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CURRENTLY @ CUIRE

CENTER FOR UNDERGROUND INFRASTRUCTURE RESEARCH AND EDUCATION

USE OF SPRAY APPLIED PIPE LININGS (SAPLS) AS A STRUCTURAL RENEWAL FOR GRAVITY STORM WATER CONVEYANCE CONDUITS

The primary objective of this two-year research project that commenced in December 2017 is to develop design equations for structural renewal of gravity storm water conveyance culverts using spray applied pipe linings for both cementitious and resin-based materials and for circular and non-circular (NC) shapes. Design equations developed with this project will use loading as detailed in the AASHTO's Load and Resistance Factor Design (LRFD) Bridge Design Specifications and will be applicable for round and pipe arch shapes. All parameters of the host culvert that may impact the design thickness such as vertical or horizontal deflections, unsymmetrical racking, section loss, cracks, material geometry (corrugations), or protrusions such as bolts and flanges will be considered. Additionally, practical limitations on the use of these design equations will be included.

Participating State DOTs

- Delaware
- Florida
- Minnesota
- North Carolina
- New York
- Ohio
- Pennsylvania

Some Benefits of SAPLs

- No traffic disruptions
- Fast
- Non-worker entry
- Durability
- Environmentally friendly

The methodology for this research and the status of each item include:

- Literature search to minimize amount of laboratory testing and field inspections- Completed
- Survey of U.S. DOTs and Canadian agencies- Completed
- A database of previous projects and experiences of participating DOTs with SAPLs- Completed
- Field data inspections of in-situ SAPL installations at participating DOTs- Completed
- Review of CIPP ASTM F1216 design equations- Active
- Soil box testing to develop and validate structural design equations with circular and pipe arch shapes with resin and cementitious SAPL materials at various thicknesses-Active
- Determine if metal pipe corrugations need to be complete filled with SAPL material (as claimed by some SAPL vendors) - Completed
- Life cycle cost analysis -Anticipated
- Finite element computational modeling-Anticipated
- Development of a performance-based construction specification-Anticipated



CUIRE Ph.D. students working on the SAPL project.

Table 1 presents SAPL suppliers who have expressed interest in participating in this important evaluation program, up to publication of this paper. Some of these vendors already have started or completed testing through NTPEP. To participate in this active project, DOTs and vendors can contact Jeffrey Syar,

P.E., Administrator, Ohio DOT Office of Hydraulic Engineering, Phone: 614-275-1373, Email: Jeffrey.Syar@dot.ohio.gov; or Dr. Mo Najafi, P.E., Phone: 817-272-9177, Email: najafi@uta.edu, the Principal Investigator for this project.

Table 1 -- Participating Vendors and Suppliers

A.W. Cook	MCOR
Advantage Reline	Milliken
CentriPipe	Raven Lining Systems
Epoxytec	Sherwin-Williams
HydraTech Engineered Products LLC	Sprayroq
Inland Pipe Rehabilitation (IPR)	Standard Cement
Lafarge	Superior Coating Solutions
	The Strong Company
	Vortex/Quadex Lining Systems

CUIRE AND INDSTT SIGN A COOPERATION AGREEMENT

Last May, an agreement of cooperation was signed between University of Texas at Arlington/CUIRE and the Indian Society for Trenchless Technology (IndSTT). The objectives of this agreement are:

- Exchange of materials in education and research, publications and academic information;
- Exchange of faculty and research scholars;
- Exchange of students; and
- Joint research and meetings for education and research
- Establishment of a CUIRE branch in Hyderabad, India

As the first educational activity, the No-Dig India Show 2018 was held in Mumbai, India, Dec. 14-15, 2018. It was organized by IndSTT and sponsored by CUIRE. The event had a technical conference covering some of the latest topics in trenchless technology sector. In addition, there was a training workshop on subsurface utility engineering (SUE). More than 1,000 professionals participated in this event.

To provide a first-hand exposure to participants, an exhibition of trenchless equipment was also organized in the show. In addition of strong representation from Indian trenchless industry, several countries, including the United States and Germany were represented.

Dr. Mo Najafi, CUIRE director, presented a keynote speech on the topic of "State of Trenchless Technology Research, Publication and Education in the United States & Collaboration Opportunities for Indian Trenchless Industry." Dr. Mo Ehsani, president and CEO, QuakeWrap Inc., presented a second keynote on "Rehabilitation of Structures with Fiber Reinforced Polymer (FRP) Products."

At the conclusion of the conference, Najafi presented a copy of his book, *Trenchless Technology: Planning, Equipment and Methods*, to Dr. Niranjan Swarup, IndSTT director. CUIRE and IndSTT have decided to work jointly for the No-Dig India Show 2019 proposed to be held in New Delhi, India in December 2019. More details of No-Dig India Show can be accessed at indstt.com or by emailing Dr. Swarup at indstt@gmail.com.

Under its joint research objective, a large size rehabilitation project for an Indian power company, North Eastern Electric Power Corporation Ltd. (NEEPCO) has been initiated by IndSTT and CUIRE. Upon conclusion, the project would result in the rehabilitation of the penstock system for a Hydro Electric



Power Plant for NEEPCO, a government of India Company, and produce enough materials for several researches in trenchless technology field focused at pressure pipelines and conduits rehabilitation. Figure 3 shows inspection of the penstock. During inspection, it was initially determined that carbon fiber reinforced polymer (CFRP) can be used to reinforce the penstock and provide a leak-proof surface.

As part of a future project, CUIRE is preparing a database of U.S. companies interested to work in India. To be included in this database, contact Najafi at CUIRE@UTA.EDU or call CUIRE at 817-272-9177.