Trenchless Rehab and Installation of Pressure Pipelines

Southeast District Ohio Section AWWA

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Pressure Pipe Rehab and Installation Objectives

- Extend life of existing infrastructure
- Structural or Semi-Structural design
- Minimally disruptive
- ANSI/NSF 61 Certified
In existence for over 40 years, cured-in-place pipe (CIPP) is a trenchless technology

- Initially used in sewers
- Pressure CIPP uses modified properties to make it suitable for the drinking water market
- End product is a joint less, pipe-within-a-pipe that protects against spills, breaks and pipe leakage

Suitable for the following applications:

- Distribution and transmission mains
- Cooling water lines
- Fire water mains
- Industrial pressure applications
- Sewage force mains
CIPP Fiber-Reinforced Composite Structure

- Epoxy/fiberglass structure
  - Provides high tensile strength
  - Number of layers vary depending on diameter and internal pressure
- Epoxy/polyester felt structure
  - Provides for external load capacity
  - Layer thickness can be varied depending on loading conditions
- PP/TPU coating
  - Water contact surface
  - Coating also provides water barrier for installation processes

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<tbody>
<tr>
<td>Diameter range</td>
<td>6” to 72”</td>
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<tr>
<td>Effluent temperature</td>
<td>Up to 130°F</td>
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<tr>
<td>Internal pressure capability</td>
<td>Up to 250 psi (safety factor of 4)</td>
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<tr>
<td>Bends</td>
<td>Up to 45°</td>
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<tr>
<td>Host pipe material</td>
<td>All materials</td>
</tr>
<tr>
<td>Mechanical properties</td>
<td>Exceeds ASTM F1216 and ASTM F1743</td>
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Pressure CIPP Design Capabilities

- Internal pressure standalone design of up to 250 psi
- Hydrostatic burst tested up to 1300 psi
- Custom designs possible
- External loading design accounts for:
  - Soil
  - Groundwater loads
  - Traffic
  - Other live loads
- Installation lengths up to 1200’
Step 1:
If required, setup bypass and excavate pits to provide access to the existing pipeline. Clean the pipeline and inspect using closed circuit TV (CCTV).

Step 2:
Install the CIPP system liner into the host pipe using water pressure. After curing with hot water, the pipe is cooled and the ends are cut. Following hydrostatic pressure testing, post-installation CCTV inspections are also completed.

Step 3:
Reconnect lined sections to the existing system using standard pipe fittings. Finally, restore excavation pits and remove temporary bypass, if applicable.
Pressure CIPP Case Study - West Palm Beach 48” Force Main Project

- 5,800 LF of 48-inch PCCP
- Location: Near Canal and Country Club
  - High-end residential area
- Operating pressure: 30 psi
- Solution: Class IV fully-structural CIPP
- Completed six sections; averaged about 1000’, longest shot 1145’
- Tube delivered to the site wetted
- Completed late summer, 2016
West Palm Beach 48” Force Main Project – Installation Site
West Palm Beach 48” Force Main Project – Completed Liner Shot
West Palm Beach 48” Force Main Project – Connected and Tested
Carbon/Glass Fiber (FRP) Systems

- High-strength, lightweight, low profile characteristics provides a less intrusive value engineering solution; adds minimal weight/area and **maintains hydraulics**
- Installed without removal and replacement of many existing obstacles... **trenchless**
- Small project site footprint... **low impact and rapid installation**
- Proven **long term durability** and excellent resistance to corrosion
- Can be applied onto **complex shapes** (tees, elbows, etc.)

<table>
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<th>Diameter range</th>
<th>36” &amp; Above</th>
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<tr>
<td>Effluent temperature</td>
<td>Up to 150°F</td>
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<td>Internal pressure capability</td>
<td>Up to 450 psi</td>
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<td>Bends</td>
<td>Any</td>
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<td>Host pipe material</td>
<td>All materials</td>
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<tr>
<td>Mechanical properties</td>
<td>Specifically designed as conditions require</td>
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Capabilities of Internal or External Wrapping with FRP Systems

- Restore pipeline to original hydrostatic pressure capacity
- Accommodate increased internal pressure requirements
- Re-establish flexural loading capabilities
- Restore original external loading capacity of pipeline
- Upgrade external loading capability due to higher live load/traffic requirements
- Provide watertight rehabilitation at joints/couplings or transition zones
• Washington Suburban Sanitary Commission discovered numerous sections of its 66-inch pipeline had broken pre-stressed wires and were structurally unsound
• WSSC determined traditional remove and replace method was not practical
• FRP system allowed for a shortened construction schedule, minimal curing time and immediate return to service
Industrial Outside Strengthening
When Long Runs of FRP Can Be Cost Effective

- Larger Diameter (48” or greater)
- Higher Pressure (90 psi or greater)
- Difficult Configuration
  - Vertical/horizontal bends or changes
- Difficult Access – Some FRP systems can be truly trenchless
  - Limited/No access needed
Tight-Fit or Close-Fit HDPE (thermoplastic) Lining Systems

- **Tight-fit or Close-fit** (not slipline)
  - Custom engineered & manufactured
  - Maximizes flow over standard IPS
  - Installed by compression or deformation
  - Allows flexibility for challenging installations
  - Usually <1” of “gap” is all that is needed
  - 2” to 54” diameter

- **Non-structural liners**
  - Liner relies on host pipe
  - Thin-wall; < DR32.5
  - Eliminates leaky joints and/or internal corrosion

- **Structural liners**
  - For use where host pipe is NOT structurally sound
  - > DR32.5, up to DR 17
  - Sections of host can be removed
  - Solves internal and external corrosion
Tight-Fit Liner Case Study – Valley Forge National Historic Park

- 30-inch force main traveling directly through Valley Forge National Historic Park along the Schuylkill River
- Over 40 years old
  - 3 separate failures precipitated need for repair/replacement
- 18,000 linear feet
- Tight-fit HDPE system was chosen to rehabilitate the pipeline
- Worked closely with CH2M Hill and general contractor, PACT, to complete the project
- Completed in 6 months
- Pressure tested at 60 psi
Trenchless Installation Methods Using New Thermoplastic Piping

- Horizontal Directional Drilling (HDD)
- Sliplining
- Pipe Bursting
HDD Trenchless Installation Method

- Guided pilot hole is drilled along a bore path
- Drilling fluids are injected into the hole to stabilize and lubricate
- Back reamer is used to enlarge the pilot hole
  - Multiple passes are required to accommodate pipe OD
  - Drilled bore hole is typically enlarged to 1.5 x OD of new pipe
  - New pipe is pulled through the bore hole
MARIETTA, OHIO MUSKINGUM RIVER CROSSING

- 1,960 LF 16-inch DR 21 FPVC® pipe
- Muskingum River Force Main
- HDD Contractor - DRS Enterprises
Slipline Trenchless Installation Method

- Provides maximum flow with an independent fully structural solution
- Results in a smaller I.D. than the host pipe
- Improvement in internal friction often minimizes flow loss – “C” factor
- Grouting of the annular space between the existing and new pipe is usually required
City of Elyria, Ohio Rehabilitates 30-inch Water Main

• Pikewood 30-inch Water Main Rehabilitation
• 2,100 LF Pipe 24-inch DR21 Fusible PVC®
• Burgess & Niple
• Slipline Contractor – Speer Bros.
Static Pipe Bursting Trenchless Installation Method

- Burst head is pulled through existing line - fracturing or cutting the pipe
- Fractured or split pipe is pushed into the surrounding soil
- New pipe is pulled in immediately behind the burst head
• Ductile iron, cast iron, asbestos-concrete and steel are typical water pressure pipe materials that are burst – high production rates are possible (project in Florida - 500 LF in 1 hour)

• Typically done in 300 - 500’ increments (~1 hour pull-back)

• Utilizes existing alignment – less engineering cost to locate adjacent utilities

• Result in same or larger I.D. (upsizing) as old pipe

• Water services must be excavated prior to construction
Dearborn Heights, MI - Replacing Aged Cast Iron Water Mains

- Dearborn Heights Water Main Improvements
  8,200 LF 8 & 12 DR18 Fusible PVC®
- Wade Trim
- D&D Water and Sewer, Inc.
Questions?

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Thank you!