Louisiana Tech University
Trenchless Technology Center Newsletter
June 2008

Encouraging Innovation in Locating & Characterizing Underground Utilities

The TTC has been working since February 2007 on a project for the second Strategic Highway Research Program (SHRP 2) of the U.S. Transportation Research Board, which has been funded by Congress to provide a targeted, short-term research program addressing key issues in highway transportation. The overall goal of the Highway Renewal program is to develop a consistent, systematic approach to performing highway renewal that is rapid, causes minimum disruption and produces long-lived facilities.

One of the important thrust areas of the SHRP 2 program concerns the impact of utility issues on highway renewal projects and several aspects of this issue are being studied. This paper discusses the findings of a SHRP 2 funded project to assess the potential for technical innovations in locating utilities, record keeping and marking of utilities and determining the operating characteristics and condition of a utility. Phase I of the project has just been completed. This was intended to survey the state-of-the-art and determine the areas with the most potential for innovation and improvement. Phase II of the project will develop specific research and development projects for funding within the SHRP 2 program and is due to be completed at the end of September 2008.

The Phase I study process included an extensive data collection effort and contact with relevant organizations in the field, specifically:

- Information was collected on current problems and issues as perceived by transportation department and agency personnel, transportation design engineers and firms whose business includes locating and characterizing utilities.
- An updated literature, patent and patent application search was conducted, which built on a previous TTC study in 1999-2000 for the Federal Laboratory Consortium for Technology Transfer (FLC) and included the FLC Statement of Need (SON) technology search process.
- A wide range of national and international organizations were contacted during this study, including contacts to more than 60 organizations identified by the Common Ground Alliance Research and Development Committee as being potentially linked to Utility Damage Prevention issues.
- Sixty case histories of utility problems on projects were collected from the literature and analyzed for common causes. Fifty-nine case histories of the application of subsurface utility engineering (SUE) were drawn from previous reports. The statistics from the Damage Information Reporting Tool (DIRT) database maintained by the Common Ground Alliance were also reviewed.

Using the information collected, the project team prepared summaries of issues or technologies in four major areas relevant to the project goals. These areas are:

- Utility issues in transportation projects
- Utility locating technologies
- Utility characterization technologies
- Implications from case histories

A broad range of potential improvements in both utility locating and characterization technologies were identified. These were then evaluated with respect to the expected time and funding constraints of the SHRP 2 program and the desire for short- to mid-term results, plus a minimum of duplication with other activities under way by other organizations. This resulted in identification of nine target research and development activities (including related educational components), which were then ranked into higher, medium and lower priorities for funding. The resulting ranked topics were as follows:

Higher Priority

Storage, Retrieval and Utilization of Utility Data: The development of dedicated software and hardware that would take advantage of recent advances in GPS and GIS technologies and increase the quality and efficiency of storing, retrieving and utilizing utility records.

Multi-Sensor Platforms: The development of multi-sensor platforms that combine two or more existing technologies for the purpose of increasing the reliability of designation activities in terms of presence and location (i.e., horizontal alignment and depth) of buried utilities (e.g., GPR and EM location or GPR and acoustic approaches).

Development of Guidelines: The development of guidelines and other tools to allow transportation designers/planners to get the most out of the SUE data they receive so as to maximize the benefit/cost to the agency.

Medium Priority

Smart Tagging: Advances in hardware and software that support smart tagging (e.g., ball markers, RFIDs) and documentation of utilities during initial installation and when exposed during excavations for various purposes.

Initiation of Education and Training: Initiation of educational, training and information dissemination activities aimed at increasing the awareness of transportation engineers and other decision-makers to the state-of-the-art and cost-benefit implications of gathering better utility information early in the design process.

Location of Deep Utilities: The development of locating technologies that target deep utilities that currently cannot be detected by surface-based approaches. These could include direct-path detection methods deployed from inside the utility or cross bore techniques based on vacuum excavated boreholes.

Lower Priority

External Soil Void Detection Technologies: The development of new technologies or enhancement of existing technologies capable of locating and characterizing external soil voids from within a buried pipe or culvert.

Bench Marking of Current Technologies: The use of existing and/or purpose constructed test facilities to systematically evaluate and document the capabilities and limitations of current utility locating equipment under controlled conditions of varying complexity.

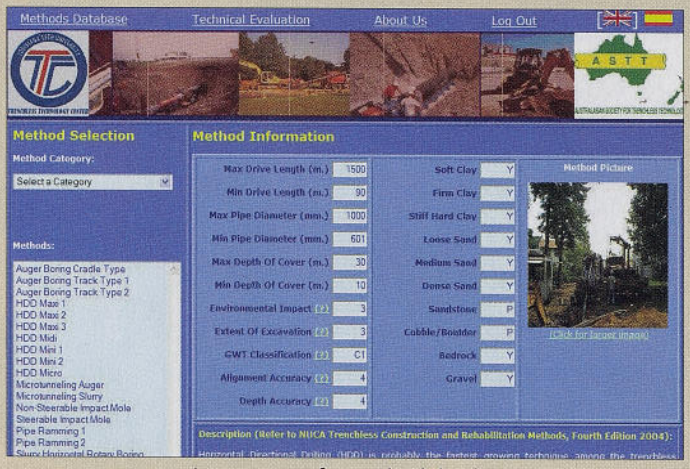
Deformation Characterization Technologies: The development of new technologies or enhancement of existing technologies capable of characterizing the cross-sectional deformation of buried pipes and culverts over time (e.g., cross-section profilometers).

The report documenting the research process and providing the rationale for the findings is expected to be released by the SHRP program later this year. Request for proposals for the detailed scopes of work developed in Phase II of the project are also expected to be released later in the year.

Web-based Decision Support Tool

The TTC is close to completing a Web-accessible decision support tool for the selection of new installation technologies for buried utilities. The project has been funded by the Australasian Society for Trenchless Technologies (ASTT) (*www.astt.com.au*) and will be made available to its membership as a membership benefit. A similar tool is already available in North America in a CD ROM-based version available from the National Utility Contractors Association (NUCA) (*www.nuca.com*) and a decision support tool for rehabilitation technologies in North America is nearing completion for the National Association of Sewer Service Companies (NASSCO) (*www.nassco.org*).

The decision support tool is intended to help owners, engineers and contractors narrow the field of applicable technologies for particular types of installations, site parameters and ground conditions. It is not intended to replace the knowledge and accumulated experience of experienced personnel since only basic job parameters can be included in the general purpose software. It is intended to be of most use to personnel with little experience with the range of methods but who need to research and select applicable technologies for a particular job. The software asks the user a series of questions — for example, to determine the purpose of the installation and the extent of open excavation that is permissible on the job.



Input screen for method database

Questions about the length of installations between surface access points, diameter of pipe to be installed, grade tolerances required plus simplified questions concerning soil conditions are used to eliminate technologies that are not appropriate. The remaining technologies are then evaluated on a simplified risk assessment basis — depending on prior owner and local contractor experience with the technology, and job characteristics in relation to maximum lengths and diameters of installation, etc. Thus, the software does not select a single method but allows the owner/engineer to quickly concentrate their investigation of technologies to those that are applicable to the particular circumstances of the job.

Besides the software development necessary for Web delivery, some adaptation of the software was necessary to reflect Australasian conditions in terms of available technologies, common terminologies and conversion to the use of metric dimensions. This review has been completed and the software is planned to go live later this summer.

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