

SECTION 02150

BORING, JACKING, TUNNELING

PART 1 GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to.
 - 1. Approach trench excavation.
 - 2. Installation of casing pipe or liner.
 - 3. Installation of carrier pipe.
- B. Related work specified elsewhere.
 - 1. Trenching, Backfilling & Compacting: Section 02221

1.02 QUALITY ASSURANCE

- A. Contractor Qualifications.
 - 1. Construction operations shall be undertaken only by a Contractor well experienced in operations of similar magnitude and condition under transportation arteries and surface areas which cannot be disturbed.
- B. Design Criteria.
 - 1. Pipe and joints of leakproof construction, designed for the earth and/or other pressures present, plus highway H20 loading or railway E80 loading with the associated recommended impact loading.
 - 2. Design bracing, backstops, and use jacks of sufficient rating so that the jacking can proceed without stoppage, except for adding pipe sections and as conditions permit, to minimize the tendency of the ground material to 'freeze' around the casing pipe.
- C. Allowable Tolerances.
 - 1. Do not overcut excavation by more than 1" greater than the outside diameter of the casing pipe.
 - 2. Install casing pipe with the determined vertical and horizontal alignment prior to installation of the carrier pipe.
- D. Reference Codes and Specifications.
 - 1. Comply with applicable Federal, State and Local ordinances, codes, statues, rules and regulations, and affected jurisdictional bodies.

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2. Pennsylvania Department of Transportation Publication No. 408 Specifications, Latest Edition.
3. Norfolk Southern Railway Rules and Regulations.

1.03 SUBMITTALS

- A. Submit history of previous work completed of equivalent nature and scope. Include qualification and experience of key personnel.
- B. Submit description of proposed construction methods, including methods to establish and maintain vertical and horizontal alignment.
- C. Submit tunnel liner design calculations and manufacturer's data on tunnel liner plate showing sizes, shapes, methods of attachment and connection details, and details of grout holes.
 1. Highway Crossings: Design tunnel for earth and/or other pressure loads present, plus AASHTO H20 live loading.
 2. Railroad Crossings: Design tunnel for earth and/or other pressure loads present, plus Cooper's Railroad E80 live loading with 50-percent added for impact.
- D. Contractor shall submit all proof of submittals, insurance and approvals from Norfolk Southern Railway Corporation.

1.04 JOB CONDITIONS

- A. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger the integrity of surface or subsurface structures or utilities, and landscape in the immediate or adjacent areas.
- B. When boring, jacking or tunneling under State highways and railroads, comply with all applicable rights-of-way occupancy permits. The Contractor shall familiarize himself with all procedures and requirements of the governing agency or company having jurisdiction over the roadway, railroad, structure, or obstruction involved, and shall furnish all materials, equipment, and work necessary to perform the work in accordance with those procedures and requirements.
- C. If boring is obstructed, relocate or jack tunnel crossing as approved by the Owner. The Contractor shall receive approval of the Owner for any tunneling with liner plate or boring operation not so indicated on the Contract Drawings.
- D. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site. When dewatering,

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close observation shall be maintained to detect any settlement or displacement of roadway embankment, etc.

PART 2 PRODUCTS

2.01 STEEL CASING PIPE

- A. ASTM A53; 35,000 psi minimum yield strength.
- B. Full circumference welded joints.
- C. Diameter and wall thickness as shown on the Contract Drawings.
- D. Asphalt coated.

2.02 STEEL STRAPPING: ASTM A36

2.02 SAND (Fine Aggregate)

- A. Section 703.1, Publication No. 408 Specifications, Latest Edition. Type A.

2.04. GROUT

- A. One part portland cement (ASTM C150), and 6 parts mortar sand mixer with water to a consistency applicable for pressure grouting.

PART 3 EXECUTION

3.01 APPROACH TRENCH

- A. Excavate approach trench using methods as site conditions require.
- B. Ensure pipe entrance face as near perpendicular to alignment as conditions permit.
- C. Establish a vertical entrance face at least 1 foot above top of casing or tunnel lining.
- D. Install adequate excavation supports as specified in Section 02221 - Trenching.

3.02 CASING PIPE INSTALLATION METHODS

- A. Boring:
 - 1. Push the pipe into the ground with a boring auger rotating within the pipe to remove the spoil. Do not advance the cutting head ahead of the casing pipe except for that distance necessary to permit the cutting teeth

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to cut clearance for the pipe. The machine bore and cutting head arrangement shall be removable from within the pipe. Arrange the face of the cutting head to provide a barrier to the free flow of soft material.

2. If unstable soil is encountered during boring retract the cutting head into the casing to permit a balance between the pushing pressure and the ratio of pipe advancement to quantity of soil.
3. If voids should develop greater than the outside diameter of the pipe by approximately one inch, grout to fill voids. Grouting to fill voids will be at the expense of the Contractor.

B. Jacking:

1. Construct adequate thrust wall normal to the proposed line of thrust.
2. Impart thrust load to the pipe through a suitable thrust ring that is sufficiently rigid to ensure distribution of the thrust load on the pipe.

C. Drilling and Jacking:

1. Use an oil field type rock roller bit or plate bit made up of individual roller cutter units solidly welded to the pipe which is turned and pushed for its entire length by the drilling machine to give the bit the necessary cutting action.
2. Inject a high density slurry (oil field drilling mud) to the head as a cutter lubricant. Inject slurry at the rear of the cutter units to prevent jetting action ahead of the pipe

D. Mining and Jacking:

1. Utilize manual hand-mixing excavation from within the casing pipe as it is advanced with jacks, allowing minimum ground standup time ahead of the casing pipe.

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3.03 TUNNELING

- A. Advance excavation for the tunnel liner in increments sufficient for the erection of one ring of liners and install liner plates immediately after each increment of excavation. Carry on excavation in such a manner that voids behind the liner plates are held to a minimum. Completely fill such voids with grout followed immediately by grout placed under pressure.
- B. Excavate to the lines, grades, dimensions and tolerances as specified and shown, to accommodate the initial support and permanent lining.
- C. Installation of Tunnel Linings:
 - 1. Install the tunnel lining in a manner that will not damage the lining or coating.
 - 2. Ensure that the edges are clean and free from material that could interfere with proper bearing.
 - 3. Install bolts for liner plates in accordance with liner plate manufacturer's recommendations and retention or replace if necessary any bolt which does not meet the requirements.
- D. Place concrete invert as required.

3.04 DEWATERING

- A. Intercept and divert surface drainage precipitation and groundwater away from excavation through the use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Develop a substantially dry subgrade for the prosecution of subsequent operations.
- C. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.05 PRESSURE GROUTING

- A. Pressure grout the annular space between the casing pipe and surrounding earth.

3.06 CARRIER PIPE INSTALLATION

- A. All provisions regarding cleaning, inspection and handling specified under pipe material sections apply to this work.

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- B. Place the carrier as shown on the Contract Drawings. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.
- C. Support pipeline within casing so that no external loads are transmitted to carrier pipe. Attach wooden skids to barrel of carrier pipe; do not rest carrier pipe on bells.
- D. After the pipe has been installed in the encasing conduit and has been tested, fill the encasing conduit with 1/4 inch clean stone chips or sand meeting the requirements of PaDOT Form 408 Section 703, Specification for Type A Fine Aggregate.
 - 1. Close one end of encasing conduit with brick and mortar before filling with fine aggregate. Close the other end of the encasing conduit with brick and mortar after filling with fine aggregate or as operation dictates.

3.07 BASIS OF PAYMENT

This item shall be paid for on a lump sum basis, complete and in-place. Such price shall include all casing pipe, fittings, connections, welding, pipe, boring, jacking, backfill, etc. In addition, all costs associated with complying with all Norfolk Southern Corporation requirements (including, but not limited to, all communication, correspondence, submittals, approvals, insurance, flagmen, etc. This LUMP SUM price shall include all materials, equipment, tools, labor, all required testing, and all work incidental thereto.

**** END OF SECTION ****