

## PART 410 – CURED-IN-PLACE PIPE

### 410.1 DESCRIPTION

- 410.1.1 It is the intent of this specification to provide for the reconstruction of existing sewer lines by forming a new pipe within an existing deteriorated pipe, which has generally maintained its original shape. The Cured-In-Place Pipe (CIPP) shall provide flow capacity equal to or greater than 100% of the original pipe's flow capacity when considering age and condition. The process is defined as the reconstruction of sewer lines by installation of a thermosetting resin impregnated flexible felt fiber tube coated on one side with polyethylene or polyurethane, which is installed into the existing sewer line utilizing a water column or cool pressurized air. Curing is accomplished by circulating hot water or steam throughout the length of the inverted tube to cure the thermosetting resin into a hard, impermeable pipe with the polyethylene/polyurethane coating on the interior surface of the new pipe. The pipe shall extend the full length of the original pipe and shall provide a structurally sound, jointless, close fitting and corrosion resistant cured-in-place pipe. A Pulled-In-Place method of installation shall be allowed for pipe diameter sizes 6", 8", 10", and 12" only.

### 410.2 REFERENCE SPECIFICATIONS

- 410.2.1 Installation and material tests of Cured-In-Place Pipe (CIPP) must meet the minimum requirements demonstrated in the following ASTM standards:
- 410.2.2 ASTM F1743 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)
- 410.2.3 ASTM F1216 Standard Practice for the Installation of Cured-In-place Pipe by Inversion Lining
- 410.2.4 ASTM D638 Test Method for Tensile Properties of Plastics (for pressure pipes only)
- |                                                          |             |
|----------------------------------------------------------|-------------|
| Tensile Stress                                           | 3,000 psi   |
| ASTM D790 Test Method of Flexural Properties of Plastics |             |
| Flexural Stress                                          | 4,500 psi   |
| Flexural Modulus                                         | 250,000 psi |
- 410.2.5 ASTM D-790 Test Method of Flexural Properties of Plastics
- |                  |             |
|------------------|-------------|
| Flexural Stress  | 4,500 psi   |
| Flexural Modulus | 250,000 psi |
- 410.2.6 ASTM D5813 (Cured-In-Place Thermosetting Resin Sewer Pipe)
- 410.2.7 ASTM D2990 (Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics)

## 410.3 SUBMITTALS

- 410.3.1 Product Data: Resin, Tube material, qualification testing results for laminate sample, resin enhancer, bond enhancer, certification of applicability of resin; sealant/caulking material, resin curing schedule showing time and temperature for each reach, manufacturer's recommended installation, pressures, minimum and maximum reach, and manufacturer's wet out report.
- 410.3.2 Design Information: Wall thickness design calculations are required for each pipe section.
- 410.3.3 Inspection Information: Video recordings (DVD/external drive) of pre- and post-inspections.
- 410.3.4 Full-length temperature sensing system to be utilized for all pipe sizes of 24" and larger.
- 410.3.5 Qualifications: Documentation for experience of lining manufacturer and installer.
- 410.3.6 Certificate: Installer Certification by the Manufacturer and a Certificate of Compliance that the tube meets all relevant specifications and ASTM Standards shall be required.
- 410.3.7 Public Relations: Notification Fliers or Door Hangers.

## 410.4 QUALIFICATIONS

Since sewer products are intended to have a 50-year design life, and in order to minimize the Owner's risk, only proven products with substantial successful long-term track records will be approved.

Products and Installers seeking approval must meet all the following criteria to be deemed Commercially Acceptable:

- 410.4.1 For a product to be considered Commercially Proven, a minimum of 1,000,000 LF of successful CIPP wastewater collection system installations shall be performed in the U.S. and documented to the satisfaction of the Owner to assure commercial viability.
- 410.4.2 For an Installing Company to be considered as Commercially Proven, the Installer must satisfy all insurance, financial, and bonding requirements of the Owner, and must have had at least 5 (five) years active experience in the commercial installation. In addition, the Installer must have successfully installed at least 100,000 feet of a cured-in-place product in wastewater collection systems in the U.S. for host pipe diameters equal to or larger than that which is intended for this project. Acceptable documentation of these minimum installations must be submitted to the Owner. Installer's project manager assigned to this project must

have minimum of 5 years of CIPP installation experience with the exact product and Installing Company intended for use with this bid.

410.4.3 Sewer rehabilitation products submitted for approval must provide third party test results supporting the structural performance (short-term and long-term) of the product and such data shall be satisfactory to the Owner. No product will be approved without independent third-party testing verification.

410.4.4 Both the rehabilitation manufacturing and installation processes shall operate under a quality management system which is third-party certified to ISO 9000 or other recognized organization standards. Proof of certification shall be required for approval.

#### 410.5 MATERIALS

410.5.1 Tube – the tube should consist of one or more layers of flexible needled felt or an equivalent nonwoven or woven material capable of carrying resin, withstanding installation pressures and curing temperatures. The tube should be compatible with the resin system used. The material should be able to stretch to fit irregular pipe sections and negotiate bends. The outside layer of the tube should be plastic coated with a material that is compatible with the resin system used. The tube should be fabricated to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowance should be made for circumferential stretching during inversion.

410.5.2 Resin – The resin system shall be a corrosion resistant polyester or vinyl ester system including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F1216, ASTM D5813, and ASTM F1743, the physical properties of herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

410.5.3 The minimum length shall be that deemed necessary by the Engineer to effectively span the pipelining distance of the necessary manhole section unless otherwise specified. The line lengths shall be verified in the field before impregnation of the tube with resin.

410.5.4 The outside of the tube, before installation, shall have an impermeable polyethylene or polyurethane plastic coating. This coating will form the inner layer of the finished pipe and is required for enhancement of corrosion resistance, flow, and abrasion properties. CIPP interior lines colors shall be white or a relatively light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

410.5.5 End Seal – A compression gasket sealing product that swells with the presence of water shall be utilized at the junction of the main and manhole. The end seal is a molded rubbered gasket that provides a full-circle compression seal to a substantial

area at the end of a mainline pipe that is rehabilitated by lining. The end seal shall be Insignia™ Hydrophilic End Seal as manufactured by LMK Technologies or engineer approved equivalent.

410.5.6 Caulking/Sealant – Sealant shall be a quick-set epoxy mortar or high viscosity epoxy with good adhesion to the line and original pipe material.

410.5.7 The Owner authorizes the use of proven materials that serve to enhance the pipe performance specified herein. Proven materials have passed independent laboratory testing, not excluding long-term (10,000 hour) structural behavior testing and have been successfully installed to repair the failing host pipes in the U.S. for at least 5 years. In addition to the aforementioned requirement, the owner may require that the contractor demonstrate that the enhancements proposed exceed the specifications herein, prior to the installation of the enhanced material systems. This section in no way shall be interpreted as authorization to deviate from the minimum standard practices set forth herein.

#### 410.6 FULL-LENGTH TEMPERATURE MONITORING

410.6.1 System shall consist of a wire probe with sensors no more than ten (10) feet apart running the length of the pipe section to be lined and a computer with vendor software for monitoring in real time and recording curing data. Data output will consist of a report indicating the time and temperature at each sensor location. System shall have the ability to monitor the curing from a remote location, and this ability will be made available to the Owner and Engineer. The Owner and Engineer will be provided training in how to access the site for remote viewing and an overview of the system. Temperature monitoring systems will be the ZIA Systems, Vericure by Pipeline Renewal Technologies, or approved equal.

#### 410.7 DESIGN

410.7.1 General Requirements of Cured-In-Place Pipe (CIPP) – The finished pipe must be such that when the thermosetting resin cures, the total wall thickness will be a homogenous and monolithic felt and resin composite matrix that will be chemically resistant to withstand internal exposure to domestic sewage. When cured, the CIPP shall be a tight fit liner to the host pipe.

410.7.2 The CIPP shall be designed to a minimum wall thickness based on the individual project parameters and the condition of the existing conduit. The pipe design shall have sufficient strength to support all dead loads, live loads and groundwater loads imposed.

410.7.3 The cured lining material shall conform to the minimum structural standards, as listed below.

| Linear Material Test<br>Cured Liner | Standard  | Results     |
|-------------------------------------|-----------|-------------|
| Tensile Stress                      | ASTM D638 | 3,000 psi   |
| Flexural Stress                     | ASTM D790 | 4,500 psi   |
| Flexural Modulus                    | ASTM D790 | 400,000 psi |

Design Parameters: (unless otherwise noted in the Drawings)

|                                                                                                     |                             |
|-----------------------------------------------------------------------------------------------------|-----------------------------|
| Design Condition: Fully deteriorated                                                                | Safety Factor = 2.0         |
| Ground water = ½ soil depth                                                                         | Ovality = 2.0%              |
| Long Term flexural modulus = 50% of short term (75% for enhanced materials with testing validation) | Live Load H2) = 16,000 lbs. |
| Soil modulus = 700 psi for depth < 10' and 1000 psi for depth > or = to 10'                         | Soil Density = 120 pcf      |
|                                                                                                     | Poisson's Ratio = 0.3       |
|                                                                                                     | Enhancement factor K = 7    |

- 410.7.4 Independent material tests for compliance with this specification shall be made according to the applicable ASTM standards. Upon request, a certificate of compliance will be provided for all materials furnished under this specification.
- 410.7.5 The contractor shall submit his price proposal based on the appropriate length, size and existing pipe parameters designated in the Bid Item or Bid Proposal Section. The deterioration of sewers is an on-going process. Should pre-construction inspections reveal the sewers to be in substantially different conditions than those in the design considerations, the contractor shall request such changes in reconstruction liner thickness, supporting such requests with design data. The deviation, if approved, shall be reflected by Change Order.
- 410.7.6 The Manufacturer must have performed long-term testing for flexural creep of the resin. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. A percentage of the instantaneous flexural modulus value (as measured by ASTM D790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Retention values exceeding 50% of the short-term test results shall not be applied unless substantiated by qualified third party test data to the Owner's satisfaction. The resin and materials utilized for the contracted project shall be of equal to or better than the materials used in the long-term test with respect to to the initial flexural modulus used in the CIPP design.
- 410.7.7 The layers of the cured CIP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If the layers separate during field sample testing, the CIPP shall be repaired or replaced by the Contractor at their expense.

#### 410.8 PRE-INSTALLATION PROCEDURES

- 410.8.1 The following installation procedures shall be adhered to unless otherwise approved by Engineer.

#### 410.9 SAFETY

- 410.9.1 CONTRACTOR shall carry out his operations in strict accordance with all OSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving working with scaffolding and engineering confined spaces.

#### 410.10 INSPECTION

- 410.10.1 Additional internal inspection as noted on drawings shall be conducted by CONTRACTOR prior to actual construction. Inspection shall be accomplished by means of closed-circuit color television. Supplemental normal cleaning (3 passes of jet nozzle) of the pipes to allow a clear and unobstructed view of the pipe walls will be the responsibility of CONTRACTOR and is considered as incidental to the work.

#### 410.11 CLEANING OF SEWER LINES

- 410.11.1 Prior to any lining of a pipe so designated, it shall be the responsibility of CONTRACTOR to remove all internal debris out of the sewer lines in accordance with Section III, "Sewer Line Cleaning" NASSCO Specifications for Sewer Collection System Rehabilitation.

- 410.11.2 Sewers shall be cleaned of all debris, roots and other materials that would block proper inversion of the Cured-In-Place Pipe. Utilizing high-pressure jet cleaning equipment, several passes shall be completed to assure that all debris is removed from the pipe. If roots are present, root cutters or mechanical brushes shall be attached to the jet nozzle and sent through the line to remove all root intrusions. Heavy cleaning (beyond normal) shall either be performed by Owner or shall be paid by separate pay item.

- 410.11.3 Owner or Engineer shall approve cleaning prior to liner insertion.

#### 410.12 TELEVISION INSPECTION

Sewers shall be CCTV inspected providing both a video recording and written log identifying all service connections and openings. Utilizing a color video inspection system with data recording capabilities, the entire pipe sections shall be recorded on standard transfer media to become the property of the City.

Identification and Pre-measurement of Lateral Connections. A 360-degree Pan-and-Tilt view camera shall be used to inspect the pipe traveling upstream. At each connection, the operator will stop and turn the camera lens toward the lateral thereby inspecting the first 8" to 12" of the lateral connection. If there remains a doubt as to whether or not the connection is live, additional "Dye and Flush" tests shall be performed. It will be the responsibility of the Engineer to review this process live or review the video to verify and approve which lateral connections are to be

reinstated. All lateral locations will be measured from the back wall (opposing wall) of the basis manhole, typically, the downstream manhole.

Inspection of Pipelines – Inspection of pipelines should be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television or man entry. The interior of the pipeline should be carefully inspected to determine the location of any conditions that may prevent proper installation of the impregnated tube, such as protruding service taps, collapsed or crushed pipe, and reductions in the cross-sectional area of more than 10%. These conditions should be noted so that they can be corrected. A pre-insertion video shall be prepared by the Contractor.

#### 410.13 LINE OBSTRUCTION

- 410.13.1 The original pipeline should be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 10% that will prevent the insertion of the resin-impregnated tube. Protruding service connections shall be removed to prevent dimpling of the finished liner unless approved by the Owner or Engineer. Maximum allowable protrusion shall be 1/2".
- 410.13.2 The Contractor shall perform all obstruction removals for the sewer section scheduled for relining. The repair shall be an adequate repair for insertion of the resin-impregnated tube. This shall be paid at the bid price for obstruction removal.
- 410.13.3 If the Contractor identifies obstructions that cannot be removed by conventional sewer cleaning equipment, then, with the Engineer's approval, an excavation shall be made to remove the obstruction.
- 410.13.4 If pre-insertion inspection reveals a condition such as a protruding service connection, dropped joint, or a collapse that will prevent the insertion process or will result in an unacceptable installation, and it cannot be removed by conventional sewer cleaning equipment, defined as high-pressure jetters, root cutter or grinders, then Contractor shall consult with the Engineer before proceeding with the appropriate remedy. If condition resulting in extra effort by the Contractor was not shown on the drawing or revealed to the Contractor at the time of the bid, the work shall be considered as a separate pay item by Changer Order.

#### 410.14 INFILTRATION

- 410.14.1 Minor infiltration is a normal condition sometimes encountered during the CIPP process. It is not a "changed condition" and should not be regarded as a reason for change orders. If in the opinion of the Engineer, infiltration is significant enough to adversely affect the curing process, chemical grouting or other remedies may be required. This additional work will be paid for by the Owner as a Change Order.

#### 410.15 SITE RESTORATION

- 410.15.1 Areas damaged or modified by the Work for his project shall be repaired or restored to a condition equal to or better than the original condition. Site restoration is incidental to the Work and shall not be regarded as a reason for change orders.

#### 410.16 PUBLIC RELATIONS

- 410.16.1 A Public Information and Notification Program shall, as a minimum, require the Contractor to be responsible for contacting homeowners or businesses who will be affected by the construction activities and informing them of the work to be done and the estimated timing for the work. Written notice shall be delivered to each home or business two (2) weeks prior to installation. Notice shall include a local telephone number of the Contractor they can call to discuss the project, and how the homeowner or business will be affected. The written notice must be reviewed by the Owner or Engineer prior to the start of any work.

A follow-up notice shall be delivered to each home or business connected to the sanitary sewer two (2) days prior to installation. The notice shall instruct occupants to minimize water usage the day of the insertion and fill all drain traps with water to prevent potential odors.

#### 410.17 BY-PASS OF FLOW AND INTERRUPTION OF SERVICE

- 410.17.1 Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe that are to be lined. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle anticipated wet weather flow or peak flow.
- 410.17.2 All procedures for maintaining flows must meet the approval of the Owner or Engineer. Contractor shall submit a detailed plan of all methods of flow management, in advance of flow interruption.

#### 410.18 INSTALLATION OF LINES

- 410.18.1 Prior to installation of the liner, the full-length temperature sensing system shall be placed and tested to ensure proper functioning. If more than two sensors in a row or more than 10% of the total sensors are malfunctioning, the entire sensor array shall be replaced and retested. Time and temperature shall be monitored in accordance with manufacturer's recommendations.
- 410.18.2 Resin Impregnation of the CIPP Tube – The Contractor shall designate a location where the tube shall be impregnated or "wet out" with resin, using distribution rollers and a "single-source" vacuum system to thoroughly saturate the tube's felt fiber prior to installation in the field. The impregnated tube shall be free of pinholes, resin voids, and other defects. If the Cured-In-Place Pipe is impregnated at the manufacturing plant, it shall be delivered to the job site in a refrigerated truck and remain refrigerated prior to installation to prevent premature curing.

- 410.18.3 The tube should be vacuum impregnated with resin (wet out) under controlled conditions. The volume of resin used should be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume should be adjusted by adding 5% to 10% excess resin per the manufacturer's recommendation for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe.
- 410.18.4 Inversion of CIPP Tube – The resin impregnated tube shall be water inverted or cool air pressure-inverted through an existing manhole or other approved access point until it has fully traversed the designated line length and the inversion face breaches the destination manhole or termination point. Thermocouples shall be placed at the top and, if possible, at the bottom interface of both ends of the liner for monitoring temperature during the cure cycle. A "Pulled-In-Place" method of installation shall be allowed for pipe diameter sizes 6", 8", 10", and 12".
- 410.18.5 CIPP Processing (Curing and Cool Down) – the cure cycle and cool down will be dictated with consideration given to actual field conditions and shall be according to the manufacturer's recommendations. The curing temperatures shall be monitored at the heater truck's water inlet and outlet lines. The temperature readings from the truck will be compared to the thermocouples to ensure that sufficient heat is being supplied to the system to effect proper cure. Once the pipe has been cured, cool water shall be slowly introduced into the rehabilitated pipe. The water temperature shall be cooled inside of the pipe at a rate of 20° to 30° per hour until the water temperature is within 20° of the ambient temperature. The cool down process will also be affected by actual field conditions and may be modified in cases of severe conditions or below normal ground temperatures. Contractor shall not discharge cooling water to storm sewer system.
- 410.18.6 Termination and Sealing at Manhole Outlets – Termination of the Cured-In-Place Pipe at the manhole is completed by trimming the inverted pipe end back within approximately 6" of the outlet.
- 410.18.6.1 **An end seal per the materials specification shall be installed at the termination of CIPP at the manhole inlets & outlets.** All roots deposits, and debris should be removed from the pipe with hydraulically powered equipment, high velocity jet cleaners, or mechanically powered equipment as per NASSCO recommended specifications prior to installation of CIPP with end seals. Since the Insignia End Seal product may be used with a variety of rehabilitative pipe liners, the standard installation practices of each individual pipe liner method should be closely followed.
- 410.18.7 Hydraulic Capacity – overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material, taking into consideration its age and condition. The roughness coefficient of the CIPP shall be verified by third party test data and certified by a letter from manufacturer or raw material supplier.

## 410.19 SERVICE CONNECTIONS

- 410.19.1 After the liner has been cured Contractor shall reconnect the service connections. All service connections to existing buildings are to be reconnected, except where disconnection is approved by the Engineer. Service connection to a vacated lot shall not be reconnected. If more than one service is found per lot then, the Contractor shall verify that service connections are active by introducing dye into the lines at cleanouts, vent stacks or other access points as approved by the Engineer. Dye testing shall be recorded by CCTV inspection at the location in the main line where the dye appears. All addresses will be noted on log sheets for future reference. Provide the address of all reconnected and disconnected services.
- 410.19.2 It is the intent of the City that all service reconnections be made by external service reconnection in accordance with 410.19.4. Where there is no protruding pipe, cracks, or leaks, or where significant surface obstructions exist, service connections shall be internally reinstated as directed by Engineer in accordance with 410.19.3 or 410.19.4. Internal reinstatement of services alone will not be permitted.
- 410.19.3 Internal Reconnection: **Internal service reconnections without an internal tee-liner or top hat type liner shall not be allowed without prior written approval by the Owner.** Without excavation, the service connection shall be reinstated by means of a television camera and a cutting device that re-establishes the connection to not less than 90% capacity. Service connections shall be cut in with neat and smooth circumferential lines to prevent snagging of debris and/or solids. Contractor shall provide a physical demonstration, in the presence of the Engineer, to show the assurance of a watertight seal of all service connections. Service interruptions to any homes tributary to the sewer line being rehabilitated shall not exceed 24 hours. **Internal service reconnections shall require submittal to Engineer and include internal tee-liner and/or top hat type reconnection.**
- 410.19.4 External Reconnection: Service connections shall be reinstated by excavation and reconnecting the service with an approved saddle or engineer approved equivalent. The Contractor shall remove the appropriate amount of carrier pipe to allow the saddle to be directly connected to the outside wall of the CIPP. An epoxy, meeting the manufacturer's recommendations, shall be applied to the saddle to assure a watertight seal between the saddle and CIPP or host pipe. The saddle shall be secured with stainless steel bands. After the epoxy has set and prior to backfilling, the Contractor shall seal any open annular space between the existing sewer and new liner pipe with a non-shrink grout. The Contractor shall then completely encase the saddle and exposed pipe in concrete. Care shall be used not to damage the CIPP. If damage occurs as a result of the Contractor's operations, the Contractor shall assume all cost associated with the repair of the CIPP.
- 410.19.5 Connections of the saddle fitting to the existing lateral shall be made using elastomeric boots, full-encirclement clamps, or by other method as approved by the Engineer.

## 410.20 FINAL INSPECTION AND ACCEPTANCE

- 410.20.1 Upon completion of the installation, the rehabilitated sewer shall be CCTV inspected providing both a video recording and log identifying all service connections and openings. The entire pipe section rehabilitated shall be recorded on standard transfer media with the video becoming the property of the City.
- 410.20.2 CIPP samples shall be prepared and physical properties tested in accordance with ASTM F1216, Section 8.1, using either method proposed. The flexural modulus must meet or exceed the value used in design in Section D (structural requirements for the pipe size and thickness furnished in design.)
- 410.20.3 Leakage testing of the CIPP shall be accomplished during curing while under a positive head. CIPP products in which the pipe wall is cured while not in direct contact with the pressurizing fluid (e.g., a removable bladder) must be tested by an alternative method approved by the Engineer.
- 410.20.4 Visual inspection of the CIPP shall be in accordance with ASTM F1216, Section 8.6.
- 410.20.5 Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.
- 410.20.6 After installation of the liner, Contractor shall TV inspect the sewer line as specified herein and perform the following test on the sewer line.
- 410.20.7 Post-insertion video recording TV log in a format acceptable to the Engineer shall be provided to the Engineer within two (2) weeks of taping. With the exception of sag locations in existing host pipe, the pipe must be dry and clean during the televising. Camera speed shall not exceed two feet per second. Video quality shall be high.
- 410.20.8 No wrinkles, or other defects, will be allowed that, in the opinion of the Owner or Engineer, will impede flow.
- 410.20.9 Cured Pipe Physical Properties: Samples of the cured pipe should have the minimum physical properties (flexural stress, modulus of elasticity, and thickness) recommended herein.

#### 410.21 MEASUREMENT AND PAYMENT

- 410.21.1 Cured-In-Place Pipe shall be paid for at the Contract Unit Prices as follows: The unit price shall cover the entire cost of sewer lining, measured to the nearest 0.1', center of manhole to center of manhole, and include any by-pass pumping, dye, and flush testing, and all acceptance testing.
- 410.21.2 Obstruction Removal shall be paid for at the set unit prices of each for obstruction removal. Where point repairs are specified, they shall be installed and paid for in accordance with Part 412 of the City of Tulsa Standard Specifications and Standard Details.

- 410.21.3 Payment for external service connections shall be paid at the unit bid prices for service connections. No additional payment shall be paid for internal service connections reinstatement unless a tee-liner or similar is specified and installed. Tee-liner or top-hat style internal liners shall be paid for by separate pay item different from external service reconnections.
- 410.21.4 Television pre-inspection shall be paid for at the unit price bid per linear foot of pipeline to be inspected. The unit price bid for Television Pre-inspection shall be payment in full for all materials, labor, and equipment necessary for televising the pipe prior to repairing or rehabilitating it. The linear feet paid shall be as measured from center of the upstream manhole to the center of the downstream manhole. Payment shall only be made once for any manhole-to-manhole pipe segment; no additional payment shall be made for multiple inspections of the same pipe segment. Payment will not be made until the pre-inspection video has been approved.
- 410.21.5 The cost of normal cleaning will not be paid for separately but shall be included in the Contract Unit Price of the rehabilitation or replacement being performed.
- 410.21.6 The cost of heavy cleaning shall be paid for at the unit price bid per linear foot of pipeline to be cleaned. The unit price bid for Heavy Cleaning shall payment in full for all materials, labor, cost of material disposal, and equipment necessary for heavy cleaning of the pipe prior to repairing or rehabilitating it.
- 410.21.7 The cost of post construction television inspection will not be paid for separately but shall be included in the Contract Unit Price of the rehabilitation or replacement being performed. This shall include all costs associated with the television inspection, such as viewing, record logs, and standard transfer media.
- 410.21.8 The prices shall be payment in full for performing and completing the work and for furnishing all labor and materials necessary including excavation and removal of existing structure, trench safety system, pipe lining materials, pipe sealing materials, labor, backfilling, surface restoration, sodding, pavement replacement, sidewalk and driveway replacement, curb and gutter replacement, all testing, and all incidental costs.

#### **END OF SECTION**