

Obtaining Underground Utility Information in Ontario 2007

By John E. Scaife, P.Geo.

Every day, new facilities are installed beneath city streets, private commercial and industrial properties, further complicating the network of underground infrastructure. Project owners and engineers, both municipal and commercial, are starting to realize the benefits of obtaining this information at the project design stage through the process of engineering locates and/or Subsurface Utility Engineering (SUE). The surveyor plays a key role in the measurement and presentation of these data. The results of these investigations provide a permanent digital record of buried infrastructure position, which is a valuable asset to the project owner.

Within this dynamic industry, the current role of the utility facility owners and their delivery of underground utility data can be confusing for those in need of this information. The survey practitioner has historically required stake outs to drive iron bars and/or establish permanent markers but has recently been challenged to obtain subsurface utility data to add valuable information to the project drawings. Delivery of this information is also compromised by varying facility owner practices with respect to municipal property versus private lands.

Definitions

For purposes of this discussion, the following definitions are offered:

Excavation Locates:

Stake outs provided for imminent excavation to protect the worker, the public and the plant. These activities, accountabilities and deliverables are regulated by many authorities including the OHSA, TSSA and MOL.

Engineering Locates:

Stake outs provided to record the position (and depth) of existing infrastructure to determine (map) the actual position of

infrastructure. This information can be used for planning additional installations and excavations, for asset inventory and management, and for confirming legal position, etc.

Excavation Locates

Excavation Locates must be secured by the excavator prior to excavating as directed by Section 228 of the Ontario Occupational Health & Safety Act. These locates are also provided for the safety of the workers and general public and to protect the underground assets of the facility owners.

Excavation Locates are normally provided by the facility owner free of charge to the caller requesting the information. However, in order to get them to mark their plant, you must initiate the process by contacting the facility owners. In most cases, this means contacting the facility owner directly, or their contracted call centre, and engaging with their staff to coordinate the dispatching of a field technician or their contracted locate service provider (LSP), to travel to your site and mark their underground plant.

Navigation of this process is mandatory if you are excavating. However, surveyors are experiencing an increase in requirements to capture the position of underground facilities as part of their programs. To secure this information, surveyors must procure Engineering Locates or may find themselves as part of an engineering design team involved in the Subsurface Utility Engineering process.

Engineering Locates

Engineering Locates are often required by project owners who wish to determine the physical location of underground plant within their specific area of interest, whether within a municipal right-of-way for reconstruction of a watermain, etc. or within private property to assist with the architectural design

of a new building. This information adds value to site survey drawings for the design engineer or architect by allowing them to produce the best design in consideration of existing subsurface site conditions.

Due to the typical size and nature of the design work, provision of engineering locates (i.e. paint on the ground) is not typically supported by the facility owners in Ontario. Therefore, getting paint on the ground requires the paid services of a private utility locate contractor. Currently in Ontario, there are a variety of suppliers providing a variety of services with different abilities, resources and experience ranging from: specialized firms who have agreements with facility owners for provision of these services; to small one-person operations with limited resources; to the large contracted LSP's; to engineering firms who have separate business entities focused on coordinating and delivering this work as an engineering document. Their deliverables can range from paint on the ground with no accountability to digital drawings backed by professional liability insurance.

From the perspective of the surveyor, you should insure that your selected contractor can legally mark the underground plant, that they carry appropriate levels of insurance, that they have the resources and skills to complete your assignment in a timely manner and that they are flexible enough to work within your unique requirements.

Subsurface Utility Engineering

Subsurface Utility Engineering (SUE) is a process to measure and depict existing subsurface utility data. The SUE provider combines traditional civil engineering practices with a documented process to affix attributes regarding the quality of the subsurface

utility information. This permits users of the data to get an understanding of the risk associated with the data.

The surveyor, through the application of principles and best practices, provides a vital role in the measurement and capture of these data and as such may find themselves as part of a project team of professionals for securing these project data. The design team may include architects or project design engineers, professional geoscientists experienced with urban geophysical technologies and mapping techniques, accredited survey professionals and vacuum excavating specialists who deliver safe excavation practices.

The understanding of 'risk' is conveyed through a series of 'Quality Levels' which are attributes of the underground information data affixed by the SUE provider. This process emerged from the U.S. and is documented by the American Society of Civil Engineers (ASCE) Standard 38-02, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data" which was published in 2003. The established quality levels are described as follows:

Level D:

This process encompasses historic civil engineering practice; a records search to obtain all known and assumed underground utility data within the project area. This includes contacting the facility owners for 'mark-ups' of their plant data, digging into archived city records, oral recollections, etc. The final product is a digital composite plan of all known or suspected underground facilities revealed by this search.

Level C:

This process is also an historic civil engineering practice such that an 'engineering survey' of the project area is completed. This investigation should include topographic information, existing landmarks, street furniture and all utility appurtenances (i.e. valves, chambers, hydrants, meters, poles, etc.) within the project area. The final product is a composite drawing combining the information from Level C with that of Level D using professional judgment in correlating these two data sets with respect to anomalies and conflicting information.

Level B:

This process involves the field survey to confirm the inferred locations of underground plant using appropriate geophysical technologies (e.g. electronic line locators, ground penetrating radar, other EM imaging tools, etc.) as shown



Figure 1: Electronic line locators are commonly used to define the routing of underground metallic utilities.

in Figure 1. The inferred spatial routing of the facilities is marked in the field by paint, flags, etc. These markings are typically pink (Figure 2) to be intentionally non-descript and their position is captured to the appropriate tolerances as defined by the project owner or local



Figure 2: Annotated pink markings are used to mark Engineering Locates, or Level B SUE information. These markings show the inferred position of a gas main.

jurisdiction. This information is then reduced to plan documents and again reviewed with professional judgment in correlating these data sets. Ultimately, a conflict matrix can be created from these data with respect to the proposed design such that each potential utility conflict can be reviewed in detail.

Level A:

After review of the conflict matrix, it may be determined that the absolute vertical and horizontal position of any 'conflicting' utility is required to evaluate the impact on the design/construction of the proposed facility. This information is typically captured by vacuum excavation activities to visually confirm and measure each exposed conflict. These data, plus other information obtained from visual inspection of the open test pit, are then captured to the appropriate tolerances and are again reduced to plan documents with professional judgment utilized to resolve or confirm the 'conflicts'. The final product is a stamped drawing showing the findings of the entire investigation, a revised conflict matrix along with all field notes, etc.

The benefits of having composite underground utility data are numerous since this information provides the design teams with 'as constructed' digital composite utility maps and drawings. From the design or project owner perspective, there are demonstrated cost savings. Independent SUE evaluations by Purdue University in the U.S. and the University of Toronto in Ontario confirm that the project owners can save, on average, in the order of \$2.00 to \$5.00 in total project costs for each dollar spent on this process. Cost savings are realized in many ways including: fewer utility relocations; fewer contractor delays and delay claims; minimized problems including disruption to the public roads; minimized service disruptions; enhanced project safety and contractor productivity.

Summary

The role of the surveyor is to measure and document the visible physical environment. Surveyors need excavation locates to drive bars and establish monuments but also need to procure engineering locates to respond to project owners' requests for

comprehensive mapping programs.

The provision of Engineering Locates is not typically supported (financially) by the utilities and in order to obtain this information the project owner, or surveyor, is required to engage with a 'user-pay' service provider. The abilities, experience and resources of these service providers vary across the province. However, provision of these data to the project owner is a documented cost saver since the final product is a comprehensive digital map of all above ground and underground facilities within the project area captured to the appropriate tolerance levels. This permits better decision-making at the design stage to avoid conflicts and headaches during the construction stage. The provision of these underground data definitely adds valuable information to engineering survey drawings measured and plotted by the surveyor.



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