Relining of Water Mains with Flexible High Pressure Pipelines
Some facts about Water Networks

- Aging water main infrastructure
- The American Society of Civil Engineers says that 6 billion gallons of treated, potable water are lost each day due to leaking deteriorated pipes
- 700 water main breaks occur each day in the US
- Rust, lead, and asbestos in aging pipes affect water quality
- Existing budget constraints for replacing infrastructure
- Trenchless Technology as an optimal alternative to rehabilitate pipe systems
Water Main – Trenchless Replacement Technologies (Structural)

1. Pipe Bursting (usually HDPE)
2. Parallel Horizontal Directional Drilling
3. Bore and Jack with casing pipe
Water Main – Lining Technologies
(Non-structural to limited structural)

1. Cement-mortar lining

2. Epoxy lining

3. Slip lining (Thermo-plastic liners – i.e. HDPE)

4. Cured-in-place lining
   - a. Felt based systems
   - b. Woven hose systems
   - c. Membrane systems
AWWA Liner Classification

- **Class I** – non-structural, coatings for internal corrosion
- **Class II** – Minimal inherent ring stiffness, relies on adhesion to host pipe, semi-structural
- **Class III** – interactive, semi-structural
- **Class IV** – fully structural, structurally independent on basis of internal load capacity
Pressure Liner Classifications

Categories of pressure pipe liners:

1.- Independent
liner is designed for all applicable loads independent of the host pipe (i.e. loose-fitting and close fitting)

2.- Interactive
semi-structural liner relies on radial support from host pipe to handle internal loads without failing
OTHER ALTERNATIVE: Flexible Pressure Pipelines

- Also Trenchless Technology
- Independent pressure liner (Internal loads)
- Loose fit
- Limited structural Liner (External loads)
## Technologies’ Classification

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<tr>
<th>Non-Structural</th>
<th>Semi-structural</th>
<th>Fully Structural</th>
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<tr>
<td>Class I</td>
<td>Class II</td>
<td>Class III</td>
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<tr>
<td>- Cement Mortar Lining</td>
<td>- CIPP</td>
<td>- Modified Sliplining</td>
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*Flexible High pressure Pipelines (*)

*not a liner
Flexible Pressure Pipelines

- No cure, no process
- Ability to negotiate bends
- Long insertion lengths (up to 1.5 miles) at once
- Even less time to perform the rehabilitation
- Minimum space requirements at construction site
- Accommodates high pressures (up to 1000 PSI)
- Current existing diameters: 6” – 20”
- Special termination fittings
Flexible Pressure Pipelines

Composition of pipe/hose

External Layer

- Abrasion-resistant PE sheath
- Protection of the fabric during insertion

Internal Layer

- Medium-specific
- Based on PE
- NSF/ANSI 61 certified

Kevlar®

- Seamless, woven aramid fibres (single or double-layered)
- Absorption of the tractive forces during insertion
Flexible Pressure Pipelines

... rehabilitates pipes made out of...

- Steel
- Cast iron
- Plastic
- Asbestos cement

... is used for

- Renewal of damaged pipes
- Pressure increase of existing systems

... also appropriate for

- Corrosion protection
- Bypass
- Stand alone solutions in the industry
Flexible Pressure Pipelines

Different Termination Fittings

- The connector can be combined with all fittings and pipe components 6” to 20” (DN 150 to DN 500) and larger.

Connection with flange

Connection with welded end
Flexible Pressure Pipelines

Connection Technology: High Pressure Fitting

Stage 1:
- Valve for Resin Injection
- External Sleeve
- Steel Jacket (malleable)
- Flexible High Pressure pipeline
- Internal Core

Stage 2:
- Steel Jacket (malleable)
- Expanded Resin
Flexible Pressure Pipelines

Some additional specifics:

- No holes in pipe possible
- Service lines only possible with addition of T-insertions
- At least 15 PSI operating pressure
- Transversal section of existing pipe is reduced – increase in Flow speed and pressure
- Less time for installation – the longer the pipe to rehabilitate the shorter the installation time in comparison with other solutions
Flexible Pressure Pipelines

- Industrial water and waste water
- Salt water
- Natural gas and crude oil
- Chemicals
- Fluids containing abrasive components (i.e. slurry pipes)
Flexible Pressure Pipelines

Installation

Video about installation
Case Study – Project Brief

- Rehabilitation of drinking water main in Germany
- 20 inch cast iron pipe without cement mortar lining
- Originally built in 1914
- Operating pressure of 145 psi
- Total length of 1,345 ft.
- 13 ft. under surface
- Two bends of 22 degrees each
- Quick rehabilitation – right before winter time
Case Study – Project Brief

- Installation of 1,315 ft. in one step – water main runs under roads and back yards
- Accommodates pressure, negotiates bends and has to be suitable for drinking water
Case Study – Solution

PREPARATION WORK

- Creation of excavation pits and access to water main
- CCTV camera inspection
- Cleaning with scrapers and pigs to remove incrustations
Case Study – Solution

Delivery of flexible high pressure pipe on transport drum directly to construction site
Case Study – Solution

Folding of flexible pipe at construction site to reduce cross-section
Case Study – Solution

- Insertion and Pull-in-place with winch
Case Study – Solution

- Installation of termination fittings
- Leak test, flushing and re-commissioning
Case Study – Solution

Installation of 1,315 ft., 20 inch high pressure hose including assembly of termination fittings in 3 working days
Summary

- Asset managers need to assess the different technologies available
- Each technology provides unique advantages
- Flexible high pressure pipes can competitively handle long lengths
- Flexible high pressure pipes suitable to increase existing operating pressures.
- Flexible high pressure pipes a competitive alternative to rehabilitate water mains
Thank you very much for your attention!