

Section 02447

DRY AND SLURRY AUGERING OF PIPE AND CONDUIT

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Installing water service pipe by methods of augering or casing by jacking and boring.
- B. Installing Telecommunication Conduit along or under Public Ways.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

- 1. No separate payment will be made for augering pipe for water lines under this Section. Include payment in unit price for Section 02511 – “Water Lines”.
- 2. When open-cut construction is requested by Contractor for his convenience in areas designated for augering, and when approved in advance by Program Manager, such areas shall be paid for at Unit Price for Section 02511 – “Water Lines”.
- 3. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- B. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
- C. ASTM D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- D. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.04 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”

- C. Section 01555 – “Traffic Control and Regulation”
- D. Section 01576 – “Waste Material Disposal”
- E. Section 01578 – “Control of Ground Water and Surface Water”
- F. Section 02233 – “Clearing and Grubbing”
- G. Section 02260 – “Trench Safety Systems”
- H. Section 02317 – “Excavation and Backfill for Utilities”
- I. Section 02425 – “Tunnel Excavation and Primary Liner”
- J. Section 02431 – “Tunnel Grout”
- K. Section 02502 – “Steel Pipe and Fittings”
- L. Section 02511 – “Water Lines”
- M. Section 02517 – “Waterline in Tunnels”
- N. Regulatory Requirements
  - 1. Conform to TxDOT requirements for installations under State Highways. Engineer will obtain required permits for State Highway crossings.
  - 2. Installations Under Railroads:
    - a. Secure and comply with requirements of right-of-entry for crossing railroad company's easement or right-of-way from railroad companies affected. Comply with railroad permit requirements.
    - b. Use auger method only.
    - c. Damages due to delays caused by railroad requesting work to be done at hours which will not inconvenience railroad will be at no additional cost.
    - d. Maintain equipment and excavations minimum 35-foot clearance from centerline of tracks.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit product data for casings, insulators / casing spacers, spacing of insulators / casing spacers for specific pipe and location on project.

- C. Prior to installation of pits, submit for Program Manager's approval, pit locations, size, depth, and areas for storage, material, and spoil handling. Acceptance of Project Manager does not relieve Contractor from responsibility to obtain specified results.
- D. Show actual pit locations dimensioned on as-built drawings so that they can be identified in field.
- E. Submit copy of executed railroad company rights of entry to Program Manager.
- F. Provide cutting head size to be used in conjunction with slurry augers.

1.06 – 1.09 NOT USED

1.10 DEFINITIONS

- A. Auger Methods:
  - 1. Dry Auger Method: Installation of steel casing by excavating soil at advancing end of casing and transporting spoil through casing by otherwise uncased auger, while advancing casing by jacking at same rate as auger excavation progresses.
  - 2. Slurry Auger Method: Installation of steel casing or carrier pipe by first drilling small diameter pilot hole from pit to pit, followed by removing excess soil and installing casing or pipe by pull-back or jacking method.
  - 3. Annular Space: space between carrier pipe and primary tunnel liner, casing, or ground.

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Criteria for Selection of Material

Contractor shall be responsible for selection of casing, pipe, and pipe joints to carry anticipated thrust of jacks or loads.

B. Piping and Fittings: As required by Specification or Plans.

C. Casings: Provide steel casing in accordance with Section 02502 – “Steel Pipe and Fittings”. The size of casing shall be based on the minimum clearance between the carrier pipe and the casing as defined in Section 02425 – “Tunnel Excavation and Primary Liner”, Paragraph 2.01.B. Additionally, the sizing of casings shall exceed the O.D. of any external joint restraints. Provide casing with smooth, continuous interior surface.

- D. Casing Spacer Dimensional Requirements: Provide casing spacer width 8 inches for pipe sizes up to and including 12 inches; 12 inches for pipe sizes larger than 12 inches. Wood skids or concrete “donuts” are not acceptable. Maximum pipe diameter for use of spacers is 30 inches. Additionally, the sizing of casing spacers shall exceed the O.D. of any external joint restraints.
1. For pipe materials 12 inches and smaller, use Advance Products & Systems, Inc. Model SI8-2, Pipeline Seal & Insulator Model C8G-2 or approved equal.
  2. For pipe materials above 12 inches, use Advance Products & Systems, Inc. Model SI12-2, Pipeline Seal & Insulator Model C12G-2 or approved equal.
- E. Casing Spacer Material Requirements: Bolt-on style with shell made of two sections of 14-gauge carbon steel, hot rolled, cleaned, and lined with PVC liner, 0.090 inch thick with Durometer A 85-90 overlapping edges to secure liner to spacer; deep embossed flanges for added strength; coated prior to installation of liner and runner with fusion-bonded PVC powder of 14 to 20 mils thickness; electroplated studs, nuts, and washers.
1. Runners: Supported by 10-gauge carbon steel MIG risers welded to shell. Total length of weld beads shall be at least 50 percent of the length of the runner. Fill bolt holes with caulk or approved equal to provide a water-tight seal. Minimum requirements: Glass reinforced plastic conforming to the following tests:
    - a. Tensile Strength: ASTM D 638; 17,600 psi
    - b. Flexural Strength: ASTM D 790; 25,300 psi
    - c. Compression Strength: ASTM D 695; 18,000 psi
    - d. Deflection Temperature at 264 psi: ASTM D 648; 405 F
    - e. Polyethylene runners are not acceptable.
- F. Casing End Seals: Provide Advance Products & Systems, Inc. Model AC, Pipeline Seal and Insulator Model C, or approved equal.
- G. Annular Grout:
1. Material: Low density (cellular) grout or sand-cement mortar mix.
  2. Provide annular grout in accordance with Section 02431 – “Tunnel Grout”.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Conform to applicable provisions of Section 02233 – “Clearing and Grubbing”.
- B. Utility Relocations: Relocate utility lines clear of pit and zone of potential significant settlement or other ground disturbance.
- C. Install casings as required by Plans, in accordance with this Section.
- D. Install temporary solid plug at open end of water line to prevent contamination.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Limits on Auger Length Without Steel

- 1. Do not exceed the lengths for auger holes in Table 1 when augering without steel casing between pits. See Paragraph 3.03.A.2 for restrictions.

Table 1  
 Acceptable Lengths for Auger Holes Without Steel Casing

Pipe Diameter	Max Length (LF)
Less than or equal to 8-inches	125
12-inches	100
16 to 20-inches	80
24 to 30-inches	60

- 2. If groundwater is encountered in the auger hole and the dewatering system is not able to dry up the subsurface to provide stable conditions, the lengths above should be reduced based on the field conditions as agreed to by the Project Manager. Reduced auger hole lengths shall be at least 25% of the above listed maximum length.

B. Traffic Control

- 1. Conform to applicable provisions of Section 01555 – “Traffic Control and Regulation”.
- 2. Secure right-of-entry for crossing Railroad Company's easement or right-of-way.
- 3. During construction operations, furnish, and maintain barricades and lights to safeguard traffic and pedestrians, until such time as backfill has been

completed and removed from site. Provide additional barricades and lights as directed by Project Manager.

C. Pits

1. Locate auger pits where there is minimum interference with traffic or access to property. Avoid locating pits close to storm drainage channels, ditches, storm water lines, or culverts, or near potentially contaminated areas.
2. Pit Size: Size pits to provide adequate room to meet operational requirements for auger construction as well as structures indicated on Plans. Provide minimum 6-inch space between casing or pipe and walls of bore pit. Maximum allowable width of pit shall be no greater than 5 feet outside of the casing or pipe. Width of pit at surface shall not be less than at bottom.
3. Excavate bore pits to a finished grade of at least 6 inches lower than grade indicated by stakes.
4. Backfill in accordance with Section 02317 – “Excavation and Backfill for Utilities”.
5. Auger pits that are excavated and backfilled as part of open-cut water line construction shall be in accordance with Section 02317 – “Excavation and Backfill for Utilities”.
6. Provide and properly maintain safety protection against traffic, and accidental or unauthorized entry. Provisions shall include concrete traffic barriers or other suitable barrier around periphery of pit as appropriate.
7. Fully cover and secure pits with steel plates where no construction activity is in progress.
8. Install sheeting, lining, shoring, and bracing required for protection of workmen and public in accordance with Section 02260 – “Trench Safety Systems”.
9. Provide groundwater control and drainage from pits while Work is in progress and until pit is properly backfilled. Conform to requirements of Section 01578 – “Control of Ground Water and Surface Water”.

D. Slurry Augering

1. Auger from approved pit locations. Excavate for pits and install shoring as outlined above under Paragraph 3.03.C, Pits. Auger mechanically with use of pilot hole entire length of crossing and check for line and grade. Diameter of auger hole not to exceed pipe bell diameter plus 2 inches. Place excavated material outside working pit and dispose of as specified. Use water or other

fluids in connection with boring operation only to lubricate cuttings; jetting is not permitted.

2. In unconsolidated soil formations, gel-forming colloidal drilling fluid may be used. Fluid is to consist of at least 10 percent of high-grade processed bentonite and shall consolidate cuttings of bit, seal walls of hole, and shall furnish lubrication for subsequent removal of cuttings and installation of pipe.
3. Depending on character of soil encountered during augering operation, conduct operations without interruption, insofar as practical, to prevent hole from collapsing or pipe from seizing up in hole before installation is complete.
4. Cover the open end of pipe before inserting into the auger hole.
5. Allowable variation from line and grade shall be as specified under Paragraph 3.03.G, Jacking.
6. Remove and replace pipe damaged in augering operations.

E. Dry Augering of Steel Casing

1. Provide jacks, mounted on frame or against backstop, of capacity suitable for forcing excavating auger and casing through soil conditions to be encountered. Operate jacks so that even pressure is applied to casing.
2. Provide steerable front section of casing to allow vertical grade adjustments. Provide water level or other means to allow monitoring of grade elevation of auger casing.
3. Bentonite slurry may be used to lubricate casing during installation. Use of water to facilitate removal of spoil and to lubricate exterior casing is permitted; however, water jetting for excavation of soil is not allowed when jacking casing.
4. The annular space of dry augers shall be grouted when necessary in accordance with Sections 02431 – “Tunnel Grout” and 02517 – “Waterline in Tunnels”.

F. Filling Annular Space When Using Slurry Auger Method

1. For pipe diameters up to 16 inches, for installation of water line, block void space around pipe in augered hole with approximately 12 inches of packed clay or approved equal material to prevent bedding or backfill from entering void around pipe in augered hole when compacted. For pipe diameters 4 inches through 8 inches use minimum ½-cubic-foot clay; for pipe diameters 12 inches through 16 inches use minimum ¾-cubic-foot clay.
2. When diameter of auger hole exceeds diameter of bell by more than 2-inches, grout the annular space between the pipe and the excavated hole.

3. For pipe diameter greater than or equal to 20 inches, grout the annular space between pipe and excavated hole.
4. Refer to the Material Applications for Tunnel & Auger Construction table under Paragraph 3.03.K.

G. Jacking

1. Comply with Section 02260 – “Trench Safety Systems” for all pits, end trenches, and other excavations relating to Work required by specifications. Dewater as required to provide safe working conditions.
2. Wherever end trenches are cut into sides of embankment or beyond it, sheath securely and brace such work to prevent earth caving.
3. Make up only one joint at time in pit or trench prior to jacking.
4. Do not interfere with operation of railroad, street, highway, or other facility, nor to weaken or damage embankment or structure.
5. Use heavy-duty jacks sized for forcing casing through embankment. Use appropriate jacking head, usually of timber, and bracing between jacks and jacking head and jacking frame or backstop. Apply jacking pressure uniformly around ring of casing. Set casing to be jacked on guides, properly braced together, to support section of casing and to direct it in proper line and grade. Place jacking assembly in line with direction and grade of casing. Excavate embankment material just ahead of casing and remove material through casing. Force casing through embankment with jacks into excavated auger hole.
6. Conform excavation for underside of casing to contour and grade of casing, for at least one third of circumference of casing. Provide clearance of not more than 2 inches for upper half of casing. Taper off upper clearance to zero at point where excavation conforms to contour of casing.
7. Excavation may extend beyond end of casing depending on character of material, but shall not exceed 2 feet. Decrease advance excavation at direction of Program Manager, when character of material being excavated makes it desirable to keep advance excavation closer to end of casing.
8. Jack casing from low or downstream end. Lateral or vertical variation in final position of casing from line and grade as shown on Plans will be permitted only to extent of 1 inch in 10 feet, provided such variation is regular and only in one direction and that final grade of flow line is in direction indicated on Plans.



9. Use cutting edge of steel plate around head end of casing extending short distance beyond end of casing with inside angles or lugs to keep cutting edge from slipping back onto casing.
10. Once jacking of casing is begun, carry on without interruption, insofar as practicable, to prevent casing from becoming firmly set in embankment.
11. Remove and replace casing damaged in jacking operations.
12. Backfill pits or trenches excavated to facilitate jacking operations immediately after completion of jacking of casing.
13. Grout annular space between casing and excavated hole when loss of embankment occurs or when clearance of 2 inches is exceeded.

#### H. Spacer Installation

1. There must be no inadvertent metallic contact between casing and carrier pipe. Place spacers to ensure that carrier pipe is adequately supported throughout length, particularly at ends, to offset settling, and possible electrical shorting. Place end spacer within 6 inches of end of casing pipe, regardless of size of casing and carrier pipe or type of spacer used. Spacing between spacers depends largely on load bearing capabilities of pipe coating and flexibility of pipe.
2. Grade bottom of trench adjacent to each end of casing to provide firm, uniform, and continuous support for carrier pipe. When trench requires some backfill to establish final trench bottom grade, place backfill material in 6-inch lifts and compact to density of undisturbed soil.
3. Install casing spacers in accordance with manufacturer's instructions. Take special care to ensure that sub-components are correctly assembled and evenly tightened, and that no damage occurs during tightening of insulators or carrier pipe insertion.
4. Seal annulus between carrier pipe and casing with casing end seals at each end of casing.
5. Insulator Spacing:
  - a. Spacing shall be as shown on Plans with maximum distance between spacers to be 10 feet for pipe sizes 4 to 14 inches and 8 feet for pipe sizes 16 to 30 inches.
  - b. For ductile iron pipe or bell-and-spigot pipe, install spacers within one foot on each side of bell or flange and one in center of joint when 18- to 20-foot-long joints are used.

- c. If casing or carrier pipe is angled, bent, or dented, reduce spacer runner as directed by Project Manager.

I. Settlement Monitoring

- 1. Monitor ground surface elevation along length of augering operation. Locate and record settlement monitoring points with respect to construction baseline and elevations. Ground surface elevations shall be monitored in at least three locations per auger drive with a maximum spacing not to exceed 100-feet. Establish monitoring points on all critical structures. Monitoring points should be established at locations and by methods that protect them from damage by construction operations, tampering, or other external influences. Record elevations to accuracy of 0.01 feet for each monitoring point location.
  - a. Railroads: Monitor ground settlement of track subbase at centerline of each track.
  - b. Utilities and pipelines: Monitor ground settlement directly above and 10 feet before and after utility or pipeline intersection
- 2. Reading Frequency and Reporting. Submit to Project Manager records of readings from various instruments and survey points. Take settlement survey readings:
  - a. Prior to auger excavation reaching point
  - b. After auger reaches monitoring point in plan
  - c. After grouting of ground supporting casing is complete
- 3. Immediately report to Project Manager movement, cracking, or settlement which is detected.
- 4. Following substantial completion but prior to final completion, make final survey of monitoring points and submit to Project Manager records of readings.

J. Disposal of Excess Material

Conform to applicable provisions of Section 01576 – “Waste Material Disposal”.

3.04 – 3.10 NOT USED

END OF SECTION