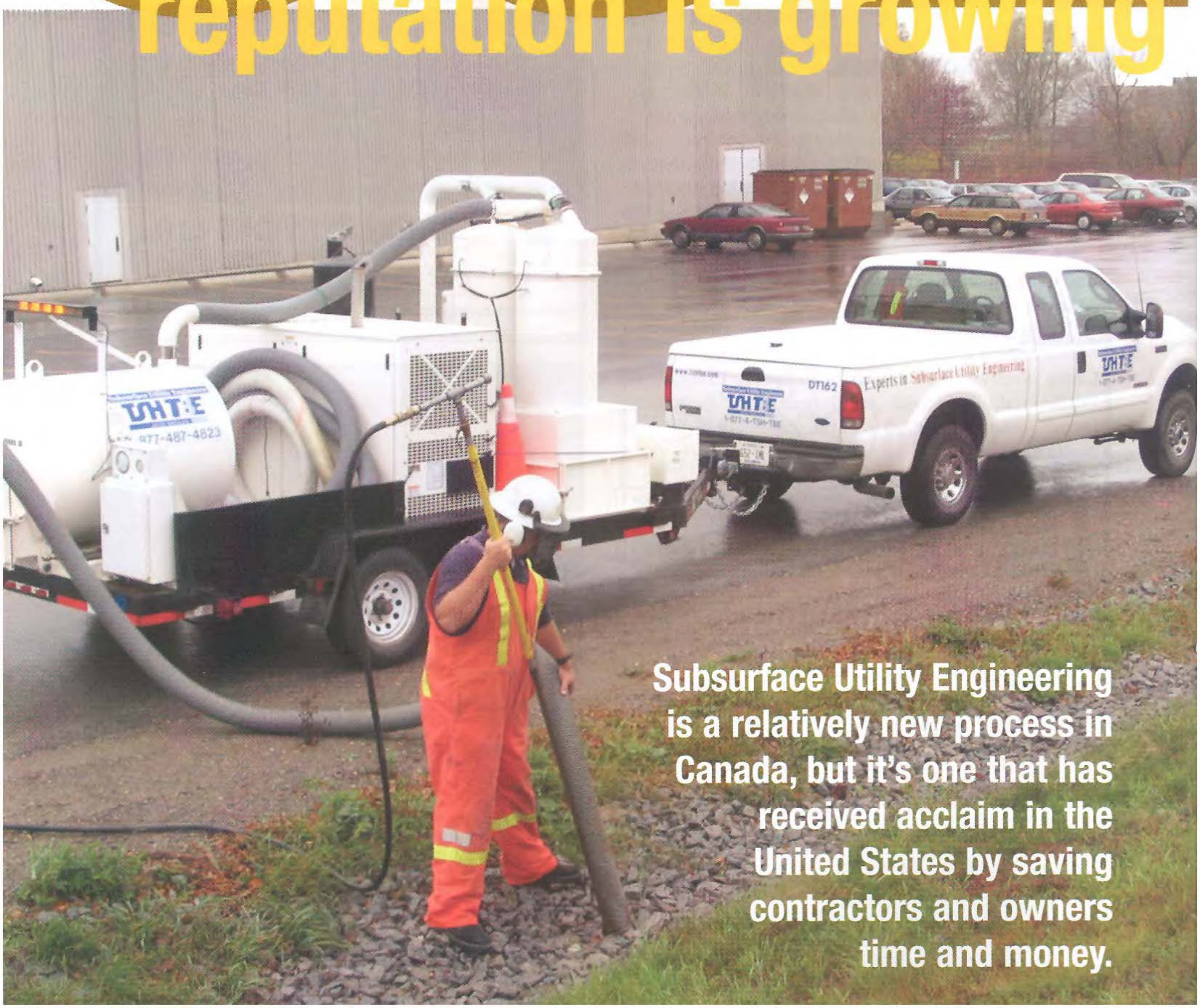
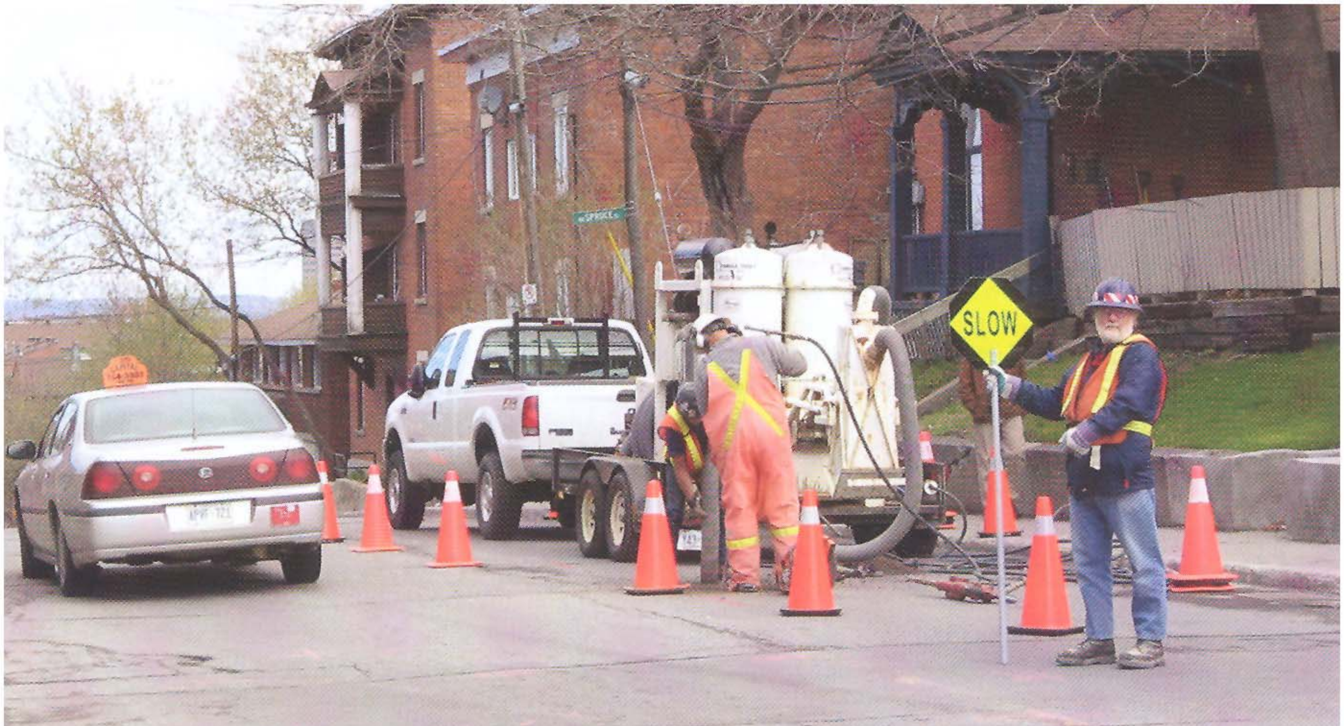
SUE's reputation is growing

SUBSURFACE UTILITY ENGINEERING



Subsurface Utility Engineering is a relatively new process in Canada, but it's one that has received acclaim in the United States by saving contractors and owners time and money.

A SUE crew uses air-based vacuum excavation equipment to install a test hole in Whitby, Ontario. Photo courtesy TSH/TBE Subsurface Utility Engineers.



The SUE pilot project on Booth Street this spring was a success, says City of Ottawa project officer Todd Penfound.
Photo courtesy TSH/TBE Subsurface Utility Engineers.

On any construction project, it's the unknown that poses the most significant risk to a job's schedule. What's hidden behind the walls in an older building can be a nightmare for a renovation contractor. Similarly, erecting a new building on wet clay or solid rock, where none was foreseen can force an entirely new approach to construction, adding costs and delays to even the best planned job.

For heavy civil contractors and engineers, the reality is no different. Though a thorough survey of the surface features of a site can provide a rough idea of what's located underground, without further investigation, it's impossible to know the exact location of telephone ducts, gas lines, hydro cables and watermains. And while that can play havoc with a job's schedule, it's also a serious safety concern for workers.

Common practice for locating underground utilities relies on consulting old maps and as-built drawings to locate, as best possible, underground utilities, but that practice is far from perfect. Lawrence Arcand is a project manager with TSH/TBE Subsurface Utility Engineers JV in Whitby and, as he puts it, "it is time to start putting as much effort into the survey of these below ground features as goes into (a site's) above ground features."

First used in the United States nearly 25 years ago, Subsurface Utility Engineering (SUE) is an engineering process that aims to address the problem of unknown underground utilities. Combining traditional civil engineering practices with new technologies, the SUE process aims to develop accurate and reliable maps of underground utility infrastructure.

The main principle behind SUE is gathering as much data as possible about the underground utilities and grading this data on a four-step scale according to their reliability. The intent is to provide a unified system so that all parties using the data can clearly understand the information being conveyed and the degree to which it should be considered reliable.

Already, the American Society of Civil Engineers (ASCE) has developed a standard rating system for the collection of subsurface utility data. Using a scale from quality level D to quality level A, data are depicted according to how they were collected and whether additional information or clarification is required.

The various steps in the SUE process should be done in order, however it is not necessary to do all the steps, for all the utilities, in all the areas. The first two steps in the SUE process are already deemed to be the commonly accepted practice in Ontario. The first step is to gather utility records from all available sources, including as-built drawings, field notes and even oral accounts. A composite drawing is then created based on these accounts and the utilities shown on the drawings are labeled as quality level D.

For the second step, additional information obtained through a site visit – manhole locations, pedestals, valves – and a topographic survey are then added to the composite drawing and update those utilities to quality level C.

The next step in the SUE investigation is to further delineate the true horizontal location of any critical utilities – those that may have an impact on the proposed design – on site. Collection of quality level B data, then, involves the use of a combination of geophysical instruments, including pipe and cable locators, ground-penetrating radar and metal detectors to determine the location of these critical utilities.

The final step in the process is to install test holes at key locations on the site where the exact nature of the utility being investigated is crucial. Typically, this involves using vacuum excavation techniques, which minimize disruption to the surrounding soil and can be restored with little additional impact to the site. The precise location of the utilities obtained through their exposure is added to the composite drawing as quality level A data.

The final result is a composite utility layer that can be used in the design drawing, which contains all the utility information at the appropriate quality level as gathered by the investigation. The engineering firm responsible for compiling the SUE data will then certify the composite site document as being accurate, thereby accepting liability for the quality of the information collected. Firms providing SUE services, then, are certified to do so by a professional engineering body and carry appropriate liability insurance.

SUE in Ontario

What's most remarkable about the SUE process is the benefits it presents to owner, contractor and designer alike. In creating a much more precise picture of a site's underground utility infrastructure, the likelihood of encountering problems on the job is significantly reduced. Designers are able to create drawings with a significant degree of accuracy; contractors can operate on site with confidence and fewer concerns about serious safety hazards; and owners benefit by spending a small amount of money up front to realize significant savings on the project's bottom line.

"Our company, personally, has worked on more than 75 projects in Ontario using SUE," says Arcand. "And when the final costing is done on the job, it's extremely rare that you see a project that has not benefited from using SUE."

A SUE test hole exposes an underground gas main.
Photo courtesy TSH/TBE Subsurface Utility Engineers.

That claim is backed up by a study conducted by Purdue University for the American Federal Highway Administration (FHWA). In studying the use of SUE on 71 projects across four states, the researchers demonstrated an average project savings of $4.62 for every dollar spent on SUE. In total, the projects showed a combined savings of more than $1 billion. Moreover, the research demonstrated that obtaining quality level B or quality level A data on these projects added less than 0.5 per cent to the total construction costs and represented a savings in construction costs of almost two per cent over quality level C and D data. Three of the 71 projects were found to have shown a negative return on investment.

A study similar to that of the Purdue group – and commissioned by the Ontario Sewer and Watermain Construction Association – is currently being conducted by a group of students from the University of Toronto. Hesham Osman, one of the study's researchers, says that the document will address SUE from three perspectives: cost-benefits and return on investment, the effects of inaccurate subsurface data on project costs and criteria under which SUE is best applied to infrastructure projects.

"We selected 10 projects upon which to base our findings, one of which was a highway project tendered by the Ontario Ministry of Transportation and the rest from municipal or regional governments," says Osman. "Our findings show that none of the projects produced negative returns from using SUE. That is, in terms of quantifiable benefits, the investment in SUE paid for itself. What we didn't measure – and what is very difficult to measure – are the qualitative savings that SUE offers, including safety, design time savings, and the cost of relocating utilities."

The findings are expected to be released later this month.

Bringing SUE to the forefront

So what next for the future of SUE in Ontario? Though the process is still very much in its infancy in the province, the Ministry of Transportation is currently testing SUE on a series of sites across the province.

The City of Ottawa was introduced to SUE for the first time this spring as TSH/TBE Subsurface Utility Engineers was brought in to conduct investigations into a section of Booth Street, between Somerset Street and Primrose Avenue. That site, says Todd Penfound, a project officer with the City of Ottawa, was highly congested in terms of the number of utilities packed into a small location and the city brought TSH/TBE on board to provide the exact locations of the utilities on site.

"This was the first time we had used SUE in Ottawa," says Penfound, "and it worked well in terms of providing exact location information."

Penfound says the city didn't track any cost savings on the Booth Street project as a result of SUE, but adds that the door is very much open for the city to test SUE procedures on future projects.

On a larger scale, the Ontario Regional Common Ground Alliance (ORCGA) is pushing ahead with an initiative of its own to bring SUE to the forefront in Ontario. Wes Armstrong, the manager of plant damage prevention with Union Gas heads a sub-committee of the ORCGA looking into creating a best practices document for SUE. That document, he says, will hopefully be released this year.

"Everyone agrees that this is a great practice with huge benefits and there are opportunities out there for SUE to be used much more widely across the province."

Whether SUE becomes a commonly accepted practice in Ontario, or remains on the fringes will become clear in time. It's a good bet, however, that with the backing of the U. S. FHWA, the process stands a good chance of becoming standard operating procedure in Canada. Plus, it's difficult to argue with the merits of a process that saves time and money on a construction site, while promoting safer workplaces at the same time.