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CURRENTLY @ CUIRE

CENTER FOR UNDERGROUND INFRASTRUCTURE RESEARCH AND EDUCATION

CUIRE PROVIDES STRUCTURAL EVALUATION OF SAPL FOR NUKOTE COATING SYSTEMS INTERNATIONAL

Spray-applied pipe lining (SAPL) is a trenchless technology renewal methodology for potential applications in pressure and gravity flow conduits such as water mains, oil and gas pipelines, culverts and storm drains, and sanitary sewers. SAPL can enhance structural and hydraulic capacity of deteriorated conduits. Considering deterioration of massive amount of underground pipelines installed many years ago, there is a big market for trenchless renewal technologies such as SAPLs. When considering trenchless renewal technologies, SAPLs have lower construction, social and environmental costs, and shorter durations for quick back to service of pipelines. As currently there is no known standard design methodology for polymeric SAPLs, such as polyurea, polyurethane and epoxy, the objective this research is to provide a design guide using analytical approach and soil box testing for large diameter circular and arch shapes as well as buckling and long-term hydrostatic testing as described in the following sections.

The soil box testing includes CMPs with 6 ft lengths and 60 in. diameter. The invert of these CMPs were cut to simulate fully invert-deteriorated culverts in field conditions to eliminate ring stiffness of the host pipe and to maximize the applied load on the geopolymer SAPL. The CMP samples were buried under 2 ft of soil cover. Once the pipes were backfilled, they were renewed with geopolymer SAPL. The results showed that the proposed analytical approach which is derived from Marston's Iowa equation is in an acceptable conformity with the test results.

Soil Box Testing

The objective of the soil box testing is to evaluate the structural capacity of invert deteriorated corrugated metal arch pipes renewed with Spray-in-Place Thermoset Plastic Liner, under actual field loading conditions. Table 1 presents the proposed soil box testing at CUIRE on the polyurea materials from the Nukote Coating Systems International LLC.

Long-term Internal Hydrostatic Pressure Test (at Constant Pressure)

The main purpose of a liner is to prevent water and sediment leakage, reduction in corrosion and enhancement of the pipe. Therefore, a liner encased by a host pipe is mainly subjected to the internal head of water that builds up once the hydraulic integrity is restored. The liner may also carry some soil pressure if the host pipe is severely deteriorated. Regardless of the source of external pressure, the encased liner fails by creep buckling under internal pressure.

Hydrostatic tests have been frequently used by industry to examine the performance of liners for hole-spanning. Long-term internal hydrostatic pressure test method covers the determination of the

Test Type	Test Number	Host Pipe Corrugated Metal Pipe (CMP)			SAPL Spray-in-Place Thermoset Plastic Liner
		Shape and Diameter, in. (m)	Invert Condition	Length ft (m)	Thickness in. (mm)
Polymeric	1	Arch 47×71 (1.2×1.8)	Deteriorated (Invert-cut)	6 (1.8)	0.5 (12.7)
SAPL	2				0.65 (16.5)
Soil Box Test	3				1.5 (38.1)

Table 1. Details of Soil Box Test Setup and Pipe Samples.

Pipe Number	Pipe Description
1	0.25-inch gap opening
2	0.5-inch gap opening
3	1-inch gap opening
4	2-inch gap opening

Table 2: Long-term Internal Hydrostatic Test, Gap Opening Size

time-to-failure of elastomeric polyurea hybrid lined pipe under constant internal pressure. The data obtained by this test is useful for establishing stress versus failure time relationships from which the hydrostatic design basis for plastic pipe materials can be computed.

Long-term, or creep tests are typically performed over a long period of time. In long-term testing a constant uniform pressure (hydrostatic) is applied on the liner confined in a host pipe for at least 10,000 hours, as illustrated in Figure 5. The design pressure is determined analytically or applying a factor of safety to collapse pressure of an identical liner found from a short-term testing. Performance of the liner is typically monitored for hole spanning of different sizes, as listed in Table 2.

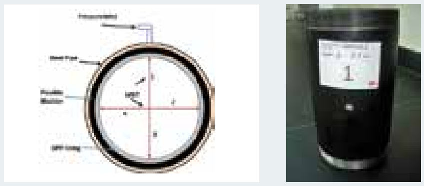

Figure 5: Long-term Hydrostatic Test Setup

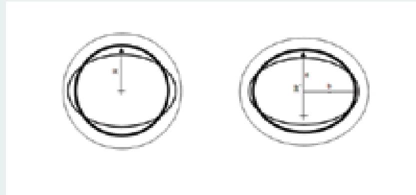

Figure 6: Liner Deformation under External Pressure.

Short-term External Buckling Pressure Test

This test method establishes the short-time hydraulic failure pressure of pipe and fittings. A liner confined in a host pipe is subjected to an increasing level of external pressure until failure occurs, as illustrated in Figure 6. Failure is defined as the first weep or leaking of fluid.

CUIRE 19TH ANNUAL CERTIFICATION SCHOOLS

CUIRE, of the University of Texas at Arlington, will hold its 19th annual Pipeline and Trenchless Technology Training and Certification Schools May 17-18, at the Music City Center in Nashville.

The 2021 program includes the two-part Advanced HDD, Geotechnical, and Pipe schools, as well as half-days of the Pipeline Inspection and Asset Management, and Microtunneling and Pilot Tube schools. Attendees may register for any of the half-day schools.

May 17

8 a.m. – Noon

- School A – Advanced Horizontal Directional Drilling (HDD) (Part One): Planning and design of large, mid- and small-size HDD projects from inception to closeout and delivery. The school includes talks on pipe loads, bore planning, drilling fluids and case studies.
- School B – Geotechnical (Part One): Geotechnical requirements for both trenchless and open-cut applications, soft soils and rock investigation methods, and how ground conditions will affect trenchless feasibility and productivity.
- School C – Pipe (Part One): This school will cover applications, capabilities, manufacturing, standards, advantages and limitations of steel and rigid pipes, such as clay and concrete, and new developments in these pipe materials and joining systems.

1 – 5 p.m.

- School D – Advanced Horizontal Directional Drilling (HDD) (Part Two): The second part of this school includes construction projects of all sizes, plus tracking, tooling and locating, and case studies.
- School E – Geotechnical (Part Two): Part Two covers planning, geotechnical reporting, and contracting requirements for trenchless technologies in different ground conditions.
- School F – Pipe (Part Two): This second part covers applications, capabilities, manufacturing, standards, advantages and limitations of flexible pipes, such as ductile iron, PVC, HDPE, fiberglass, polypropylene, and new developments in these pipe materials and joining systems.

May 18

8 a.m.–Noon

- School G – Microtunneling and Pilot Tube: This school covers planning, design and construction of Microtunneling methods (MT) and pilot tube and other guided boring methods (PTGBM) and will include case studies. A discussion of new ASCE Microtunneling Standards and Manual of Practice on PTGBM will be presented by authors.
- School H – Pipeline Inspection and Asset Management (NEW!): This school will cover pipeline inspection for gravity and pressure applications, including water, sewer (sanitary and storm), oil and gas. It will also include Information on how to use pipeline inspection and assessment data to renew deteriorated pipelines.

Each half-day school qualifies for 0.4 Continuing Education Units (CEUs) and 4 Professional Development Hours (PDHs) through the University of Texas at Arlington.

Registration fees for these schools are $195 for the half-day, $365 for the 1-day and $515 for the 1.5-day before April 16. On or after April 16 the fee is $295, $465 and $615, respectively. At-site registration is available by cash or check only and is $350, $465 and $850, respectively.

For more information, contact CUIRE at 817- 272-9177, *cuire@uta.edu* or at *https://uta.engineering/cuireschools/*

CUIRE MOURNS LOSS OF ITS BOARD MEMBER

Walter Chiang, Ph.D., founder of CP&Y, died Aug. 7, 2020, leaving behind a rich legacy. As a prominent leader in the environmental and civil engineering industry, Chiang enjoyed a long and distinguished 50-year engineering career filled with countless accolades and awards. His lifelong dream of being a "Partner for a Better Quality of Life" is rooted in the firm's tagline and is the foundation of an extraordinary man who devoted himself to the improvement of environmental services, civil engineering initiatives and education of future generations of engineering professionals. Up until the time of his passing, Chiang served on the Civil Engineering Advisory Boards for both the Civil Engineering Department of the University of Texas at Arlington and CUIRE. For many years, he supported CUIRE's educational and outreach activities both financially and attendance in meetings and workshops.

FOR MORE INFORMATION REGARDING CUIRE: *CUIRE.ORG*