A Solid Solution for Internal Reinstatement of Services
In CIPP Lined Water Mains

Steve Soldati, P.E. – Regional Sales Mgr.

Houston...We have a problem!
First Step...Choosing to install CIPP!

Step 1:
If required, setup a temporary water bypass and excavate pits to provide access to the existing pipeline.

Clean the pipeline and inspect using closed circuit TV (CCTV) in order to ensure the host pipe is free of any potential hazards.

Step 2:
Install the InsituMain® liner into the host pipe using:
- Air (steam cure)
- Water (water cure)
- Pull-in (steam or UV cure)

After curing, the pipe is cooled and the ends are cut. Following hydrostatic pressure testing, post-installation CCTV inspections are also completed.

Step 3:
Reinstate service connections (if present) and/or reconnect lined sections to the existing system using standard pipe fittings.

Finally, restore excavation pits and remove temporary bypass, if applicable.

Take a Step Back...WHY did we choose to install CIPP!

- End product is a jointless, pipe-within-a-pipe that protects against spills, break, and pipe leakage
- Certified to ANSI/NSF 61 standards
- Minimally Disruptive
- Creates a new "pipe within a pipe"
  - 50+ yr engineered design
- Pipe is fully deteriorated
- Access to dig and replace is difficult
- ETC...
Hot Topics Related to CIPP Pressure Pipe Lining?

### Structural Classification of Liners

<table>
<thead>
<tr>
<th>ISO Class</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>Class D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>Interactive</td>
<td></td>
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</table>

- loose-fit
- close-fit
- inherent ring stiffness
- relies on adhesion
- relies on adhesion

<table>
<thead>
<tr>
<th>Fully structural</th>
<th>Semi-structural</th>
<th>Non-structural</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWWA Class IV</td>
<td>Class III</td>
<td>Class II</td>
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Water-tight seals at service connections and end terminations:
- Internal reinstatement
  - Based on bond or adhesion?
  - Mechanical system without reliance on bond and pipe preparation
- Provide a complete system independent of host pipe

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## Historical service reinstatement options

### Excavated mechanical reconnections

- Involves open-cut excavation and installation of new mechanical connections at each service.

### Adhesive reconnections

- Plug and drill method whereby liner adheres to host pipe and service corporation
Traditional Internal Reinstatement

• All systems have common requirements/processes
  1) Prepare internal surface
     • No specification, installer’s requirements
  2) Plug existing corp stops – system specific
     • Direct tapped
     • Saddled more complicated – likely require digs
  3) Install CIPP pressure pipe liner
  4) Cut liner at ends of lined pipe
     • Processes and effectiveness to provide leak tight seal at terminations vary
  5) Locate service under liner – its a small projection
  6) Open service by drilling out plug

What Defines Required Bond?

No formal standard or specification
• AWWA Structural Classification Document comments on need and proving bond if inferred or required by product

### Requirements for Pressure Pipe Related Applications

<table>
<thead>
<tr>
<th>Application</th>
<th>Requirement/Target Pull-off Force</th>
<th>Preparation/Installation Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spray on liners (AWWA C620)</td>
<td>200 psi</td>
<td>Resist forces related to surges</td>
</tr>
<tr>
<td>Hand applied Fiber Reinforced Polymer</td>
<td>1000 psi for metal pipe</td>
<td>Abrasive blasted</td>
</tr>
<tr>
<td></td>
<td>Concrete material to separate before liner pulls off</td>
<td>High pressure water – 30,000 psi Dehumidification</td>
</tr>
<tr>
<td>Fusion bonded epoxy (Coatings on fittings and appurtenances)</td>
<td>3000 psi</td>
<td>Abrasive blast preparation with short timeframe to apply coating (prevent flash corrosion)</td>
</tr>
</tbody>
</table>
Surface Preparation Practices

- Key areas are end terminations and at services – provide “profile” and increased surface area
- Current practices – varying degrees of “clean”
  - Drag scraping
  - Flushing
    - Low pressure (2000-5000 psi)
    - High pressure – 10,000 psi+, pipe condition drives
  - Mechanical
    - Rotating chain flail
    - Rack bore
- Airborne abrasive (Tomahawk System)
  - Provides SSPC-SP6/NACE #3 or Commercial Blast Clean
  - Enhanced surface profile and ability to focus on specific locations
  - Current deliberations may question desirability of full length bond – some more brittle materials may crack or fail with host pipe failures

Service Connections – Adhesive

- Step 1 – Intense cleaning to prepare pipe surface for resin
- Step 2 – Plugging of existing service connection
- Step 3 – Locating of the existing service (after lining)
- Step 4 – Reinstatement of the existing service (via drilling)

* This process relies solely on the integrity of the host pipe (long term) in order to maintain water tightness
Adhesive Bond Reliant Summary

- Different levels of effort provide varying results
  - Applying some methods is not practical in small diameter municipal water mains
- No consensus on need/want of full length bond
- Long term effectiveness currently not characterized
- No defined standard to achieve
- Difficult to measure effectiveness

Service Connections – Adhesive vs. Mechanical

- Step 1 – Cleaning to prepare pipe surface for resin
- Step 2 – Plugging of existing service connection (prior to lining)
- Step 3 – Locating of the existing service (after lining)
- Step 4 – Drilling of the existing service (most CIPP product manufacturers/contractors stop at this step – plug and drill)
- Step 5 – Reinstatement of the existing service (via installation of the mechanical fitting)

* The mechanical reinstatement process DOES NOT rely on the integrity of the host pipe (long term) in order to maintain water tightness
Mechanical Service Reinstatement

System Components

**Measurement probe**
Consists of laser sensors and inspection camera

**Self-locating plug**
Installed prior to lining to prevent resin migration

**Drilling tool**
Detects exact location of plug prior to drilling

**Mechanical fittings**
Utilizes a patented push-in-place “Corpbite” system that maximizes pull-out force

**Cartridge loading system**
Holds up to 8 plugs/mechanical fittings to maximize production

**Interface software**
Provides operator with easy-to-use interface for reinstating connections

Plugging of service prior to lining (video)
Installed Mechanical Fitting

- **Direct Tap Service**
  - Reduces or eliminates need for costly excavations
  - ½", ¾" and 1" diameter reinstatement options
  - Pipe diameters from 6" to 12"

- **Saddled Tap Service**

Service reconnection hardware – mechanical fitting

- Manufactured utilizing specialized stainless steel materials and gaskets that are capable of withstanding long-term exposure
- Utilizes a patented push-in-place “Corpbite” system that maximizes the pull-out force of the device while maintaining the low force required for installation
Mechanical fitting installation (video)
Why should you utilize mechanical service connections?

Less disruptive  Long term reliability  Reduced cost

At the End of the Day!

- Long-Term Reliability
- Normal Daily Routine
- Improved Schedule
- Improved QA/QC
This concludes the education portion of this session...

Happy to discuss further…

Steve Soldati, P.E.
Regional Sales Manager of Pressure Pipe- East Region
Aegion Corporation

ssoldati@aegion.com
407-576-0849
Find me on LinkedIn!