Sustainable Municipal Pipelines

Centre for Advancement of Trenchless Technologies

Building Sustainable Buried Infrastructure for the Future

Issue 5 September 2013

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Message from the Chair, Board of Directors

CATT has become a resource and research centre that is recognized both nationally and internationally in the Trenchless industry. This is due in large part to the belief and dedication of the volunteers and the membership that there is a need for quality, realistic solutions that address the needs of municipalities with respect to deteriorating infrastructure and asset management. To all of you, board members, committee chairs and members, researchers, support staff, volunteers and members, a big Thank You for your time and dedication to making CATT a truly identified and valued resource to the Trenchless industry. Last fall, partly in preparation for CATT's Report to Senate in the spring of this year, and also to provide focus, direction and goals to our organization, the Board of Directors met and worked out a five-year plan. The format that was followed was to objectively evaluate the past five years, identify the characteristics that make an organization healthy and successful, identify our strengths and weaknesses, and then set targets and a strategy for the coming five years. A year later, in review, it is refreshing to see the progress that we have made due to the energy and commitment to take something that is good and needed, and make it even better! CATT is a dynamic organization with a forward-looking vision and it is exciting to see the development and advances of the industry, knowing that we are an integral part of it, and contributing to it. The 2014 CATT/BMI Roadshow is fast approaching, and the planning for it promises an awesome show….see you there!

Jonathan Pearce, Board of Directors Chair

CATT's First Canadian Annual Municipal Trenchless Survey

2012 marked the first CATT annual municipal trenchless survey. This survey was developed to obtain information on the state of the Canadian Trenchless market and industry trends. Since this is our first survey it will establish a baseline for understanding industry trends. In total 117 surveys were completed by Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, and Ontario water utilities. Figure 1 shows the survey response by Province. As expected 90 percent survey responses were received from a wide variety of small and large utilities from Ontario. In future surveys we hope to increase participation from across Canada. The survey results are under analysis and will be released in a report in early 2013. (CONTINUED ON PAGE 5).

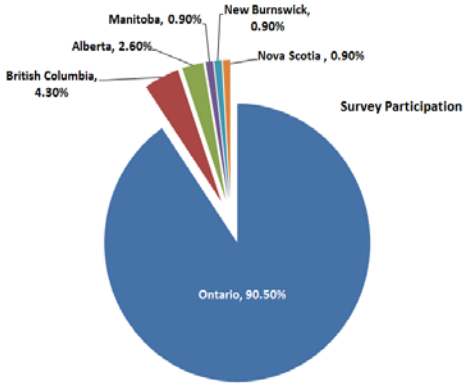

Figure 1 Survey participants

Project Highlight: Resolute Bay Non-Invasively Locates 11 Underground Leaks on HDPE Watermains Using Advanced Acoustics

Alex Shorter, Mueller Water Products, Inc.

Resolute Bay is an Arctic waterway in the Qikiqtaaluk region of Nunavut, Canada. Home to approximately 250 people, it is one of the most northerly communities in Canada and is also one of the coldest inhabited places in the world, with an average yearly temperature of −16.4°C (2.5°F). Resolute Bay's water system was plagued by underground leaks that were responsible for losing approximately 40% of the town's drinking water. Water loss presented an especially costly problem for the community considering the significant expenses required to treat the water and continuously heat and circulate it through the system to help prevent freezing and to minimize the expansion and contraction of its insulated watermains that are located under permafrost and comprised of high density polyethylene (HDPE).

The main challenge of this project was to address the conditions identified in the geotechnical investigations

The government of Nunavut employed numerous leak detection technologies to locate the leaks but found none of the methods were effective due to: insulation and plastic composition of the watermains; lack of service fittings; and inability of to differentiate the noise created by circulating water from noise created by leaks. Traditionally, the acoustic detection of leaks on plastic watermains is painstakingly difficult. Unlike metallic pipes, leaks on plastic mains are characterized by relatively low noise frequencies and amplitudes that are almost impossible to accurately detect with typical leak noise correlators. Desperate for a solution, Nunavut turned to Kudlik Construction Ltd., to help remedy Resolute Bay's water loss problem.

Action

Kudlik Construction researched numerous leak detection solutions before partnering with Mississauga-based Echologics, a developer of acoustic-based technologies for water loss management, leak detection and pipe condition assessment. Kudlik's decision to partner with Echologics was a result of a report from the National Research Council of Canada's Institution for Research in Construction, which documented the effectiveness of the company's acoustic-based technologies in providing accurate, non-invasive leak detection, especially in scenarios involving plastic pipe, multiple leaks and excessive background noise.

Traditional acoustic leak detection methods often involve the insertion of hydrophones (water microphones) into a pipe and having the water carry them downstream as they listen for leaks. However, such intrusive technologies would not work in the case of Resolute Bay, as the diameters of pipes in its water system were too small. Echologics' technology—LeakFinderRT™--is non-invasive, as it uses standard pipe appurtenances such as hydrants, valves or direct attachments to the pipe's outer wall. Surface mounted sensors are placed at two locations along the suspect water line, in most cases valves or hydrants. Sensors can be placed between 120 m and 1,300 m apart.

A correlator compares the acoustic signature of the leak with the expected speed of sound in running water and a computer algorithm uses the data to accurately pinpoint the location of the leak. Recent enhanced correlation function has dramatically improved the ability to accurately identify and locate narrow-band leak noise. This has enabled the technology to accurately detect leaks on pipes of various materials such as plastic pipe. The improved technology was deemed ideal for Resolute Bay's water system has plastic pipes, multiple leak situations, and excessive background noise created by water flows.

Results

During the three day project, engineers acoustically surveyed more than 2,800 m of plastic mains using surface mounted accelerometers placed either on service shut offs, on valves, or directly on the pipe. The test area was broken down into 39 sections based on the layout and geometry of accessible fittings.

Site Location	Pipe and Diameter	Surveyed Distance	Number of Leaks	Estimated Water Loss
6	HDPE/150 mm	97.0 m	1	4 gpm
7	HDPE/150 mm	100.3 m	1	4-5 gpm
9	HDPE/150 mm	61.7 m	1	4-5 gpm
11	HDPE/150 mm	48.6 m	2	1-3 gpm
13, 14	HDPE/150 mm	83.2 m	1	3 gpm
17	HDPE/150 mm	22.4 m	1	3 gpm
24	HDPE/150 mm	80.0 m	3	3-5 gpm
36	HDPE/150 mm	108.3 m	1	3-5 gpm

Engineers non-invasively correlated a total of 11 leaks located in eight of the sections. Each of the leaks were located between the surface mounted sensors, which were placed an average of 75m apart. Leaks that were located during the survey were each estimated to be responsible for losing an average of 3.5 gallons of water per minute (gpm). "Water loss is a critical issue to water service providers of all sizes and geographical locations, considering the significant amount of resources they focus on treating water and distributing it to their customers," said Simon Goulet, Senior Project Manager for Kudlik Construction. "Our use of advanced leak detection helped Resolute Bay improve the efficiency of its water system by identifying numerous underground leaks on its plastic watermains, which Nunavut was initially unable to detect with traditional leak detection systems. Not only were we able to help our customer reduce water loss and gain a better understanding of their water system, we were able to do so without breaking ground or disrupting service."

Alex Shorter
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The Benefits of GPS Mapping Technology for CIPP Lining

Geoff Britnell, Fer-Pal Infrastructure Canada, Inc.

Trenchless construction can restore watermains on an economical and sustainable basis. One way to do this is for a CIPP installation contractor to maximize the use of the excavation that must occur. If digging has to occur how can an installer, as well as the customer, maximize the value of the pit?

FER-PAL Infrastructure found a way to do this through the development of a GPS Acquisition System that can map underground water pipes. This system can be added to a municipal CIPP contract to have a complete profile of the watermain or other pipe to located all internal pipe features with surface features.

Typically most municipalities will conduct an above ground survey to find service connections, valves and other asset locations. Points such as a main stop and hydrant leads are often not traceable.

The system merges a trenchless technology installation process with a GIS mapping service to create a dynamic product that links internal pipe measurements with GPS coordinates. Thus, it links internal pipe attributes to ground surface measurements using the access pits that are already being used.

The system merges a trenchless technology installation process with a GIS mapping service to create a dynamic product .

The GPS Acquisition System was developed in house by FER-PAL in 2011 as part of a contract with the City of Toronto. The system works with the FER-PAL laser profiler that measures the exact interior diameter of a watermain. To properly fit a CIPP liner in a watermain, knowing the exact internal diameter is critical. Past experience has shown that when liners are not properly sized excessive wrinkles and fins can occur.

The GPS system that FER-PAL developed works by using a Trimble Unit and a GPS location device in unison. The Tremble unit provides an exact location to each access pit by establishing GPS latitude, longitude and altitude at bot the pipe start and end locations. These start and end locations are set as base points or as reference points. The GPS unit is then pulled through the pipe using the references to assign XYZ locations of features, such as main stops inside pipes. The same device also uses a gyroscopic to map bends, deflections and change in elevation inside the pipe. GPS and gyroscope measurements are then complied with the laser profile data to develop a three-dimensional (3D) image and profile of the pipe.

This new system integrates both above ground GPS analysis with a in ground pipe survey analysis. By using the Trimble Unit, GPS, gyroscope and laser profiler measurement assigned to each locate, are +/- 1mm in diametrical accuracy can be achieved.

Geoff Britnell,
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CATT's First Canadian Annual Municipal Trenchless Survey (continued from page 1)

The survey collects information on industry perspectives with respect to open-cut and trenchless construction methods used for water, wastewater and storm water construction and renovations, benefits of trenchless construction methods, industry barriers to the use of trenchless methods, contractor and consultants performance and expectations, financial information on professional training, renewal and renovation budgets and ranking of methods to reduce/ eliminate infrastructure deficits. The survey produced many interesting and surprising results. Figure 2 shows construction methods used for construction and renovation of water and waste water pipes. This figure shows that Open-Cut replacement is the dominant construction method for water and wastewater pipelines at 92 and 86 percent respectively. Directional drilling and Cured in-Place Pipe (CIPP) are also shown to be the preferred trenchless construction methods. It is interesting to note that despite of proven track record of over 30 years and significantly lower cost, CIPP is used nearly half of the time compared to open cut (47.9% vs. 86.3%).

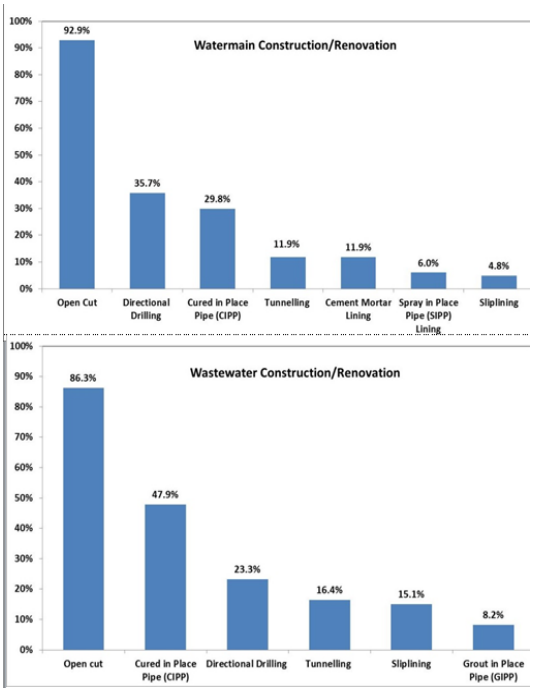

Figure 2 Watermain and wastewater pipe construction and renovation methods

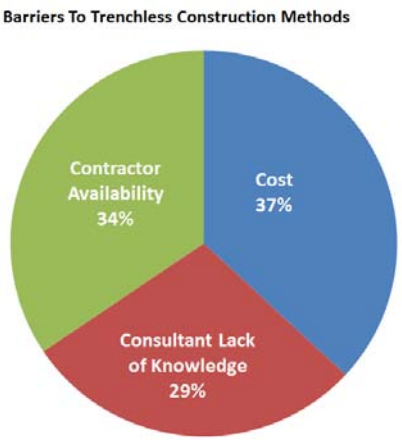

Figure 3 Barrier to trenchless construction methods

Figure 3 shows survey results for barriers to the use of trenchless construction methods. It should be noted that cost and contractor availability are cited as the main barriers (37 and 34 percent respectively) while consultant lack of knowledge is cited at 29 percent. The above survey results present a brief snap shot of the state of the Canadian industry. Final survey results will be compared to similar USA surveys, such as, annual market surveys reported in Underground Construction and Trenchless Technology. It is envisioned that this Canadian only survey will help better understand the state of the trenchless and water utility industry and will be used to assist policy makers.

Mark Knight PhD, CATT Executive Director, Associate Professor

Upcoming Events - *Visit www.catt.ca for more details*

NOVEMBER 14, 2013 | CIPP Design & Construction and Quality Assurance, Waterloo, ON.
NOVEMBER 21, 2013 | Horizontal Directional Drilling (HDD) Pipeline Construction, Design and Quality Assurance, Waterloo, ON.
JANUARY 29, 2014 | Introduction to Microtunnelling, Mississauga, ON.
FEBRUARY 20, 2014 | Risk Management for TT Projects, Mississauga, ON.
MARCH 21, 2014 | Rehabilitation of Laterals and Water Services, Mississauga, ON.
MAY 27to 30, 2014 Trenchless Technology Roadshow, ScotiaBank Convention Centre, Niagara Falls, ON.

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Feature Product - ULS-200 Underwater Laser Scanning

2G Robotics Inc. of Waterloo, Ontario has taken ULS-200 underwater laser scanner to a wide range of applications.

In the fall of 2012, 2G Robotics launched the ULS-200 underwater laser scanner. This scanner is ideal for capturing highly detailed measurements at distances spanning from .25 meters to 2.5 meters, and can provide 360 degree coverage in one scan. - ideal for tunnels and pipelines. The ULS-200 offers a data capture rate of up to 4500 points per second and provides hundreds of times higher resolution than sonar and unlike video inspection, the data from the ULS-200 can generate detailed 3D models. Underwater Laser Scans can provide actionable engineering data about the current status of an asset. The resulting data helps identify if and where maintenance is required due to structural changes such as cracks and erosion - taking some of the guess work out of the assessment and saving valuable resources.

When details matter, the ULS-200 is at it's best. However, it has some range limitations given that it is an optical solution. Ultimately, if water clarity is sufficient to see the target with video, then it is sufficient for the underwater laser scanner. Operation of the scanner is not difficult and 2G Robotics can provide training to ensure safe and effective use of the equipment. When purchasing an underwater laser scanner is not a practical solution, a rental service can be arranged and can come with or without a highly trained technician who can travel anywhere in the world to get the data you are looking for.

For more information contact Sherry Slejska, sslejska@2grobotics.com.

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Industry News

Alliance Between Vermeer and BoreAid to Benefit Contractors Vermeer has acquired all product assets for BoreAid. The acquisition agreement includes a long-term alliance with the software creators to provide support of both the Vermeer BoreAid 4.0 software system, which will be released in November 2013, and the previous BoreAid 3.0 version. The partnership with Vermeer allows for collaboration on further development and enhancements of the Vermeer BoreAid product with its creators, Dr. Karl Lawrence and Dr. Ali Bayat of Terein Inc. BOREAID was developed at the University of Waterloo and with CATT support.

CATT Conducts Successful Short Course at GEOMONTREAL2013 Conference. On September 29, 2013 Mark Duckworth Bariod IDP and Dr. Mark Knight offered a course on "Geotechnical Considerations for Successful Trenchless Technology Projects".