Fiber Reinforced Cured-in-Place Rehabilitation Under an Interstate

UCT Conference - February 2017

Presented By Chantal Evans

Representing Owner – Jonathan Stathis/Cedar City

AEGION®
Stronger. Safer. Infrastructure.®

Insituform®

Owner and owner issues

- Cedar City, Utah (4 hours south of Salt Lake City and 2.5 hours north of Las Vegas)
- Had leakage under interstate
- 10-inch drinking water main
- 310 LF
- No services or bends
- Ran under I-15 with limited access and UDOT ROW

Owner Considerations for Solutions

- Pre-design included full research of technologies available
- Pre-design resulted in smaller selection of technologies
  - Technology footprint
  - Technology mobilization
  - Technology pricing (small scope)

Owner Bidding Strategy

- Two technologies-two bid schedules
  - Bore under I-15 with 20” casing
  - Fiber reinforced CIPP install in existing WM

Schedule 1

BID SCHEDULE #1 – BORE UNDER I-15

400 North Waterline Replacement (Through I-15 Right-of-Way) Project 2015

Bidders shall fill in all blanks on the following bid sheets. The contractor shall be required to complete a minimum of **25%** of the project with their own forces unless this requirement is waived by the City. Bidder agrees to perform all work as specified in the Contract Documents for the following unit or lump sum prices:

Item	Description	Unit	Estimated Quantity	Unit Price	Amount	Specification Division	% of Work Done By Bidder	% of Work Done By Sub-Contr.
1	Mobilization and Demobilization.	L.S.	1			01	%	%
2	Survey / Layout, including as-built survey data.	L.S.	1			01	%	%
3	Encroachment permit and bonding with UDOT.	L.S.	1			01	%	%
4	Minimum 20-inch diameter Steel Casing (min. 0.375-inch wall thickness; min. 35,000 psi yield strength), including Horizontal Bore.	L.F.	320			02, 33	%	%
5	Video inspection of steel casing after installation.	L.F.	320			33	%	%
6	Casing end seals for the steel casing.	Each	2			33	%	%
7	10-inch diameter ductile iron Class 50 Pipe inside steel casing, including casing chock spacers at specified locations. Locking gaskets are required at all pipe joints.	L.F.	320			33	%	%
8	10-inch diameter ductile iron Class 50 pipe outside steel casing, per Detail R1. Locking gaskets are required at all pipe joints.	L.F.	60			02, 31, 33	%	%

Schedule 2

BID SCHEDULE #2 – CURED-IN-PLACE PIPE (CIPP) LINER

400 North Waterline Replacement (Through I-15 Right-of-Way) Project 2015

Bidders shall fill in all blanks on the following bid sheets. The contractor shall be required to complete a minimum of **25%** of the project with their own forces unless this requirement is waived by the City. Bidder agrees to perform all work as specified in the Contract Documents for the following unit or lump sum prices:

Item	Description	Unit	Estimated Quantity	Unit Price	Amount	Specification Division	% of Work Done By Bidder	% of Work Done By Sub-Contr.
1	Mobilization and Demobilization.	L.S.	1			01	%	%
2	Encroachment permit and bonding with UDOT.	L.S.	1			01	%	%
3	Cured-in-Place Pipe (CIPP) Liner inside existing 10-inch diameter cast iron waterline; including cleaning of existing waterline, installation of CIPP liner, chlorinating, pressure testing, and final flushing.	L.F.	310			33	%	%
4	Video inspection after cleaning of existing waterline	L.F.	310			33	%	%
5	Video inspection after CIPP liner installation.	L.F.	310			33	%	%
6	End Fittings, complete. This item includes all work and materials necessary to make the final connections to the existing waterline. (PVC pipe is not allowed – the final connections must be made using ductile iron pipe and fittings per City standards. Fittings must be restrained with mega-lugs.)	Each	2			02, 31, 33	%	%

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Pricing and Evaluation

- Close results!!!!
  - CIPP $141,288
  - Bore $172,436
- Both local
  - Boring contractor
  - Insituform Manufacturing
- Familiar with boring
- Unfamiliar with pressure pipe CIPP but have done gravity CIPP
  - First use for Southern Utah
- City Council vote for newer technology

Fiber Reinforced CIPP

Fully Structural CIPP

- CIPP liner is fully structural and **independent** of host pipe
- Diameter ranges: 6-inch to 86-inch
- Jointless, continuous pipe lining
- Materials inhibit further corrosion or internal buildup
- Potable or non-potable water

Fully Structural CIPP

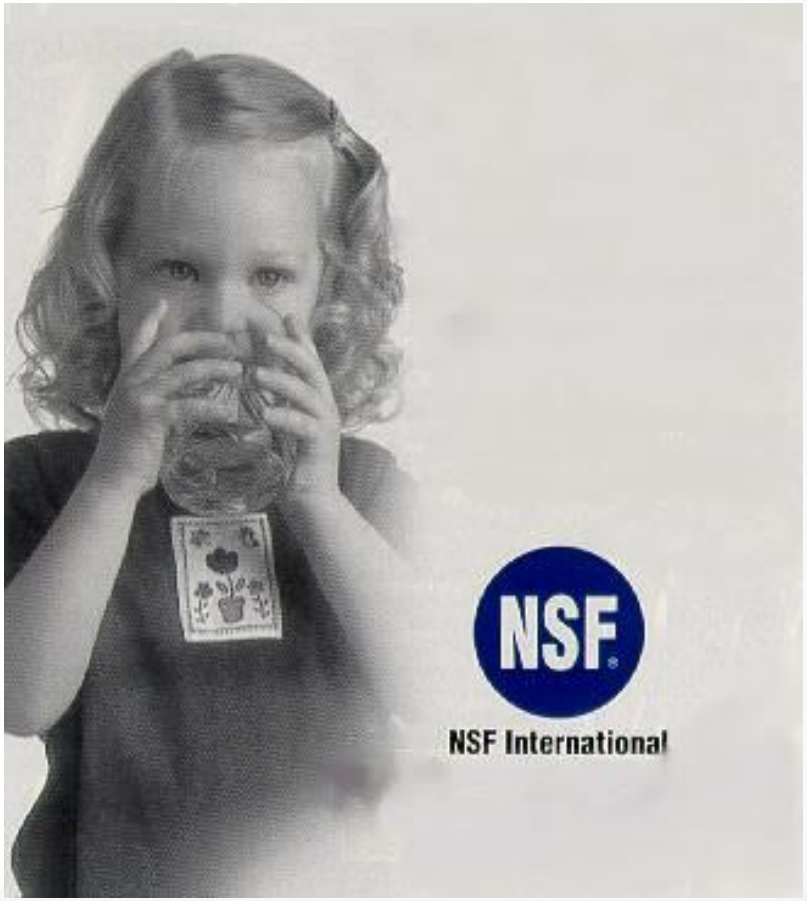
- Structurally independent of host pipe for internal pressure and external loading

- Addresses the following:
  - Severe host pipe deterioration
  - Corrosion from internal/external
  - Host pipe pinholes
  - Joint separation
  - Joint leaks
  - Breaks in host, typically point repaired then lined due to a timing of the rupture

CIPP in Potable Water Applications

NSF/ANSI 61 Certification

- Lining products offered in potable water applications are to be third-party certified as complying with the requirements of NSF/ANSI Standard 61

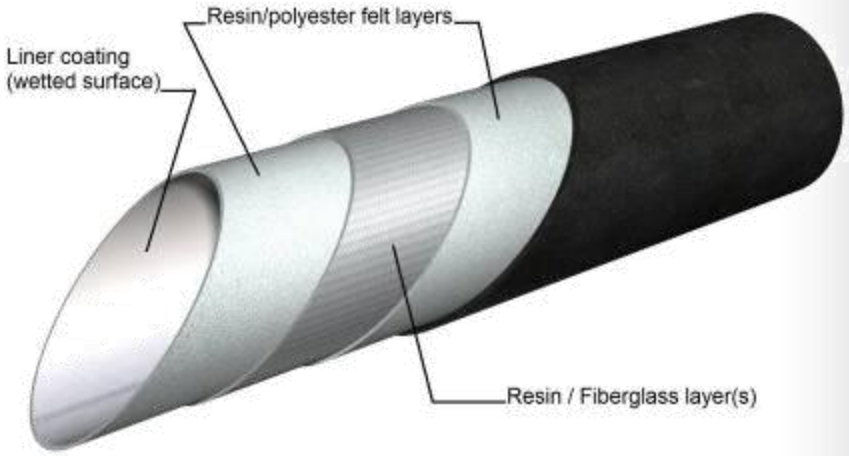


Fully Structural CIPP

- InsituMain® System
  - Fully structural- AWWA Class IV
  - Totally independent of failing host pipe
  - Maximum allowable pressure rating:
    - 250 psi
  - Bends up to 45 degrees; dig 90's
    - 45's decrease pressure rating by half
- Robotic service connection reinstatement
  - ½ -inch to 1-inch
  - Pipe ID 6- to 12-inches
- Fittings
  - Hymax, compression fitting
  - Miller WEKO internal end seal
  - Other industry standard internal & external fittings

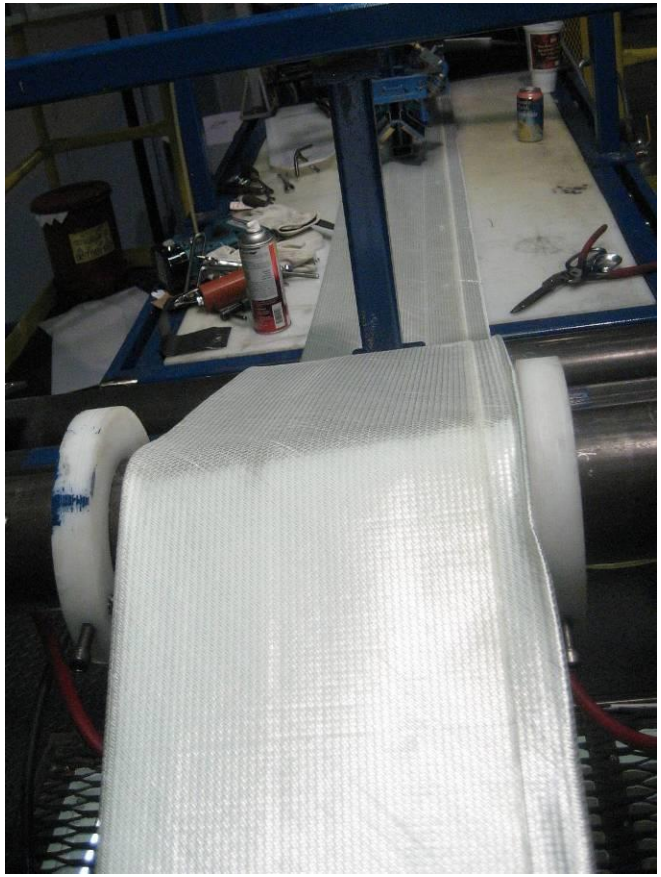
Fully Structural CIPP

- Similar to CIPP for gravity pipelines
- Differences
  - Utilizes epoxy or vinyl ester resin systems
  - Fiberglass reinforcement added or woven in to withstand pressure
    - Directional glass
    - Needled glass reinforcement



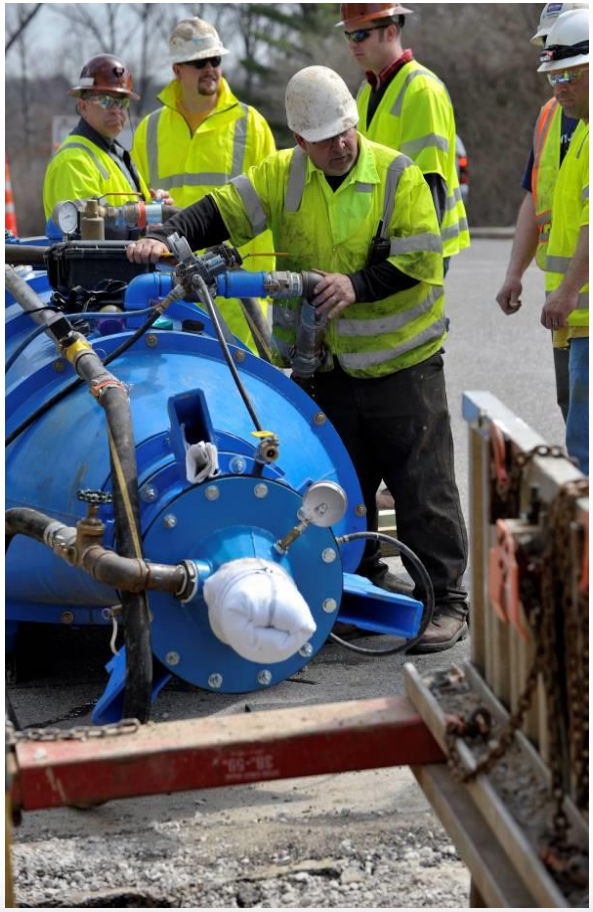
Tube Construction

- Custom made to project specifications
- Fiber construction and thickness can be adjusted for pressure and bends
- Fiberglass reinforcement added to tube
- Construction allows it to negotiate bends more easily
- Epoxy/Polyester structure, in conjunction with glass layer(s), provides internal and external load capacity
- Fiberglass reinforcement is customized based on project specifications/client needs
  - External Load
  - Pressure



Installation Process

- Excavate access
- Temporary Service
- Clean/CCTV
- Prepare and insert service plugs
- Invert Liner/Cure/Cool Down
- Flush main
- Pressure test
- Reinstate services
- Disinfect and reconnect



Temporary Service and Pipeline Access

- Temporary service is set up pre-installation
- Disinfection to AWWA/owner standards
- Pits excavated for access lines (~ 6 x 8 ft)

Pre-Installation – Cleaning

- Pipeline is cleaned using drag scrapers, high pressure water jetting, pigs or other similar equipment, as needed

Installation Procedure

- Inversion installation
- Hot water or steam cure, preference is water.
- Typical installation lengths:
  - 500 ft to 800 ft
- Robotically reinstate service corporations
- Hydrostatic pressure testing follows lining, as required

Installation Equipment

- Torpedo Launcher
  - Small diameter: 6 to 16-inches

- CHIP or Downtube Tower
  - 12-inches and above

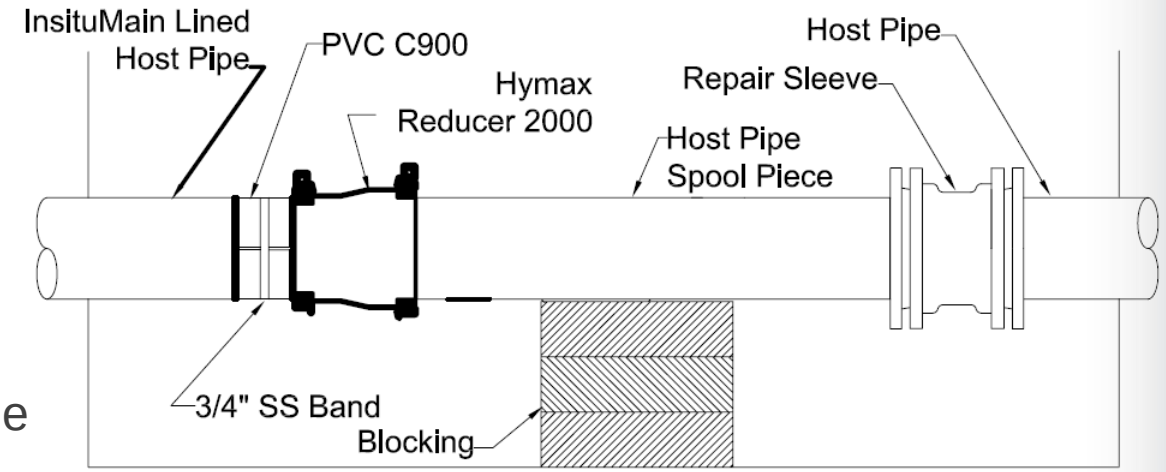
Restoring Service

- Disinfection to AWWA/owner standards
- Standard fittings (Hymax) for reconnection to existing system
- External fitting secured directly to liner

Connections During and After Lining

- Repairs and connections after lining:
  - Owner can add fittings (valves, tees, ARV's, repair spool pieces, etc.) with standard equipment and readily available fittings

- Damage to lined pipe:
  - Typically requires removal of damaged section of host pipe and potentially liner
  - New spool piece inserted, or stainless full encirclement clamp
  - Common external couplers reconnect spool piece on either side



Testing

- 3rd party- typically a submittal requirement in order to bid
  - Certified to NSF/ANSI Standard 61
  - IAPMO
  - Physical testing
    - Tensile Strength

IAPMO RESEARCH AND TESTING, INC.

5001 East Philadelphia Street, Ontario, California 91761-2816 • (909) 472-4100 Fax (909) 472-4244 • www.iapmo.org

NSF / ANSI 61

CERTIFICATE OF LISTING

IAPMO Research and Testing, Inc. is a product certification body which tests and inspects samples taken from the supplier's stock or from the market or a combination of both to verify compliance to the requirements of applicable codes and standards. This activity is coupled with periodic surveillance of the supplier's factory and warehouses as well as the assessment of the supplier's Quality Assurance System. This listing is subject to the conditions set forth in the characteristics below and is not to be construed as any recommendation, assurance or guarantee by IAPMO Research and Testing, Inc. of the product acceptance by Authorities Having Jurisdiction.

Effective Date: April 2013 — Void After: April 2014

Product: Drinking Water System Components - Health Effects — File No. N-6070

Issued To: Insituform Technologies, Inc.
17988 Edison Avenue
Chesterfield, MO 63005

- In-house
  - Hydrostatic burst – ASTM D1599
  - Hazen-Williams C = 140 (test = 147)

Key Advantages of the InsituMain® System

- Fully structural pipe with no reliance on host pipe strength
  - Ensures maximum design life of the product
- The InsituMain® system is the only product ISO:9001 certified for manufacturing and installation
- Withstands a burst test up to 1300 psi, in accordance with ASTM 1599

Questions?

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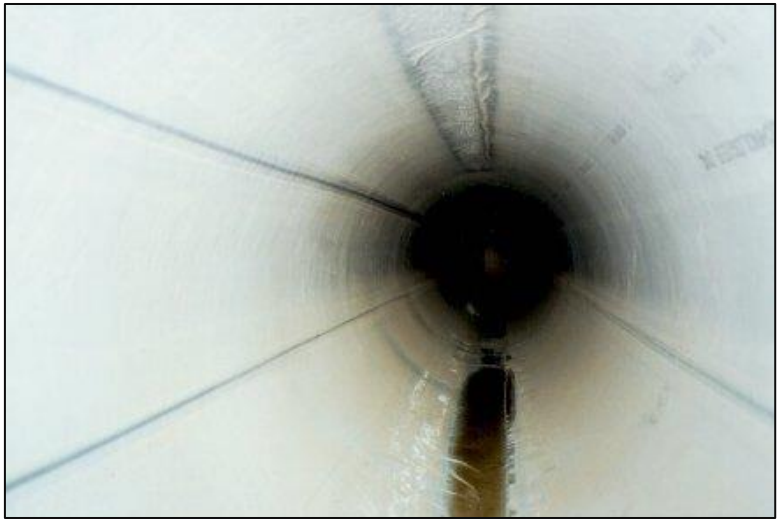

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