Performance Based Specifications & Trained, Certified Inspectors are the Key to Successful CIPP Installation & Service Life

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Collection System Managers Workshop
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Introduction

- The Cured-In-Place Pipe (CIPP)technology was first installed over 44 years ago.

- Based on periodic inspection and testing, the condition of the CIPP, installed 44 years ago, is still in great condition and anticipated to have significant additional design life remaining

Successful CIPP Installation

- Determine rehabilitation requirements, structural, leakage control and corrosion resistance or all of the above
- Selected the correct technology
- Design to meet the pipelines condition and rehabilitation requirements
- Prepare detailed performance specifications
- Bid and award to best quality, lowest cost, qualified, responsible bidder, meeting the contract requirements
- Require contractor, to submit a Performance Work Statement (PWS) outlining the means and methods to be employed to achieve the contract deliverable
- Assign a trained inspector to observe, inspect, document and test the materials provided, the means and methods implemented and the quality of the delivered product.
- Develop a warranty inspection checklist
- Warranty inspections to verify product design service life
- Contractor affects repairs if applicable

Technical Specifications

The technical specification of the contract documents are the instructions for the contractor to furnish a product or completed project that meets the contract requirements

The technical specifications also instruct the inspector on what needs to be observed, measured, documented and tested to ensure that a product meets the contract requirements

- Typical specifications can be described as
- Prescriptive
- Performance
- A combination of Prescriptive and Performance

Prescriptive

A significant element of a prescriptive specification includes:

The design engineer's required means and methods to be implemented by the contractor to achieve the project results.

If the means and methods are properly executed but the results are not achieved, the question posed is, who is responsible?

Performance

Performance specifications require that the contractor use whatever innovative means at its disposal, to deliver a specified product at a defined level of quality.

This type specification requires that the contractor, not the engineer, defines the means and methods by submitting a detailed performance work statement (PWS)

If the means and methods are properly executed but the defined level of quality is not achieved who is responsible?

Performance Work Statement (PWS)

- The contractor defines the installation means and methods and submits a written plan (PWS). A detailed installation plan describes the means and methods to be implemented, by the contractor, for the project
- PWS Submittal examples might include:
  a) Statement of product conformance to the contract documents
  b) Installation to manufacturers recommended standards
  c) Detailed installation plan
  d) Statement of contractor experience & lead personnel
  e) CIPP wall thickness to be installed
  f) Manufacturers technical data
  g) Listing of redundant tools & equipment
  h) Proposed public notification program
  i) Odor control plan during installation
  j) Manufacturer recommended CIPP repair/replacement procedures if required

  And more……

Combination Prescriptive and Performance

- The contractor is required to define the means and methods for installation but the engineer also defines certain installation criteria that must be followed by the contractor.
- Who is responsible for unacceptable results if:
  - Some means and methods are defined by the contractor
  - Additional means and methods are defined by the engineer

Industry Specification Guidelines

- Industry standards include dozens of ASTM published design, testing, inspection and construction documents that recommend standard methods for achieving CIPP quality.
- NASSCO provides specification guidelines, written by industry professionals
- How should these be used for contract specifications?

ASTM

How should these standards be used?

- Simply referenced in contract
- Intent of standards defined in contract
- ASTM detailed content should be defined in the contract

- **Designation: F1216 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube**
- **Designation: F1743 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)**
- **Designation: F2019 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)**
- **Designation: D5813 Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems**

NASSCO Specification Guidelines

- How should specification guidelines be used?
  - Write standards specifications
  - Develop specific contract specifications
  - Common formatting of specifications

PERFORMANCE SPECIFICATION GUIDELINE

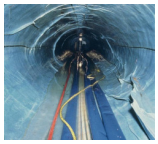
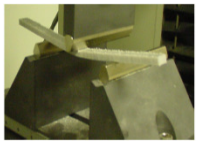
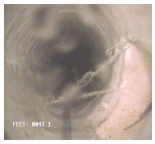
FOR THE INSTALLATION OF

CURED-IN-PLACE PIPE (CIPP)

2nd Edition June 2011

CIPP Expected Life

The installed CIPP must have the specified design and service life of defined projected years (Generally 50 years or longer).

Specifications should not promote the cheapest products available to meet the minimum requirements but should require the best and highest quality products at the lowest competitive price, to meet the owner's expectations

Expected CIPP Life

Inspections and testing performed to verify design life
- Before and during installation
- At completion of installation

Further inspection and testing to verify service life
- Before expiration of warranty

The CIPP installation must achieve a long term Design Life as well as a long term Service Life as defined by the manufacturer

Projected Design Life

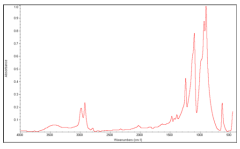
Represents the length of time that the CIPP, correctly installed, is expected to re-structure the existing pipeline

Typically verified by measuring:

- The resin quality
- Resin quantity
- Installation quality
- Curing in the field during installation
- Service reconnections as applicable
- Visual quality after installation
- Physical properties after installation
- Wall thickness after installation

Resin Quality

Resin quality information must be specified.
Then verified through inspection, testing, submittals and field installation verification of wet-out reports.



Fourier Transform Infrared Spectroscopy (FTIR)

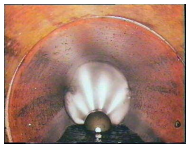
Resin Quantity

Liner resin saturation must be calculated, by the inspector, from wet-out reports submitted by the contractor and resin saturation charts supplied by the manufacturer.

Wet-out - 85% resin to 15% felt, ratio by volume, for felt liners

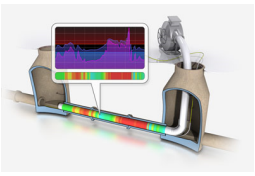
Installation Quality

- Existing pipeline condition must be inspected just prior to the contractor installing the resin liner to prevent lining, over defects, obstructions, and into pipelines not properly prepared to contract standards



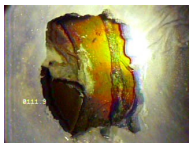
CIPP Manufacture (Curing)

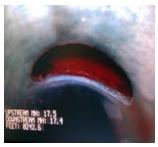
- The CIPP product is manufactured in the field
- Cured to manufacturers recommended standards
- Monitored in the field to assure full cure
  - Thermo-couples
  - Sensor strip



Service Reconnections

All connections re-opened to contract and/or ASTM recommended standards including size and quality of the cut.

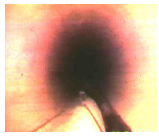




Visual Quality After Installation

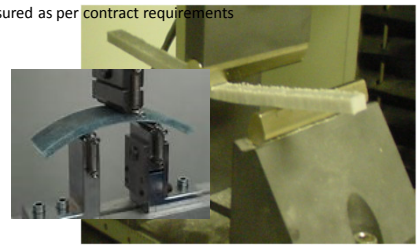
Visual inspection of the final installed product to verify a defect free and functional CIPP

The finished pipe should be continuous over the entire length of an inversion run and be free of dry spots, lifts, and de-laminations. If these conditions are present, remove and replace the CIPP in these areas.



Physical Properties After Installation

Measured as per contract requirements



Wall Thickness of Installed CIPP

Dimensional conformance to approved designs for each section installed (Pipe Thickness Measured).

ASTM D5813 Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems. Para. 8.1.2 *Wall Thickness*—Take wall thickness measurements in accordance with Practice D 3567 for samples prepared in accordance with Para.7.2.

Projected Service Life

The length of time that a product will function for its intended service (1, 5, 20 or 50 years or the same period as the design life ?)

Typically verified by measuring:

- Infiltration after installation
- Infiltration before expiration of the warranty
- Corrosion resistance before expiration of the warranty

If the pipeline is suffering from infiltration and the intended product is intended to stop leakage into the pipeline, the leakage should be stopped not only at the time of project completion but for how many years in the future, as specified in the contract?

Infiltration After Installation

- Exfiltration test as per ASTM F1216
- Air pressure test
- Visual Inspection

Or

- Application of secondary technology to eliminate infiltration

Corrosion After Installation

- Resistance to corrosion typically present in the pipeline system (Manufacturers certification for municipal applications)
- ASTM D5813 paragraph 6.4.2 Specimens of each grade used in sanitary sewers shall be evaluated by qualification test in accordance with 8.2.2 at a temperature of 73.4 6 3.6° F (23 6 2° C).

TABLE 1 Chemical Resistance Test Solutions

Chemical Solution	Grade 1	Grade1/Grade 2
Nitric acid, 1.0%	Yes	Yes
Sulfuric acid, 5.0%	Yes	Yes
ASTM Fuel C/A, 100%	Yes	Yes
Sodium Hydroxide, 0.5% Hot	5.0PS	Not Recommended
Vegetable oil (cottonseed, corn or mineral oil) 100%	Yes	Yes
Detergent*, 0.1%	Yes	Yes
Soap**, 0.1%	Yes	Yes

*In accordance with Specification D 4914.

**In accordance with Test Method D 543.

Achieving CIPP Quality

In addition to:

- Selection of the correct rehabilitation technology
- Writing comprehensive specifications that define the owners expectations
- Testing and measuring all measurable contract requirements
- Re-verifying quality by testing and measuring during warranty period

Provide for trained inspector on the construction site

Trained Inspector

- Regardless of how well the specifications are written, the resulting product quality will be related to the experience of the contractor's crew and to the training and knowledge of the onsite inspector

Qualified Inspector

- Familiar with the specification requirements
- Knowledge of ASTM standards as referenced in the contract
- Fully educated on the technology being inspected
- Certified on field documentation requirements
- Ability to observe, inspect, document and test

Inspector Training Programs

- NASSCO Inspector Training & Certification Program - Designed to provide technology educational opportunities for engineers, inspectors and anyone else that wishes to become knowledgeable in a selected technology.
- NASTT Good practices educational program- provides an basic overview of wastewater mainline and lateral pipe rehabilitation using CIPP from planning and design to job completion.
- CUIRE educational programs – Basic program scheduled annually in conjunction with the Underground, Construction Technologies Conference and Exhibition

Warranty or Maintenance Guarantee

- A written guarantee provided, to the owner of a utility, by the contractor, usually specifying that the contractor will make any repairs or replace defective parts free of charge
- Typically written by an insurance company guaranteeing performance by the contractor for a stated period of time after completion of the contract

Warranty Inspection

- Based on inspector recommendations for 10-15% of the project
- Manufacturers recommendations
- Contractor performance
- Inspector performance documentations

Time for Warranty Inspections

- At least one month before the end of the warranty or at specified times for longer warranty's
- Inspection by Owners personnel
- By third party

Warranty Inspection Funding

- Separate funded account for warranty inspections
- Maintenance or operations funding by the owner

Questions