

SUE - Subsurface Utility Engineering

By Cheryl Rego

Canada is lagging in the use of a well-established technology that could save money, avoid delays, save lives and prevent injuries. In light of the recent devastating gas explosion from a damaged pipe in Etobicoke, Ontario, OSWCA representatives and industry experts say contractors and project tenders should be looking at Subsurface Utility Engineering (SUE) to accurately depict utilities on construction plans, reduce utility damage, reduce delays, improve safety and protect the environment.

Subsurface Utility Engineering has been in use in the US since the mid-1980s. SUE combines geophysics, surveying and civil engineering in a process that provides accurate identification and mapping of underground facilities. SUE results go beyond the standard two-dimension-

were not included and only three projects had a negative return.

Cost-savings is not the only benefit of using SUE. The level of accuracy with SUE goes a long way in preventing accidents. For example, a highway project in Virginia used SUE techniques in 156 locations where the highway and utilities might conflict. Sixty-one potential conflicts were found and eliminated at the design stage.

The SUE process involves four major activities. Records research and comprehensive utility agency contact begins the process. Then, underground Utility Designating uses geophysical prospecting techniques to

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locate by providing detailed information including the depth of buried lines, conflict analysis and resolution during design instead of during construction.

In the US, where SUE has been widely used, the Federal Highway Administration commissioned a study to find out SUE's effectiveness in reducing project costs. The resulting report, published in 2000 by Purdue University, found that 71 projects studied showed an average cost savings of \$4.62 per \$1.00 spent. In the study, un-quantifiable savings

determine the existence and horizontal position of underground utilities. Underground Utility Locating uses non-destructive excavation equipment, such as vacuum excavation, to determine the precise horizontal and vertical position of the underground utility line. Finally, Data Management takes the information from the first three activities, enters it into a Computer-Aided Design (CAD) system, allowing designers to examine project options and plan ahead to eliminate utility conflicts.

SUE services are now available in Ontario, as Canadian companies



Ground Penetrating Radar (GPR) used to obtain QL - B information at an airport.

proceed based on the US experience. One such company, TSH, an engineering consulting company with ten locations and 320 employees across Ontario, has formed a joint venture with TBE Group Inc., an ENR top 500 engineering firm with over 25 offices across the US and a recognized leader in SUE. The joint venture's mandate is to increase the use of SUE in the province and ultimately, in Canada. TSH/TBE already has a number of projects for which SUE has been used. These include a roadway/infrastructure improvements project on Ritson Road Project in Oshawa, a forcemain installation project on Steeles Avenue in Toronto, and a pilot project for locating subsurface water and wastewater system infrastructure for the Region of Niagara.

Lawrence Arcand is a SUE project manager at TSH/TBE. Arcand said it is the quality of information that

Technology May Save Lives and Money

SUE provides that makes the difference. "There is a history of some of the different elements of SUE being used in the Province, but not within the confines of SUE engineering standards," Arcand said.

SUE has four different quality standards. At the most basic level, Quality Level D information comes solely from existing utility records. It provides an overall "feel" for the congestion of utilities, but is highly limited in terms of comprehensiveness and accuracy. Information from

produces two-dimensional mapping information. This information is usually sufficient to accomplish preliminary engineering goals. Decisions can be made on where to place storm drainage systems, footers, foundations, and other design features in order to avoid conflicts with existing utilities. Slight adjustments in the design can produce substantial cost savings by eliminating utility relocations. Electromagnetic, Magnetic, and Elastic Wave methods of designating equipment, including GPR (Ground Penetrating

Radar) equipment are used to produce Level B information. GPR is recognized as one of the most powerful, remote sensing instruments available today. Using a series of high frequency, high amplitude radio waves that reflect off the underground irregularities, GPR collects subsurface information as digital images. The GPR images are fed into a portable laptop computer and displayed as a real-time "picture" of a slice of the subsurface area, pinpointing the precise location of the subsurface feature.

Quality Level A involves the use of non-destructive excavating equipment, usually vacuum excavation, at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material, and other characteristics. When surveyed and mapped, precise plan and

profile information are available for use in making final design decisions. Additional information such as utility material, condition, size, soil contamination, and paving thickness is also produced from Quality Level A activity.

TSH/TBE owns and operates state-of-the-art technology that, together with their proven TSH/TBE SUE process, gives clients the most comprehensive information on a site. TSH/TBE owns the most up-to-date GPR equipment available and uses it for a broad range of engineering and environmental applications.

TSH/TBE's clients are already seeing the benefits of SUE. During the rehabilitation of a watermain at Evans and Kipling Avenue in Etobicoke, the application of SUE services resulted in design changes. SUE results showed that a telephone duct system and electric transmission facilities were in conflict with the original design. The contractor estimated his bid was reduced by 5% due to the accuracy of the utility information provided. In another project in the City of Oshawa, SUE services accurately verified the location of the gas main in the corridor and eliminated the need to relocate that gas main to accommodate the project.

Through practice and studies done, there is no doubt that SUE saves project costs. In the aftermath of the Etobicoke gas explosion, the only question is how fast the Canadian construction industry will adopt this technology that not only gives contactors the accuracy they need to control their projects, but also saves lives. ■



SUE demonstration at Kipling/Evans Avenue in Toronto (Aug 2001).

this level is limited to project planning and route selection activities.

Quality Level C involves surveying visible aboveground utility facilities, such as manholes, valve boxes, markers etc., and correlating this information with existing utility records. At this stage, locators commonly find underground utilities have been either omitted or erroneously plotted.

Quality Level B involves the use of surface geophysical techniques to determine the existence and horizontal position of underground utilities. Also called "designating", this activity