Trenchless Technology Center Newsletter

JUNE 2013

TTC Partners with Queen's University and the Transportation Research Board to Examine Soil-Structure-Liner Interaction

TTC's Dr. Erez Allouche and Dr. Robert McKim have partnered with Dr. Ian Moore of Queen's University, Ontario, Canada, and the Transportation Research Board to undertake a large-scale experimental research program focusing on the rehabilitation of culvert structures. There are millions of culverts in North America — many of them in advanced states of deterioration that can cause serious disruption and safety issues for the travelling public if they continue to degrade. Culverts are an integral part of a road's design; a culvert's failure, such as road subsidence or even roadway collapse, can lead to serious consequences for vehicular traffic.

A dominate degradation mechanism of culverts is corrosion, driven by water containing high levels of chlorides from road salt, which accelerate corrosion at the invert of corrugated metal pipes commonly used for culvert construction. While trenchless rehabilitation methods have been deployed in gravity wastewater systems for many years, these pipes are predominantly rigid pipes (RCP, VCP, ACP, etc). The research work focuses on examining the soil-structure-liner interaction in the case of deteriorated flexible pipes. Another focus area is the response of corrugated metal pipes (pre- and post-rehabilitation) when sizable voids are present in the embedment zone immediately outside of the pipe's outer wall. This research uses either exhumed deteriorated corrugated metal pipe culverts or corrugated metal pipes which were deteriorated by mechanically removing 25 percent of the metal within a pre-determined arc along the lower half of the culvert. The culvert specimens are carefully bedded, backfilled, and compacted in soil within large test chambers, and then loaded. Queen's University is using a hydraulic system to simulate the fully factored loads associated with a standard AASHTO design truck, while the TTC uses a pneumatic system to simulate deep burial conditions (e.g., embankment), as well as shallow burial conditions. Deformation and strains are measured at multiple locations around the circumference of the culvert's structure during the application of the load, while earth pressure cells record the stresses in the embedment zone. The deformed culvert is then rehabilitated using a cured-in-place liner, a slip liner, or a spiral-wound liner (grouted and ungrouted), and the external load is re-applied. The responses of the deteriorated and rehabilitated soil-pipe systems are recorded and compared.

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The goal of this research is to establish distress and failure mechanisms for rehabilitated culverts made from corrugated metal and concrete pipes, as well as liner-culvert-soil interaction mechanisms, in support of the development of sound design methodologies for these repairs. The TTC is testing 24- and 48-in. metal culverts, while Queens University is testing 48-in. and larger diameter metal and concrete culverts. The resulting test data will form the basis for a design manual for culverts for Transportation Departments throughout the United States and Canada.

Trenchless Technology Center Reference Room Online

Established in 1995, the trenchless technology reference room at Louisiana Tech University represents one of the largest collections of technical papers, books, technical reports and trenchless-related product information in the world, with more than 25,000 entries and growing.

This extensive collection of knowledge and technical data regarding the specification, design, installation and inspection of dozens of trenchless-based construction methods has attracted visiting researchers from Europe, South America and China, who spend between several days to several weeks exploring the wealth of knowledge in this reference room. The reference room is also used on a regular basis for supporting research activities at the TTC, responding to hundreds of trenchless-related inquiries from municipalities and vendors and supporting undergraduate and graduate students' research papers.

As its library collection grew, the TTC invested thousands of man-hours in the organization and documentation of the material, scanning and cataloging many thousands of articles, technical reports and product brochures. An in-house database was developed for managing and searching the growing electronic and hardcopy collections. As the collections grew and their value to the industry became more evident, it was apparent that dedicated resources and a more systematic approach would be required to support the collections. It also became clear via our interaction with members of the TTC Industry Advisory Board and others in the trenchless industry that a means of remote access to collections that would eliminate the necessity to travel to Ruston is required to allow the industry to take full advantage of this wealth of knowledge.

In 2012, the Louisiana Contractors' Education Trust Fund provided a grant for Phase I of the project. The TTC acquired and installed an online software solution, then began transferring its records in order to test its accuracy and accessibility. The goal is to provide an automated online catalog and computer-based library management system that will provide access to the largest collection of literature on trenchless technology for the research and learning needs of engineers around the world. Citations will be available for all records; where copyright allows, a full electronic copy of the document itself may be provided. Students and staff are currently reviewing and updating entries. We expect a working version by the fall 2013.

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Trenchless Technology Center *Newsletter*

June 2013

Trenchless Technology Center

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The TTC Newsletter is published as a department within TrenchlessTechnology. All newsletter materials are prepared by TTC. Communications should be directed to the center.