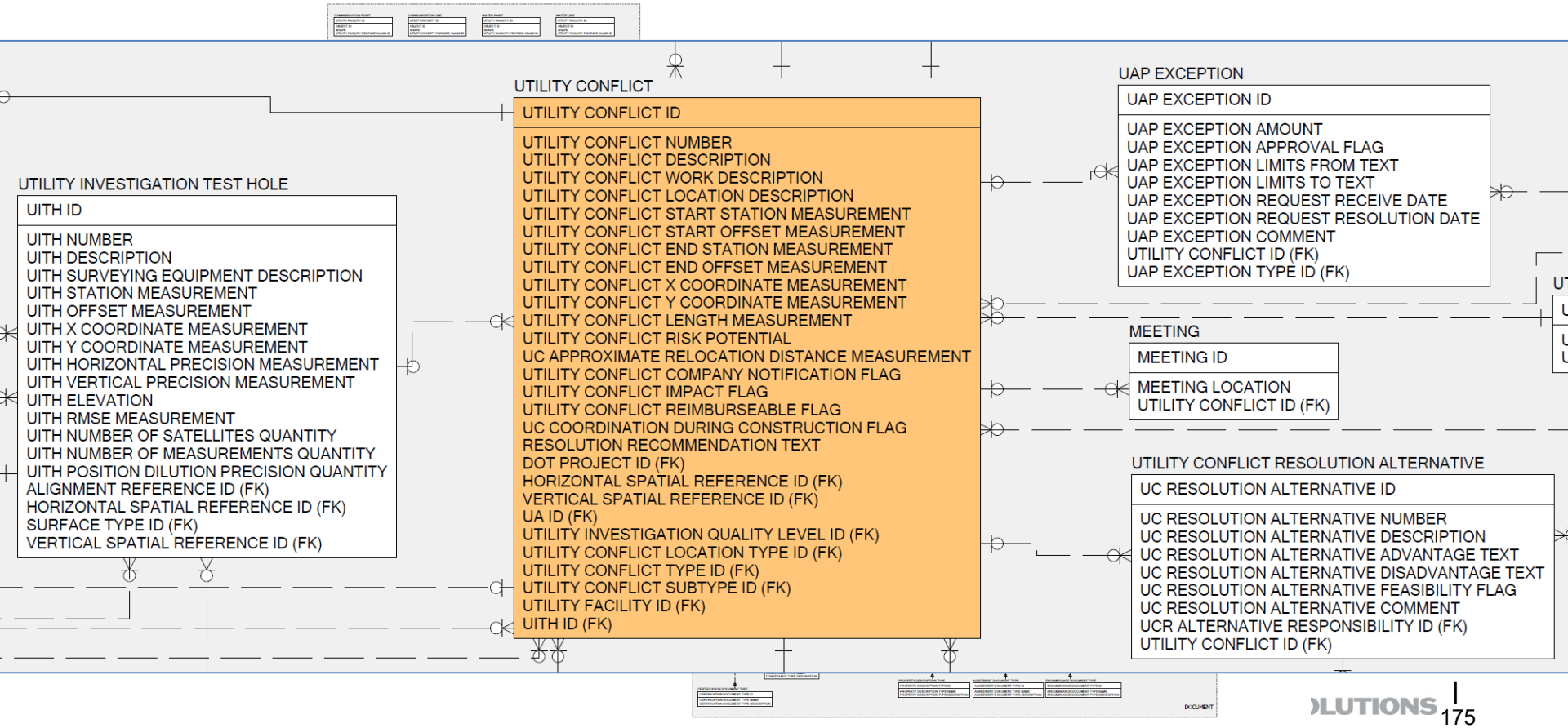
Utility Conflict Management (UCM) - Analysis of Utility Conflict Resolution Alternatives

Utility Conflict ID	Alternative Number	Alternative Description	Alternative Advantages	Alternative Disadvantages	Impact on Project Delivery Time (Months)	Engineering Cost (Utility)	Direct Cost (Utility)	Engineering Cost (DOT)	Direct Cost (DOT)	Other Costs	Total Cost	Feasibility	Decision

Identifying and Managing Utility Conflicts (R15B)

SHRP2 R15B Products

- Product 2: Utility conflict data model and database



SHRP2 R15B Products

- Product 3: One-day UCM training course

R15B Implementations

Standalone

- California
- Delaware
- Indiana
- Maryland
- New Hampshire
- Oklahoma
- Oregon
- Pennsylvania
- South Carolina
- South Dakota
- Texas
- Vermont
- Washington

Enterprise

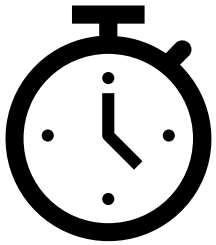
- Iowa
- Kentucky
- Michigan
- Montana
- Utah

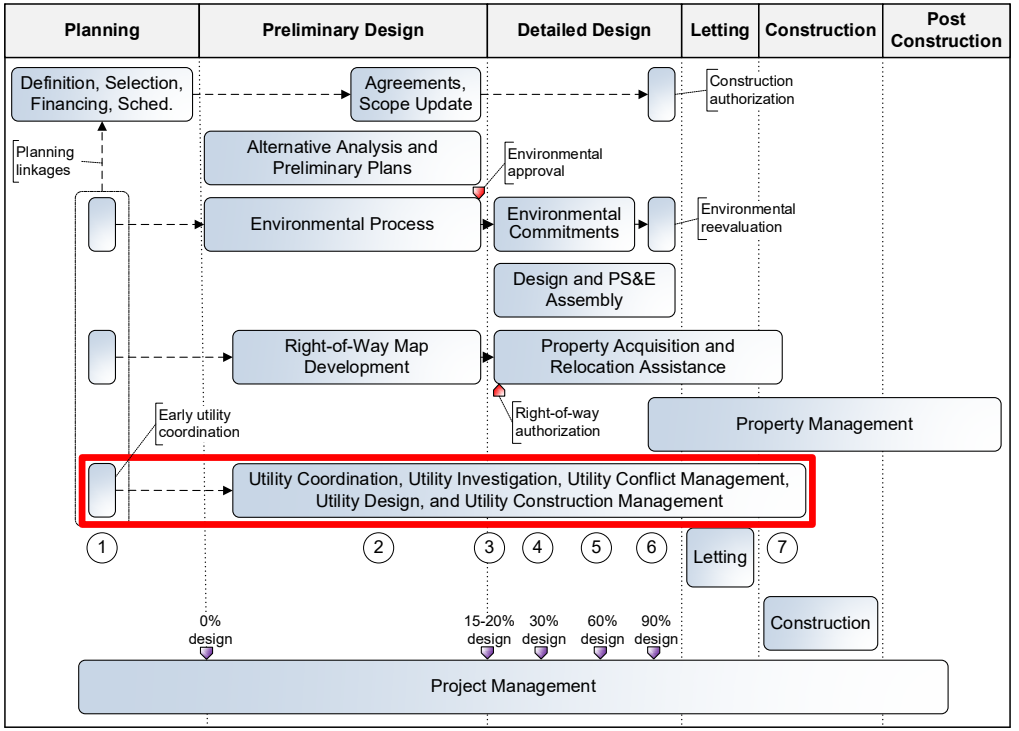
Lessons Learned

- Obtain and maintain buy-in from the administration
- When in doubt, pursue a standalone UCM implementation
- Follow standard IT phases for enterprise UCM system
- Substantial economic benefits of UCM
- Upfront costs are real, but consider them as an investment
- Other related utility process components are also critical
- UCM training is critical
- Satisfaction with one-day UCM training course
- UCM training should target project managers and designers
- Increased awareness of the project delivery process
- Need to improve utility data management practices
- UCM standardization is critical

Benefits

- Standardized method and form for tracking utility conflicts and resolutions
- Significant economic and project delivery time savings
- More positive working relationship with the industry
- Better understanding of utility issues that can affect project delivery



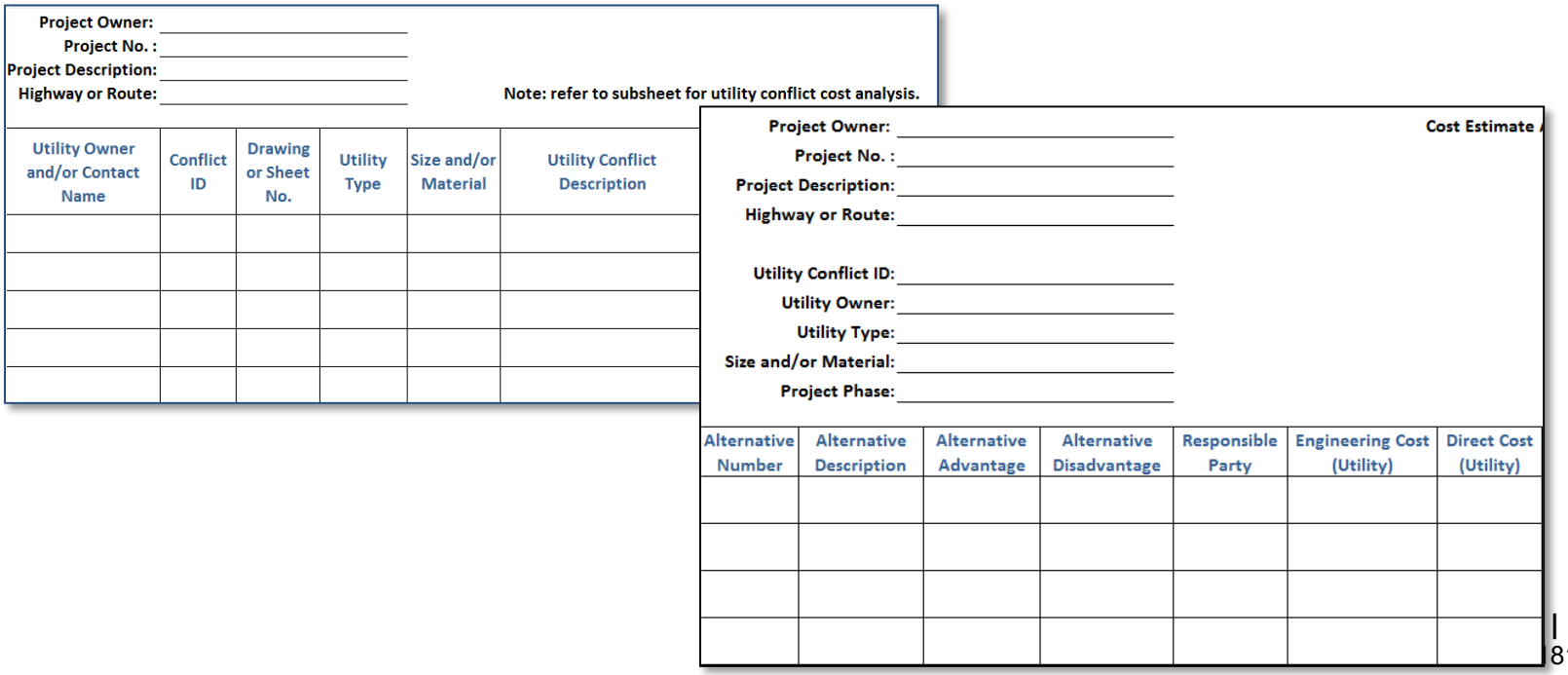


Needs, Potential Strategies, and Next Steps

- Leadership may not be necessarily aware of the importance of managing utility conflicts effectively or the connection between UCM and project schedules and costs. Identifying champions within the administration who understand these concepts is key to securing support for UCM initiatives and implementations.
- FHWA and AASHTO should play a leading role in increasing the level of awareness among state DOT leadership about the benefits and potential of UCM.

Needs, Potential Strategies, and Next Steps

- UCM is about changing business processes first
- When in doubt, pursue a standalone UCM implementation
  - Fewer challenges than enterprise implementations
  - UCM is about changing business processes
  - Focus on business process first, even without IT component



Project Owner: _____
Project No. : _____
Project Description: _____
Highway or Route: _____

Note: refer to subsheet for utility conflict cost analysis.

Utility Owner and/or Contact Name	Conflict ID	Drawing or Sheet No.	Utility Type	Size and/or Material	Utility Conflict Description

Project Owner: _____
Project No. : _____
Project Description: _____
Highway or Route: _____

Cost Estimate A

Utility Conflict ID: _____
Utility Owner: _____
Utility Type: _____
Size and/or Material: _____
Project Phase: _____

Alternative Number	Alternative Description	Alternative Advantage	Alternative Disadvantage	Responsible Party	Engineering Cost (Utility)	Direct Cost (Utility)

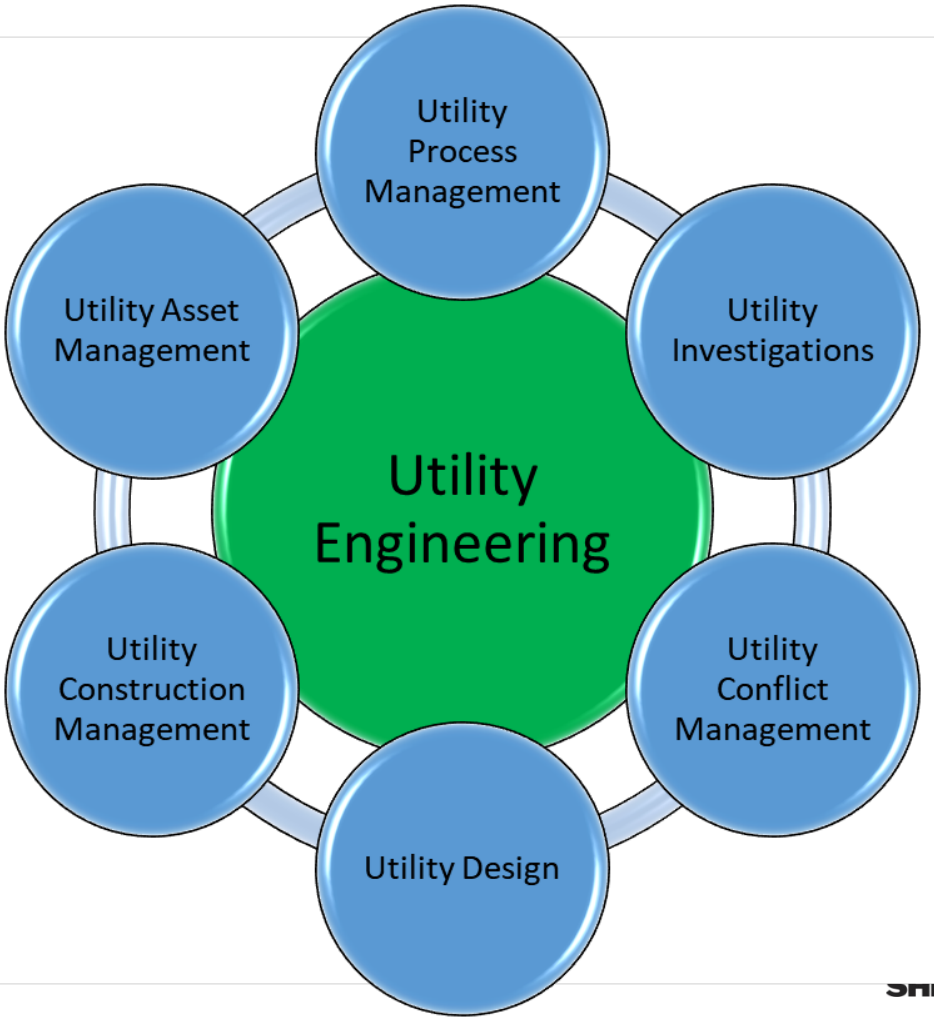
Needs, Potential Strategies, and Next Steps

- Connect UCM to the increasingly accepted specialty of utility engineering.

Utility Engineering is a branch of engineering that focuses on the planning, design, construction, operation, maintenance, and asset management of any utility system, as well as the interaction between utility infrastructure and other civil infrastructure

Needs, Potential Strategies, and Next Steps

- Connect UCM to the increasingly accepted specialty of utility engineering.



Needs, Potential Strategies, and Next Steps

- Although the standalone utility conflict list template included in the R15B product is a valuable tool, learning how to use it effectively is not trivial
  - Engage internal AND external stakeholders
    - Project managers
    - Designers
    - Utility engineers
    - Utility coordinators
    - Utility owners
    - Consultants
    - Surveyors
    - ROW agents
    - Construction managers

Needs, Potential Strategies, and Next Steps

- Improvements in utility data management practices could result in more effective UCM practices, particularly in these areas:
  - Utility investigation timing, scope, quality, and completeness
  - Mapping and documentation of utility data on projects
  - Utility conflict locations on project files

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

3D Utility Location Data Repository (R01A)

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

3D Utility Location Data Repository (R01A)

R01A Research

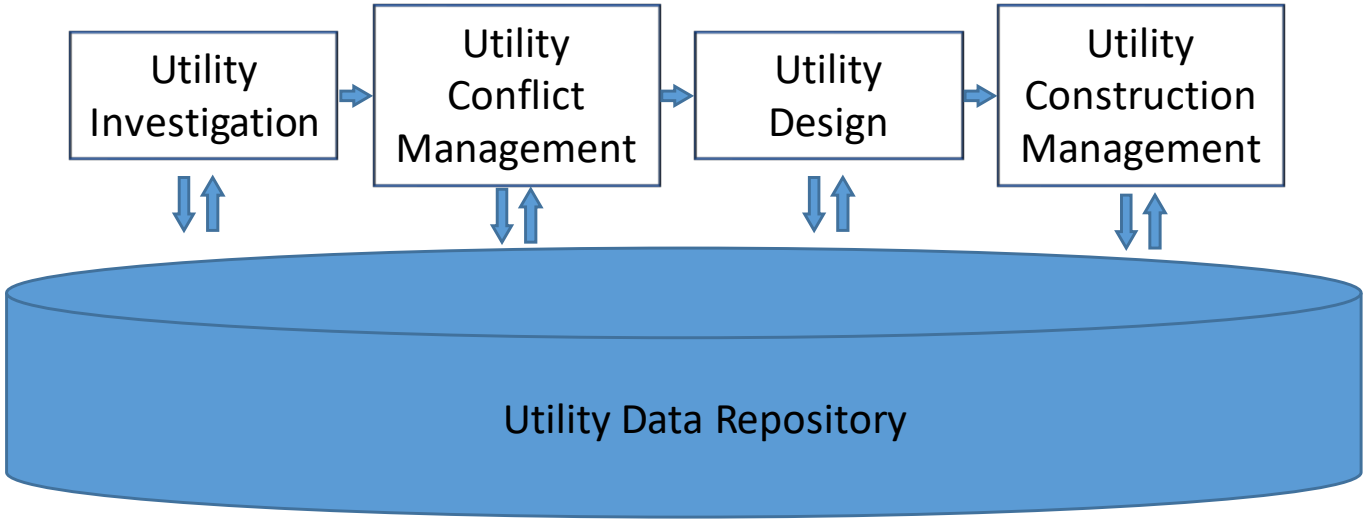
- Purpose:
  - Identify best practices for modeling, structuring, storing, retrieving, visualizing, and integrating 3D utility data in a multiuser environment
  - Develop innovative approach for 3D utility inventories
- Deliverables:
  - Non-implementable 3D model of utilities for project in Virginia
  - Highly aggregated data model using the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE)
  - Data workflow from One Call center point of view

R01A Implementations

Goals

- Conduct a pilot utility data repository implementation
- Implementation framework:
  - Results of other federal and state research and research implementation efforts
  - Industry-developed utility data models and standards
  - State DOT-driven data programs and initiatives
- Technical assistance focus:
  - Present available options to each state DOT
  - Outline advantages and disadvantages of each approach
  - Provide information to state DOTs as questions emerged as to what approach to consider

Implementation Framework



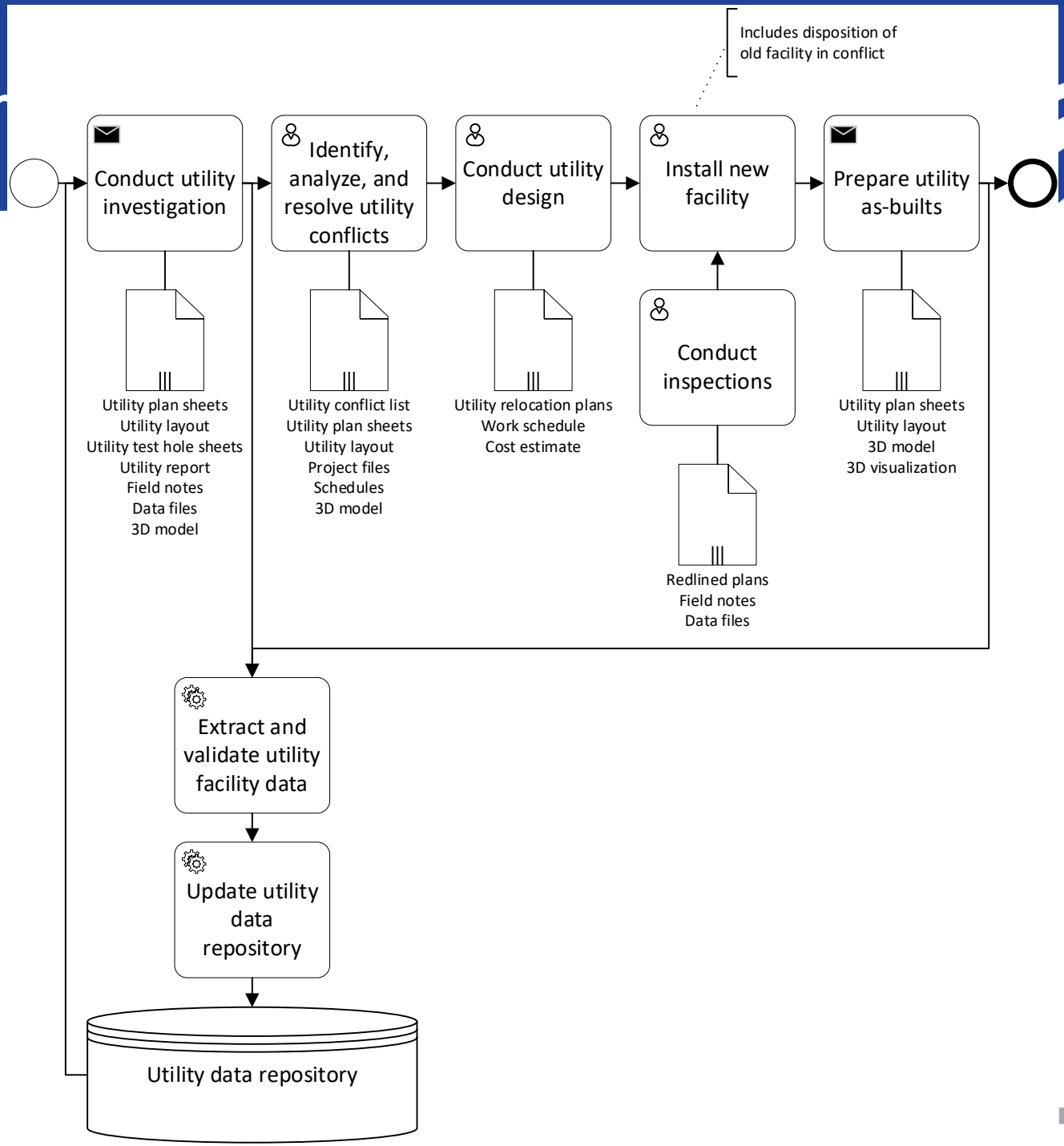
Highway Construction Project

Planning/Preliminary Design → Design → Construction

Corridor Operations and Maintenance

Maintenance Permit Review, Approval, and Utility Installation

Implem


Includes disposition of old facility in conflict
Conduct utility investigation
Identify, analyze, and resolve utility conflicts
Conduct utility design
Install new facility
Prepare utility as-builts
Utility plan sheets
Utility layout
Utility test hole sheets
Utility report
Field notes
Data files
3D model
Utility conflict list
Utility plan sheets
Utility layout
Project files
Schedules
3D model
Utility relocation plans
Work schedule
Cost estimate
Conduct inspections
Redlined plans
Field notes
Data files
Utility plan sheets
Utility layout
3D model
3D visualization
Extract and validate utility facility data
Update utility data repository
Utility data repository

Implementation Framework

Project No.	Title	Completed
SHRP2 R15B	Identification of Utility Conflicts and Solutions	2011
SHRP2 R01A	Technologies to Support Storage, Retrieval, and Utilization of 3D Utility Location Data	2013
FHWA-PROJ-12-0043	Feasibility of Mapping and Marking Underground Utilities by State Highway Agencies	2018
5-2110-01 (Texas)	GIS-Based Inventory of Utilities	2005
BDR74 977-03 (Florida)	Strategic Plan to Optimize the Management of Right-of-Way Parcel and Utility Information at FDOT	2013
n/a (Michigan)	Geospatial Utility Infrastructure Data Exchange (GUIDE)	2015

Implementation Framework

- ASCE Standard Guideline for Recording and Exchanging Utility Infrastructure Data
  - Minimum and optional elements of spatial and non-spatial attribute data associated with utility infrastructure
  - Recommendations for effective practices to facilitate data exchange among project stakeholders

Positional Accuracy Level	Positional Accuracy (English Units)	Positional Accuracy (SI Units)
1	0.1 feet	25 mm
2	0.2 feet	50 mm
3	0.3 feet	100 mm
4	1 foot	300 mm
5	3 feet	1000 mm
9	Indeterminate	Indeterminate

Implementation Framework

- ASCE Standard Guideline for Recording and Exchanging Utility Infrastructure Data

	Applies to Feature Type								
Feature Attribute	Segment	Device	Access Point	Support Structure	Containing Structure	Secured Utility Area	Encasement	Marker	Tracer
ID	M	M	M	M	M	M	M	M	M
Owner	M	M	M	M	M	M	M	M	M
Operator	O	O	O	O	O	O	O	O	O
Utility Type	M	M	M	M	M	M	M	M	M
Utility Subtype	O	O	O	O	O	O	O	O	O
Feature Type	M	M	M	M	M	M	M	M	M
Component	M	M	M	M	M		M	O	O
Conveyance Category	M	M		M	M		M	O	O
Intended Permanence	O	O	O	O	O	O	O	O	O
Underground Status	O	O	O	O	O	O	O	O	O
Operational Status	M	M	M	M	M	M	M	M	M
Horizontal Spatial Reference	M	M	M	M	M	M	M	M	M
Vertical Spatial Reference	M	M	M	M	M	M	M	M	M
Horizonal Accuracy	M	M	M	M	M	M	M	M	M
Vertical Accuracy	C	C	C	C	C	C	C	C	C
Accuracy Units	C	C	C	C	C	C	C	C	C
XYZ	M	M	M	M	M	M	M	M	M
Azimuth		C	C	C	C	C			
XYZ Observed	O	O	O	O	O	O	O	O	O
XY Relative Position	C	C	C	C	C	C	C	C	C
Z Relative Position	C	C	C	C	C	C	C	C	C
XYZ Junction Point	O	O	O	O	O	O	O	O	O
Quality Level	O	O	O	O	O	O	O	O	O
Linked File	O	O	O	O	O	O	O	O	O
Date Data Collected	O	O	O	O	O	O	O	O	O
Data Sensitivity Level	O	O	O	O	O	O	O	O	O
Is Certified	O	O	O	O	O	O	O	O	O
Certification Summary	O	O	O	O	O	O	O	O	O
Material	O			O			O		O
Is Cathodic Protected	O			O			O		O
Is Encased	O								O
Is Filled	O				O		O		
Fill Material	O				O		O		
Conveyance Method	O	O							
Cross Section Configuration	O								
Number of Conduits	O								
Inside Height	O				O		O		
Inside Width	O				O		O		
Inside Length					O				
Outside Height	O	O		O	O		O		
Outside Width	O	O	O	O	O	O	O		
Outside Length		O	O	O	O	O			
Wall Thickness	O				O		O		
Measurement Units	C	C	C	C	C	C	C		

Minimum Requirements:

- ID
- Owner
- Utility Type
- Feature Type
- Component
- Conveyance Category
- Operational Status
- Horizontal Spatial Reference
- Vertical Spatial Reference
- Horizontal Accuracy
- Vertical Accuracy
- XYZ

R01A Implementations

Standalone

- DC
- Kentucky
- Indiana
- Texas
- Washington

Enterprise

- California
- Michigan
- Montana
- Oregon
- Pennsylvania
- Utah

Lessons Learned

- Obtain and maintain buy-in from the administration
- Understand short-term and long-term needs and objectives
- Focus on low-hanging fruit to begin a utility data repository
- Follow standard IT phases for enterprise utility data repository
- Address challenges for developing robust 3D models

Benefits

- Availability of depth and elevation of utility facilities throughout the project
- Integration with aboveground 3D project data
- Capability to generate cross sections at any desired location
- 3D representation of subsurface environments with a high concentration of utility installations within a limited space
- 3D design and analysis of utility conflicts
- Acceleration of project delivery and fewer delays
- Increased safety, less risk, and less damage to utilities
- Less utility exposures because of proof of utility installation existence, location, and attributes

Benefits

- Cost to develop 3D models is decreasing rapidly, making it difficult to separate this cost from other costs to develop and deliver projects
- BIM benefits:
  - 75% reduction in the number of construction of change orders
  - 50-75% reduction in construction change order amounts
  - 8-14% in project cost savings
  - Extrapolate benefits to 3D utility inventories (???)

Needs,
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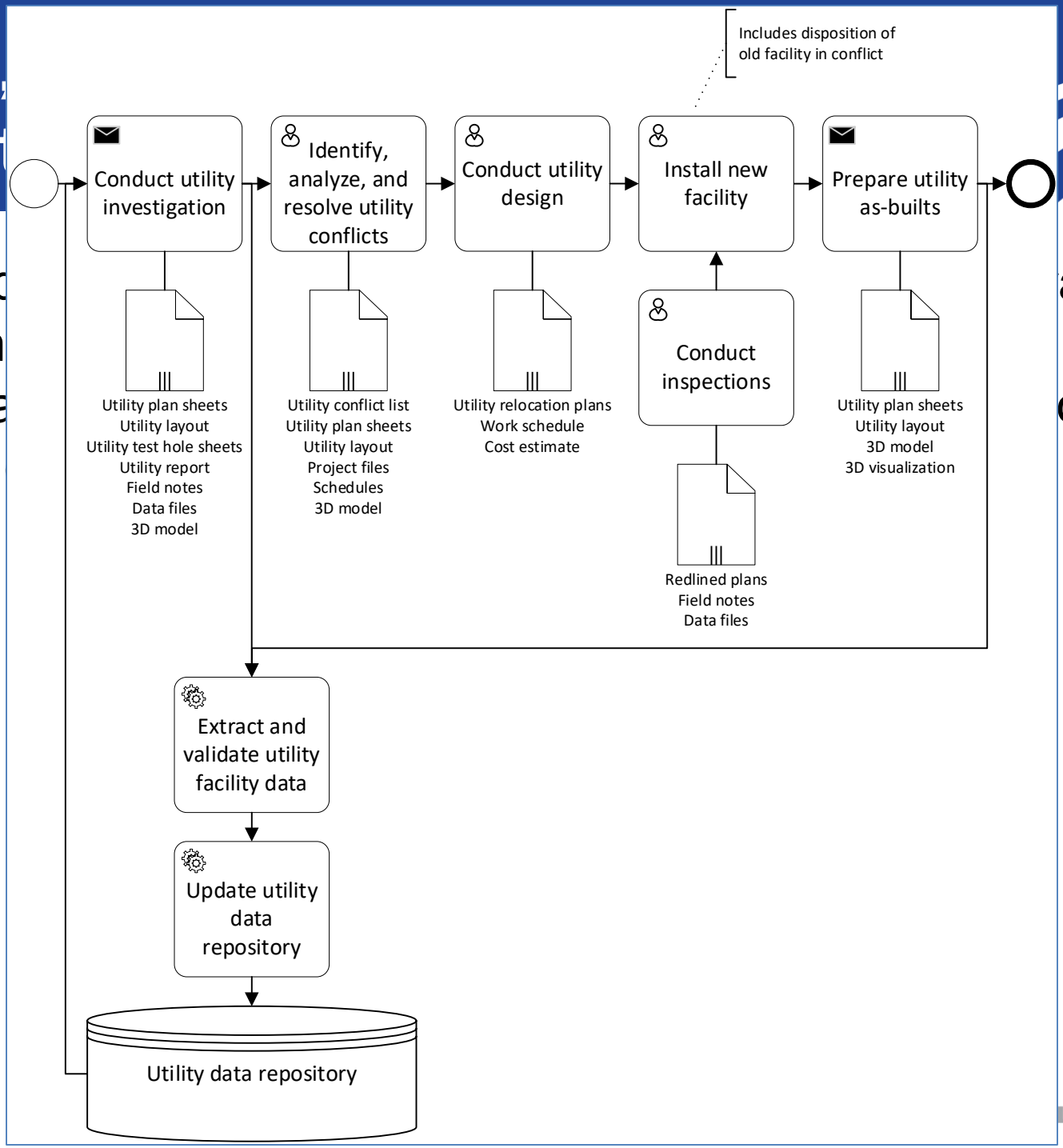
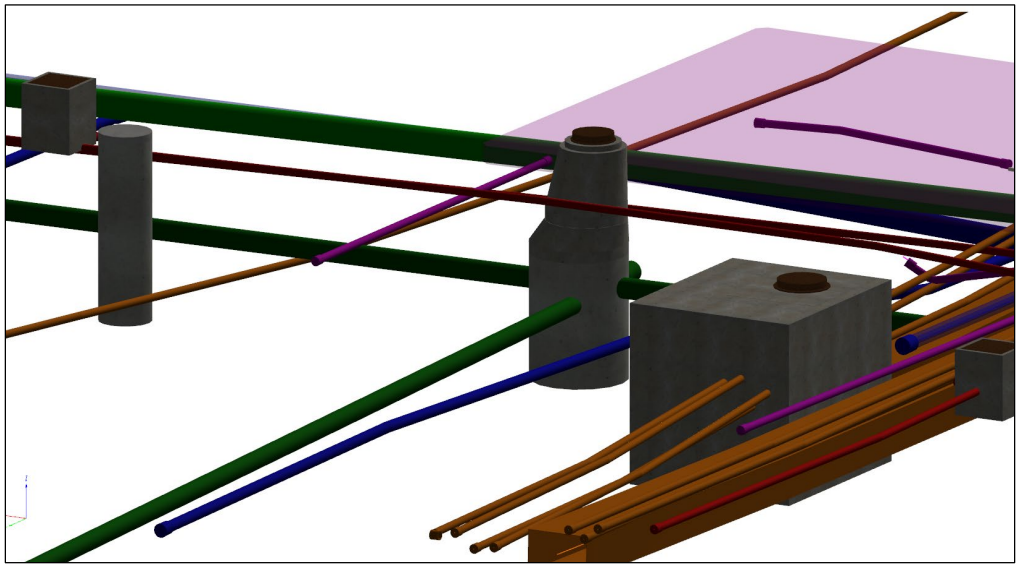


Needs, Potential Strategies, and Next Steps

- Requirements and specifications for hardware and software components depend on the level of implementation the agency has identified for the utility data repository, which, in turn, depends on factors such as business needs, available funding, and access to IT resources.
- Focus on low-hanging fruit to begin a utility data repository
  - Focus on relatively simple utility data repository
  - Fewer challenges than enterprise implementations
  - Downside: Issues with scalability and sustainability
  - Critical to engage IT personnel
  - Critical to engage other groups

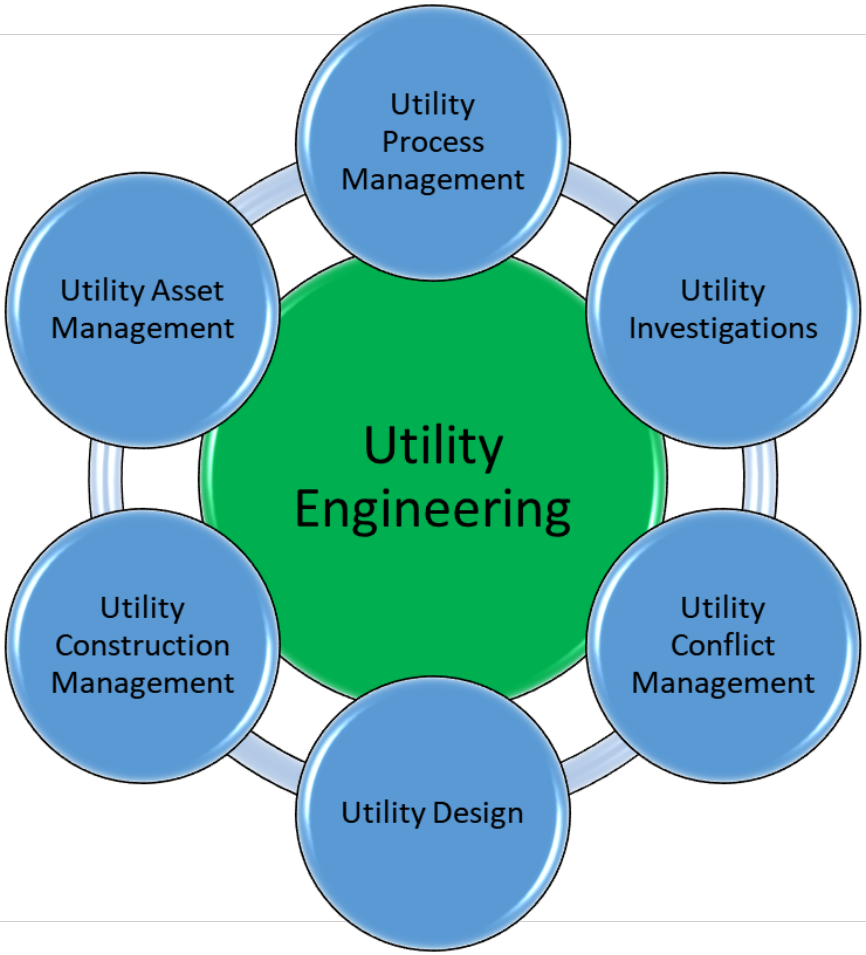
Needs, Potential Strategies, and Next Steps

- Utility data quality is an important requirement for most state DOT applications, but is particularly critical in a 3D design and construction workflow.
- Migrating to a 3D platform involves the development of a library of 3D objects to represent typical utility features. Developing 3D cell libraries of utility features can take a significant amount of time and effort.



Needs, Potential Strategies, and Next Steps

- Connect utility data management to the increasingly accepted specialty of utility engineering.



Research Needs

Topics	Urgency
Strategies to Eliminate Delays and Higher Costs to Transportation Projects Caused by Conflicts with Utilities	1
Strategies to Improve the Participation of Utility Owners During Project Delivery	4
Technologies to Improve the Detection and Documentation of Existing Utility Infrastructure	2
Quantification and Management of Utility-Related Risks During Project Delivery	3
Early Data Management Strategies to Enhance Damage Prevention Practices	5
Small Cell Tower and Other Communication Technologies	7
Curriculum Development and Training for Transportation and Utility Stakeholders	8
Technologies and Processes to Improve Utility Data Management Practices Through the Entire Life Cycle of Transportation and Utility Features	6
Strategies to Ensure an Effective Dissemination of Research Results to Users	9
Strategies to Generate Revenue and Optimize the Societal Value of The Right of Way	11
Strategies to Manage Out-of-Service Utility Infrastructure	10
Assessment, Risk Management, and Rehabilitation of Aging Utility Facilities within the Right of Way	11

Vision

- R01A: Document and manage the location and characteristics of all utility facilities that exist within the right of way
- R15B: Identify and resolve utility conflicts as early as possible during project delivery to avoid unnecessary utility relocations, utility-related delays, and higher project costs
- Consider the utility process as an integral component that covers all phases of project delivery—starting as early as planning and continuing through preliminary engineering, design, and construction

BREAK

15 Minutes



SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

SHRP2 Program Wide Discussion

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

Goals of Implementation Research

Three Goals for National SHRP2 Implementation:

- Provide opportunities thru funding and technical assistance to implement the research products.
- Expose, educate, and train if necessary, both decision makers and implementors on each product.
- Measure benefits on multiple levels.

Results of Implementation Projects

- SHRP2 funding was focused on many needs that would otherwise not have been addressed due to lack of resources.
- SHRP2 drew stakeholders to the table and provided a forum to discuss challenges and successes of implementation.
- SHRP2 products measured implementation results but also exposed areas needing further development and more data collection.

SHRP2 Program Wide Discussion

If we were to ever have another program like SHRP2 we want your thoughts about what worked well and what could be improved.

Focusing specifically on the overall **SHRP2 Research phase**:

- Was the SHRP2 research program successful? If yes, why? If not, why not?
- Was the timeframe adequate for delivery?
- If you were going to document the key takeaways from the SHRP2 research program what would they be?

Research Phase

- Was the SHRP2 research program successful? If yes, why? If not, why not?

Research Phase

- Was the timeframe adequate for delivery?

Research Phase

- If you were going to document the key takeaways from the SHRP2 research program what would they be?

SHRP2 Program Implementation

- What are the key takeaways from the overall SHRP2 implementation efforts?
- Were you satisfied with the maturity of the products?
- Was the SHRP2 program easy to implement within your state? How was the application process received? Was it well integrated into DOT planning and decision-making processes? Is it part of the way you do business?
- From an implementation perspective, is there a need for any of these products or other products in the SHRP2 program to have greater national penetration? If so, which ones? How would you go about supporting that?
- If we could launch this research/implementation program over again, what would you do differently?

Implementation Phase

- What are the key takeaways from the overall SHRP2 implementation efforts?

Implementation Phase

- Was the SHRP2 program easy to implement within your state?
- How was the application process received?
- Was it well integrated into DOT planning and decision-making processes?
- Is it part of the way you do business?

Implementation Phase

- From an implementation perspective, is there a need for any of these products or other products in the SHRP2 program to have greater national penetration?
- If so, which ones? How would you go about supporting that?

Overall Program

- If we could launch this research/implementation program over again, what would you do differently?

Other thoughts?

BREAK

15 Minutes




SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Utilities Products Retrospective Discussion

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

SHRP2 Utility Products

3D Utility Location Data Repository R01A

For R01A, implementation ranged from developing a 2D-standalone geographic database of existing utilities within the right of way to developing an enterprise system architecture to manage utility facilities in a 3D-environment.

Utility Location Technologies R01B

For R01B, implementation focused on the use of multi-channel ground penetrating radar (MCGPR) and time-domain electromagnetic induction (TDEMI) technologies to detect underground utility facilities.

Identifying and Managing Utility Conflicts R15B

Implementation of R15B ranged from using the standalone utility conflict list at a sample of pilot projects to the development and implementation of enterprise system modules to automate specific utility conflict management features.

Utilities Products Retrospective Discussion

- Were the IAP goals for this product accomplished?
- Was the implementation of these Utilities product successful? If yes, why? If not, why not?
- Was this SHRP2 product easy or was it a challenge to implement within your state? Was it well integrated into your DOT processes? Is it now part of the way you do business?
- If you were going to document the key takeaways from the implementation efforts and activities of this Utility product, what would they be?
- What lessons did we learn about this technical product implementation?
- If we could launch the research for this specific product over again, what would you do differently to prepare for implementation? (Is there a better way forward knowing what we know now?) What activities and events were most successful and why?

R01A IPW Implementation Goals

IPW participants identified three general goals:

- A critical mass of early implementing transportation agencies will include the 3-D utility storage system (on multiple vendor software/platforms) for use on proof of concept pilot projects.
- An enterprise-level solution, with the flexibility to operate on multiple platforms, for agencies to store, maintain, and retrieve the location and elevation for all utilities, as well as important attribute data about the utilities, so that the product can be effectively integrated into the existing business processes of the agency.
- IT support for 3 years to determine the requirements for maintaining, upgrading, and storing 3-D utility components.

R01A

- Was the implementation of R01A successful?
  - If yes, why?
  - If not, why not?
- Was R01A easy or was it a challenge to implement within your state?
- Was it well integrated into your DOT processes?
- Is it now part of the way you do business?

R01A Key Takeaways

R01A Lesson Learned

R01A What to do differently?

- If we could launch the research for this specific product over again, what would you do differently to prepare for implementation?
- Is there a better way forward knowing what we know now?
- What activities and events were most successful and why?

R01B IPW Implementation Goals

- Educate industry and agencies about benefits and limitations of subsurface utility engineering (SUE) investigation technologies, when it may be advantageous to incorporate multi-channel utility designation into business practices, and how to implement these systems.

- Establish standard processes to incorporate SUE across agency departments.

- Develop ability of agencies to incorporate SUE in total cost of facility ownership to improve return on investment.

R01B

- Was the implementation of these Utilities product successful?
  - If yes, why?
  - If not, why not?
- Was this SHRP2 product easy or was it a challenge to implement within your state?
- Was it well integrated into your DOT processes?
- Is it now part of the way you do business?

R01B Key Takeaways

R01B Lesson Learned

R01B What to do differently?

- If we could launch the research for this specific product over again, what would you do differently to prepare for implementation?
- Is there a better way forward knowing what we know now?
- What activities and events were most successful and why?

R15B IPW Implementation Goals

- Widespread adoption and use of UCM
- The UCM products ready and available for agencies' implementation
- Stakeholders aware of how utility information and the UCM can be used to improve the identification and coordination of utility conflicts on projects.
- State DOTs using the UCM in the development and delivery of individual highway projects
- Agencies using the UCM in the development and delivery of their highway program to possibly use on all future projects

R15B

- Was the implementation of these Utilities product successful?
  - If yes, why?
  - If not, why not?
- Was this SHRP2 product easy or was it a challenge to implement within your state?
- Was it well integrated into your DOT processes?
- Is it now part of the way you do business?

R15B Key Takeaways

R15B Lesson Learned

R15B What to do differently?

- If we could launch the research for this specific product over again, what would you do differently to prepare for implementation?
- Is there a better way forward knowing what we know now?
- What activities and events were most successful and why?

Other Thoughts?

LUNCH



SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Future and Next Steps Discussion

U.S. Department of Transportation
Federal Highway Administration

American Association of State Highway and Transportation Officials
AASHTO

Future and Next Steps Discussion

- What are the barriers to future implementation?
- Are there marketing or other activities that would enhance continued implementation of these Utilities Products?
- Is there a need for further development of any of these products?
- What future activities are needed for further implementation?
  - AASHTO support
  - FHWA support
  - Agency policy changes
- What will it take to build these tools into ongoing practice? What else is needed?
- How do we accomplish this and ensure that the products are relevant?
- What are the recommended next steps?

Future and Next Steps Discussion

- What are the barriers to future implementation?

Future and Next Steps Discussion

- Are there marketing or other activities that would enhance continued implementation of these Utilities Products?

Future and Next Steps Discussion

- What future activities are needed for further implementation?
  - AASHTO support
  - FHWA support
  - Agency policy changes

Future and Next Steps Discussion

- What will it take to build these tools into ongoing practice?
- What else is needed?

The Future and Next Steps

- How do we accomplish this and ensure that the products are relevant?
- What are the recommended next steps?

BREAK

15 Minutes



SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Strategic Roadmap Forward

U.S. Department of Transportation
Federal Highway Administration

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Strategic Roadmap Forward

- What steps should be taken next based on lessons learned?
- Develop a high-level forward plan for each product:
- What form should further implementation take?
  - More research? – if so, through what process (NCHRP, TRB, others)
  - More activities? – if so, who would initiate and who would fund?
  - New forms of marketing? – if so, who needs to hear this story and who needs to tell it?

R01A

R01B

R15B

Report Out and Wrap Up

THANK YOU FOR PARTICIPATING!

Travel Safely!

For More Information

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AASHTO Web Page: http://shrp2.transportation.org

FHWA Web Page: https://www.fhwa.dot.gov/goshrp2