LOUISIANA TECH UNIVERSITY

Trenchless Technology Center Newsletter

December 2006

Michels Corp. Becomes Major Building Donor

A major gift of $50,000 toward completing the National Trenchless Technology Research Facility was recently received from Michels Corp., Brownsville, Wis.

Michels Corp. joins many other trenchless technology industry companies and Louisiana Tech alumni in supporting the construction of the new facility. Michels Corp. started in 1960 in the gas pipeline sector and has rapidly grown to become a major national construction company with 16 operating divisions. Michels is a leading firm on both the new installation and rehabilitation sides of trenchless technology. The gift will allow the "strong" floor to be completed within the high-bay testing area, which can then be used to set up a variety of custom testing configurations for pipes and other utility-related structures.

Building completion is scheduled for April 2007 with the soil-structure interaction facility and the strong floor to be constructed once the shell is complete. The support of Patrick D. Michels, president, and the whole of Michels Corp. is most appreciated.

IPEX Corp. Joins TTC Industry Advisory Board

Manufacturing PVC pipes since 1954, IPEX is currently one of North America's largest manufacturers of thermoplastic piping systems including pipes, values, fittings and auxiliary components. IPEX made its first targeted entry to the trenchless market in 2004 with the introduction of TerraBrute, a restrained joint mechanism for pressure piping systems for portable water and sewer applications. The IPEX commitment to the trenchless market was further solidified with the recent introduction of TerraCon, a conduit raceway system designed for HDD installations. IPEX has been supporting Dr. Erez Allouche's research in the development of alterative piping systems for pull-in-place trenchless construction methods since 2001, a research effort that is still ongoing at the TTC. We are pleased to welcome IPEX to our Industry Advisory Board.

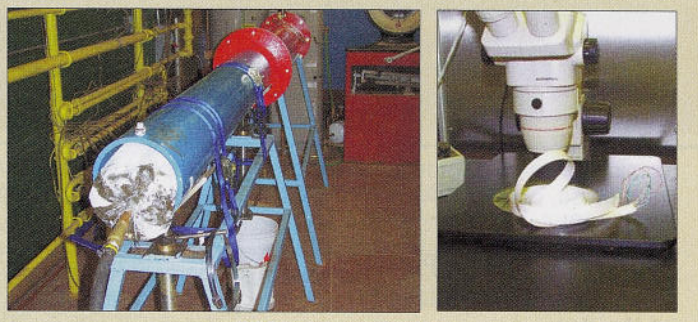
IAB members, faculty and students meet in Ruston.

TTC Industry Advisory Board Meets in Ruston

The main meeting of the year for the TTC Industry Advisory Board was held Oct. 18-20 at Louisiana Tech University in Ruston, La. The chance to have the meeting in Ruston allows the full range of faculty and students active in trenchless technology-related research to meet with the Board members. For the members, it is a chance to get a preview of research that is still in process and for the faculty and students, it is a chance to benefit from the broad practical experience of the municipal, consultant and industry members of the Board. The meeting was the largest in the history of the TTC and reflects the growing size and range of both the Board and the research and educational activities of the center.

Sensor Innovation and CIPP Inversion Unit Tested

The TTC recently demonstrated its new pipe inversion chamber (see photo), inverting and curing a 6 ft length of 8-in. diameter cured-in-place pipe (CIPP) liner during the TTC Industry Advisory Board meeting. Both the system temperature (up to 200 F) and pressure can be closely regulated in the test set up. The facility will be used for student laboratories, continuing education courses and also for laboratory research on CIPP liners. The demonstration also gave the opportunity to try out newly developed instrumentation to monitor curing temperature, which was developed by Louisiana Tech's Institute for Micromanufacturing (IFM). The sensor consisted of a narrow, ribbon strip inserted along the length of the liner between the inner and outer felt layers prior to wet-out. The rugged ribbon sensor easily withstood the rigors of the wet-out and liner inversion process and was able to continuously monitor resin curing temperature at three locations spaced at 20-in intervals along the length of the liner. Plans are in the works to field test full length sensor strips with up to 12 sensors along the length of each ribbon. Vertical and horizontal temperature gradients during the inversion process could be studied by using several strips within a larger diameter field installation. The TTC would like to thank Composites One for supplying the resin and Masterliner for supplying the liner material and providing the liner wet-out at its facility in Hammond, La.



CIPP Inversion Chamber

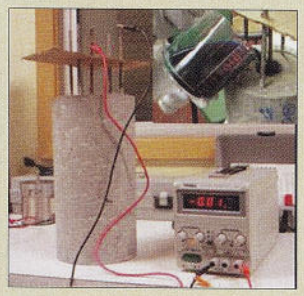
Use of Nanomaterials for Concrete Pipe Protection

Microbial induced corrosion (MIC) in concrete sewer conveyance systems is one of the most common types of deterioration encountered in such structures. Sulfide oxidizing bacteria, which grow on the sewer crown region above the water line, convert hydrogen sulfide to sulfuric acid which interacts chemically with the hydration products in the hardened concrete paste, altering the concrete chemical composition. Consequences include early deterioration, loss of strength and in extreme cases pipe collapse due to inability to resist external

earth and live loads. The current research seeks to break this chemical-microbiological cycle by creating a semi-permanent biocide condition on the surface of the concrete pipe that hinders the colonization of the sulfide oxidizing bacteria.

The TTC is developing an innovative technique for coating partially deteriorated concrete pipes using electrokinetics. In this coating process, nano-scale particles of cuprous oxide are driven into the concrete under the influence of a weak electric field. By physically driving the copper ions into the hardened concrete matrix a mechanical anchor is formed, which reduces leaching to negligible levels and can create the presence of a biocide layer on the inner wall of the pipe for a prolonged period (i.e., years) even during erosion caused by the flowing wastewater stream.

Above: 900-mm concrete sewer pipes that experienced severe MIC; **Below:** Electrokinetic coating process using cuprous oxide lactate solution process under way.



Tests have been conducted on scaled concrete pipe specimens (300 mm in height and 150 mm in diameter). The specimens were degraded using sulfuric acid solution (pH = 0.7), before being electrokinetically coated using a copper lactate solution in the presence of sodium hydroxide. Aside from depositing biocide agent to a depth of several millimeters inside the hardened concrete, this process also elevates the pH of the concrete at the wall-stream interface, thus providing further protection from MIC. Following the coating process, a series of optical and chemical tests were undertaken to evaluate the effectiveness of this coating process in terms of the extent of penetration of the nanoparticles into the concrete and the concentration of the heavy metal as a function of depth.

Preliminary results in terms of images from optical microscopy examination and atomic absorption spectroscopy analysis have been obtained. The analysis confirmed an increase in copper concentration within the target zone of a 25 mm depth. It is expected that the increase in concentration immediately below the concrete surface is far greater. Studies currently under way include establishing the relationship between the treatment parameters (i.e., duration, concentration and pressure) and the concentration profile of the copper ions within the pipe wall. Future studies will include examining the durability of the coating under physical, thermal and chemical loadings and a half-scale performance assessment where treated specimens will be exposed within a simulated sewer environment and colonized with bacteria cultures.

For more details, contact Dr. Allouche at *allouche@latech.edu* or call (318) 257-4072.

TTC Municipal Forum News

Four forums were held in the fall of 2006: in Littleton, Colo.; Hillsboro, Ore.; Ruston, La; and for the first time in the New York area, in Long Island City, N.Y. The forums were well attended as usual, especially the Colorado forum with 60 participants and the New York forum with 52 participants.

At the end of this season, the TTC municipal forum program will mark a total of 60 forums held from the inception of the forum program in 1998. Over the years, between 150 and 200 presenters have had a chance to talk before groups of municipal personnel eager to learn about new advances in trenchless technology and the capabilities/limitations of particular technologies or trenchless methods in general. The presenters also often talk about specific case studies passing on the experiences gained in specific applications. For most municipal participants, the highlight of the day, however, is the chance for a peer-to-peer, closed-session discussion in the afternoon of the forum.

As many as nine forums are planned for spring 2007: in Los Angeles, Boston, Denver, Olympia, Wash., Minneapolis, Dallas, New York, Miami, and Columbus, Ohio. Exact dates as well as topics of presentations have not yet been selected. Any municipal participants not yet involved but interested in attending these forums are encouraged to e-mail the TTC for further information (*ttc@engr.latech.edu*) before January 2007. Industry interest in presentations to the forum also is welcomed. Priority is given to topics requested by the municipal participants but presentation slots are available periodically.

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