Subsurface Utility Engineering

By: Thornton J. Williams, Williams Wilson P.A.

The inability to obtain reliable underground utility information needed for highway plans has been a long standing problem during the development of highway projects. The engineering practice known as Subsurface Utility Engineering (SUE) was developed to alleviate this problem by providing highway designers with horizontal and vertical locations of underground utilities to produce an accurate picture of underground infrastructure. This accurate information helps to mitigate the risk of cost overruns and other safety issues associated with underground utilities. The concepts and practice of SUE were systematically put into professional practice in the 1980s.[1] It has since been developed and refined over the years.

According to the American Society of Civil Engineers (ASCE) and the Federal Highway Administration (FHWA), the definition of subsurface utility engineering is:

> *"A branch of engineering practice that manages certain risks associated with subsurface utilities via: utility mapping at appropriate quality levels, utility coordination, utility relocation design and coordination, utility assessment, communication of utility data to concerned parties, utility relocation cost estimates, implementation of utility accommodation policies and utility design."*[2]

Primarily utilized by State Transportation Departments (DOTs), local highway agencies, utility companies, and highway design consultants, it has become a routine requirement on highway projects in many states.[3] The process combines civil engineering, surveying, and geophysics and utilizes several technologies, including vacuum excavation and surface geophysics.

[1] http://www.fhwa.dot.gov/programadmin/pus.cfm

[2] http://www.fhwa.dot.gov/programadmin/sueindex.cfm

[3] http://www.fhwa.dot.gov/programadmin/history.cfm

The FHWA has been encouraging the use of Subsurface Utility Engineering on highway construction projects since 1987.[4] In 1996, the FHWA commissioned Purdue University to study the effectiveness of subsurface utility engineering (SUE) as a means of reducing costs and delays on highway projects. The study showed a savings of $4.62 for every $1.00 spent on SUE which was quantified from a total of 71 projects with a combined construction value in excess of $1 billion. The study concluded that "SUE is a viable technologic practice that reduces project costs related to the risks associated with existing subsurface utilities and, when used in a systemic manner, will result in significant quantifiable and qualitative benefits. Using the SUE savings factor data from this study and a national expenditure in 1998 of $51 billion for highway construction that was provided by the FHWA, the use of SUE in a systemic manner should result in a minimum national savings of approximately $1 billion per year."[5]

However, SUE is not confined to just highway projects. It can be utilized on airport, railroad, transit, building construction, military, sanitation, nuclear, and any other public works project where underground utilities may be encountered. It can also be used for environmental purposes, such as detecting and mapping underground storage tanks, septic fields, and even contaminants. [6]

The American Society of Civil Engineers (ASCE) has developed a *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data*, CI/ASCE 38-02. This standard guideline describes four quality levels of utility depiction:

- Quality Level D (QL D): Information derived solely from existing records or verbal recollections.
- Quality Level C (QL C): Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D information.
- Quality Level B (QL B): Information obtained through the application of appropriate surface geophysical methods to identify the existence and approximate horizontal position of subsurface utilities. "Quality level B" data are reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances and reduced onto plan documents.
- Quality Level A (QL A): Information obtained by the actual exposure (or verification of previously exposed and surveyed utilities) of subsurface utilities, using (typically) minimally intrusive excavation equipment to determine their precise horizontal and vertical positions, as well as their other utility attributes. This information is surveyed and reduced onto plan documents. Accuracy is typically set at 15mm vertical, and to applicable horizontal survey and mapping standards.

[4] http://www.fhwa.dot.gov/programadmin/pus.cfm

[5] http://www.fhwa.dot.gov/programadmin/pus.cfm#conclusions

[6] http://www.fhwa.dot.gov/design/sue/suebrochure.cfm

The scope of services and level of effort is established in the quality levels of information to be provided. The quality level is a professional opinion of the quality and reliability of utility information desired or provided. Each of the four established quality levels is established by different methods of data collection and interpretation. [7]

There are many benefits to utilizing SUE on highway and other construction projects, including reduction in unforeseen utility conflicts and relocations, reduction in project delays caused by waiting for utility relocation work to be completed so highway construction can begin, lower project bids, reduction in claims and change orders, reduction in cost of project design, improvement in contractor productivity and quality, minimization of environmental damage, facilitation of electronic mapping accuracy, reduction in right-of-way acquisition costs and overall increased efficiency.[8]

In Florida, the Florida Department of Transportation (FDOT) has the responsibility to maintain state highways as necessary to preserve the operational safety and function of the highway facility. Determining the location of existing utilities on State highway right of way is a cooperative effort between the FDOT and the Utility/Agency Owner (UAO).[9] Undoubtedly, by utilizing the practice of SUE , state DOTs are better able to manage the risks associated with subsurface utilities via: utility mapping at appropriate quality levels, utility coordination, utility relocation design and coordination, utility condition assessment, communication of utility data to concerned parties, utility relocation cost estimates, implementation of utility accommodation policies, and utility design.

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[7] http://www.dot.state.fl.us/rddesign/ppmmanual/2006/Volume1/zChap05.pdf

[8] http://www.fhwa.dot.gov/programadmin/pus.cfm#scope

[9] http://www.dot.state.fl.us/rddesign/ppmmanual/2006/Volume1/zChap05.pdf