



INDOT Research

TECHNICAL *Summary*

Technology Transfer and Project Implementation Information

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DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR SELECTION OF TRENCHLESS TECHNOLOGIES TO MINIMIZE IMPACT OF UTILITY CONSTRUCTION ON ROADWAYS

Introduction

The need to replace deteriorating underground utility infrastructure and to expand utility services increases the need for utility conduits to intersect roadways. Open-trench method is currently the most widely used method for installation of underground pipelines and conduits of all sizes. However, open-cut construction has several shortcomings, chief amongst which are: health and safety concerns of workers, surface disturbance, disruption to vehicular/pedestrian traffic and reduction of pavement life. Cost-effective alternatives that do not require roadway excavation are needed in order to minimize traffic disruption. Trenchless technologies provide promise for the installation of conduits beneath roadways with minimal trenching (excavation). These technologies also have the potential of reducing environmental impacts, and have the added benefit of minimizing the handling, treatment and/or disposal of contaminated soil.

While the benefits of trenchless technology are quite apparent when compared to the conventional open-cut process, it is necessary to carefully evaluate the suitability and appropriateness of trenchless technologies on a project-by-project basis through due consideration of site conditions such as, access, right-of-way, geotechnical conditions, etc. Unfortunately, this is not always

done due to the lack of a proper evaluation tool that takes into account all the project-specific criteria in a systematic fashion. Consequently, in some instances, the improper use of trenchless technologies has resulted in failures such as heaving or subsidence of the pavement damage to nearby utilities and facilities, and even fatalities.

A study was conducted to identify key trenchless technologies that have been successfully used for trenchless installation of new underground utility conduits, and to develop a decision support tool for the selection of trenchless technologies for the installation of conduits under highways. Based on an extensive literature review, discussions with contractors, and numerous site visits, five trenchless technologies have been selected for further analysis. These include: auger boring, horizontal directional drilling, microtunneling, pipe bursting and pipe ramming. Pipe bursting is also included in the research, as it is a trenchless renewal method. In addition, key features of pilot tube microtunneling, which is a hybrid of microtunneling and horizontal directional drilling, are described in this report.

Findings

The following objectives were addressed through this study:

- a) Trenchless technologies comprise an array of different methods or techniques, with each

method having certain capabilities and limitations. Installing conduits beneath roadways with trenchless technology requires not only different equipment but

also different personnel skills than those needed when open excavation is used. Thus, not only is it critical to ensure that the proper equipment and method are selected for a particular application, but also that the operator and crew have adequate skills and experience. In addition, municipalities, state transportation agencies, and utility companies need good tools for sound decision-making regarding the selection of appropriate technologies for the project of installation of conduits. **A decision support tool, named SETT – Selection and Evaluation of Trenchless Technologies, was developed in order to facilitate the decision-making processes for the selection of trenchless technologies during the early stages of utility and pipeline infrastructure projects.**

- b) In 1989, when the current specifications related to trenchless pipeline installation were adopted, the area of trenchless construction was in its infancy, with very little track record, and even fewer instances of documented performance criteria or specifications. Since that time, the technologies examined addressed in the specifications (namely, horizontal earth boring, pipe jacking and utility tunneling) have been enhanced; and new technologies have been developed. The new

technologies rely on sophisticated guidance systems, and increased instrumentation and operator skill requirements to carry out the tasks. The current INDOT specifications fail to address the newer trenchless technologies such as horizontal directional drilling, pipe bursting, pipe ramming, etc. Hence, **specifications were developed, in collaboration with INDOT engineers and designers, and contractors for the evaluation and use of trenchless methods for utility installations. These specifications were adopted by the INDOT Specifications Committee in March 2002.**

- c) Extensive discussions with the Study Advisory Committee indicated the importance of having an appropriate training tool to assist entry-level engineers and infrastructure asset managers in gaining a basic understanding of trenchless technologies. **A multimedia educational tool was developed using photographs and video clips that were collected from project sites. The video clips enable the users to “see” the different steps in each of the trenchless technologies, the installation of equipment, the drilling mechanisms, and so on.**

Implementation

Personnel from the Information Technology and Systems Technology groups at INDOT have been involved with the research team and the Study Advisory Committee regarding implementation issues.

- a) The source code of Decision Support Tool, SETT, has been transferred to Mr. James Pendleton and Mr. Richard Lively, INDOT Systems Technology group.
- b) The multimedia educational tool will be hosted on the JTRP server. At present it is hosted on a Purdue server.

It is recommended that technical details in SETT and the descriptions in multimedia educational tool be updated every two-three years.

- c) The specifications developed as part of this study have been adopted by the INDOT Specifications Committee and are available to INDOT engineers.

It is recommended that INDOT conduct an evaluation of the utilization of the decision tool, SETT and the multimedia education tool, after they have been deployed. Such an evaluation will provide valuable information when updates are planned on these tools.

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