Section 2553. Trenchless Construction

2553.01 DESCRIPTION.

This section was developed in conjunction with Section 3020 of the SUDAS Standard Specifications, with modifications to suit the needs of the Department.

A. Excavate launching and receiving pits.

B. Install casing or carrier pipe by trenchless methods.

C. Install carrier pipe inside casing pipe (if required).

D. Place backfill material in excavations.

2553.02 MATERIALS.

A. Carrier Pipe.

1. Carrier Pipe Installed within Casing Pipe.

- **a. Sanitary Sewer Gravity Main.**
  Apply Article 4149.02, A.
- **b. Sanitary Sewer Force Main.**
  - **1) Restrained Joint Ductile Iron Pipe:** Apply Article 4149.02, B.
  - **2) Restrained Joint PVC Pipe:** Apply Article 4149.02, B.
- **c. Storm Sewer.**
  Apply Article 4149.03.
- **d. Water Main.**
  - **1) Restrained Joint Ductile Iron Pipe:** Apply Article 4150.02, A.
  - **2) Restrained Joint PVC Pipe:** Apply Article 4150.02, A.

2. Carrier Pipe Installed without a Casing Pipe.

- **a. Sanitary Sewer Gravity Main.**
  - **1) Reinforced Concrete Pipe:** Apply Article 4149.02, A.
  - **2) Vitrified Clay Pipe:** Apply Article 4149.02, A.
  - **3) Restrained Joint Ductile Iron Pipe:** Apply Article 4149.02, B.
  - **4) Restrained Joint PVC Pipe:** Apply Article 4149.02, B.
- **b. Sanitary Sewer Force Main.**
  - **1) Restrained Joint Ductile Iron Pipe:** Apply Article 4149.02, B.
  - **2) Restrained Joint PVC Pipe:** Apply Article 4149.02, B.
- **c. Storm Sewer.**
  - **1) Reinforced Concrete Pipe:** Apply Article 4149.03.
  - **2) Reinforced Concrete Arch Pipe:** Apply Article 4149.03.
  - **3) Reinforced Concrete Elliptical Pipe:** Apply Article 4149.03.
  - **4) Reinforced Concrete Low Head Pressure Pipe:** Apply Article 4149.03.
- **d. Water Main.**
  - **1) Restrained Joint Ductile Iron Pipe:** Apply Article 4150.02, A.
  - **2) Restrained Joint PVC Pipe:** Apply Article 4150.02, A.
- **e. Roadway Pipe Culvert.**
  Reinforced Concrete Pipe: Apply Section 4145.

B. Casing Pipe.

1. Pipe.
Use only new steel pipe meeting the requirements of ASTM A 139/A 139M, Grade B; ASTM A 252, Grade 2; or ASTM A 53/A 53M, Grade B. Pipe may be welded or seamless. Wall thickness will be as specified in the contract documents.

2. Joints.
- **a.** Comply with American Welding Society Code D1.1M/D1.1. Weld all joints with full penetrating weld. Welders shall be qualified according to Materials I.M. 560. Welds shall comply with Materials I.M. 558.
- **b.** Upon approval of the Engineer, an interlocking casing pipe connection system may be used in lieu of field welding the sections of casing pipe.

3. Pipe Diameter.
Minimum inside diameter as specified in the contract documents. If diameter is not specified, use a minimum inside casing diameter of at least 4 inches greater than the largest outside diameter of the carrier pipe, including pipe bells.

C. Casing Spacers.

1. Use manufactured casing spacers to position carrier pipe in casing. Do not use wood skids.

2. Meet the following material requirements:
- **a. HDPE Band/Panel and Riser:** ASTM D 638.
- **b. Stainless Steel or Carbon Steel Band/Panel and Riser:** Type 304 stainless steel according to ASTM A 240/A 240M or carbon steel according to ASTM A 36/A 36M.
  - **1) Liner:** Elastomeric PVC per ASTM D 149.
  - **2) Spacer Skid/Runner:** Abrasion resistant polymer with a low coefficient of friction.
  - **3) Fasteners:** Type 304 (18-8) stainless steel per ASTM A 193/A 193M.

D. Backfill Material for Abandoned Tunnels.

1. Option 1: Use Class C concrete, approximately 4 inch (100 mm) slump.

2. Option 2: Flowable mortar according to Article 2506.02.

3. Option 3: CLSM according to Article 2552.02, E, 3.

E. Backfill Material.

1. Excavated Materials.
Apply Section 2435 for classification of excavated materials. Use only suitable material for backfill material.

2. **Special Fill Materials.**
   For use where specified in the contract documents.
   a. **PCC:** Use Class C concrete, approximately 4 inch (100 mm) slump.
   b. **Flowable Mortar:** Apply Section 2506.02.
   c. **Controlled Low Strength Material (CLSM):** Apply Article 2552.02, E, 3.

F. Casing End Seal.

1. **Manufactured:** Minimum 1/8 inch (3.0 mm) thick manufactured synthetic rubber casing end seal with stainless steel bands and fasteners.

2. **PCC:** Apply Section 2403. Do not use PCC casing end seals with flexible carrier pipes.

2553.03 CONSTRUCTION.

A. Excavation.

1. Notify the Engineer prior to the start of excavation activities.

2. Remove topsoil to minimum depth of 12 inches (300 mm) and stockpile.

3. Excavate the minimum size pits necessary to safely and properly perform the work.
   a. Protect existing facilities, trees, and shrubs during excavation.
   b. Place excavated material away from trench.
   c. Grade and shape spoil piles to drain and protect adjacent areas from runoff. Do not allow spoil piles to obstruct drainage. Stabilize stockpiles with seeding and provide sediment control around stockpiles.

4. Remove rock, rubbish, debris, and other materials not suitable for use as backfill material.

B. Sheeting Shoring, and Bracing.
Apply Article 2552.03, C.

C. Dewatering.
Apply Article 2552.03, D.

D. Trenchless Installation.

1. **General.**
   Select a method of installation that is appropriate for the soil conditions anticipated and will: 1) allow the pipe to be installed to the desired line and grade within the specified tolerances; 2) prevent heaving or settlement of the ground surface or damage to nearby facilities; and 3) prevent damage to the carrier pipe and lining materials within the carrier pipe.

a. Installation Methods.

1) Auger Boring: A method that utilizes a rotating cutting head to form the bore hole and a series of rotating augers inside a casing pipe to remove the spoil.

2) Directional Drilling: A method for installing pipe from a surface launched drilling rig. A pilot bore is formed and then enlarged by back reaming and removing the spoil material. The pipe is then pulled in place.

3) Open-ended Pipe Ramming: A method that involves driving a steel casing pipe with a percussive hammer. The front end of the casing pipe is open ended. Spoils are removed from the pipe.

4) Pipe Jacking: A method in which pipe is pushed into the ground with hydraulic jacks while soil is simultaneously excavated. Excavation is normally completed with a tunnel boring machine.

5) Microtunneling: A method of pipe jacking using a remote controlled tunnel boring machine.

6) Utility Tunneling: A method of forming large diameter tunnels. As excavation takes place at the front of the tunnel, a liner is constructed to temporarily support the tunnel. Upon completion of the tunnel the pipe is pushed in place.

7) Other: Other methods may be allowed with the Engineer's approval.

b. Line and Grade.

1) Install pipe at line and grade that will allow the carrier pipe to be installed at its true starting elevation and grade within a maximum alignment deviation of the pipe centerline.

2) When no deviation tolerances are specified in the contract documents, apply the following maximum deviations to the carrier pipe:

a) Gravity pipe:

(1) Horizontally: ± 1.0 foot per 100 feet (0.3 m per 30 m).

(2) Vertically: ± 0.2 feet up to 100 feet (0.06 m per 30 m). An additional ± 0.1 foot per 100 feet (0.03 m per 30 m) thereafter. Backfall in pipe will not be allowed.

b) Pressurized pipe:

(1) Horizontally: ± 2.0 feet (0.6 m).

(2) Vertically: ± 1.0 foot (0.3 m). Maintain the minimum depth specified in the contract documents.

c) Greater deviation or interference with other identified facilities may be cause for rejection.

c. Deviation from Line and Grade.

1) Provided adequate clearance remains for proper installation of the carrier pipe, the Contractor will be allowed to correct deviations in grade of a casing pipe in order to achieve design grade of the carrier pipe by:

- Pouring an invert in the casing pipe, or
- Shimming the carrier pipe with casing spacers to a uniform grade.

2) Installations deviating from the specified tolerances that cannot be adjusted to conform to the specified tolerances may be

rejected by the Engineer. If a non-conforming installation is not rejected, provide all additional fittings, utility accesses, or appurtenances needed to accommodate horizontal or vertical misalignment, at no additional cost to the Contracting Authority.

3) Abandon rejected installations and place special fill materials, at no additional cost to the Contracting Authority. Replace abandoned installations, including all additional fittings, manholes, or appurtenances required to replace rejected installations.

2. Casing Pipe or Un-cased Carrier Pipe Installation.

a. Install pipe by approved methods.

b. Use a jacking collar, timbers, and other means as necessary to protect the driven end of the pipe from damage.

c. Do not exceed the compressive strength or tensile capacity of the pipe during pushing or pulling operations.

d. Fully support bore hole at all times to prevent collapse. Insert pipe as soil is removed, or support bore with drilling fluid.

e. Fully weld all casing pipe joints. Use an interlocking connection system when approved by the Engineer.

f. Fill space between the inside of the bore hole and the outside of the pipe with special fill material if the space is greater than 1 inch (25 mm).

3. Carrier Pipe Installation through Casing.

a. Clean dirt and debris from the interior of the casing pipe after installation.

b. Install casing spacers on carrier pipe sections as necessary to support the pipe barrel according to the pipe manufacturer's recommendations subject to the following minimum requirements:

1) Install a spacer within 1 foot (0.3 m) of each side of the carrier pipe joint and at a maximum spacing of 6 feet (1.8 m).

2) Do not support pipe by joint bells.

3) Lubricate casing spacers with drilling mud or flax soap. Do not use petroleum-based lubricants or oils.

c. Ensure that thrust loads will not damage carrier pipe joints. Provide thrust collars between joint shoulders of concrete pipe.

d. Provide timbers for sufficient cushioning between the end of the pipe pushed and the jacking equipment to prevent damage to the pipe. Do not allow the steel jack face to thrust against the unprotected pipe end.

e. Position jacks so that resultant force is applied evenly to the entire end of the pipe.

f. Assemble pipe joints in the jacking pit before pushing the carrier pipe into the casing.

g. Close the end of the casing pipe around the carrier pipe with a casing end seal.

h. When specified in the contract documents, fill the annular space between the carrier and casing pipe with flowable mortar or CLSM.

E. Pit Restoration.

1. Remove installation equipment and unused materials from the launching and receiving pits.

2. When the carrier pipe extends beyond the limits of trenchless installation and into the bore pit, place bedding and backfill material according to Section 2435.

3. Place suitable backfill material in the pit. Apply the testing requirements of Section 2435.

4. Restore the site to original condition or better.

2553.04 METHOD OF MEASUREMENT.

Trenchless Construction will not be measured for payment. Excavation for boulders less than or equal to one-third the diameter of the pipe being installed, or parts of existing structures identified in the contract documents will not be measured for payment, but are to be considered incidental to the price bid for trenchless construction. Excavation and removal of boulders larger than one third the diameter of the pipe being installed, or parts of existing structures not identified in the contract documents, will be paid for in accordance with Article 1109.03, B.

2553.05 BASIS OF PAYMENT.

Trenchless Construction is incidental to the underground utility pipe being installed and will not be paid for separately.