LOUISIANA TRANSPORTATION RESEARCH CENTER
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Cost and Time Benefits for Using Subsurface Utility Engineering in Louisiana

INTRODUCTION

Subsurface utility engineering (SUE) is an engineering process that utilizes data processing and site characterization technologies to accurately locate and depict underground utilities in the preliminary stages of a project. The discovery of unforeseen underground utility lines during construction can lead to catastrophic results, delay, and cost increases. The damage to utility lines has, in fact, been identified as one of the most significant issues faced by the construction industry. According to data collected by Common Ground Alliance (CGA), an underground utility line is damaged about once every six minutes, creating a major concern for constructors. SUE is aimed at addressing this concern.

OBJECTIVE

The objective was to determine the cost and time benefits of utilizing SUE services to locate underground utilities in Louisiana. A secondary objective was to determine the type of project that benefits the most from applying SUE.

SCOPE

The standard method for locating the underground utilities prior to construction in Louisiana is to have the utility company or Louisiana One Call locate them. However, not all agencies that place utilities in the road reserve submit the location of their facilities to One Call. This research was limited to identifying the potential benefits of applying SUE services to projects funded by the Louisiana Department of Transportation and Development (DOTD). All project data for this study were provided by DOTD and the information used in the analysis was obtained from DOTD data systems.

METHODOLOGY

For a design engineer, constructor, and project owner to understand the concept of SUE, it is essential to first address the four quality levels (QL) of underground utility information that are commonly used. The quality levels represent various combinations of records research, site surveys, surface geophysical methods, and non-destructive locating methods. As quality levels progress from QLD to QLA, accuracy, reliability, and cost of the data collected rises. Quality levels of SUE are defined as:

Quality Level D: Applies when making broad decisions about route selection. This information is derived from existing records and oral recollections.

Quality Level C: This quality level is typically recommended on rural projects or on projects where there is thought to be minimum utility conflicts. Information is gained by physically surveying visible above-ground utility features and correlating this information to Level D information.

Quality Level B: This quality level is used by the designer to make educated decisions on where to place storm drainage systems, footings, and foundations, etc. to avoid conflicts with existing utility facilities. It is recommended on urban type projects or on projects where there is thought to be many utility conflicts. A variety of geophysical techniques are used to determine the existence and approximate horizontal position of subsurface utilities. Quality Level B includes Quality Levels C and D.

Quality Level A: Exact three-dimensional (x, y, z) mapping of utilities are achieved at this quality level. Utilities are physically located to provide identification and precise horizontal and vertical location of the utility.

To determine the benefits of SUE in Louisiana, the projects that used QLA and QLB SUE services were first identified. Since the SUE program is fairly new to Louisiana, only a few projects have applied SUE in the past. There were hardly any records on historical SUE contracts, which made the process somewhat challenging. SUE projects were identified by

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PRINCIPAL INVESTIGATOR:
Chester Wilmot, Ph.D., P.E.

LTRC CONTACT:
Julius A. Codjoe, Ph.D., P.E.
225.767.9761

FUNDING:
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Louisiana Transportation Research Center

4101 Gourrier Ave
Baton Rouge, LA 70808-4443
www.ltrc.lsu.edu

reviewing data from the Contracts Information System (CIS) and contacting project managers.

Project managers were contacted to provide a list of projects that used SUE services in the past. However, most of the projects had not been let or were still under construction. The list was narrowed down to projects that were at least 90% complete. In addition to contacting project managers, data from the CIS was reviewed. The CIS contain various types of DOTD contracts. Keywords such as contractor names and project manager names were used to recognize SUE contracts. At the end of this process, 13 projects that used SUE in the past were identified.

In this study, and in line with other studies by other states in the past, the benefit of using SUE was evaluated on the basis of return on investment (ROI). The return is considered to be the benefit of avoiding the cost and delay encountered when SUE is not used. The cost is the cost of applying SUE. In this study, projects that used QLA and QLB SUE services were first identified, but since actual costs and delay of utility conflicts were used to estimate the benefits of using SUE, only projects that used SUE services after encountering utility conflicts during construction were evaluated. The utility-related costs were the actual costs of encountering unexpected utilities during construction, and the total cost of SUE was the actual amount spent on SUE services for each project. Therefore, the ROI indicates the dollar saving for each dollar spent on implementing SUE.

There are numerous costs related to utilities, but this study identified 7 costs that could be identified due to availability and accuracy of data. The costs were obtained through DOTD data systems such as Site Manager and included the following:

1. The cost of unexpected utility conflicts and relocations due to insufficient utility information.
2. The cost of project delays due to utility relocations.
3. The costs resulting from filing a claim or requesting a change order due to unexpected utility conflicts.
4. The costs of project design work due to inaccurate utility information.
5. The cost for road users due to project delays caused by utility conflicts.
6. The costs of person injury and third-party damage.
7. The additional cost of gathering and verifying information due to unexpected utility conflicts.

Of the 13 projects that have used SUE in Louisiana in the past, only three projects were suitable for use in the analysis to determine ROI. The projects were let between 2006 and 2009 and had a project cost that ranged from $11,012,063 to $451,215,018.48. All three projects used the highest quality level of SUE, with SUE costs ranging from $58,590.00 to $197,944.81.

Project No.	Construction amount	Year Let	SUE QL	SUE cost	SUE year	SUE % of construction amount
013-12-0032	$24,887,297	2006	A	$140,442.00	2007	0.56%
817-41-0008	$11,012,063	2009	A & B	$58,590.00	2009	0.53%
005-10-0037	$451,215,018.48	2008	A & B	$197,944.81	2010	0.04%

Table 1. Characteristics of past SUE projects

All three projects encountered costly conflicts and project delays due to unexpected underground utilities. The total utility-related costs of the projects ranged from $153,021.74 to $632,747.10. The ROI of SUE ranged from 2.13 to 3.20, with an average ROI of 2.73. This implies that $2.73 can be saved for every $1 spent on SUE services, if SUE is used correctly during the early stages of a project.
This analysis is somewhat different from the Purdue study and other studies, but the results were similar. All previous studies obtained their cost savings information via interviews with project managers, utility owners, constructors, and designers; whereas, this study used the actual costs of encountering utilities during construction. The Purdue study, one of the most well-cited studies that examined the benefits of SUE, found a savings of $4.62 for every $1 spent on SUE. The PennDOT study had the highest ROI of $22.21, and the Toronto study had the lowest at $3.41. Although these studies differ in their methodologies, they all show that SUE is an effective process to maximize cost savings for excavation projects.

In order to determine what type of projects benefit the most from SUE, various categories of projects were proposed. However, the sample size of projects was too small to provide meaningful results.

CONCLUSIONS

1. Three projects that used SUE showed a return on investment ranging from $2.13 to $3.20, with a mean of $2.73. Thus, on average, a savings of $2.73 for every $1 spent on SUE was realized by applying SUE to the projects analyzed in this study.
2. The sample size of SUE projects used in this study was too low to determine the type of project that would benefit the most by applying SUE.

RECOMMENDATIONS

1. The sample size of SUE projects for this study was limited due to the age of the program and unattainable data. Several data project elements were not being tracked, which had an effect on the scope and results of the study. SUE data items, such as cost and time stamp, were obtained by reviewing all SUE contracts, some of which could be lost over time. It is essential for DOTD to track this information to facilitate future research on SUE services.
2. Consider using SUE QLA & QLB on complex, more expensive projects, but project managers should use their discretion and expertise in determining what projects should use SUE.
3. Develop a program to increase awareness of SUE and its potential benefits among DOTD officials.