STANDARD SPECIFICATIONS
SECTION 02445
BORING AND JACKING

PART 1 GENERAL

1.1 DESCRIPTION

A. Section includes requirements for boring and jacking casing pipe.

1.2 DEFINITIONS

A. Carrier Pipe: Sewer or water pipe.

B. Casing Pipe: Sleeve through which carrier pipe will be placed.

C. Boring and Jacking: Method of installing casing pipe by cutting, hand mining, or boring an opening in soils material, simultaneously forcing casing pipe through it with hydraulic jacks.

D. Casing Spacer: Fabricated item for positioning a carrier pipe inside a casing pipe.

1.3 SUBMITTALS

A. Submit following Section 01330.
   1. Shop drawings for casing pipe showing sizes and hold down assemblies or casing spacers for carrier pipe.
   2. Shop drawings of bulkheads when shown on Drawings.
   3. Shop drawings of access manholes shown on Drawings.
   4. Design mixes for concrete, grout and flowable fill.
   5. Working drawings and written procedures describing in detail proposed bore and jack method and entire operation to be used, for information only, including, but not limited to:
      a. Working and receiving shafts.
      b. Dewatering.
      c. Method of removing soils and installation of casing and carrier pipe.
      d. Size, capacity, and arrangement of equipment.
      e. Backstop.
      f. Shaft base material.
      g. Type of cutter head.
      h. Method of monitoring and controlling line and grade.
      i. Detection of surface movement.
      j. Procedure for installing pipe supports, anchors, or placement of grout between carrier pipe and casing pipe.

k. Bulkhead details and proposed positive method of anchoring carrier pipe to prevent flotation.
l. Catalog data for casing spacers when used for temporary support during construction.
m. Procedure for monitoring line and grade.

6. If modifications to methods are required during construction, submit working drawings delineating modifications, including reasons for them.

B. Submit Certificate of Compliance following Section 01450 before delivery of materials.
1. Steel or reinforced concrete pipe for casing pipe when annular space between casing and carrier pipes is not filled with concrete.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Unload and handle materials with equipment of adequate capacity.
1. Store materials on site in reasonably level, well drained area free from brush.
2. Store individual pieces and bundles with safe walking space between to allow full view for inspection purposes.

1.5 PROJECT CONDITIONS

A. Bore so as not to interfere with, interrupt, or endanger surface and activity thereon.
1. Minimize subsidence of surface, structures, and utilities above and in vicinity of bore.
2. Support ground continuously to prevent loss of ground and keep perimeters stable.
3. Be responsible for settlement resulting from operations.
4. Repair and restore damaged property to its original condition before being disturbed at no cost to the Commission.

B. Follow applicable ordinances, codes, statutes, rules, and regulations of State of Maryland, MSHA, applicable County building codes, affected Railroad Company, and applicable regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A10.16-1995 (R2001), “Safety Requirements for Tunnels, Shafts, and Caissons.”

1.6 ADDITIONAL CRITERIA FOR WORK UNDER RAILROADS

A. Do not schedule work within and adjacent to Railroad property until Engineer and Railroad approve submittals, including proper Railroad insurance.
1. Approval does not relieve Contractor of responsibility for adequacy and safety of procedures.

B. Give Railroad advance written notice as described in permit, copied to Engineer, before entering and working on Railroad property.

C. Place in effect before work proceeds, safety, precautionary, and protective devices and services required by Railroad.

D. Follow AREMA or other applicable railroad specification and permit requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Casing Pipe.
   1. General: Use casing pipe following Drawings.
      a. When boring installation method for 8 inch and smaller diameter carrier pipe is not shown on Drawings, use one of following type casing pipes with minimum inside diameter of not less than 1 inch larger than largest outside diameter of carrier pipe.
   2. Steel Pipe.
      a. Smooth walled with minimum yield strength of 36,000 psi (ASTM A1011 Grade 36).
      b. Minimum wall thickness: 3/8 inch or as indicated on Drawings.
      c. Joints: Fully welded around circumference of pipe with complete penetration weld.
         1) Weld of sufficient strength to withstand forces at pipe joints without distortion of pipes.
         2) Minimum welds: Follow Standard Detail.
      d. Coating: None.
   3. Reinforced Concrete Pipe: ASTM C76, minimum Class IV, with concrete joint and smooth exterior without joint bulge.
      a. Use resilient material for placement in joint to prevent concrete damage when jacking forces are applied.

B. Carrier Pipe: Specified elsewhere in specifications.

C. Casing Spacers.
   1. Treat stainless steel metal surfaces and welds in order to reduce chemical reactivity of its surface.
   2. Bands and Risers.
      a. Minimum 2 pieces, stainless steel plate: ASTM A666 Type 304.
      b. Band: Minimum thickness: 14 gage for carrier pipes up to 12 inches diameter and 12 gage for more than 12 inches.
   3. Runners.
      a. High density molecular polyethylene or polymer reinforced fiberglass with DURO Hardness A of 80 and minimum dielectric strength of 500 volts per mil with sufficient compressive and shear strengths.
      b. Attach to risers with bolts or welded studs.
      c. Fill bolt holes with silicone caulk.

4. Spacer Band: Line with minimum 0.090 inch thick ribbed PVC liner of DURO Hardness A of 80 and minimum dielectric strength of 50,000 volts per mil.
5. Approved Manufacturers:
    a. Pipeline Seal and Insulator Inc.
    b. Cascade Waterworks Manufacturing Company.
    c. Advanced Products and Systems, Inc. (APS)
    d. Or equal (Minimum 5 years of fabricating casing spacers in the United States).

D. Casing End Seals.
1. Approved Manufacturers:
    a. Advance Products & Systems, Model AC or AM
    b. Pipeline Seal & Insulator, Inc., Model S or C.
    c. Maloney Technical Products, MULTIFLEX End Seal.
    d. Or equal.

E. Grout.
1. Cement: ASTM C150, Type I or Type II.
2. Water: See Section 03300.
3. Sand: ASTM C404, Size No. 1.
4. Voids Between Casing and Existing Ground: Minimum compressive strength of 100 psi, attained within 24 hours, and sufficiently fluid to inject through lining and fill voids, with prompt setting to control grout flow.
5. For Carrier Pipe Bedding and Filling Annular Space between Casing Pipe and Carrier Pipe: 3 parts ASTM C144 sand, to 1 part ASTM C150 cement.

F. Concrete for Cradle or Filling Void between Casing and Carrier Pipe: See Section 03300.

G. Flowable Fill for Filling Void between Casing and Carrier Pipe: See Section 03300.

H. Subsurface Settlement Indicator Fabrication: See Standard Detail M/7.0

I. Dielectric Material:
1. Thermoplastic; Minimum strength of 400 volts for each mil, and water absorption less than 0.02 percent (24-hour period).

J. Surface Settlement Markers:
1. Within Bituminous Concrete Paved Areas: "p.k." nails.
2. Within nonpaved Areas: Wooden hubs.
3. On Concrete Surfaces: Paint

K. Casing Pipe Access Manhole: When required on Drawings and following Standard Details.

L. Bulkheads: Follow Drawings or Standard Details.

PART 3 EXECUTION

3.1 GENERAL

A. Review and interpret available geotechnical reports and investigate work site soil conditions before bidding.
   1. Encountering rock or water will not entitle Contractor to additional compensation.

B. Notify Engineer immediately if obstruction stopping forward motion of operation is encountered during installation.
   1. When impossible to advance bore hole or pipe, discontinue operation, abandon completed portion in place, and fill with grout or plug, unless otherwise directed by Engineer.

C. Dewatering: When water is encountered, develop and maintain dewatering system of sufficient capacity to remove water continuously, keeping excavations free of water until backfill operation is in progress.
   1. Keep removal of soils particles to minimum.
   2. Dewater into sediment trap following Section 01570.
   3. Observe settlement or displacement of surface facilities due to dewatering.
   4. Should settlement or displacement be detected, notify Engineer immediately and act to maintain safe conditions and prevent damage.

3.2 PREPARATION

A. Excavate Shafts: Follow Working Drawings and Section 02315.

B. Perform preliminary work, including constructing backstop, placing guide timbers, and placing boring apparatus.

C. Settlement markers for crossing State highways and other roads: Locate following Contract Documents.

3.3 SHAFT CONSTRUCTION

A. Design, construct, maintain, and remove shaft, including any damage attributed to shaft construction.
   1. See MOSH for bore and jack shafts and ingress and egress to bore and jack.

B. Construct shafts following working drawings.

C. Excavate, backfill, and grade following Section 02315 and to requirements specified herein.

3.4 BORING OPERATION

A. General.
   1. Use removable auger and cutting head arrangement.
   2. Control line and grade.

B. Boring and Jacking.
   1. Jack casing pipe with auger rotating within pipe to remove spoil.
      a. Hand mining may be used for large bore casing pipe, provided method is submitted in detail and acceptable to Engineer.
   2. Maintain face of cutting head to preclude free flow of soft or poor soils material.
   3. Overcut of Cutting Head:
      a. Not to exceed outside diameter of casing pipe by more than 1/2 inch.
      b. For hand mining no overcut will be permitted.
   4. Use positive means for continuous monitoring and controlling grade of casing pipe during boring operation.
   5. Weld steel pipe casing as required herein.
      a. When coating is required, repair coating damage on each side of weld and recoat complete weld area.
   6. Reinforced Concrete Pipe for Casing:
      a. Jointing: Follow Section 02530 for rubber gasket joints and for all others follow manufacturer's recommendation.
      b. Place resilient material in pipe joint area to prevent damage to concrete during pipe installation.

3.5 DETECTION OF MOVEMENT

A. Surface Settlement Markers.
   1. Unless otherwise specified, shown on Drawings or directed by Engineer, locate surface settlement markers according to a grid, spaced 10 feet by 10 feet and extending as shown on Drawings, but not less than 20 feet either side of the tunnel centerline.
   2. Establish elevation of settlement markers to bench marks unaffected by tunnel operations.
   3. Take readings and permanently record:
      a. Before start of dewatering operations and/or shaft excavation.
      b. After steel casing has been advanced beyond pavement limits of each roadway.
   4. Take elevation measurements to nearest 0.01 foot, and furnish reports to Engineer.
   5. In the event of settlement or heave on any marker:
      a. Immediately cease work and take immediate action to prevent further settlement or heave and concurrently report settlement or movement to Engineer
      b. Restore surface elevations to that existing before start of tunnel operations at no cost to the Commission.

B. Subsurface Indicators.
   1. When shown on Drawings, install subsurface settlement indicators following Standard Details before start of dewatering or tunneling.

2. Monitor movements of indicators to accuracy of 0.01 foot following approved schedule.
3. Whenever tunneling occurs within 50 feet of indicator, monitor movements of indicator before and after each advance of tunnel face within 50 feet of indicator.

C. Report settlement or movement immediately to Engineer and take immediate remedial action, at no cost to the Commission, except when from dewatering operations.

3.6 FIELD QUALITY CONTROL

A. Maintain line and grade following Drawings to within 2 inch tolerance.

3.7 INSTALLATION OF CARRIER PIPE: Follow Sections 02315, 02510, and 02530, Standard Details, Drawings, and specified herein.

A. Use thermoplastic or other dielectric material (except wood) between carrier pipe and steel sleeve to prevent metal to metal contact and damage to pipe and coating during placement.

B. Hold Down Method in Casing Pipe.
1. Water mains, force mains, and pressure sewer mains: Concrete invert and hold down assembly or casing spacers following Standard Details and Drawings.
2. Gravity sewer.
   a. Fill annular space between pipe and casing with concrete, grout, or flowable fill following Standard Details and Drawings.
   b. Provide positive means to prevent floatation during placement of fill in casing.

C. Unless shown otherwise on Drawings, install ductile iron water pipes and ductile iron sewer force mains following Standard Details.

D. Bulkheads: Follow Drawings.

3.8 ACCESS MANHOLES

A. Install access manhole at each end of casing pipe following Standard Details when required on Drawings.

PART 4 MEASUREMENT AND PAYMENT

4.1 BORED AND JACKED CASING PIPE

A. Measurement: By linear foot of each diameter, measured horizontally along centerline of pipe between inside faces of boring shafts.

B. Payment: At unit price for each linear foot listed in Bid Schedule.

1. Payment includes excavation, backfill, shafts, disposal of excess excavated material, casing pipe, boring equipment, subsurface settlement indicators, and settlement markers.
2. Carrier Pipe installed inside casing pipe is measured and paid for as described elsewhere in these specifications.

4.2 ACCESS MANHOLE

A. Measurement: By vertical foot measured from top of base slab to bottom of frame of various types and sizes installed complete, in place, including installation of Commission furnished frame and cover.

B. Payment: At unit price for each vertical foot as listed in Bid Schedule.
1. Payment includes excavation, bedding and backfill, and provision of manhole complete.

WSSC