COST SAVINGS ON HIGHWAY PROJECTS UTILIZING SUBSURFACE UTILITY ENGINEERING

Prepared by Purdue University Department of Building Construction Management

January 2000

Prepared for the

Federal Highway Administration

Office of Program Administration

Washington, D.C.

FHW A Contract Number DTFH61-96-C-00090
1. Report No. | FHWA-HIF-00-014
---|---
2. Government Accession No. | 
3. Recipient's Catalog No. | 

4. Title and Subtitle
Cost Savings On Highway Projects Utilizing Subsurface Utility Engineering

5. Report Date
1-19-0

6. Performing Organization Code

7. Author(s)
Jeffrey J. Lew


9. Performing Organization Name and Address
Purdue University
Department of Building Construction
1414 Knoy Hall
West Lafayette, Indiana 47907

10. Work Unit No. (TRAID)

11. Contract or Grant No.
DTFH61-96-C-00090

12. Sponsoring Agency Name and Address
Federal Highway Administration
Office of Program Administration
400 7th Street, S.W.
Washington, DC 20590

13. Type of Report and Period Covered
Final Report
Sep. 1996 to Dec. 1999


15. Supplementary Notes
FHWA Contract Manager (COTR): Paul Scott (HIPA-20)

16. Abstract
The Federal Highway Administration (FHWA) has been promoting the use of subsurface utility engineering (SUE) since 1987 as a means to save costs on highway construction projects. In 1996, the FHWA commissioned Purdue University to study the cost savings from four States’ departments of transportation (DOTs) that routinely utilize utility quality levels while producing contract drawings.

A total of seventy-one projects (71) from Virginia, North Carolina, Texas, and Ohio were studied. The total construction costs of these projects were in excess of one billion dollars. These projects involved a mix of Interstate, arterial, and collector roads in urban, suburban, and rural settings. DOT project managers, utility owners, constructors, and designers were interviewed. Two broad categories of savings emerged: quantifiable savings and qualitative savings.

A total of $4.62 in savings for every $1.00 spent on SUE was quantified. Qualitative savings were non-measurable, but it is clear that these savings are also significant and may be many times more valuable than the quantifiable savings. Only three projects returned less in savings than expenditures. This leads to the conclusion that SUE is a viable technologic practice that reduces project costs related to the risks associated with existing subsurface utilities and should be used in a systemic manner.

17. Key Words
Subsurface Utility Engineering, Utility Mapping, Utility Quality Levels, Purdue University, Construction Risk Management, Value Engineering, SUE

18. Distribution Statement
No restriction. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classification (of this report)
Unclassified

20. Security Classification (of this page)
Unclassified

21. No. of Pages
216

22. Price

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

This form was electronically produced by Elite Federal Forms, Inc.
The Federal Highway Administration (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 effectiveness study was conducted and the results and accompanying recommendations are presented here. The concepts and practice of SUE have been developed and refined over many years, but basically were systematically put into professional practice in the 1980s. Several states have programs whereby the State Department of Transportation (DOT) contracts with SUE providers to map utilities on their projects.

Subsurface utility engineering is the convergence of new site characterization and data processing technologies that allows for the cost-effective collection, depiction, and management of existing utility information. These technologies encompass surface geophysics, surveying techniques, mapping techniques, CADD/GIS systems, etc. Rather than disclaiming responsibility for existing utility information, subsurface utility engineers certify utility information in accordance with a standard classification scheme (utility quality levels) that allows for a clearer allocation of risk between the project owner, project engineer, utility owner, and constructor.

Previous studies and statements of cost savings were performed by various State DOTs, providers of SUE services, and the FHWA. Commissioning Purdue University to conduct this study allowed for an independent and impartial review and study of costs savings.

Virginia, North Carolina, and Ohio were initially selected to be part of this study. Texas was added due to their rapidly growing SUE program. These four states had a total of 71 projects studied in detail. These projects were selected randomly from a list of projects that utilized SUE. They involved a mixture of Interstate, arterial, and collector roads in urban, suburban, and rural settings. DOT project managers and engineers, utility owners, constructors, designers, and subsurface utility engineers were interviewed.

Wyoming, Puerto Rico, and Oregon were given ‘seed’ money from the FHWA to try SUE on a select project. These projects are also included in the study (see Appendices), although data from these projects are extremely limited. Finally, several other states have studied their own projects or programs and have supplied information for this study. Overall, approximately one hundred projects were evaluated in some level of detail in order to accomplish the FHWA study mission.

A savings of $4.62 for every $1.00 spent on SUE was quantified from a total of 71 projects. These projects had a combined construction value in excess of $1 billion. The costs of obtaining Quality Level “B” (QL B) and Quality Level “A” (QL A) data on these 71 projects were less than 0.5 percent of the total construction costs, and it resulted in a construction savings of 1.9 percent over traditional Quality Level C (QL C) and/or Quality Level D (QL D) data. Qualitative savings were non-measurable, but it is clear that those savings are also significant and may be many times more valuable than the quantifiable savings.
The figure $4.62 is somewhat less than the $7.00 to $1.00 (previous Virginia DOT study), $18.00 to $1.00 (previous Maryland DOT study), and $10.00 to $1.00 (Society of American Value Engineers) returns on investment that were previously reported in the literature. However, the quantity of studied projects is much higher; the projects are more random in nature; and no qualitative costs were included in the total. Indeed, one individual project had a $206.00 to $1.00 return on investment (North Carolina DOT). Only 3 of 71 projects had a negative return on investment.

The simple conclusion of this study is 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.