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
State Transportation Innovation Councils

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

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1 Executive Summary

1.1 VALUE PROPOSITION

The Michigan Utility Coordination Committee's (MUCC) Geospatial Utility Infrastructure Data Exchange (GUIDE) initiative revolutionizes spatial awareness and spatial quality of underground utility infrastructure information by capturing accurate 3-dimensional geospatial location data on underground utility infrastructure at the time of installation, and storing this information in a highly accessible and secure repository. The ability to share spatial information with all stakeholders will help reduce utility conflicts during project design, reduce utility conflicts during construction, reduce overall utility life cycle costs and enhance the safety of the general public. Through the acquisition, preservation and accessibility of precise spatial data on new underground utility installations, roadway agencies, consultants and utility companies will have the ability to better plan projects, anticipate and identify utility conflicts before construction activities, prevent unexpected utility relocations, and share high-value spatial information among all project stakeholders.

1.2 2014 GUIDE PILOT INITIATIVE AND GOALS

In the spring of 2014 the Michigan Utility Coordination Committee (MUCC), Consumers Energy, DTE Energy, and AT&T set out to acquire accurate 3-dimensional geospatial information during the installation of utilities on seven pilot projects strategically identified by each utility company—now formally known as the 2014 GUIDE Pilot. The pilot projects consisted of new permitted utility installations located within existing Michigan Department of Transportation (MDOT) right-of-way. Accurate survey data was acquired on the installed utilities for all seven projects according to the GUIDE requirements document that was developed in 2013, with the following specific goals and anticipated benefits:

1.2.1 Goals

1. Focus the acquisition of accurate geospatial utility information solely on underground utilities
2. Identify challenges associated with acquiring accurate spatial data during installation
3. Identify short and long-term benefits of acquiring accurate spatial data
4. Identify the technical considerations for acquiring accurate spatial data
5. Create a central repository where all survey data can be submitted, stored, managed and shared
6. Provide user access to the central repository in order to allow stakeholders access to the geospatial utility information

1.2.2 Anticipated Benefits

1. Increased efficiency in project coordination during design
2. Better project decision making
3. Improved project communication
4. Better recordkeeping
5. Reduce costly utility conflicts during construction
6. Develop more accurate utility source data on newly-installed utility infrastructure
7. Reduce the impact to the public (user delay fees)
8. Improve public safety and reduce owner risk by reducing impact to high risk utilities

1.3 OUTCOME

The 2014 GUIDE Pilot was successful from the perspective of a pilot project, as the concept was proven, best practices were found, key findings were identified and lessons were learned. The GUIDE Pilot identified several items which should be addressed before moving forward with a fully implemented GUIDE program. Several revisions to the original draft requirements document are recommended prior to full implementation, some of which are technical and others being more procedural. In addition to the lessons learned, innovative solutions were proposed and implemented to address some of the challenges identified. The following key findings will be examined in greater detail later in this report.

1.3.1 Key Findings

1. Further development of the GUIDE requirements document is required to support a larger role out of the program. Primarily, these development items include:
    a. Expand on what is required at intermediate changes in horizontal and vertical geometry.
    b. Revise the required data format to include a single file format for submitted data files, expand data attribution to include other utility types.
    c. Develop the data submittal, QA/QC review, data acceptance and final upload process.

2. There is the potential for significant roadway agency impacts that are structural, cultural, technical and procedural in nature, which any agency will need to be prepared to address, such as:
    a. Data management and IT resource allocation to support the storage, management and sharing of the geospatial data.
    b. Need for additional personnel resources.
    c. Resource commitment to long term maintenance of the geospatial data.

3. Industry training may be necessary to educate the industry on best practices, lessons learned, proper data collection techniques, coordination techniques, defined processes for submitting data and other valuable information gleaned from the GUIDE Pilot.

4. Survey staff proximity to each project site is key to successful, timely and cost-effective coordination of surveying activities.

5. Coordination of the surveying efforts is a significant challenge for the utility companies in acquiring the geospatial data at the time of installation. External contractor coordination and internal survey crew staff coordination were common challenges for all three utility companies involved in the GUIDE Pilot. However, by employing creative coordination techniques, it was discovered that proper coordination can be done efficiently and economically.

6. Utility companies may need to develop a special contract provision or specification for their own internal construction crews and external contractor crews in order for contractors to properly bid projects with the appropriate expectation of coordination efforts for data collection. As contractors and in-house construction crews become familiar with GUIDE and the coordination that will be required, it will become normal practice. For the GUIDE Pilot projects, however, the contractors were

generally unaware of what would be required of them at bid time, therefore once construction commenced they were being asked to perform additional work that was not typical. If the utility companies add GUIDE coordination as a pay item, it may be an incentive to contractors to properly coordinate efforts that support data acquisition.

7. Accurate construction delay cost information, specifically due to utilities, was not available from MDOT. A single contract modification can include numerous items, making it difficult to query only those that involve utilities. This type of data has not historically been accurately tracked. The lack of available information makes it challenging to identify verifiable quantitative value. Therefore, benefits are perceived with the support of intuition and experience.

1.3.2 Cost Summary

Figure 1 represents a general summary of the overall cost of GUIDE implementation on the seven pilot projects. In addition, a comparison to estimated construction cost has been provided, and a unit price breakdown has been provided.

	Consumers Energy			*AT&T*		*DTE Energy*	
	M-21	**M-43**	**M-20**	**M-61**	**M-17**	**M-5**	**M-85**
Length (feet)	1,340	4,398	4,021	10,000	125	13,000	100
Utility Type	Gas	Gas	Gas	Fiber	Fiber	Gas	Gas
Primary Installation Method	Directional Drill	Directional Drill	Open Cut	Directional Drill	Directional Drill	Insertion	Open Cut
Cost of GUIDE	$ 6,700	$ 10,254	$ 11,044	$ 4,098	$ 935	$ 8,318	$ 3,197
GUIDE as Percent of Construction	4.06%	0.92%	2.80%	0.83%	4.20%	N/A	N/A
GUIDE Cost per Linear Foot	$ 5.00	$ 1.75	$ 2.16	$ 0.39	$ 7.48	$ 0.64	$ 31.97
GUIDE Cost per Data Point	$ 148.90	$ 87.49	$ 112.70	$ 23.55	$ 58.41	$ 39.61	$ 245.90

Figure 1: 2014 GUIDE Pilot Cost Summary

2 2014 GUIDE Pilot Initiative

2.1 GUIDE BACKGROUND

The Michigan Utility Coordination Committee (MUCC) was formed by combining two existing teams. One being the Michigan Department of Transportation's (MDOT) Design Task Force - Utility Subgroup and the other being the MISS DIG Design/Survey Ticket committee. Both of these teams shared common industry representatives as well as similar goals. Goals were to identify potential utility issues related to design and construction of transportation projects then work towards resolution, and ultimately provide improvements to the existing processes. Industry representation included several major utility companies, MDOT, Michigan Infrastructure Transportation Association's (MITA), MISS DIG, County Road Association, Michigan Municipal League, the American Council of Engineering Companies and construction contractors. The first official MUCC meeting was held on November 7, 2007. The initial meeting included documenting the discussed goals. These goals have been included as Appendix D following this report.

In 2009, MUCC held the first statewide Michigan Utility Coordination Conference. The conference was an overwhelming success and continues to be an annual event organized and sponsored by the MUCC. Since inception, the MUCC has completed several initiatives. Some of the more noteworthy items include the following:

- Utility Coordination Checklist (2011) – checklist document that summarizes tasks in which local agencies and consultants should complete for utility coordination.
- Depth of Utilities Pilot Project (2012) – field pilot project involving the one call utility locators providing depth information and then comparing to the utilities actual depth during construction.
- Utility Initial Submittal Requirements (2012) - document that outlines the information a utility should send a designer when requesting initial facility location and facility information.

The GUIDE Pilot project gained momentum in February of 2013 when Consumers Energy gave a presentation titled *"Considerations in the Use of GPS Technology for Damage Prevention" originally presented by (W.R (Bill) Byrd, P.E., RCP Inc.).* MUCC was looking to take on a new initiative and realized that GPS locations of utilities were one of the original MUCC documented goals. The consensus at the meeting was to have MDOT take the lead on developing a draft GPS guideline for new permitted utility installations. The 2013 MUCC meeting minutes have been included as Appendix E following this report.

MDOT shared the GUIDE's first draft document at the May, 2013 MUCC meeting titled *"Geospatial Data Collection Requirements for Permitted Utility Installations Performed within the Michigan Department of Transportation (MDOT) right-of-way (dated April 22, 2013)."* It was determined that a MUCC Subgroup would be formed to work on the geospatial data collection initiative. MDOT, MITA, MISS DIG, AT&T, Consumers Energy and DTE Energy all volunteered to be included in this Subgroup.

The first official GUIDE meeting took place on May 30, 2013. Members agreed to collaboratively work together and draft a requirements document which would outline the specifics in collecting geospatial utility information for new underground permitted installations. Members agreed to the following schedule:

- January 2014 MUCC conference – Prepare PowerPoint presentation of the GUIDE initiative and draft requirements
- 2014 construction season - the three participating utility companies , AT&T, Consumers Energy and DTE Energy, would pilot 2-3 projects collecting data as outlined in the GUIDE requirements document
- January 2015 MUCC conference – Present 2014 pilot field results

In February of 2014, MDOT applied for and received Michigan State Transportation Innovation Council (MI-STIC[1]) funding for the MUCC GUIDE initiative. The approved funding allowed MDOT to hire a consultant to professionally document the MUCC's 2013 and 2014 GUIDE initiative. The STIC application submitted by MDOT and the FHWA approval has been included as Appendix F following this report.

On April 23, 2014, MDOT authorized Spicer Group, as the selected consultant, to prepare the technical report and presentation (January 2015 MUCC conference) which will comprehensively document the 2013 and 2014 MUCC's GUIDE initiative.

2.2 KICKOFF AND PILOT PROJECT IDENTIFICATION

On April 30, 2014 the GUIDE subgroup of the MUCC met in Okemos at the Michigan Infrastructure and Transportation Association (MITA) office. At the kickoff meeting, Nick Lefke (MDOT) introduced Eric Barden, P.S. (Spicer Group) to the GUIDE subgroup and explained what Spicer Group's role would be for the 2014 pilot project. Mr. Lefke explained to the GUIDE subgroup that MDOT had applied for and been awarded a 20% match grant through the Federal Highway Administration's (FHWA) Every Day Count's (EDC) initiative. Specifically, the grant was awarded through the Michigan State Transportation Innovation Council (MI-STIC) and became the funding source for Spicer Group's efforts of following the GUIDE Pilot through the 2014 construction season and reporting on the program's outcome. As part of the grant requirements, the FHWA agreed to allow the costs incurred by the utility companies to be used to fulfill the 20% match requirement. Each utility company provided personnel labor rate information to MDOT and then tracked their hours associated with the GUIDE efforts throughout the 2014 construction season.

In addition, the GUIDE subgroup discussed the overall expectations of the GUIDE Pilot initiative which included establishing a program that could be used as a policy decision making tool for many roadway agencies. The expected outcome of the effort was that the subgroup would be able to glean insights into the viability of acquiring accurate geospatial data on utilities during installation, providing analysis of the cost impact to the utility company, impacts to the construction project or contractor, and cost impact to the roadway agency. In addition other considerations were evaluated such as:

- Construction project schedule impact
- Design considerations
- Data management and sharing considerations
- IT and other infrastructure related considerations
- Training considerations

[1] State Transportation Innovation Council (STIC) is part of the Federal Highway Administration (FHWA) Every Day Counts (EDC) initiative. The concept behind STIC is to bring together key players in the area of highway transportation within a state and evaluate and determine innovations that will work best for them.

- Additional ideas associated with acquiring accurate geospatial data for utility installation

At the GUIDE Pilot kickoff meeting, the three utility companies identified the projects they were going to include in the pilot project. These projects and their respective owners are detailed below.

Consumers Energy

1. 1,340 feet of 6" gas distribution main relocation along M-21 in Shiawassee County
2. 4,398 feet of installation of 8" steel high-pressure gas main and 19 feet of 1" steel high-pressure gas main along M-43 in Eaton County
3. 4,021 feet of installation of 6" plastic medium pressure gas main and 70 feet of 2" plastic medium-pressure gas service on M-20 in Isabella County

AT&T

1. 2 miles of 1.25" HDPE (fiber optic) installation along M-61 in Gladwin County
2. 2,100 feet of communication duct bank relocation, horizontal directional drilling (HDD) under I-75 at the University Drive Interchange in Oakland County.[2]
3. 125 feet of 1.25" HDPE (fiber optic) installation along M-17 in Washtenaw County

DTE Energy

1. 100 feet of 12" high pressure gas main relocation at M-85 (Fort Street) and Gibraltar Road in Wayne County
2. 2.96 miles of gas main renewal. 3" and 4" medium-density plastic main inserted into existing 6" cast iron mains along M-5 (Grand River Avenue) in Wayne County

Each utility set out to acquire the data as specified in the GUIDE requirements document (Appendix C) on the above-referenced projects, and each utility approached the acquisition of the geospatial data using different approaches and techniques,--all of which are be discussed below.

2.3 DATA ACQUISITION STRATEGIES

Each utility company pursued the data acquisition in a slightly different manner with the ultimate goal of achieving the same results according to the GUIDE requirements document.

2.3.1 Consumers Energy Pilot Projects

In an effort to get a better assessment of various methods of coordination for the acquisition of geospatial data on newly-installed utilities, and the costs associated with each, Consumers Energy approached each of their pilot projects very differently. For the M-21 project, the construction crews used 4" diameter cardboard tubes and placed those tubes over the gas main and backfilled around the tubes. For the M-43 project Consumers Energy built the project as they normally would, without any surveying or coordination for locating utilities during installation. After construction, Consumers Energy coordinated a vacuum excavation truck to locate the gas main at the appropriate locations, and the surveyors obtained the required data while

[2] Due to permitting issues the I-75 at University Drive project for AT&T did not get constructed during the 2014 construction season, therefore the project was not included in the GUIDE pilot project.

the utility was exposed. For the third project on M-20, Consumers Energy coordinated all surveying data acquisition during construction activities through daily coordination.

M-21 Shiawassee County (6" gas main relocation)

For the open cut portions of this project, Consumers Energy identified an innovative idea to help mitigate some of the anticipated challenges with having survey crews coordinating with contractors to locate utilities. In addition this project was partially underway by the time internal Consumers Energy staff were prepared enough to begin the data acquisition component. As a result, Consumers Energy staff came up with the idea of having the contractor place a 4" diameter cardboard tube over the newly-installed gas main in the areas where the main was open cut (Figure 2). This technique allowed the construction crew to backfill and continue working without having to worry about leaving the utility exposed while waiting for a survey crew to arrive, or having to coordinate with the survey crew at the time of installation.

Figure 2: Cardboard Tubes Placed over Gas Main

This project also consisted of areas where the gas main was installed by HDD. For those areas, the drill crew was marking the pipe centerline location above the bore head with wood stakes, and marked on the edge of pavement the depth reading from the ground as indicated from the HDD drill head.

Figure 3: Surveying Utility inside Cardboard Tube

These two techniques combined allowed for the construction crews to do minimal extra work in the field, while simplifying the coordination of the surveying activities. Survey crews could then arrive after the project was completed and perform the required survey observations without impacting construction. Direct observations were obtained by placing the GPS pole down each tube and observing the top of pipe position (Figure 3), and ground observations were obtained at the staked locations in the HDD areas,

using the depth reading that was marked on the pavement to calculate the top of pipe elevation.

All surveying was performed prior to restoration. Once the restoration crew mobilized to the site, they backfilled the cardboard tubes with sand, cut them off slightly below grade and restored the site.

Conclusion

Consumers Energy came up with an innovative idea to mitigate daily survey crew coordination by having the contractor install the stand tubes over the utility during backfill operations. Generally speaking the tubes worked as planned, and they allowed the surveyors to mobilize and collect all project data during a single site visit. There were, however, a few challenges. The contractor spent an additional 37 hours of labor effort for preparing, installing and backfilling these tubes. However it did mitigate the scheduling and coordination challenges involved with daily coordination. Another shortcoming of the tubes was stabilization during backfilling operations. There were areas where multiple tubes needed to be placed within the same excavation so that fittings and tie in points could be surveyed. There were difficulties backfilling around multiple tubes in the same localized area and some of the tubes partially filled with backfill material. In general, the stand tube method can help minimize daily coordination challenges and may be suitable under the right circumstances as a valid method for coordinating surveying efforts.

M-43 Eaton County (8" S-HP gas main installation)

For this project, Consumers Energy elected to build the entire project as they normally would. Construction crews had no knowledge of GUIDE and made no attempt to coordinate surveying activities during construction. Upon completion of the project, Consumers Energy contracted a vacuum excavation contractor to expose the newly installed utility. With direction from Consumers Energy staff, the contractor first located the utility on the surface at the required locations using electromagnetic locating equipment. The contractor then vacuum excavated the gas main at the required locations (Figure 4). This activity took about 3 days for the vacuum excavation crew to expose the utility at the proper locations.

Figure 4: Vacuum Excavation Truck (left) and Gas Main (Right) Exposed through Vacuum Excavation

On the third day, the survey crew arrived and collected the required survey observations, using Real Time Kinematic (RTK) GPS connected to the nearest MDOT Continuously Operating Reference Stations (CORS)

(Figure 5). Once survey observations were recorded, the exposed utility holes were then backfilled and restored.

This technique, although anticipated to be the most costly, mitigated contractor and survey crew coordination. It also allowed the construction personnel to stay focused on their typical duties with no concern of additional work or cost for coordinating survey efforts.

Figure 5: Survey Crew Obtaining Positional Data on Exposed Utility

Conclusion

In general, this technique worked. Its primary goal was to eliminate the need to impact construction activities by eliminating daily contractor coordination with survey crews. It did not necessarily follow the intent of GUIDE, however it was good to include this method in the GUIDE Pilot project to gain insights into the different options available to the utilities and contractors if coordination during construction simply cannot happen.

There were a few noted limitations. Since the utility was completely installed, it had to be located with locating technology before vacuum excavation could begin. There is a potential concern that critical alignment changes could be missed, since the utility was exposed at the required interval per the GUIDE requirements, and not necessarily at every change in horizontal or vertical geometry. This was less of a concern for Consumers Energy, since their installation practices involved tracking all fittings during installation. This is the same general concern shared with HDD techniques. It is recognized that with either technique, there are many variables affecting the final location of the utility and without visual confirmation of horizontal and vertical geometry changes, the potential exists for greater deviations than is desirable between the survey observations.

M-20 Isabella County (6" P-MP gas main installation)

Consumers Energy approached this project by having the surveyor and the Consumers Energy construction crews coordinate the utility locating efforts during construction. At the onset of the project, Consumers Energy's engineering team leader, the consultant surveyor and the Consumer Energy construction crew met on site to discuss the overall goal of the project and the specifics of the GUIDE Pilot. The consultant surveyor and the construction crew exchanged contact information and were left to coordinate efforts for the remainder of the project.

Figure 6: Surveyor Recording a GPS Observation on Gas Main in Open Cut Section

The consultant surveyor indicated the coordination efforts with the construction crew went very well. Daily communication was the key to success. There was a slight inconvenience to the construction crew over their normal operations, since they would leave portions of the open cut sections of the installation open when they backfilled the remaining sections. These sections were left open so that the survey crew could collect the appropriate information at the required locations the morning following that installation (Figure 6). Once the surveyor collected the appropriate observations, the construction crew would complete backfilling.

Conclusion

This project went exceptionally well with all critical horizontal and vertical changes in pipe direction being documented during installation and at the required intervals. This project required the daily communication between the surveyor and contractor to coordinate efforts based on construction progress. This was accomplished by committed team members from both the utility and surveying consultant. This project followed the intent of GUIDE, and has likely captured the most complete dataset without missing any critical fittings, tie-in locations or horizontal and vertical changes. This project did require additional time from the construction crew to coordinate backfilling efforts with the surveyor.

2.3.2 AT&T Pilot Projects

AT&T took a different approach than Consumers Energy. At the onset of the GUIDE Pilot project in May of 2014, AT&T solicited proposals from consultants that met the licensure requirements of the GUIDE requirements document to complete the surveying. AT&T placed a consultant engineering and surveying company under contract to support their 2014 GUIDE pilot projects. Although AT&T staff was very responsive and helpful in following the requirements of GUIDE, they turned over the GUIDE requirements to their consultant and let them handle all coordination efforts. This included informing the contractors at pre and post bid time about GUIDE, and daily coordination for all surveying activities. The AT&T engineering team performed all internal coordination and staff education on the GUIDE requirements, otherwise AT&T primarily turned the GUIDE data acquisition over to their selected consultant.

M-17 Washtenaw County (1.25" HDPE conduit installation (Figure 7))

This project consisted of approximately 125 feet of fiber optic distribution cable installed by HDD. This was a small project that provided an accurate analysis of what the basic level of effort would be to acquire geospatial data for utility installations even on the smallest of projects.

AT&T's surveying consultant for this project met the contractor on site prior to work beginning, to review the data collection requirements with the contractor. Since this project involved HDD installation method, the contractor was going to have to be involved in marking the HDD conduit location and depths at the required locations stated in the GUIDE requirements document. This was an unexpected activity for the contractor, since they had no idea what GUIDE was prior to being awarded this project.

The contractor participated and marked the requested locations during the HDD installation. There was some misunderstanding on how to accurately locate the tie-in points at each end of the HDD installation. The surveying consultant requested that the contractor also mark the tie-in locations along with the depth, even though at one point during installation the actual tie-in location was exposed and could have been observed directly with surveying instruments if properly coordinated. The GUIDE's intent is for all exposed utility locations to be directly observed if possible, therefore the tie-in locations should have been coordinated so the surveying consultant could obtain direct observations at those locations.

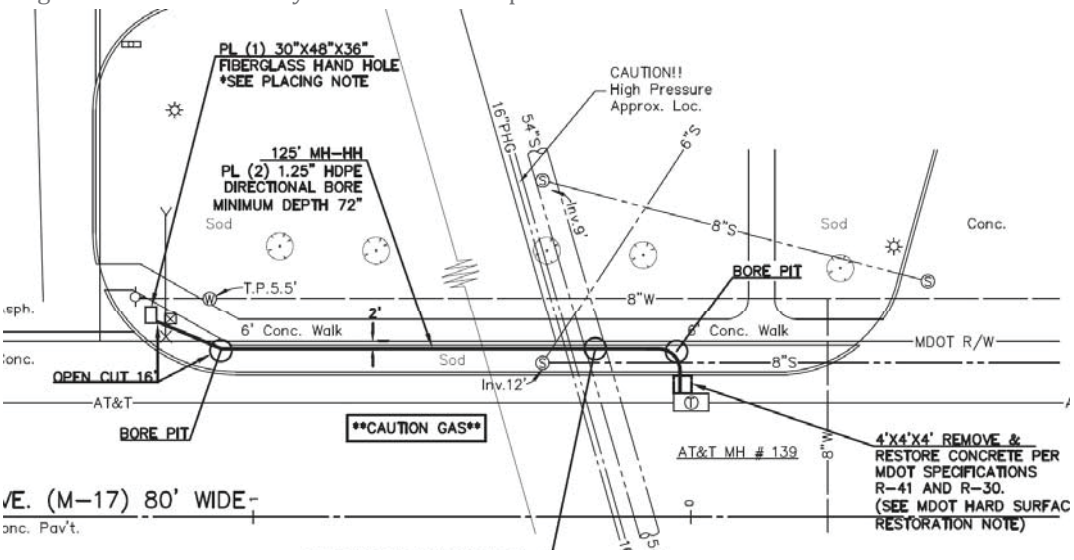

Figure 7: AT&T Plan Set of Project Area

As a result of the lack of quality records relating to the spatial location of existing utilities, and the lack of certainty in locating existing utilities with locating equipment, AT&T's contractor had to repair a damaged fiber line. The particular utility was marked by a locate company prior to construction, however it was marked in the wrong location and was then discovered during excavation activities when the contractor cut the cable. The project experienced additional field time due the additional effort involved in repairing the damaged fiber line. In addition, there will be potential for additional costs due to user outage costs, as the cause of the damaged line goes through the AT&T claims process.

Conclusion

One potential limitation of surveying HDD utilities is that it's not always feasible for surveyors to occupy projects during the entire HDD operations. Therefore, the contractors have to be relied upon for providing accurate location markings and depth readings during the HDD operation. HDD is a common installation method for non-gravity utilities due to its cost effectiveness and the ability to navigate other utilities in the field. All of the other GUIDE Pilot projects had some component of the project installation completed by HDD as well. Developing methods to precisely document the HDD utilities X, Y and Z position, while minimizing the impact on construction, is an issue that needs to be further investigated. Some licensed professionals may have a difficult time justifying the data certification where some component of the data is relayed by someone not under their direct supervision.

M-61 Gladwin County (1.25" HDPE conduit installation)

All project coordination and data acquisition responsibilities were placed on AT&T's surveying consultant. The surveying consultant was on board before the project started. Therefore, the consultant was able to attend the pre-bid meeting and had an opportunity to explain to the bidding contractors about GUIDE and what would be expected of the contractors in order to coordinate the surveying of the utility during installation.

Once construction proceeded and the contractor began placement of the stakes, the surveyor met again on site with the contractor to review the contractor's markings to ensure stakes were placed at the appropriate locations. The contractor attempted to place PVC tubes over the exposed utility at tie-in and bore pit locations, then backfill around those tubes similar to what Consumers Energy had done on the M-21 project. Once on site, the surveying consultant noticed that the PVC tubes had filled with water and sand had seeped in preventing the utility from being visible. In addition some of the stakes that had been set by the contractor were in mowed yard areas and home owners had removed a few (Figure 8). Since some of these staked locations were removed, the surveying consultant had to delay dispatching the survey crew so the contractor could first place the fiber in the duct. Once the fiber was placed in the duct the contractor toned the fiber location and depth at the areas where stakes were missing. Toning was completed with standard electromagnetic locating equipment. This was the only viable method of re-locating the newly-installed utility where the stakes were removed, short of vacuum excavating the utility at those locations.

Figure 8: Contractor's Stake in Yard Area Prone to Removal

Once the facilities were relocated, the survey crew was then dispatched to the site to obtain the required observations. The consultant surveyor was able to quickly coordinate with the contractor on site and obtain the required survey observations of the installed utility.

Conclusion

Generally, coordinating with the HDD contractor to mark the HDD location and depth works well, however additional coordination needs to be done in order to properly survey the areas where the utility is exposed. One risk of placing stakes that mark the HDD utility location and depth is the potential for stakes to be removed.

The proximity of the surveying consultant to the project site was noted as a minor challenge which added additional costs to the surveying efforts. The consultant for this project was about 2.5 hours from the project site, therefore each site visit required an additional five hours of travel time to the overall effort. Survey staff proximity to the project site will impact the overall cost of surveying activities for future GUIDE projects.

2.3.3 DTE Energy Pilot Projects

DTE Energy coordinated the data acquisition of its projects during construction. Direct coordination took place by the DTE professional surveyor in charge and the contractor's foreman. In order to successfully achieve the GUIDE objectives, daily coordination was required and as a result DTE was able to properly educate the contractor on the GUIDE initiative and successfully coordinate the data acquisition activities during construction, although coordination was the most difficult component of acquiring the geospatial data.

M-85 (Fort Street) and Gibraltar, Wayne County (HP Gas Main Relocation)

This project consisted of 100 feet of a 12" high-pressure gas main installation by jack and bore method in the Fort Street (M-85) right-of-way at Gibralter Road in the City of Brownstown, Wayne County. Due to a proposed culvert crossing on Gibralter Road on the west side of Fort Street, DTE was required to lower an existing 12" high-pressure gas main. DTE coordinated data acquisition activities directly with the contractor on site while the main was exposed. Due to the depth of installation, and steel sheeting used as shoring around the open excavation, GPS was not an ideal tool for acquiring the direct observations on the gas main (Figure 9). DTE's surveyors quickly recognized this and established control points near the excavation. Survey control point coordinates were established by static GPS observations through single 20 minute static GPS sessions. Data for those control points were submitted to OPUS (National Geodetic Survey's Online Positioning User

Figure 9: 12" High Pressure Gas Main in Open Excavation

System) which automatically processes static GPS observation data to the nearest Continuously Operating Reference Stations (CORS) and returns to the user XYZ coordinates on the user selected coordinate system. DTE's surveyors then used a Total Station and occupied the established control points to make direct observations on the exposed utility with a prism pole.

One notable occurrence was the additional day that was added to the contractors schedule due to the inability to locate the appropriate 12" high-pressure (HP) gas main that had to be relocated. DTE's records indicated the gas main's location relative to the right-of-way of Fort Street as depicted in DTE's land base records system. However, at some point the Fort Street right-of-way width changed, and DTE's land base did not reflect this change, consequently the contractor used outdated reference information to locate the 12" gas main. This is another indication that accurate geospatial information on existing utilities is tremendously valuable information since the absolute geospatial position information can be relied upon for locating future utilities, rather than relying on a utility's relative location to an outdated land base records system.

Conclusion

Many challenges relating to coordinating the surveying efforts were also noted as a part of this project, all of which were overcome with diligent and careful coordination. These projects require staff that are committed to making the necessary coordination.

The lack of highly-accurate utility information on existing infrastructure impacted this project directly. The contractor added an additional construction day to the schedule due to the inability to locate the existing gas main that was to be relocated. Existing records were tied to an old land base, causing unnecessary delays in locating the required gas main.

This project demonstrated that GPS is not always a suitable primary tool for data acquisition and additional work with other survey technologies is often required. This project also demonstrated that safety protocols may prevent direct access by the surveyor to the facility, necessitating additional cooperation from the contractor's personnel.

M-5 (Grand River Avenue), Wayne County (3" and 4" Gas Main Installation)

This project was very unique and interesting as it involved the installation of 15,629 feet of 3" and 4" medium-density plastic gas mains that were to be inserted into existing 6" cast iron gas mains. (Figure 10) New mains were being installed on both sides of Grand River Avenue, therefore the length of new main being installed for this project was approximately 30,000 feet. Ninety percent of the project was completed by the insertion method with approximately ten percent of the installation being completed by HDD and open cut installation where insertion was not feasible. Data collection efforts for this project spanned approximately 5 months from early June 2014 to the GUIDE Pilot cutoff of November 10, 2014. This was a large project and provided great insight into the level of effort required to acquire accurate geospatial data in an ongoing effort over several months for larger and more complex projects. Since this project consisted of installation methods other than HDD, data collection efforts had to be coordinated closely with construction activities.

Figure 10: 4" MDP Gas Main Inserted into Existing 6" Cast Iron Main

Figure 11: Installation Pit for Insertion Method. Survey Observation Locations Identified

DTE surveyors employed multiple data collection techniques including static GPS, RTK GPS and Total Station data collection techniques. For this project installation pits were excavated approximately every 250 feet along the project (Figure 11) for the insertion method. At each open pit the survey observations were recorded where the gas main was exposed and

accessible (Figure 10 and 11). The gas main was relatively shallow therefore access by the surveyors was generally not a concern when obtaining the required observations.

One item which helped make the coordination efforts more effective was the project's location. This project was only a few minutes from DTE's Detroit headquarters where DTE's field surveyors were stationed. This close proximity to the project site allowed DTE survey crews the ability to mobilize to the project site very quickly in the event an area was open and available for survey data acquisition.

Similar to other pilot projects, coordination was the most difficult challenge. This project, as well as all of the GUIDE Pilot projects discussed, the data acquisition component is the easiest part, since professionals are being deployed to collect the data. Technical aspects of delivering the required files was an added challenge that will be discussed later in this document, however those technical challenges can be overcome with further refinement of the GUIDE requirements document.

Construction for this project extended beyond the cutoff date of the GUIDE Pilot program. Therefore despite the fact that all survey work was done in accordance with GUIDE's requirements it is only approximately 82% complete.

Conclusion

This project went well and surveying activities were coordinated effectively with construction operations. A benefit to the coordination of this project was the close proximity of the DTE surveyors to the project site. Travel time was reduced to a very minimal amount, therefore the actual labor effort in acquiring the survey data ended being fairly minimal for a project of this size.

2.4 PILOT PROJECT RESULTS

The 2014 GUIDE Pilot projects went very well. Multiple data acquisition strategies were executed in an effort to gain a broad understanding of the level of effort required to capture accurate geospatial data per the GUIDE requirements document under varying project conditions. All three utility companies actively participated in making GUIDE a success during the 2014 construction season.

There were several results discovered regarding the logistics of capturing accurate geospatial data during utility installations that will help everyone become better prepared in the future. The overall process needs to be further refined before it is ready for widespread implementation with MDOT or other roadway agencies.

2.4.1 GUIDE Key Findings

Eight key findings were identified throughout the 2014 construction season during the GUIDE Pilot project. Each finding is discussed below.

1. ***Further Development of the GUIDE Requirements Document***

   a. Expand on the requirement for changes in geometry

   An area of uncertainty raised during the GUIDE pilot project was the uncertainty of what constitutes a change in horizontal and vertical geometry. The GUIDE requirements document states that each utility will be surveyed at changes in horizontal and vertical alignment, however

the document does not expand on what qualifies as a change. It was noted by all utility companies that it is unclear what is determined a change in geometry since utilities installed by HDD and open trench can vary in horizontal and vertical alignment by large amounts during installation. It was suggested a parameter be defined to qualify a horizontal and vertical change in alignment. A suggestion may be that a vertical change of 1 foot in every 10 foot or more horizontally will constitute a change that should be surveyed.

b. Revise data format requirement and expand data attribution

As GUIDE implementation expands to include other utility types, the data attribution requirements need to expand to include other utility types, and applicable data attribution. In addition, the requirements document should be revised to have stricter guidelines and requirements around the type of data file that will be accepted. It is recommended that a 3-dimentional Esri Shapefile be required that adheres to a strict set of data attribution standards.

During the processing of each data file to a 3-Dimensional shapefile, Spicer Group identified several issues with each of the data files submitted ranging from incorrect units, to missing attribute fields, to incorrectly-coded line work connectivity. For the GUIDE Pilot, Spicer Group corrected the files, however that would not be an option in a larger scale program.

c. Develop the data submittal, QA/QC review, data acceptance and final upload process

There was a need for a defined data submittal, QA/QC review, final acceptance and upload process during the GUIDE pilot. At the inception of the GUIDE pilot, there was no defined process for utility companies to submit their data files once the data was acquired and checked internally. MDOT setup a Microsoft Office 365 SharePoint web site and granted user access to the GUIDE committee members when the project began. This website was setup as a simple location to upload and share files associated with the GUIDE Pilot, including data files collected for each project. This solution was never intended to be a viable solution for larger programs, however for the GUIDE Pilot, it served the data sharing needs. Going forward, it is evident that a conditioned and well-defined process needs to be developed for utility companies to submit data collected, have data checked by the roadway agency (MDOT in this case), pass a set of defined criteria for final acceptance, and be uploaded to the central GIS repository. The process, as defined for the GUIDE Pilot had very little structure, however going forward it is recommended a rigid process be developed to promote structure and consistency.

A defined process where the data file can be received, viewed and checked against the permit information and construction plan, is essential to validate the surveyed point connectivity. The data file could then be validated for data structure compliance, and any deficiencies would be directed back to the utility company to revise and resubmit. This process could be built directly into the online permitting system with all data file submittals being tracked.

It is clear that a process will need to be developed to assure the quality, consistency and accuracy of data prior to being accepted into the system.

2. Potential for Significant Roadway Agency Impacts

a. Data management and IT resource allocation

Data management will be a significant consideration for a broader program. This refers to the management and maintenance of the data over time, not data storage requirements. The central database of utility information will be a very dynamic environment with continuous change, and procedures and resources will need to be devoted to its maintenance. Data will not simply be able to be received and uploaded, it will have to be validated to the permit information and any change from previous data reconciled within the GIS environment.

MDOT proved the concept of the central GIS repository for the GUIDE pilot project through its Arc GIS Online mapping service. With relative ease, MDOT developed a simple, secured web interface for approved users to access the geospatial utility data. The mapping service provide the user an intuitive user interface to view an area of interest and identify what utility information is available near that area. The user has basic functionality to then download the 3-dimensional utility data with a few common data format options.

b. Need for additional personnel resources

There will be training required within roadway agencies, and there will be some level of roadway agency impact with staff in coordinating individual roadway agency utility permits with the data submitted for those permits and getting the data to the central GIS repository. For MDOT, it is anticipated that one or two full-time equivalent (FTE) employees could handle the workload across the entire MDOT program. Generally, data management would directly correlate to the amount of urbanization within a roadway agencies jurisdiction. This report does not have the support of actual permit data from other roadway agencies however it is suspected that large municipalities like the City of Detroit or the City of Grand Rapids may have more permitted utility installations than MDOT.

However, to minimize this impact, it is recommended that roadway agencies subscribe to or participate in the central GIS repository and not attempt to receive and manage the data themselves; this will solve two major problems:

- It will keep data and program requirements consistent
- It will keep the data in one central location where it can be accessed and shared with approved users.

c. Resource commitment to long term maintenance of the data

Roadway agency impacts will be long term. In the beginning, the impact to MDOT will be greater since MDOT is allocating the resources and building the IT related infrastructure to store and maintain the geospatial data. GUIDE is the implementation of a new program therefore the commitment to manage, store and maintain the data going forward is a permanent commitment.

However, as other roadway agencies begin to participate the onus may need to be shifted to a more central data host agency such as a state's one call center, shifting the data management and IT commitments away from roadway agencies.

For example; there is the occasional instance where a new utility installation must be built to replace or support a distribution loop that became inadequate due to unforeseen developments, or increased demand by commercial or industrial customers. In this case, the agency managing the geospatial data will need to add the data about the new installation to the system and update the status of the original installation, as needed to reflect the permitted improvements. The long term management and maintenance of the data will need to be addressed to support broader implementation of GUIDE.

3. Training Requirements

For broad implementation of GUIDE, there will have to be an industry-wide training initiative that would need to coincide with GUIDE implementation at whatever level GUIDE is deemed viable to be implemented. Installation contractors, subcontractors, utility companies, roadway agencies and consultants will need to be educated on GUIDE, including its goals, realistic expectations, costs, data acquisition techniques and standards. In addition, there will need to be specific training relating to the process that is developed for submitting data, checking data, and uploading data for projects. At this point, there are many aspects to realize how an all-encompassing GUIDE initiative will work, including the processes associated with receiving, checking and storing the data acquired,. However, training will need to occur as the initiative matures from a pilot project effort into a more concrete and standardized initiative.

4. Survey Staff Proximity to Projects

An expected key conclusion worth highlighting, is that the proximity of the survey staff to each project area will help minimize the data acquisition costs. When coordinating data collection activities during construction, each survey crew site visit generally requires one to two hours of data collection effort, based on the contractor's progress since the previous time data was collected. Having survey staff that is relatively near each project will substantially reduce the data collection costs by minimizing travel. We can reference the AT&T project on M-61 in Gladwin where the survey consultant was deploying staff from approximately 2.5 hours away from the job site. For projects that span multiple days or may require multiple days of data collection, having survey staff near each project could reduce the total survey effort by fifty percent (50%) or more.

5. Coordination of Surveying Efforts

Coordination of surveying efforts was a challenge for the utility companies. Coordinating the acquisition of geospatial data at the time of installation requires diligent communication with the construction staff to stay aware of daily construction progress. In addition, internal coordination was a challenge for the utility companies that have their own surveying staff performing the data collection, it was a challenge to coordinate their own survey crews in a timely manager. However, by employing creative coordination techniques, it was discovered that proper coordination can be done efficiently and economically.

6. Development of Contract Specific Language

Utility companies may need to develop a special provision or specification for their own internal construction crews and external contractor crews in order for contractors to properly bid projects with the appropriate expectation of coordination efforts for data collection. As contractors and in-house construction crews become familiar with GUIDE and the coordination that will be required, it will become normal practice. For the GUIDE Pilot projects, however, the contractors were generally unaware of what would be required of them at bid time, therefore once construction commenced they were being asked to perform additional work that was not typical. If the utility companies add GUIDE coordination as a pay item, it may be an incentive to contractors to properly coordinate efforts that support data acquisition.

7. Lack of Supporting Utility Conflict Cost Data

In an effort to quantify potential cost savings during construction, it was discovered there was a lack of documented data to support real costs of utility conflicts during construction. From MDOT's perspective, obtaining documented, accurate costs for construction overages, project delays, contractor claims or any other project overage attributable to a utility conflict is very difficult. The lack of concrete data to support real costs to a project due to utility conflicts creates a significant challenge in developing the quantifiable case for the return on investment (ROI) of GUIDE.

2.4.2 Major Benefits

Five major benefits have been identified by the GUIDE committee as key drivers behind the GUIDE program, and below are specific examples from the 2014 GUIDE Pilot that support the perceived benefits. All of these benefits are recognized by most parties involved. However, since most benefits discussed are long-term benefits realized after potentially several years or even decades, it is difficult to quantify the perceived benefits with actual cost data to quantitatively support each benefit.

1. Identify Utility Conflicts Early

A major benefit is the ability to identify potential utility conflicts, with accurate geospatial information on existing utilities, during the planning and design phase of a project. It is an indisputable fact that knowing precisely where existing utilities are in X, Y and Z produces significant benefits during the planning and design phase of a project, which translates to even bigger savings during construction. Two of the seven GUIDE Pilot projects had utilities with inaccurate location information that resulted in additional time on the project for the construction contractor to resolve. That additional time resulted in additional project costs and both projects were relatively small in size.

The AT&T project on M-17 only included 125' of fiber cable installation. Prior to construction, AT&T had a utility-locating company mark the existing AT&T communication line through Michigan's One Call System, MISS DIG. Using locating equipment, the locator marked the AT&T facility in the field, however the utility was marked incorrectly. It is unknown if it was user error or inaccurate readings from the locating equipment, however since that communication facility had unknown or highly inaccurate location information prior to construction, there was no way to identify before starting construction that the utility had the potential of being improperly located. Construction crews had

to rely on the field markings and proceed with their excavation activities. The mismarked utility was consequently hit by the contractor during the excavation activities.

An AT&T claims group will now spend resources to investigate the reason why the cable was cut during construction. If the cable was located incorrectly, then a claim will be filed against the utility-locating company. If it was determined that the contractor was at fault, a claim will be filed against the contractor's insurance for the amount of AT&T's additional cost and lost revenue due to service outages. Currently for this project, it is unknown what these additional costs are in real dollars, but we can speculate that a significant amount of personnel resources, contractor resources and the potential for lost revenue due to service outages could have been avoided if the utility-locating company had access to accurate geospatial information on the utilities it was field locating. Had the locating company been provided accurate geospatial information, conceivably the field-located utilities would have matched the known position of the utility as it was depicted on the design plans, and all parties would have had a high-level of confidence that the utilities were marked accurately in the field.

Similar to the AT&T project, the DTE gas main relocation project at Fort Street and Gibraltar also had additional construction time added to the project due to the lack of accurate geospatial data on the existing gas main. The problem with much of the existing utility records data is that it is generally referenced by measurement data to an existing land base, as was the case with the Fort Street project. This is a common scenario with the internal records of most utility companies. The specific problem is attributed to land base information changing because records are not proactively maintained to ensure that they change with the land base, or the land base changes without the knowledge of the utility company's records group. DTE has internal records that showed the 12" high-pressure gas main relative to the Fort Street right-of-way. The problem with a relative location tie such as this is right-of-way change as do other features that a utility may be referenced to such as the centerline of the road or edge of pavement. The right-of-way at Fort Street had changed, however DTE's land base had not been updated to reflect this change. As a result the contractor spent one additional day on site simply trying to locate the 12" high-pressure gas main that he was contracted to then relocate per the design plans. This is a common problem with records systems that are based on outdated land base information, or that have the utility located using relative dimensional ties to other features. For this report, we were not able to obtain the actual additional cost to the project that was incurred because additional time spent by the contractor.

The Fort Street project is a great example of why obtaining absolute geospatial position information on utilities is far more valuable than a relative location-based records system. The absolute coordinates of that utility do not change, however features that a utility may be relatively tied to including roads and/or right-of-way, change often over time rendering the existing record information useless.

2. Reduce Future Utility Conflicts During Construction

Having accurate geospatial information on utility infrastructure will help reduce future utility conflicts during project construction. A major challenge of the GUIDE Pilot project was the ability to quantify the savings to a construction contract over a construction season due to reducing utility

conflicts during project construction. Everyone was in agreement that it costs less to mitigate utility conflicts during design when the conflict is known, versus dealing with the conflict during construction. The cost to redesign or modify a design to accommodate a known utility conflict can be significantly less during design than the cost at time of construction to relocate the utility or make other field changes to accommodate the utility conflict. Again, it is extremely difficult to quantify the savings due to a number of reasons. One reason being that roadway agencies do not always document utility conflicts and associated costs. Typically, the additional effort by consultants and/or contractors gets buried in other pay items or work tasks, and then can never be tracked or associated with a given utility conflict. This happens often as evidenced by testimony from Doug Needham of MITA, which is the contractor's trade organization representing participating road builders in Michigan.

Spicer Group performs as-needed construction services for MDOT, and has firsthand experience of significant additional project costs incurred due to utility conflicts. During the construction season of 2012, Spicer Group was performing construction staking services on an as-needed basis for a large freeway reconstruction project. During the installation of the storm sewer along a service road, a large communication duct bank was discovered that conflicted with several storm sewer crossings. The communication utility's plans showed a single line drawn on a plan indicating an existing cable, and this same line was shown on the design plans for the freeway reconstruction project. When the utility was discovered during storm sewer installation, it was actually identified as a major communication duct bank with 12 conduits running in parallel. It was determined that relocating the duct bank was not feasible, therefore Spicer Group was asked to redesign the storm sewer to avoid relocating the communication duct bank. Significant time and money was spent to have our team redesign the storm sewer, rather than allow the contractor to go on down time or delay the overall construction project schedule. Although having Spicer Group redesign the storm sewer in order to keep the contractor progressing forward cost a few thousand dollars, it was significantly less than risking downtime or project delays. These added costs were simply buried in our as-needed contract and in no way highlighted as being associated with any type of utility conflict.

The GUIDE committee acknowledges this happens regularly, however without the costs being tracked as being tied to a utility conflict, it is extremely difficult to quantify the savings during construction, although the perceived benefit is significant. GUIDE has the potential to significantly reduce or eliminate pay items for "Exploratory Investigations" where contracts include a line item on their bid to account for the costs associated with exploratory digging to find unknown utilities during construction.

3. Utilize Accurate Utility Source Data for Better Design Coordination

MDOT provided insight into the level of effort spent internally on the coordination of utilities for a typical highway improvement project. During the design phase of a project, there is a significant effort placed on requesting and coordinating existing utility information to support current design efforts. This effort includes all or most of the following high level tasks for each project:

- Utility research identification and obtaining utility contact information
- Project notification and early communication, verifying utility involvement

- Review information received for adequacy, disseminate to project team
- Follow-up with non-responsive utilities
- Utility coordination meetings, information sharing and conflict resolution
- Utility coordination follow-up, continue to coordinate utility conflict resolution
- Final design stage of utility coordination, prepare contract documents
- Construction phase coordination if necessary

MDOT provided an estimate of hours which a Utility Coordinator position may spend on a typical MDOT project. An average of 77.4 hours is spent performing various utility coordination tasks during the design and/or construction phase of a project. Using the current loaded (hourly pay rate plus overhead) hourly rate of $77.32 multiplied by 77.4 hours, translates to $5,984.57 spent on utility coordination activities per project. When considering these costs over an entire MDOT program on an annual basis, there is a significant amount of money being spent on proper coordination of existing utility information.

4. Reduce Public Impact

For a roadway agency, this is likely one of the largest areas that GUIDE will have a significant positive impact. User or public impact is a significant issue for owner agencies. During the design phase of an MDOT project, a user delay fee is developed for many projects based on the projects anticipated construction impact to the motoring public. Average daily traffic counts are evaluated, and anticipated detour routing delays are considered when determining user delay fees for a project. Of course, projects with the most significant user delay fees are the projects in the more urban areas of the state, and those projects are the projects with significantly more utility infrastructure and potential for significant utility conflicts.

As an example, on the December 5, 2014 MDOT bid letting, there is a 4.8-mile road reconstruction project on M-53 in Macomb County that has an approximate construction cost of $34 million with a two-year construction schedule. This project has several major utilities within the limits of construction with many proposed utility crossings. For example, the storm sewer has several proposed crossings with significant high-risk utilities, such as a 12” high-pressure gas main, a 36” water main, and underground electric facilities.

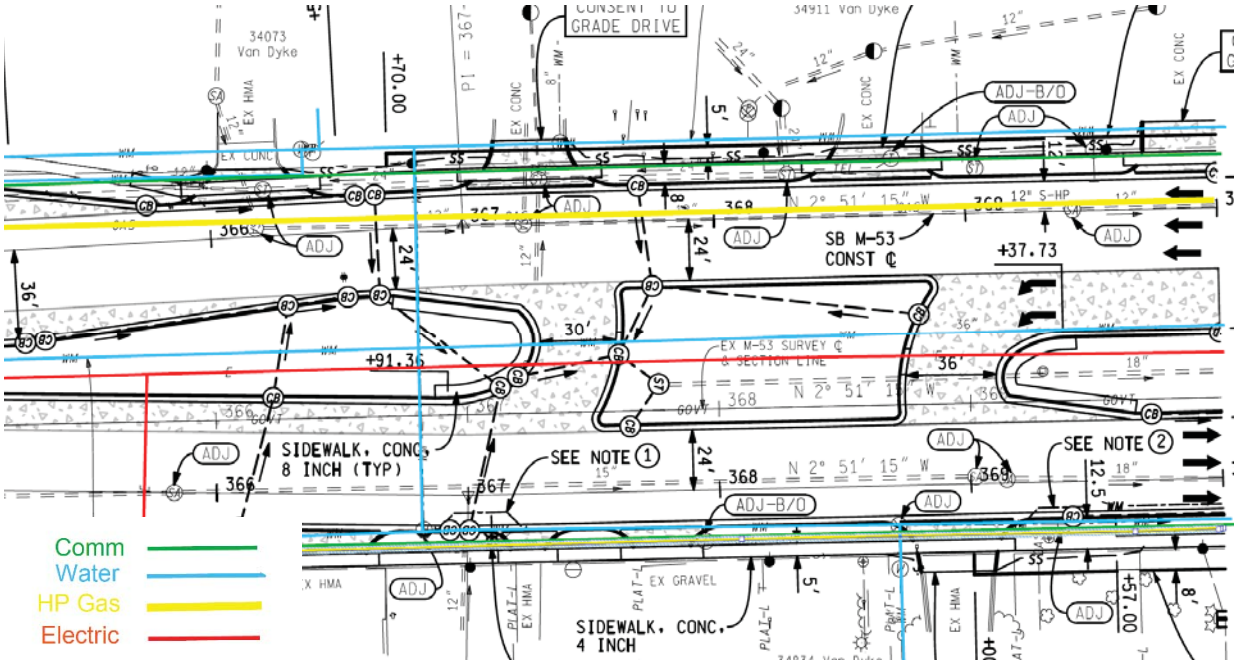

Figure 12: M-53 Construction Plan Sheet with Existing Utilities Identified

Spicer Group requested the existing utility information that was provided by some of the utility companies during the design phase on this project. During evaluation of the existing information, it is evident that existing as-built plan information is not adequate to properly determine utility

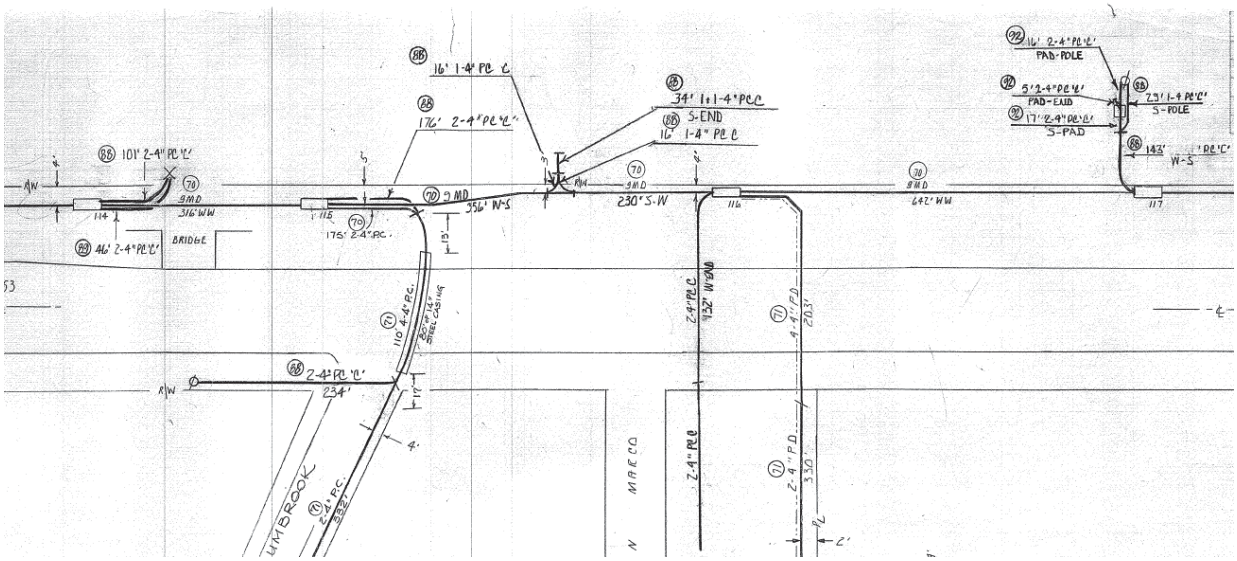

Figure 13: Typical Record Drawing As-built Plan for Communication Utility (AT&T)

location information in order to mitigate conflicts. Figure 13 and 14 show a typical record utility drawing submitted to MDOT on this project. In addition, field survey evidence discovered during the survey phase didn't match the plan information provided.

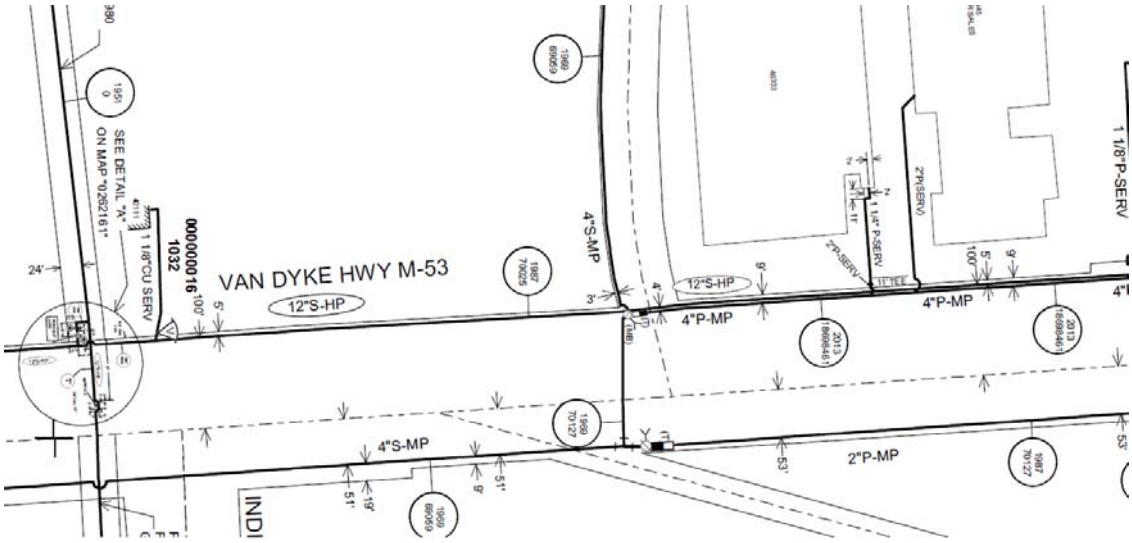

Figure 14: Typical Record Drawing As-built Plan for Gas Utility (Consumers Energy)

This project will already have a significant impact to the public under normal planned construction operations. The amount of additional days a project with this many utility crossings will be impacted is speculative due to inaccurate utility information, however it is a probable concurrence that there will be utility conflicts that will add time to this project over the course of a two-year construction life.

The calculated user delay cost for the M-53 project is determined to be $25,000 per day. Therefore, from a roadway agency's perspective, like MDOT, recovering one, two or potentially many more days due to having highly-accurate geospatial utility data at the onset of a project can very quickly return huge dividends during construction.

Please note that user delay costs are exclusive of interruption costs to utility service recipients. They are also exclusive of costs of accidents due to collisions with high-risk utility infrastructure.

5. Improved Public Safety and Reduced Owner Risk

Safety is paramount for everyone involved in construction projects, including the utility companies, roadway agencies, consultants, contractors, land owners, tenants and all stakeholders. Having accurate geospatial utility information in the future will undeniably increase the opportunity for a safer work environment for the public, roadway agencies, contractors and all other project stakeholders. Not knowing precisely where existing utilities are is a huge liability for all parties

involved. This is a difficult benefit to quantify, but if one life can be saved as a result of knowing precisely where a utility is versus not knowing, then the benefit warrants no quantitative justification.

2.4.3 Data Acquisition Lessons Learned

The acquisition of accurate geospatial data that complies with the GUIDE requirement's documents is not a difficult task when properly trained and licensed professionals are in responsible charge of the execution of the data-collection tasks. Properly trained and licensed professionals implement sound surveying principles. However, there were several challenges relating to the formatting of the submitted data as discussed earlier in this report. Three key challenges are discussed below.

1. Data Delivery Standards

The GUIDE requirement's document specifies the attribution requirements for all geospatial utility data collected, as well as the acceptable data delivery formatting options. For the GUIDE Pilot project, attribution was determined and selected specific to the types of utilities participating in the pilot projects; gas, electric and communication utilities.

MDOT prepared a sample Excel spreadsheet template (Appendix G) as an example of an acceptable data format type that could be submitted. In addition to Microsoft excel (.xls) format the following formats were also acceptable: .shp, .gdb, .txt, or .csv.

All participants for the GUIDE Pilot elected to deliver their geospatial data using the Microsoft Excel template. There were some technical challenges with the submitted files submitted for the GUIDE Pilot project that required editing and additional quality checking before they could be imported to an Esri geodatabase.

One of the data files submitted was prepared using incorrect units. The file was prepared using US Survey Foot units rather than the statutory International Feet unit definition for the Michigan State Plane Coordinate System. This was discovered when the file was imported into ArcGIS and shown with a georeferenced aerial photograph in the background. It was immediately evident that there was a shift in the dataset since it didn't line up with the aerial image.

Several other data files submitted were missing critical data. For example, files were submitted with missing data in the following columns: SegmentNum, USegNum, and Sort. The inconsistency and incompleteness of the data files submitted caused unnecessary time to review and edit the files to ensure completeness. Ultimately, this data will feed into ArcGIS in downstream workflows for generating the 3-dimensional point and polyline data that represents each utility in the overall enterprise GIS environment. Data consistency will become extremely important as this data is part of an overall process where data files are received, checked for completeness and uploaded to the central GIS repository.

Looking at the problem from a technical perspective, our recommendation would be to require a single file format, being an Esri shapefile (.shp). MDOT, as the roadway agency, would build the data dictionary to encompass all utility types and share the structured file publicly for all interested parties to use. Guidelines would need to be developed identifying what attribute fields are required and what fields are optional. A defined process would also need to be developed where the roadway

agency (MDOT in this case) would receive the file, perform a cursory review, and if the file did not meet the data standard requirement, it would be rejected and returned to the submitting organization. This would solve the data inconsistency problem and minimize the burden on the roadway agency in having to perform a review and quality check on multiple different file formats.

In addition, the Esri shapefile format is a widely-accepted format in the surveying community and most surveyors should have no trouble producing a file that complies with the requirement. Most modern surveying data collection equipment can either collect data directly to shapefile format or export a shapefile directly. In addition, this requirement would place no additional cost burden on the utility company's surveyors or surveying consultants, since there are several free software programs available for editing and creating Esri shapefiles, such as, Quantum GIS®, OpenJUMP®, and uDig® GIS. As a result, this requirement would not demand that consultants or utility companies own the Esri ArcGIS® product in order to produce the required files. Shapefiles are universally accepted throughout all CAD and GIS applications, therefore the data could be used and shared among project stakeholders.

Further discussion is warranted on the data file format requirement and the file structure of the required data files. The GUIDE requirements document outlines very clearly the attribution requirements that were developed by the GUIDE committee during the standards development in 2013. If GUIDE expands to other utilities, other roadway agencies and other regions of the state, the data structure will grow to accommodate the varying types of utilities, installation methods, utility sizes, materials and other differences that will exist as the program grows to include all subsurface utility infrastructure. As a result, other utility companies and roadway agencies will need to participate in GUIDE in order to assist in the development of an all-encompassing data standard that captures data that is relevant to all stakeholders as it relates to all other utilities that would fall under GUIDE requirements.

It is recommended that the GUIDE committee actively reach out to other participants for their input in the development of the standard as GUIDE implementation grows to affect other utility companies and roadway agencies alike.

2. Coordination of Data Collection

During the 2014 GUIDE pilot, it was learned, from all three participating utilities that the coordination of efforts between surveying staff and construction staff is the single biggest challenge each utility company faced. As such, with some creative thinking, there are several ways to successfully coordinate the acquisition of the required geospatial data. Depending on the utility installation method, depth of installation, soil conditions and several other factors, successful coordination of efforts can be accomplished several different ways. It is not always a requirement to have surveying staff and construction staff coordinate the surveying activities on a daily basis. Most likely each project will be coordinated using multiple coordination techniques since most projects will involve varying installation methods and other varying conditions that warrant different coordination.

As discussed earlier, Consumers Energy piloted using 4" diameter cardboard stand pipes that were placed over the installed gas main and backfilled around them. This was a verified successful tactic

that allowed Consumers Energy survey crews to mitigate the daily coordination efforts with the contractor.

In addition, where the utility installation method included HDD, the only viable coordination method is to have the contractor mark the utility location and depth during HDD operations. Ideally, markings should be made on pavement or other semi-permanent feature to promote longevity. However, if no other option exists, placing stakes at the required interval and marking the depth from the ground at the stake is a viable option, although wood stakes will not last as long as other options depending on the site conditions. Regardless, marking the HDD utility mitigates a significant coordination challenge by eliminating the need for surveyors to make daily job visits. Portions of a job could be installed and the surveyor coordinated to deploy and collect the required observations on large portions of a project at a time. Although, coordination is still required at tie-in locations, bore pits, and other areas where the utility is exposed.

An additional option, although the most costly, Consumers Energy provided evidence that obtaining the required surveying observations is even possible after a utility has been completely installed. Through vacuum excavation, the utility can be exposed at the required locations post construction, and the surveying activities can be coordinated at one time. However, vacuum excavation is not recommended as the primary method of coordinating the surveying efforts due to it being the most costly. As an alternative, vacuum excavation is a viable method in the event that a few required observations were not able to be successfully coordinated during installation. Surveying during installation operations through proper coordination is the preferred and recommended method since it has the lowest cost impact.

External construction contractor and surveyor coordination is a significant challenge noted by all three participating utilities for various reasons. However, as GUIDE becomes implemented, like any new requirement, it will become a normal part of the contractors' operations and coordinating the efforts will become less challenging.

In addition to the external coordination challenges noted above, there were also internal coordination challenges. The initial plan for Consumers Energy on their first pilot project on M-21 was to have a Consumers Energy survey crew collect the required GUIDE data. During initial discussions it became apparent that coordinating the internal resources was going to be a significant challenge. Consumers Energy does not have significant internal surveying capacity, so having internal forces readily available when needed is problematic. Consumers Energy realized this early on and quickly retained the services of one of their surveying consultants already under contract for "as-needed" surveying services. Placing the responsibilities of survey coordination and collection on an outside consultant mitigated any internal coordination of their own resources.

DTE Energy committed early on to obtain the required geospatial data for their pilot projects using their own internal survey staff. DTE Energy maintained this commitment throughout the pilot projects and successfully obtained the required geospatial data, although they noted significant challenges using their own resources. Again, with limited resources already committed to outstanding responsibilities, it was a challenge dedicating the appropriate resources to the GUIDE

Pilot projects. DTE Energy recognized they would need additional surveying staff if GUIDE were under widespread implementation.

AT&T does not employ internal surveying staff therefore they immediately reached out to a preferred consultant to acquire geospatial data on their projects. Therefore, the coordination responsibilities were placed on their consultant, and AT&T didn't experience the internal coordination challenges that Consumers Energy and DTE Energy did.

3. Utility Contract Provisions for GUIDE

It became evident early that there may be a need to include a special provision, or specification in bidding documents, to include appropriate language for proper contractor coordination of surveying activities. Although, the GUIDE requirements could end up being a condition of an issued utility permit, which the installation contractors would need to fulfill, there may need to be additional contract language developed to encourage contractors to properly coordinate the surveying activities. A suggestion would be to add a bid pay item for "*GUIDE Coordination",* associating contractor payment with successful coordination of GUIDE surveying activities. This would be similar to how MDOT may develop a special provision for a new activity and place it in the bid documents for all contractors to see at bid letting time. The special provision would provide detail on GUIDE, and layout the expectation of the contractor for that activity and become part of the contract documents.

Greater discussion on this topic is warranted as the results among different utility companies will vary based on their own internal policies and practice. It is recommended that roadway agencies pursue the development of contract specific language with performance based-compensation to incentivize the installation contractors to actively coordinate GUIDE efforts during construction.

2.4.4 Concerns

During the 2014 GUIDE pilot project Spicer Group had the opportunity to talk to all parties involved on a regular basis and gain valuable feedback throughout the entire construction season. Below is discussion on seven valid concerns that were brought up during the pilot project.

1. Safety

Safety of construction personnel was brought up as a point of paramount concern. For many types of utility installations, the GUIDE requirements are not creating a situation any different than normal daily surveying activities that take places throughout the state on a given day. However, a valid concern was brought up about working near live gas mains. It was noted by DTE Energy that electronic equipment is not allowed in an open excavation where a live gas main exists. Considering all modern surveying equipment is electronic, if personnel are not aware of this requirement, the requirement of obtaining geospatial data on a live gas main could place personnel in danger. This situation is mitigated through proper industry-wide training and education on the safety concerns associated with live gas mains and electronic equipment. In addition, this concern can be addressed by modifying the type of equipment being used in those situations. Rather than having electronic GPS or robotic Total Station equipment near a live gas main, traditional non-robotic Total Stations can be used where the total station emits an infrared laser that reflects from a prism mounted to the

top of a traditional surveying pole. This technique would not require any electronic equipment near a live gas main.

During open-cut installation of utility infrastructure, the additional time required to leave an excavation open in order to properly coordinate surveying activities is also a safety concern. This concern is heightened in areas that have pedestrian traffic near construction activities. Adverse weather conditions may also pose additional risk in areas where excavations are left open longer than anticipated, even if it may only be a few additional hours.

2. Difficulties in Coordination

There are challenges associated with properly coordinating the collection of accurate geospatial data during construction. However, these challenges can all be overcome with proper planning and resource allocation. If GUIDE implementation expands, it may be required to take on additional internal utility resources. Otherwise, outside consultants may be necessary for successful implementation of the GUIDE requirements.

In addition, the 2014 GUIDE Pilot was successful in identifying multiple coordination strategies for the successful acquisition of the geospatial data. Each coordination strategy mitigates a specific coordination issue, and most likely, projects in the future will require a combination of different strategies to properly coordinate efforts.

3. Initial Cost

There is an initial cost associated with capturing accurate geospatial data on newly-installed utilities. Utility companies will have their own opinions as to the actual and perceived value of this initial cost. From a roadway agency's perspective, the initial costs will be viewed differently than from the utility companies. The initial cost of data acquisition for each pilot project, will be illustrated later in this report.

4. Data Accuracy

Although the GUIDE requirement's document outlines the accuracy specification as 5cm (0.16 feet) horizontally and 10cm (0.33 feet) vertically, there will be wildly varying accuracy levels on the actual utility below ground. In open-cut installation scenarios, the surveyed accuracy at the surveyed point represents the utility within the same specified level. However, many underground utility installations are installed by HDD, and as a result will have varying positional accuracies between each of the survey observation locations.

Utilities installed by HDD can vary by as much as 1' to 3' between each 100-foot interval survey observation--specifically in urban areas where significant horizontal and vertical movement is required to navigate other utilities. Several variables impact the accuracy of HDD including soil conditions, technology used, experience of staff involved, etc. In addition, even at the actual location where the survey observation was recorded with a depth reading from the drill head, it was noted that the pipe can move several inches vertically within the bore hole before it settles in its final resting position.

Large multi-duct HDD installations could have potentially inaccurate elevation data if the position of the HDD head is not considered. The HDD head, from which the alignment and depth reading is obtained, lies near the center of the multi-duct and depending on the size of the duct, the vertical component could be inaccurate unless the surveyor accounts for ½ the width of the drill when computing the top of the utility.

Regardless of the potential for inaccuracies in elevation, the data being collected under GUIDE is far more accurate than anything that is being collected for utility infrastructure today. However, the concern for variations in vertical accuracy is a valid concern, and becomes critical when we get into discussions on how the data may be used in the future to identify potential utility conflicts in X, Y and Z during the project's design phase.

5. Uniformity of Standards

An important concern is the potential for varying GUIDE-type initiatives among other roadway agencies and the potential for varying standards across the state. If GUIDE has widespread implementation in future years, it will be important for all roadway agencies to adopt a uniform standard for the acquisition and delivery of accurate geospatial data.

One scenario that would have negative economic impact for the utility companies would be to have multiple roadway agencies begin the development and implementation of their own standard. It would be a detriment and work in opposition to the overall intent of GUIDE. The core premise of GUIDE is the overall acquisition, exchange and sharing of the accurate utility data among agencies, utilities, consultants, contractors and other project stakeholders.

This concern is one reason MDOT volunteered to be the roadway agency for the GUIDE Pilot. MDOT felt it was important to establish best practices to help in the development of viable guidelines and to lay the groundwork for a potential statewide geospatial utility exchange program. It's anticipated there could be significant utility resistance if roadway agencies began developing different requirements for their own permitted installations. One of the stated goals is to develop a central utility repository where all utility survey data can be submitted, stored, managed and shared through controlled user access.

6. Data Security & Controlled Access

It is anticipated that there will be significant concern regarding data security and who has controlled access to the data among the utility companies. Data security is a major concern among utility companies. Further discussion will be required to address the concerns of the utility companies around who has access to the collected data and how that access will be controlled and managed.

MDOT addressed data security in the development of the GUIDE mapping portal through its ArcGIS Online mapping service. MDOT manages the site, and has full control over user access and permissions. Using current technology, there are many options for the development of simple, safe and secure online mapping services where the data host agency has full control of user access and permissions.

7. Organizational Change Requirements

The utilities participating in the GUIDE Pilot recognized the value of GUIDE and the value of the data being collected. The companies recognize the value of the data to the roadway agency, however they also recognize that data is being collected on their own utility infrastructure and the value associated with that data. They also realize the value goes beyond the need to simply fulfil a permit requirement, and the important benefits the data will produce long into the future. The data being collected has value to the utility far beyond a current project or installation and in most cases is more accurate than any record information the utility has today. However, they recognize that to fully realize the value of the data within their own organization through records, reconciliation and maintenance will require internal process changes and improvements.

For example, most large utilities maintain a land base that is not geospatially accurate. Their entire records infrastructure is based on this inaccurate land base that doesn't always get updated as parcel lines and right-of-way lines change. The concern introduced with a GUIDE implementation would be the difference between geospatially-accurate data used to plot the precise utility locations on the inaccurate land base. The utility lines will not graphically appear in their correct position relative to right-of-way lines and parcel lines within the land base. Most would argue that absolute positioning is better than showing positioning relative to features that are subject to change, however they recognize that so much of their internal processes depend on their land base, which can be inaccurate.

Simultaneously, this concern could actually prove to be a huge opportunity for the utility companies. This could be the opportunity for the utility companies to resolve the inaccuracies in their land base record system and move to develop a record system better suited for the future since the cost to acquire accurate data has been declining and continues declining as technology develops.

2.4.5 Cost Impact Summary

During the 2014 GUIDE Pilot, each utility company tracked all costs associated with each of their pilot projects. Cost tracking included internal labor effort multiplied by a loaded labor rate unique to each staff classification. In addition, all consultant and contractor costs were tracked as they applied to each of the pilot projects. There were many different variables affecting the overall cost of the GUIDE activities including some of the following:

- Utility installation method
- Coordination strategy
- Proximity of survey staff to job site
- Familiarity with GUIDE requirements by utility and construction staff

GUIDE Activity Cost Breakdown by Project

CONSUMERS ENERGY

1. **M-21 in Shiawassee County:** This project consisted of 1,340' of gas transmission main relocation. 80% of the project was installed by HDD while approximately 20% of the project was installed using open excavation methods.
   - **Utility Type**: Gas

- **Primary Installation Method:** HDD and open cut (80/20)
- **Estimated Construction Cost:** $165,000
- **GUIDE Activity Cost:** $6,700
- **GUIDE Percent of Construction:** 4.06%
- **Cost per linear foot:** $5.00
- **Cost per data point:** $148.90
- **Comments:** 24% of the total GUIDE Cost ($1,610) was internal Consumers Energy coordination labor effort. It is our opinion that after the first few projects are implemented, the internal coordination efforts will diminish to only around $200-$300 per project, bringing the cost of GUIDE activities on this project down to approximately 3 % of construction. Significant additional time was spent on internal coordination, educating utility staff as well as the contractor on GUIDE and each person's expectations.

2. **M-43 Eaton County:** This project consisted of 4,398' of installation of an 8 " steel high-pressure gas main and 19' of 1 " steel high pressure gas main installation.
   - **Utility Type**: Gas
   - **Primary Installation Method:** Open cut
   - **Estimated Construction Cost:** $1,110,000
   - **GUIDE Activity Cost:** $10,254[3]
   - **GUIDE Percent of Construction:** 0.92% (0.70% using reduced costs, see footnote 4)
   - **Cost per linear foot:** $1.75 ($1.47 using reduced costs, see footnote 4)
   - **Cost per data point:** $87.49
   - **Comments:** The relative cost of GUIDE related activities for this project are more realistic and in line with what is expected as construction costs and project scale increases. As expected, there appears to be economy of scale. As project cost and size increases, the relative cost of the GUIDE related activities decreases. This project may have revealed that it is less costly on larger projects to expose the utility after installation by means of vacuum excavation. Those involved expected this method of coordinating the surveying activities to be the most costly. However when a project is large enough to take advantage of a vacuum excavation crew for an entire day or more it appears it may significantly reduce the surveying effort required. For this project the surveying effort was reduce to two days on site, since the surveyor could come in after the utility had been exposed.

3. **M-20 in Isabella County:** This project consisted of 4,021 ' of installation of 6 " plastic medium-pressure gas main and 70 ' of 2 " plastic medium-pressure gas service.
   - **Utility Type:** Gas
   - **Primary Installation Method:** Open Cut

[3] Consumers Energy reported significantly higher internal coordination and oversight hours than the other two utilities, increasing the actual costs required to collected the by approximately 16%. In addition, based on an evaluation of the consultant hours reported, it is Spicer Group's opinion that excessive consultant data processing time was reported. Overall, in review of the hours reported, it is Spicer Group's opinion that the overall costs of this project were reported 25% higher than what should be typically required.

- **Estimated Construction Cost:** $396,000
- **GUIDE Activity Cost:** $11,044[4]
- **GUIDE Percent of Construction:** 2.80% (2.13% using reduced costs, see footnote 5)
- **Cost per linear foot:** $2.16 ($1.73 using reduced costs, see footnote 5)
- **Cost per data point:** $112.70
- **Comments:** Similar to the M-21 project, it is Spicer Group's opinion that after the first few projects are implemented, the internal coordination efforts will diminish significantly to only around $200-$300 per project, bringing the cost of GUIDE activities down to approximately 2 % of construction. Significant additional time was spent on these early projects on internal coordination and educating the involved staff and the contractor on GUIDE and each person's expectations.

AT&T

1. **M-61 in Gladwin County:** This project consisted of 2 miles of 1.25" HDPE (fiber optic) installation.
   - **Utility Type:** Fiber optic
   - **Primary Installation Method:** HDD
   - **Estimated Construction Cost:** $491,722
   - **GUIDE Activity Cost:** $4,098
   - **GUIDE Percent of Construction:** 0.83%
   - **Cost per linear foot:** $0.39
   - **Cost per data point:** $23.55
   - **Comments:** This project better represents the actual costs on a typical project scale and also demonstrates the economy in scale involved with an effort such as GUIDE.

2. **M-17 in Washtenaw County:** This project consisted of 125'of 1.25" HDPE (fiber optic) installation along M-17 in Washtenaw County.
   - **Primary Installation Method:** HDD
   - **Estimated Construction Cost**: $22,237
   - **GUIDE Activity Cost:** $935
   - **GUIDE Percent of Construction**: 4.20%
   - **Cost per linear foot:** $7.48
   - **Cost per data point:** $58.41
   - **Comments:** This project was a small project, therefore the costs are difficult to correlate to other projects over wider GUIDE implementation. However, Spicer Group fully expects significant economy in scale as is evidenced by the M-61 project for AT&T, where additional costs per linear foot are around $0.39.

[4] Based on an evaluation of the consultant hours reported, it is our opinion that excessive consultant data processing time was reported. Overall, in review of the hours reported, it is our opinion that the overall costs of this project were reported 19% higher than what would be required.

DTE ENERGY

1. **M-5 (Grand River Avenue) in Wayne County:** This project consisted of 2.96 miles (30,000 linear feet of pipe) of gas main renewal, where 3" and 4" gas mains are being inserted into existing 6" cast iron mains.[5]
   - **Primary Installation Method:** Insertion
   - **Estimated Construction Cost:** N/A[6]
   - **GUIDE Activity Cost:** $8,318
   - **GUIDE Percent of Construction:** N/A
   - **Cost per linear foot:** $0.64
   - **Cost per data point:** $39.61
   - **Comments:** This project represents actual GUIDE costs very well where proximity of survey staff to the project site is not factor. Efforts were coordinated during construction and minimal travel time was required to fulfill the GUIDE requirements.

2. **M-85 (Fort Street) at Gibraltar Street in Wayne County:** This project consisted of 100'of high-pressure gas main relocation.
   - **Primary Installation Method:** Jack and bore
   - **Estimated Construction Cost:** N/A[7]
   - **GUIDE Activity Cost:** $3,197
   - **GUIDE Percent of Construction:** N/A
   - **Cost per linear foot:** $31.97
   - **Cost per data point:** $245.90
   - **Comments:** This project was a small project, therefore the costs are difficult to correlate to other projects over wider GUIDE implementation. However, we fully expect significant economy in scale as is evidenced by the Grand River Avenue project for DTE Energy, where additional costs per linear foot are around $0.64.

2.5 OVERALL COST BENEFIT

Based on evidence presented in this report, and feedback provided by all parties involved, it is evident there will be significant long-term cost benefits realized from GUIDE implementation. Just how much of a return on investment (ROI) will be realized is incredibly difficult to quantify. One way we can support the ROI claims of GUIDE is to reference two comprehensive studies on the cost benefits associated with Subsurface Utility Engineering (SUE). One study was commissioned by the Federal Highway Administration completed by Purdue University titled "*Cost Savings on Highway Project Utilizing Subsurface Utility Engineering*" (Purdue University Department of Building Construction Management, 1999). Another similar study of the utilization of SUE was prepared by the University of Toronto titled "*Evaluating the use of Subsurface Utility Engineering in Canada*" (Osman & El-Diraby, 2006).

[5] Approximately 13,000 linear feet of pipe was included in the GUIDE project. The remainder of the project was constructed after GUIDE data collection activities were halted on November 10, 2014.

[6] DTE Energy did not provide estimated construction cost information

[7] DTE Energy did not provide estimated construction cost information

The University of Purdue study indicates an overall savings of $4.62 for every $1.00 spent on SUE as a quantifiable savings based on a total of 71 projects that were studied from four states. Similarly, the University of Toronto study indicates a quantifiable savings in the range of $2.05 to $6.59 for every $1.00 spent on SUE after careful study of nine construction projects of varying scope. Two independent studies conducted approximately seven years apart came to similar conclusions about the quantifiable cost savings of SUE.

The University of Ontario study reported that SUE cost in the range of 0.2% to 3.5% or an average of 1.6% of construction for the nine projects studied. The Purdue University study reported that obtaining Quality Level A (QL-A) and Quality Level B (QL-B) data on the 71 projects studied resulted in an average cost of 0.5% of the total construction costs, resulting in a construction savings of 1.9% on average for the71 projects studied.

Similarly, we have concluded from the 2014 GUIDE Pilot project that GUIDE activities cost in the range of 0.75% to 2% of estimated construction costs for the seven projects piloted.

Implementation of a GUIDE program is effectively capturing SUE QL-A and B level data at the time of utility installation. Therefore one could argue that the value of GUIDE is greater than obtaining SUE data at the design phase due to several key differences, noted below:

1. GUIDE data is being captured at the earliest time possible (at installation), therefore accurate geospatial information on the utility infrastructure has a greater opportunity to realize ROI over the life of that utility, and conversely SUE level data would be acquired during the design phase and only within the project limits of a particular project.

2. GUIDE data would be a requirement of the roadway agency, however it is being captured by the utility company. Therefore the utility company has the opportunity to utilize the same data within its own business process to improve records. On the other hand, SUE data collection is initiated at the design level by the roadway agency and is used singularly for the design of a given project.

3. GUIDE data is being captured, stored, managed and shared to all project stakeholders for future and continual use. SUE data collection is initiated at the design level by the roadway agency and is used singularly for the design of a given project, and is likely not stored or uploaded to a central GIS repository for future and continual use.

4. It could be argued that data collected under the GUIDE initiative is more accurate and complete than data acquired during SUE activities. Since the utility is being surveyed during installation, there is a high probability that all horizontal and vertical (significant) changes in geometry are being captured. Conversely, even during SUE QL-A activities where the utility is being exposed, there is a high probability that horizontal and vertical changes in geometry are being missed since the utility is only being exposed at certain intervals or predetermined locations.

Above are four very key differences in data collected during a GUIDE initiative versus data collected during SUE activities. All of these indicate greater opportunity for continual use of the data being collected, further supporting the ROI of GUIDE. GUIDE has the opportunity to provide continual ROI, where SUE typically results in ROI only for a particular project.

2.5.1 Conclusion

Based on the seven pilot projects involved in GUIDE we have narrowed down the expectation of the initial costs on a per-project basis of implementing GUIDE on a large scale. It can be expected that the initial cost of GUIDE is expected to be in the 0.75% to 2% range of estimated construction costs depending on the type of facility being installed and the type of installation methods employed[8]. The initial GUIDE efforts employed by utilities may include additional internal support and initially coordination time as the utility companies work to implement GUIDE activities. However, this effort should diminish quickly as internal personnel become familiar with GUIDE and staff build GUIDE expectations into their current workflow.

[8] Only those costs associated with implementing GUIDE on each pilot project were tracked. Spicer Group has not evaluated how GUIDE may affect internal business processes, records reconciliation or documentation, if utility companies choose to use the data collected to support their internal records updating or other business processes.

3 Future of GUIDE

Spicer Group has identified several recommendations for the next step in the GUIDE implementation. Although it is clear that GUIDE is not ready for widespread implementation, it is recommended that a strategic implementation plan be developed. Spicer Group's recommendation includes staged implementation over the next five years according to the following plan.

Stage 1 (2015-2016) – The MUCC should continue to work with MDOT as the lead agency to further refine the requirements documents from the 2014 GUIDE Pilot's lessons learned and best practices. The requirements documents should include all utility types, as if a statewide implementation were to take place. Create additional informative literature which clearly explains and illustrates the GUIDE requirements.

Stage 2 (2016-2017) – Using the revised and newly created documents from Stage I, move from a pilot to a "proof of program" implementation. Consider implementing GUIDE within an entire MDOT Transportation Service Center boundary. Also implement GUIDE on several MDOT construction projects. Consider having a few larger municipalities participate during the same period.

Stage 3 (2017-2018) – Implement GUIDE within an entire MDOT region, however include all construction projects within that region in the GUIDE program. This pilot year would provide for a valid test of the viability of implementing GUIDE across all new construction projects where all exposed utilities could be actively surveyed and included in the central GIS repository.

Stage 4 (2018-2019) – Include full GUIDE implementation across all MDOT regions for all underground permitted utility installations and all underground utilities on new construction projects.

Stage 5 (2019-2020) – Continue with full implementation across all MDOT regions and include any participating municipalities, road commissions, or other roadway agencies where underground utilities are installed.

The above recommendation is simply based on Spicer Group's opinion having witnessed the complexities of a program like GUIDE, and the many consideration involved in the broader implementation of such program.

3.1 CONSIDERATIONS FOR THE FUTURE

During the GUIDE Pilot Spicer Group discovered several key items in the current GUIDE requirements document that need to be addressed along with several key areas that must be addressed for successful GUIDE implementation going forward.

Before GUIDE moves forward into broader implementation, a look at the scale of such a program as it relates to MDOT is warranted. MDOT queried its permit database for calendar year 2013 permitted utility installations. The permitted utility type installations where the GUIDE requirements would apply have been evaluated. Figure 15 depicts a summary of those permitted installations for calendar year 2013 by utility applicants. Figure 16 depicts a summary of those permitted utility installations for calendar year 2013 by governmental agencies.

Utility Company	Number of Permits	% of Total
Consumers Energy	114	10%
DTE Companies	101	9%
AT&T	322	29%
All others	559	51%
Total Permits in 2013	**1096**	100%

Figure 15: GUIDE Applicable Utility Permits for Calendar Year 2013 by Utility Companies

Utility Type	Number of Permits	% of Total
Watermain	42	41%
Sanitary Sewer	34	33%
Storm Sewer	10	10%
Communication or Electric	16	16%
Total Permits in 2013	**102**	100%

Figure 16: GUIDE Applicable Permits for Calendar Year 2013 by Governmental Agencies and Utility Type

If 2013 was a typical year for permitted utility installations, MDOT GUIDE alone would impact approximately 1,198 utility installation projects annually. These permitted facilities vary significantly in size and complexity.

In order to support a program at this scale, several critical items, as noted below, would need to be addressed before a broader implementation of GUIDE should be considered.

3.1.1 GUIDE Requirements Document Improvement

The GUIDE requirements document will need attention to address the following items as a way to support broader GUIDE implementation.

1. Data Format and Structure

Spicer Group recommends removing the option for multiple data formats for the data being collected. It is recommended to require a 3-dimensional shapefile as the only option for data submittal, with explicit detail developed relating to the attribution requirements, attribute field naming, and available attribute options for each field. It is imperative that files received are complete and follow the appropriate data structure otherwise it will create unnecessary complications and additional burden for the data manager. It is recommended that MDOT develop and provide a sample 3-dimensional shapefile for each utility feature class that will be included in GUIDE.

2. Update Requirements to Include Other Utility Types

It will need to be determined what other utility types will be included in a broader GUIDE program, and explicit detail will need to be provided on the expectation of what will be required for other

utilities, similar to how it was developed for gas, electric and communication. For example, if water main is included, will all services be required to be included or only those of a certain size?

3. Update Data Attributing Libraries

The geodatabase schema will need to be updated to include the attribution requirements for other utility types. Input would be required from other industry professionals and utility companies to identify the different attribution that may apply to other utility types, such as material types, installation methods, material sizes and anything else that may apply to other utilities not part of the 2014 GUIDE Pilot.

3.1.2 Data Management

For broader GUIDE implementation, a central data repository, hosted by MDOT or some other road agency, needs to be developed. Initially, if GUIDE proceeds only with MDOT, then MDOT will need to determine what interface will be used for the storing and sharing of the data, and develop the central repository. MDOT will need to develop the required interface, setup user access, address utility security concerns, and implement a process for receiving, checking and uploading data files received.

Ultimately, if GUIDE expands beyond MDOT, discussions need to take place on where the data should be stored and maintained. Would every roadway agency house and maintain the geospatial data for the roadways under their jurisdiction? Some GUIDE committee members mentioned a possible option may be to have MISS DIG Systems be the organization that receives, stores and maintains the geospatial utility infrastructure data collected statewide. There will be many considerations before taking GUIDE to this level, such as:

1. Will MISS DIG Systems take on this responsibility?
2. How will MISS DIG support the IT infrastructure and staffing resources required to support the data being collected?
3. Will member fees have to be increased to support the required infrastructure needed to support broad GUIDE implementation?

All of these are valid questions that will need to be addressed in the future.

3.1.3 GUIDE Process Improvement

Once the data repository infrastructure and interface is developed, a defined process will need to be developed for utility companies to submit their data files. The process must include the initial receiving of the data, some level of QA/QC, a process for returning incomplete files and then receiving those revised files back for another round of QA/QC. Once the files pass the QA/QC stage and have been accepted for inclusion in the central data repository, they will need to be uploaded to the system.

Spicer Group recommendation is that this process be tied into the online permit system already being used for MDOT permits. Once the project is complete, the utility company could log onto the permit system and close out the permit by uploading the data files that will be required as a condition of the permit. Once the file is accepted by MDOT, the permit could be closed. This is simply one suggestion, and further discussion is warranted on how it should be handled, however it will be a critical item for broader efficient implementation of GUIDE.

3.1.4 Intended Use

There were concerns among the utility companies relating to the intended use of the data being acquired for GUIDE. There were concerns, that designers in the future would simply use the available 3-dimensional utility information during their design phase, without consideration of all of the variables that may impact the accuracy of the data. Accuracy may be a concern as there may be end users that expect the utility in the ground that is represented with 3-dimensional data is as accurate as the spatial accuracy requirements of GUIDE. As a result, there is concern that a utility may be held liable for a utility conflict that was caused as a result of a designer not using this data appropriately. Should utility companies be held harmless for future conflicts resulting from misuse of GUIDE data? This is a valid concern and should be addressed before broader GUIDE implementation.

Our recommendation is for MDOT to develop a guidance document for consultants and designers for best practices when using GUIDE data to identify proposed utility conflicts through clash detection methodologies. The document should develop guidance on acceptable buffer zones that should be applied to utility data when attempting to identify conflicts. Significant thought should go into this document since there are many different scenarios that could be used. For example, an acceptable buffer zone around a gas main that was installed by open cut techniques may be significantly smaller than a buffer zone used around a gas main that was installed by HDD. An open cut installation should have a more accurate 3D position since it was directly observed, whereas a utility installed by HDD could have significant variations between where the actual survey observations were collected.

In addition, it's recommended that when a user, through granted user access, logs into the central GIS repository to view and download GUIDE data to use, they accept a set of user conditions that limit any future liability of the utility companies as a result of using the data. This could be similar to how MDOT currently make users of reference information documents (RID) for construction projects accept that the information being provided is for reference only and is being used solely at the risk of the user.

3.1.5 Accuracy

The resultant accuracy of the underground utility was brought up as a valid concern by the utility companies. Mainly as it relates to HDD, it was noted that there can be significant variation in the 3-dimensional location of a pipe or communication duct that is installed by HDD. With survey observations being recorded generally every 100' along a HDD utility, the variation in position between each survey observation is not being recorded, and the resultant 3-dimensional utility location as surveyed could be significantly different underground than it may look when the survey observations are collected. The GUIDE committee recognizes this, however this potential for inaccuracy is what needs to drive the intended use guidance document discussed above. There are many factors that could affect how much the utility varies between observations, such as soil conditions, installation method, and utility size, bore head location relative to the actual top of pipe or size of conduit duct. It's recommended that this is addressed in the user waiver of liability process to convey the understanding that no matter how accurate the survey observations are, there could be significant variation in position between those observations.

3.1.6 Safety

Safety of field personnel was brought up as a potential concern among the utility companies. Additional consideration needs to be made to ensure GUIDE is not placing field personnel at risk. Based Spicer Group's observation, GUIDE is not requiring anything beyond what is done by surveyors' everyday through typical surveying operations on construction projects. There are risks involved, specifically when working around live gas mains. However, there are simple precautions that can be taken to mitigate that risk. Education and training will help inform personnel about the dangers involved when working around high-risk utilities and provide information about proper field equipment and procedures to mitigate the potential risk.

3.1.7 Training

In order to support broader GUIDE implementation, industry-wide training will be required. GUIDE has the potential to impact many more utility companies than just DTE, Consumers Energy and AT&T, therefore industry wide-training about GUIDE will be imperative. Spicer Group recommends the implementation of training sessions, webinars, and soliciting industry engagement through industry organization that represent all impacted parties, such as MITA, MDOT, CRA, MUCC, MOGA, MML, MACDC, ACEC, and ASCE.

3.1.8 Data Security

The entire concept of GUIDE revolves around the idea of data exchange or sharing of the geospatial utility data, therefore users outside of each utility organization will have access to the data being collected. How that access is controlled and managed will require further discussions to address the concerns of the utility companies.

Spicer Group believes that GUIDE could actually improve data security and help mitigate data security concerns among utilities. The same concerns must exist now within utility companies as utility data is being emailed, and mailed to users across the state based on current utility requests. GUIDE could ultimately eliminate the unsecure emailing and mailing of utility plan information since the information will be electronic and hosted through a secure web interface where only those users that have been granted proper user access credentials will be able to view and download.

3.1.9 Statewide Standardization

Statewide standardization is critical to a broader GUIDE implementation and the long-term success of the project. As GUIDE expands beyond MDOT, and other roadway agencies begin requiring accurate geospatial data on utilities installed in their right-of-way, the other agencies must standardize the GUDIE process, data format and structure requirements. It will create an undue burden on utility companies if other roadway agencies begin requiring geospatial data be collected on utilities installed in their right-of-way and they begin to develop their own standards and requirements. If this happens, then companies will have to comply with multiple data standards and processes across the state.

Currently, GUIDE is being piloted by MDOT and could possibly be implemented by adding GUIDE to the permit fulfillment requirements of each utility permit. There is real potential of having other agencies begin to require it as well. If other agencies begin requiring GUIDE-type data acquisition before the overall process is properly vetted by MDOT, it will likely be detrimental to the entire GUIDE implementation process and create a significant burden on the utility companies.

Spicer Group recommends that all roadway agencies continue to let MDOT properly vet the GUIDE process, refine the standards and develop the plan for broader GUIDE implementation before attempting to require utility companies begin providing this information.

Spicer Group believes the only certain way to avoid this scenario and begin to develop and standardize GUIDE requirements would be to recommend a legislative change that mandates anyone requiring the geospatial data collection of utility installations within their right-of-way to follow the established standards as defined by GUIDE.

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Appendix A – Acronyms

GUIDE – Geospatial Utility Infrastructure Data Exchange

OPUS – Online Positioning User System

RTK – Real Time Kinematic

CORS – Continuously Operating Reference Station

GNSS – Global Navigation Satellite System

OSHA – Occupational Safety and Health Administration

MiOSHA – Michigan Occupational Safety and Health Administration

MUCC – Michigan Utility Coordination Committee

FHWA – Federal Highway Administration

MI-STIC – Michigan State Transportation Innovation Council

MITA – Michigan Infrastructure and Transportation Association

MDOT – Michigan Department of Transportation

SUE – Subsurface Utility Engineering

TSC – Transportation Service Center

ITS – Intelligent Transportation System

QAQC – Quality Assurance Quality Control

RID - Reference Information Documents

CRA – County Road Association of Michigan

MOGA – Michigan Oil and Gas Association

GIS – Geographic Information System

FTE – Full Time Equivalent

NGS – National Geodetic Survey

HDD – Horizontal Directional Drilling

Appendix B – List of Figures

Appendix C – GUIDE Requirements Document

Appendix C – Draft Requirements Document
PILOT PROJECT
Michigan Utility Coordination Committee (MUCC)
Geospatial Utility Infrastructure Data Exchange (GUIDE)

The geospatial data requirements for the 2014 pilot projects, completed by AT&T, Consumers Energy and DTE, will capture and present location identification information for permitted underground facility installations placed within the MDOT right-of-way.

Required Observations
Northing (MISPC International Feet), Easting (MISPC International Feet), and Elevation (NAVD 88 Datum, International Feet) from the top of the pipe. The values reported for actual observations must be collected relative to survey grade accuracy [Horizontal 5cm (0.16 feet) and Vertical 10cm (0.33 feet)].

- Transmission/distribution main lines
    - Starting and ending points
    - Every 100 feet with the following additional points:
        - Deviation(s) in installation alignment (horizontal and vertical)
        - Changes in facility characteristics (e.g. change if size, material, or number of pair)
        - Start and end points for vaults

    Note: For multi-duct installations, observations shall be taken from the top center of the duct bank.

- Appurtenances* installed concurrently with new main installations
    - Tap-in at main and ROW line points
- New appurtenances* from existing mains
    - Tap-in at main and ROW line points for:
        - Gas - 2 inches and greater
        - Telephone - Fiber or copper cables 25 pair and greater
        - Electric - Secondary and higher voltage lines

Note: Directional drilling requires the actual observations at the starting and ending points as well as enough intermediate points to provide elevation curve data. Intermediate points not directly accessible for observation shall be derived from actual ground elevation minus boring head depth readout.

Note: Facilities installed inside an existing conduit will have the installation method identified as “insertion”. The required observations will be dependent on the existing conduit’s location relative to the existing roadway infrastructure.

*Appurtenances, with respect to this pilot, are defined as service leads and stubs.

File Specifications
The utility file is acceptable in these formats: .xls, .xlsx, .shp, .gdb, .txt, or .csv.

The utility file will contain the following attributes:

Required Attributes and Column Headers	
Required Attribute	**Column Header**
Utility Company	UtilComp
MDOT Permit Number	MDOTPerNum
Installation Method	InstMethod
Professional Surveyor License Number	LicenseNum
Collected By	CollectBy
Method of Locatable	MethOfLoc
Point Number	PointNum
Michigan State Plane Zone	MISPCZone
Northing (ift)	Northing
Easting (ift)	Easting
Elevation	Elevation
Calculated Elevation	CalcElev
Feature Type	FeatType
Segment Number	SegmentNum
Unique Segment Number	USegNum
Sort	Sort
Installation Year	InstYear
Material	Material
Diameter	Diameter
Notes**	Notes

Note: The database header has a 10 character limit; therefore column headers need to be truncated according to the table. Utilization of the provided data container files is recommended.

** The Notes field is reserved for the utility's use with no specification to what is included. The Notes field may be left empty if desired.

Line Connectivity

Line connectivity is required in the utility file. The most important fields in achieving line connectivity are the SegmentNum and Sort fields.

The SegmentNum field is used to show the points associated with a particular line. If the file has points that make up two separate lines, every point that is a part of the first line would have a "1" in this field and every point that is a part of the second line would have a "2".

The Sort field tells the database what order the points connect in, so the first point in the line would have a "1" in this field, the second would have a "2", etc. The first point of each line always starts with a "1".

The USegNum field is used for data management purposes to ensure that only one instance of a particular segment occurs in the database. The field concatenates the MDOTPerNum field with the SegmentNum field.

Installation Method
Directional Drilling
Open Cut
Plowed
Insertion

Method of Being Locatable
Tracer Wire
Marker Ball
Radio Frequency Identification (RFID)
Facility

Feature Type Codes	
Line Codes	**Description**
Natural Gas	
GAST	Natural Gas Transmission

GASD	Natural Gas Distribution
GASS	Natural Gas Service
Electric	
ELD	Electric Distribution
ELS	Electric Service
ELV	Electric Vault
Telecommunications	
TEL	Telecommunications Line
TELS	Telecommunications Service
TELV	Telecommunications Vault
TELDB	Telecommunication Duct Bank

Material
Fiber Optic
Copper Cable
Steel
PVC
Plastic
Aluminum Cable

Appendix D – MUCC Goals

Appendix D – MUCC Goals
Grouping of Goals/Purpose discussed during the Nov 7th, 2007 MDOT/Industry Design Task Force – Utility Subgroup

1. **Improve knowledge of each other's business**
    a. Gain a better understanding of each others businesses
    b. Develop a better understanding of each others affects on projects
    c. Find areas of common work to reduce overall costs
    d. Gain a better understanding of when to have a contractor bid utility work and in turn billing the utility for that work
    e. Educate road/bridge designers what is needed for utility design
    f. Minimize conflicts between the contractors and utilities work schedules
    g. Develop an understanding for how long certain utility items of work (i.e. splicing of fiber optic cable) can take

2. **Improve Coordination**
    a. Create open lines of communication between owner agencies, designers, utility companies, and contractors
    b. Reduce cost by increasing coordination for utilities, contractors, and agencies
    c. Determine when utility coordination should begin in the design process
    d. How to effectively coordinate contractors and utility resources
    e. Ensure utilities have sufficient lead time to relocate
    f. Ways to ensure utilities can be designed around if possible
    g. Identify the utility company's "responsible in charge" contact person
    h. Improve utility coordination by gathering better information
    i. Improve utility coordination for local agency projects
    j. Work with local agencies to improve timing and scheduling problems

3. **Construction improvements**
    a. Reduce delays and cost associated with utility conflicts
    b. Reduce field changes due to utility conflicts
    c. Create a pathway for designers to contact contractors regarding constructability issues with surrounding utility facilities

4. **Locating/Identifying existing utilities**
    a. Ways to improve accuracy for designers and utility companies
    b. Need to improve the accuracy of underground utility information shown on plans
    c. Improve reliability of where the utility is located
    d. Increase use of equipment to accurately locate existing facilities (i.e. ground penetrating radar and vacuum excavation)
    e. Determine the correct level of accurate information in the contract documents. (i.e. when to use Subsurface Utility Engineering (SUE))
    f. Discuss the placement of GPS coordinates on all new utility installations

5. **Design Standards**
    a. Develop standards for installing utilities

6. **Regulations**
    a. Investigate Wisconsin's Trans 220 requirement

Appendix E – MUCC Meeting Minutes

Appendix E – MUCC Meeting Minutes

Michigan Utility Coordination Committee
February 4, 2013
9:00 am
MITA Office

Anjanette Lee, Mick Blunden, Ryan Akers,
Pat Fenech, Adolfo Castillo – Detroit Edison
Dirk Dunham – Consumers Energy
Mark Loch – OHM
Craig Fons – Fonson
Nick Lefke– MDOT
Doug Strauss - Benesch
Doug Needham – MITA

1. 5th Annual MUCC Review
    a. 171 participants with the following breakdown:
        i. 41% Utility companies
        ii. 32% MDOT and Local Units of Government
        iii. 9% Contractors
        iv. 18% Designers/Consultants
    b. Received a number of positive comments regarding the Utility Perspective.
    c. Suggestions for next years conference:
        i. Break-out options
        ii. Group table exercise
        iii. Designer/MDOT Perspective
        iv. Railroad Involvement
        v. Allow more time for audience participation/questions
    d. Presentations from the 5th Annual MUCC can be located at the following link: http://www.mi-ita.com/Engineering/MichiganUtilityCoordinationConference.aspx

2. GPS Technology Concerns in Damage Prevention
    a. Consumers Energy gave a brief summary of "Considerations in the Use of GPS Technology for Damage Prevention" originally presented Dec 5, 2012 by W.R. (Bill) Byrd, P.E. – President of RCP
    b. The presentation highlighted on the importance of a common datum.
    c. Also, the accuracy of GPS is irrelevant unless known datum and nomenclature are used (i.e. degree/minutes/seconds vs. decimal degrees)
    d. MDOT utilizes a uniform datum and has stations across the state (State Plan Coordinate System).
    e. It was determined that more information should be discussed during our next meeting.
    f. It was suggested that this committee could lead the development of a "Best Practices" for utility mapping.
    g. MDOT will internally discuss the possibility of taking the lead to develop a GPS standard for new permitted utility installations.

3. ASCE New Committee to Develop Standards for Mapping Utility Lines
    a. The Construction Institute is establishing a new committee that will formulate a nonmandatory standard for mapping and documenting newly installed utility infrastructure and related appurtenances at or below grade.

b. The work of this new committee, the Standards Committee for Utility "As-Built" Data, will complement the ASCE standard 38-02 (Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data).
c. The MUCC committee has recently developed the "Utility Initial Submittal Requirements" and feels that this would be a good reference document for the newly formed ASCE committee.
d. Brenke will investigate the details and requirements of the proposed committee.
e. It was suggested that a representative from the MUCC participate in this new committee.

4. Expanded Utility Depth Study
    a. Information about a utility cable and pipe locator (RD 7000+) was distributed and discussed. The manufacturer states (in good conditions) the depth accuracy is +/-5% for 4" to 10' for a location using line locating and +/-5 % for 4" to 23' for locating using Sonde locating.
    b. It was mentioned that the 2012 Utility Depth study utilized the RD 8000 locators.
    c. After considerable amount of discussion, MDOT mentioned that they were not willing to further the advancement of this study by either placing in an upcoming project or submit for research funding.
    d. The utility companies are still concerned with providing an estimated depth even with disclaimers.
    e. MITA will continue to discuss with various owner agencies, designers, and utility companies to determine if there is a path for future pilot projects during the 2013 construction season.

5. Light Poles on Bridge Decks
    a. DTE mentioned MDOT bridge projects, involving railing and/or fencing installations sometimes prevent access to hand holes as well as complicating light pole inspection. DTE was wondering if there was a standard bridge railing detail that could be modified to allow for continued access to their poles.
    b. MDOT mentioned there are numerous bridge railing/fencing details to fit the many types of existing bridges. Modifying these to include all the various types of bridge lighting situations would be challenging.
    c. To address current access issues, it was suggested to contact the TSC. To address future projects, it was suggested to discuss during plan review utility coordination meetings.

6. Next Meeting
    a. The next meeting is scheduled for May 6. 2013 at 9:00am at the MITA Building.

Appendix E – MUCC Meeting Minutes

Michigan Utility Coordination Committee
May 6, 2013
9:00 am
MITA Office

Erik Smith, Adolfo Castillo – Detroit Edison
Dirk Dunham – Consumers Energy
Mark Loch – OHM
Craig Fons – Fonson
Nick Lefke– MDOT
Al Dionese – AT&T
John LaMacchia II – MML
Bryan Rewa – Anlaan
Bruce Campbell - MISSDIG
Doug Needham – MITA

1. DRAFT - Geospatial Data Collection Requirements for Permitted Utility Installations
    a. A DRAFT version of the "Geospatial Data Collection Requirements for Permitted Utility Installations Performed within the MDOT ROW" was distributed and discussed.
    b. Topics discussed were:
        i. Elevation verses depth requirements
        ii. Desired level of accuracy for x, y and z
        iii. Reference State Plane Coordinates
        iv. Applicable to new permitted installations but need a way to capture existing utilities during construction projects that expose facilities.
    c. It is anticipated that a final DRAFT document will be developed by November 2013 and be discussed during the 2014 MUCC Conference.
    d. A subcommittee was formed to further develop the concepts defined in the DRAFT document. Subcommittee volunteers - MDOT, AT&T, Consumers Energy, Detroit Edison, MISSDIG, and MITA
    e. MDOT will coordinate the scheduling of the subcommittee meeting.

2. SHRP 2 Report S2-R15B-RW-1: Identification of Utility Conflicts and Solutions
    a. The SHRP 2 Report has been discussed in great detail during previous MUCC meetings. It was reported that the Utility Conflict Matrix is finally published and is currently at the following location http://onlinepubs.trb.org/onlinepubs/shrp2/R15BTrainingMaterials/UtilityConflictMatrix.xls or by following the link contained the final report for SHRP 2 R15-B titled "Identification of Utility Conflicts and Solutions" http://www.trb.org/Main/Blurbs/166731.aspx and clicking on the link titled "training materials".
    b. MDOT distributed the Utility Conflict Matrix to MDOT TSC Utility Coordinators and ACEC for their reference and use. This recently released matrix is an excellent tool that was designed to help State DOTs in their efforts to improve the handling and documentation of utility conflicts.

3. VA DOT/PHMSA Vertical/Horizontal Utility Location Grant
    a. MISS DIG presented possible grant opportunities to assist with the development of locatable requirements for various utility facilities along with unique opportunities for pipeline safety matters.

b. The PHMSA's Technical Assistance Grants (TAG) program was discussed in detail. This grant offers new opportunities to strengthen the depth and quality of public participation in pipeline safety matters. TAG program awards enable communities and groups of individuals to obtain funding for technical assistance in the form of engineering or other scientific analysis of pipeline safety issues and helps promote public participation in official proceedings.
c. The deadline for applications for the PHMSA grant is March 2014. It was decided to apply for this grant once the final DRAFT Geospatial Data Collection Requirements for Permitted Utility Installations is completed.

4. ASCE New Committee to Develop Standards for Mapping Utility Lines
    a. ACEC is continuing to investigate the details and requirements of the proposed committee. No future details were reported during this meeting.

5. Other
    a. AT&T is restructuring and will be dedicating an individual to be the one point of contact for all road construction projects. It is anticipated that this individual will be attending future MUCC meetings.

6. Next Meeting
    a. MITA will schedule the next meeting in July/August.

Appendix F – FHWA Mi-STIC Approval Package

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **ACTION**: MI – FY14 STIC Incentive Program

Date: February 25, 2014

From: Mary Huie /*original signed by*/
Program Coordinator,
Center for Accelerating Innovation

Reply to
Attn. of: CAI

To: Russell L. Jorgenson
Division Administrator
Lansing, MI

Per your request on February 25th, the allocation of $50,000 in STIC Incentive is hereby made for development of a comprehensive report on MDOT's pilot application of Geospatial Utility Infrastructure Data Exchange (GUIDE). The report will document the effort to collect and maintain geospatial data (w, y and z coordinates) for underground utility locations on MDOT Right-of-Way. This report is in support of MDOT's decision to require geospatial data as a standard condition for all utilities located on MDOT ROW via permit.

In accordance to the program guidance, a progress report on the project is due every 6 months followed with a final report when the projects are completed.

This memorandum authorizes the Michigan Division to obligate FY 2014 funding from program code M37B (Delphi Code 15X0445060) up to the allocated amount of $50,000. The STIC Incentive fund includes a 100 percent obligation limitation. This allocation and the accompanying obligation authority are available only for the specific projects listed above.

By copy of this memorandum, we request that the Finance Division - FMIS Team of the Office of the Chief Financial Officer process this allocation.

Cc: FMIS Team
Ted Burch
Hari Kalla
Michael Rosenstiehl
Ewa Flom

RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

KIRK T. STEUDLE
DIRECTOR

February 24, 2014

Mr. Theodore Burch
Assistant Division Administrator
Federal Highway Administration
315 West Allegan Street, Room 201
Lansing, Michigan 48933

Dear Mr. Burch:

The Michigan Department of Transportation (MDOT) is formally submitting the enclosed application for Michigan State Transportation Innovation Council (MI-STIC) incentive funding. MDOT's Geospatial Utility Infrastructure Data Exchange proposal involves an innovative pilot project that accurately captures utility location information at the time of installation. The requested MI-STIC funding will provide assistance in documenting this pilot project.

If you have questions regarding this information, please contact me at 517-241-3998.

Sincerely,

Mark Van Port Fleet
Deputy Chief Engineer
Director – Bureau of Development

Enclosure

MVPF:NL:kar

cc: K. Steudle
G. Johnson
M. DeLong
R. Whaley
N. Lefke

STIC Incentive Application

Michigan Department of Transportation (MDOT) **January 29, 2014**

General Information: The Michigan Utility Coordination Committee (MUCC) initiated a pilot project in 2013. The pilot project's goal is to collaborate and develop a concept and requirements which outline the way utilities will need to capture, present, analyze, and manage "As-Built" geospatial data identifying the location of permitted underground facilities placed within the MDOT Right-of-Way. Obtaining accurate utility information is essential for transportation infrastructure projects. Collecting and maintaining geospatial data needs to be standard practice for all underground utilities located in MDOT's Right-of-Way. This MUCC initiative, titled *Geospatial Utility Infrastructure Data Exchange* (GUIDE), is intended to lead the way to completion of this goal.

1. **Provide a brief description of the proposed work:**

The proposed work involves hiring a qualified consultant to prepare a comprehensive report detailing the actual work activities, impacts and efforts of the GUIDE utility partner's data collection and management. During the 2013 calendar year, the MUCC developed a draft requirements document for use in its 2014 pilot field implementation study involving three of the state's largest utilities: AT&T, Consumers Energy and DTE Energy. These utilities will select two or three planned new facility installations during the summer of 2014. These new installations will pilot the work associated with collecting geospatial data identifying the precise location of the newly installed underground facility. The geospatial data will be provided to MDOT for inclusion in an enterprise geodatabase. MDOT will establish procedures, standards and systems for the retention and distribution of geospatial utility information using ESRI's ArcGIS Server technology and ArcGIS Online.

The proposed work will consist of hiring a consultant to document and prepare a comprehensive report detailing the efforts of the MUCC in 2013, documents the utility field installations during 2014 and researches additional information such as, but not limited to:

- Additional costs/administrative burden
- Personnel impacts
- Required time to process data
- Feedback on requirements
- Best practices
- Positive/negative impacts to utilities
- Implementation costs to MDOT and utilities
- Presentation of results to MUCC

2. **Amount of STIC Incentive Funds Requested:**

The estimated cost for the detailed comprehensive report is $50,000.

3. **Project Schedule:**

The proposed project schedule involves having the three utilities performing field work during the summer of 2014. The consultant would be required to have the final report due to MDOT no later than December 19, 2014.

4. **Commitment of Other Funds:**

Soft match costs are estimated for each utility performing field collection campaigns concurrent with the actual installation. It's estimated each installation will require the utilities to obligate one person to three days of actual field work and four office hours for data review/preparation for submittal to MDOT. This estimate does not include costs associated with training, travel and administration.

Utility Company	Field Collection Installation #1	Field Collection Installation #2	Office Data Review/Prep. & Submittal	Utility Total Cost
AT&T	3 – 8 hr. days for field collection 24 hrs. @ $100/hr = **$2,400**	3 – 8 hr. days for field collection 24 hrs. @ $100/hr = **$2,400**	4 hrs. / each field installation 8 hrs. @ $100/hr = **$800**	**$5,600**
Consumers Energy	3 – 8 hr. days for field collection 24 hrs. @ $100/hr. = **$2,400**	3 – 8 hr. days for field collection 24 hrs. @ $100/hr. = **$2,400**	4 hrs. / each field installation 8 hrs. @ $100/hr. = **$800**	**$5,600**
DTE Energy	3 – 8 hr. days for field collection 24 hrs. @ $100/hr. = **$2,400**	3 – 8 hr. days for field collection 24 hrs. @ $100/hr. = **$2,400**	4 hrs. / each field installation 8 hrs. @ $100/hr. = **$800**	**$5,600**
			TOTAL COST	**$16,800**

5. **Project Administration:**

MDOT will provide all project administration.

6. **Will the TIDP funds be obligated and reimbursable work performed within six months of the date the funds are made available? (Y/N and include the estimated Obligation Date and to whom)**

   The funds would be obligated within six months upon being available. MDOT would need to create an RFP for the contract services. The estimated obligation date is May 1, 2014. Full reimbursement to the consultant would more than likely extend beyond six months.

7. **Indicate where in the STIC implementation plan the project work is referenced.**

   The proposed GUIDE pilot project report will be an invaluable resource in accurately documenting the collection and maintaining of geospatial data for permitted underground utility installations. The report will be instrumental in assisting MDOT's decision to move forward with requiring geospatial data, as a statewide standard permit condition, for all underground utilities permitted within MDOT's Right-of-Way.

Appendix G – Sample Data Delivery Template in MS Excel

Appendix G - Sample Data Delivery Template in MS Excel

UtilComp	MDOTPerNum	InstMethod	LicenseNum	CollectBy	MethOfLoc	PointNum	MISPCZone	Northing	Easting	Elevation	CalcElev	FeatType	SegmentNum	USegNum	Sort	InstYear	Material	Diameter	Notes