



In the early 1990s, the City of Waterloo began experiencing premature failures of Black Fibre Pipe (also known as Orangeburg or Bermico pipes) sewer laterals that were in-service for less than 20 years. Black fibre pipes, 51 to 200 mm (2 and 8 in.) in diameter, are compressed paper fibre tubes that are vacuum impregnated with bituminous coal tar pitch to form a pipe composed of approximately 25% fibre stock and 75% bitumen.

During World War II, governments mandated limited domestic use of steel to aid the war effort. This and the lower manufacturing cost of black fibre pipe as compared to steel, clay, and concrete pipes led to the rapid usage of black fibre pipe for sanitary laterals, drains, and conduits. Black fibre pipe remained a popular choice for sewer laterals following the end of the war, until the late 1960s, when plastic pipes were introduced. During the 1950s and 1960s, a period of rapid growth at the City of Waterloo, approximately 4,000 residential sewer laterals consisting of black fibre pipes were installed.

Soon after the installation of those black fibre laterals, home owners began experiencing sewer back-ups due to the collapse of pipes. Initially the failed house laterals were replaced by new pipes using open-cut excavation from the houses to the streets. The open-cut construction took several days to complete, was disruptive to both homeowners and city residents, and cost approximately \$6500 per lateral. Since the homeowner owned the lateral, the construction cost was shared between the home owner and the City. Due to the large number of premature failures and construction issues, the City of Waterloo decided to assume the full cost of replacing failed black fibre pipe sewer laterals. As a result of this decision, the City of Waterloo had to assume \$26 million dollar liability.

In 1994, the City of Waterloo and the University of Waterloo entered into a partnership to explore low cost, less disruptive black pipe sewer replacement methods. This partnership led to replacing the failed laterals by pulling a pipe bursting tool, which was attached to a high density polyethylene pipe, from a small excavation made inside the basement to a small excavation made at the street. The new trenchless construction method allowed the lateral replacement to be completed within a day with little disruption to homeowner and the City residents. It also reduced the cost of a lateral replacement from \$6,500 to \$4,500. The \$2,000 per lateral cost savings reduced the City of Waterloo black fibre pipe replacement liability by approximately \$8 million dollars. To date, the City of Waterloo estimates that the use of pipe bursting for lateral sewer replacement has saved the City at least \$4 million dollars.

The success of the City of Waterloo's partnership with the University of Waterloo and trenchless technology led to the support for the development of a research centre devoted to helping municipalities solve their buried infrastructure problems, including, operating, condition assessment, repairing, rehabilitation, and replacing potable water, wastewater and storm water pipelines with limited financial and personnel resources. In 1994, The Centre for the Advancement of Trenchless Technologies (CATT) was founded at the University of Waterloo through a partnership between the University of Waterloo, City of Waterloo, National Research Council of Canada, and 25 founding municipalities, industrial equipment and material suppliers, contractors, consultants, and gas company members. In November 1996, the University of Waterloo Senate officially recognized CATT as a Research Centre, making it one of the only two



centres of its kind in North America, the other one being the Trenchless Technology Center at the Louisiana Tech University. Today CATT has over 70 members that represent over 1500 industry professionals across Canada.

CATT is a grouping of university, municipal, industrial, business, and government agencies committed to the advancement of knowledge, materials, methods and equipment used in trenchless technologies. CATT's role is to serve its members and the public by addressing critical issues facing underground infrastructure installation, assessment, repair, renewal, and management. This is accomplished by providing a forum for:

- Identification of members' research needs;
- Initiation and support of fundamental research;
- Assistance with the development of new products;
- Training of highly qualified personnel in the area of underground infrastructure;
- Creation and delivery of education and technology transfer programs in the area of trenchless technologies and infrastructure management;
- Support municipalities and utilities in the identification and application of management systems and technologies;
- Development of industry protocols, good practice guidelines, as well as material and installation specifications;
- Networking with national and international researchers and organizations specializing in buried infrastructure and related research.

CATT is led by an executive director and a member-elected Board of Directors. CATT's Board of Directors consists of dedicated volunteers that represent industry, municipalities, and academia including the University of Waterloo's Dean of Engineering and the Chair of the Department of Civil and Environmental Engineering. A representative from the National Research Council of Canada also sits on the Board.

CATT is a not-for-profit organization that is funded by membership's fees, and fees collected from educational activities, contracts, and research. It is internationally recognized as a leader in trenchless technology education and research, and has received numerous awards from the North American Society for Trenchless Technology (NASTT) including No-Dig 2001 NASTT Student Chapter Award, NASTT 10th Anniversary Award, and NASTT 15th Anniversary Award.

This success would not have been possible without membership support and participation.

In 2001, CATT organized and hosted the Underground Infrastructure Research (UIR) Conference and Road Show. More than 180 delegates from nine countries attended the Conference and Road Show, presented over 50 technical papers, and discussed buried infrastructure research needs. The conference papers are available in the book entitled *Underground Infrastructure Research: Municipal, Industrial and Environmental Applications*, edited by Drs. Knight and Thomson, and published by Swets & Zeitlinger, Lisse, The Netherlands. In 2003, 2005, 2007 and 2010, CATT and Benjamin Media, Cleveland, Ohio, hosted successful Trenchless Technologies Road Shows in Southern Ontario. These Road Shows consist of two full days of technical presentations and field demonstrations with over 40 technical exhibits, and has grown to be one of the largest Trenchless Technology related events in North America. Planning is currently underway for the 2012 UIR Conference and Road Show.



Each year CATT's Seminar committee plans, organizes, and hosts approximately six workshops and seminars that discuss critical issues facing municipalities, the promotion of new technologies, and research findings. These programs are developed to provide industry, municipalities, academics, and students the opportunity to contribute and learn about advancements in trenchless technology, underground infrastructure initiatives, and buried infrastructure asset management and strategic asset planning. These programs have been conducted across Canada and the USA. Since 2008, CATT has partnered with the Engineering Institute of Canada (EIC) to issue continuing Education Units (CEUs) to workshops' participants.

CATT, with the help of its members, has also developed the trenchless technology short courses that promote the use of good practices and design of successful trenchless projects. These short courses have been delivered across Canada, the USA, and Malaysia. In 2004, CATT developed a very successful Cured-in-Place-Pipe (CIPP) Good Practices course for the North America Society for Trenchless Technology (NASTT). In 2010, CATT developed the NASTT Cured-in-Place-Pipe (CIPP) Good Practices Manual. This manual is currently under review by industry experts, and is planned to be released by NASTT in the fall of 2010.

It is recognized that the engineering practitioners, just like other professionals, work in a world of expanding knowledge and rapid technological change, and that learning has become a lifelong process. CATT's membership has identified the need for a professional training program in Civil Infrastructure Systems to address Canada's critical issue of renovating and reconstructing the aging and deteriorating buried piping systems. To address this need, CATT has developed the new training program: *Education Program for Civil Infrastructure Professionals (epCIP)*. Through epCIP trenchless technology education is provided to engineers and related professionals by a distilled and packaged format for working professionals that teaches the "why" as well as the "how". The program is designed to fill the gap between university programs and industry short courses and targets the advancement of the skills of civil infrastructure professionals by offering a series of high-quality engineering courses that lead to a university diploma. Details about the epCIP can be found at www.epcip.ca.

CATT's Technical committee has focused on the development and revision of Ontario Provincial Standard Specifications (OPSS) for trenchless technology construction specifications. Many of CATT developed specifications have been adopted as national and international trenchless specifications, (I would add a listing of the specifications)

CATT's current research efforts involve investigating and developing cost-effective, innovative tools and procedures to improve maintenance, rehabilitation, and replacement of aging sewers, watermains, and other components of water and wastewater infrastructure. The four key focus areas include: 1) condition assessment for water and wastewater conveyance systems; 2) system rehabilitation for water and wastewater networks; 3) advanced design and engineering concepts; and 4) innovative technologies for the management of buried wastewater, storm water, and drinking water networks. CATT's research has led to the development of new software such as BOREAID and WatBAMS (Waterloo Buried Asset Management Systems). BOREAID, a horizontal directional drilling design tool, is being used around the world by contractors and designers. Currently, a new strategic planning tool for sustainable buried water and wastewater infrastructure is under development. The new and unique planning tool will allow municipalities to better determine short- and long-term user rates required to operate and maintain water and



wastewater systems in a financially self-sustainable manner, and to better understand the implications and impact of financial and resource allocation decisions.

Developing validated and realistic deterioration models for water and wastewater pipelines is essential for proper strategic planning. Working with the City of Niagara Falls, CATT has advanced the wastewater pipelines' deterioration models.

CATT has made significant progress since its inception and continues to evolve to reflect the industry's changing needs. As it continues to serve municipalities and the trenchless technologies industry, CATT has gradually realized its long-term goal of becoming an internationally recognized centre of excellence in the areas of underground infrastructure research, management, and education.

For more information about CATT, upcoming events, or to get involve in CATT, please visit our website: www.catt.ca or contact Dr. Mark Knight, Executive Director, by e-mail at maknight@uwaterloo.ca or telephone (519) 888-4770.