SECTION 2445 - CASING PIPE CONSTRUCTION

PART 1 - GENERAL

1.01 SUMMARY
A. Section Includes: Providing casing pipes in the locations shown and according to details shown on Drawings.

1.02 REFERENCES
A. ASTM:
   1. A 449 Longitudinal Bolts
   2. C 76 Concrete Pipe
   3. A 53, Grade B Carbon Steel
   4. A 513 Hot-dip Galvanizing
B. MDOT 8.08.03 Reinforcing Steel
C. AASTHO:
   1. M167 Bituminous Coating
   2. M190 Bituminous Coating

1.03 SUBMITTALS
A. Shop Drawings: Submit in accordance with Section 1330. Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
   1. CONTRACTOR shall submit complete plans and details of the boring installation, including:
      a. Arrangement of cutter head.
      b. Location and size of jacking and receiving pits.
      c. Shoring/Sheeting of jacking and receiving pits.
      d. Method of grouting.

PART 2 - PRODUCTS

2.01 STEEL PIPE FOR USE UNDER ROADWAYS
A. Pipe shall be shall be ASTM A 53, Type E or S, Grade B, or ASTM A 106, Grade B or C, with a minimum yield strength of 35,000 psi
B. The ends of the steel pipe to be jacked shall be prepared for field welding at joints.
C. The nominal outside diameter and wall thickness, in inches, for steel pipe shall be as shown below.

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<thead>
<tr>
<th>Nominal Size</th>
<th>Wall Thickness</th>
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<tr>
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2.02 STEEL PIPE FOR USE UNDER RAILROAD TRACKS

A. Steel pipe used under railroads shall meet the requirements of The American Railway Engineering Association.

B. Pipe shall be ASTM A 53, Types E or S, Grade B, or ASTM A 160, Grades B or C, with a minimum yield strength of 35,000 psi.

C. Minimum wall thickness for steel casing pipe based on a Cooper E80 loading shall be as shown below (in inches).

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Wall Thickness</th>
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<tbody>
<tr>
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2.03 CONCRETE PIPE

A. Concrete jacking pipe shall be reinforced concrete pipe meeting requirements of AASHTO M 170M, Class IV pipe, as specified in MDOT Standard Specifications 909.04.

B. Joints in reinforced concrete pipe used for jacking shall be tongue and groove, jointed with cold mastic and inside tuck-pointing.

C. A cushioning material, similar to celotex or hardboard, shall be placed in the joint shoulder between pipe sections to distribute uniformly the jacking pressures.
D. After the jacking operation is complete, the joints in pipe 36 inches and larger shall be pointed on the inside by removing any existing materials to a depth of 1/2-inch and cementing this space by pointing with cement mortar composed of one part cement and two parts sand.

2.04 CARRIER PIPE SUPPORT

A. Provide steel assemblies fabricated of steel beams, angles and small-diameter pipe to guide and support large carrier pipe at required grade.

B. Provide casing pipe spacers equivalent to Ranger Plastic Casing Spacers manufactured by Pipe Seal and Insulator, Inc., or provide notchedwood skids with 1-inch banding straps to guide and support small carrier pipes at required grade.

PART 3 - EXECUTION

3.01 PREPARATION

A. CONTRACTOR shall excavate and dispose of material of any nature required to carry out Work. All tunnel and shaft excavation shall be performed in accordance with any paragraphs under Part 3 which may apply. All excavated material, except that needed for backfill, shall be promptly removed and disposed of.

B. Drainage: CONTRACTOR shall provided and maintain all facilities for collecting, conveying, and disposing of water in tunnels and shafts until the completion of Work as required in Section 2240. CONTRACTOR shall have on hand at all times sufficient machinery for all emergencies that are likely to arise on Work of this character, and such machinery shall be kept in good working order. The pumping and power supply to the pumps shall be under the direct charge of competent mechanics, constantly attended on a 24-hour basis.

C. Effective and continuous control of water during the work shall be required. CONTRACTOR shall maintain the groundwater table to a level two feet below the casing invert during construction.

D. Protection of Drainage Facilities: If, in the course of construction, it may be necessary to block a ditch, pipe or other drainage facility, temporary pipes, ditches or other drainage facilities shall be installed to maintain adequate drainage, as approved by the owner of the facility being crossed. Upon completion of Work, the temporary facilities shall be removed and the permanent facilities restored.

E. Power and Lighting: All power machinery and tools used shall be operated by electricity or compressed air. No electric voltage in excess of 440 volts will be permitted. Transformers, if used, shall be mounted on platforms or in an approved enclosure. The use of gasoline in power is prohibited.
   1. All machinery and equipment used in tunnel headings or shafts under gaseous conditions shall bear the approval plate of the United States Bureau of Mines.
   2. Work shall be lighted with electricity at the expense of CONTRACTOR. A sufficient number of lights shall be provided to illuminate properly all parts of Work. All lighting circuits shall be thoroughly insulated and kept separate from power circuits. In gaseous conditions, all lamps shall be mounted in protected gas-and-vapor-proof fixtures.
3.02 INSTALLATION

A. Ventilation: CONTRACTOR shall keep the tunnel air in a condition suitable for the health of the workers and clear enough for the surveying operations. Provisions shall be made for quick removal of gases. Whenever a 24-hour tunneling operation exists, CONTRACTOR shall have attainable, within one hour's time, any spare piece of equipment or material vital to the tunnel operation.

B. Jacking and Boring Pipe: Jacking and receiving pits shall be completely sheeted to provide proper support for the banks and adequate support for reaction blocks. Jacking shaft shall be constructed long enough to provide room for jacking head frame, reaction blocks and two sections of pipe. The width shall be sufficient to allow ample working room. The backstops or reaction blocks shall be placed absolutely perpendicular in all directions to axis of the pipe and the guide timbers carefully installed to the proper line and grade.

1. Prior to jacking the pipe out of the shaft, the outside surface may be coated with bentonite or other suitable lubricant. Bentonite, or other suitable lubricant, may be applied at the front face of the lead pipe simultaneously with the jacking operation. A lubricant sill plank may be required in the heading to maintain vertical alignment.

2. The front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger from leading the pipe so that there will be no unsupported excavation ahead of the pipe.

3. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. If the obstruction cannot be removed without excavation in advance of the pipe, the casing pipe shall be filled with grout and abandoned unless otherwise directed by ENGINEER.

4. Jacking pressure must be applied by a pushing frame at right angles to the line to avoid breaking the pipe or forcing it out of alignment. A positive stop boring arrangement to prevent excavation ahead of the pipe shall be provided. Excavation ahead of the pipe shall not be permitted.

5. When excavating, voids outside the pipe and disturbances of the surrounding material shall not exceed 1/2-inch. Excessive voids shall be filled immediately with sand or other suitable material and thoroughly compacted.

6. The jacking operating shall be continuous insofar as possible to prevent seizure of the pipe. However, if the operation is discontinued for any time, the excavation shall be safely supported with wood bulkhead and adequate blocking.

C. Grouting Casing Pipe: All voids around the outside of the jacked pipe shall be filled by means of pressure grouting with approved material as specified in MDOT Standard Specification 702. Grouting shall be completed within 48 hours of completing the bore.

1. A sufficient number of grout holes shall be provided in the casing pipe to ensure complete grouting of the space between the casing and the surrounding soil. Grouting pressure shall be sufficiently high to fill all voids.

2. Following satisfactory pipe grouting operations, the grout pipe shall be removed from the grout hole after the grout has taken its initial set. The space occupied by the grout pipe shall be completely filled with stiff mortar and troweled smooth at the inner face or a threaded plug installed.

D. Safety Requirements: All operations shall be conducted so as not to interfere with, interrupt, or endanger the operation of trains or damage, destroy, or endanger the integrity of railroad facilities. All work on or near Railroad Company property shall be conducted in accordance with Railroad Company safety rules and
regulations. CONTRACTOR shall secure and comply with the Railroad Company safety rules and shall give written acknowledgment to Railroad Company that they have been received, read, and understood by CONTRACTOR and his employees. Operations will be subject to Railroad Company inspection at any and all times.

1. All cranes, lifts, or other equipment that will be operated in the vicinity of the railroad’s electrification and power transmission facilities shall be electrically grounded as directed by Chief Engineer.

2. At all times when the Work is being progressed, a field supervisor for Work, with no less than 12 months experience in the operation of the equipment being used, shall be present. If boring equipment or similar machines are being used, the machine operator also shall have no less than 12 months experience in the operation of the equipment being used.

3. Whenever equipment or personnel are working closer than 15 feet from the centerline of an adjacent track, that track shall be considered as being obstructed. Insofar as possible, all operations shall be conducted at no less than this distance. Operations closer than 15 feet from the centerline of a track shall be conducted only with the permission of, and as directed by, a duly qualified railroad employee present at site of Work.

4. Crossing of tracks at grade by equipment and personnel is prohibited except by prior arrangement with, and as directed by, Chief Engineer.

3.03 CARRIER PIPE INSTALLATION

A. Pipe Placed in Casings: Under this Section, CONTRACTOR shall place the carrier pipe, fill the annular space between the casing and carrier pipe with sand or pea stone, place bulkheads, and complete all backfilling. All necessary skidding materials required to protect the carrier pipe shall be provided.

B. Carrier Pipe Support: Place pipe spacers, wood skids, or steel frames so as to prevent contact between carrier and casing pipe and to guide carrier pipe without damage into the casing pipe to its required grade. Place pipe spacers or wood skids within 12 inches of casing pipe ends, at each carrier pipe joint, and at intervals to prevent pipe deflection. Maximum distance between supports shall be 7 feet. If grout is to be used to fill annular space between carrier and casing pipes, place support at top of carrier pipe to prevent flotation.

C. Casing Pipe under State (MDOT) or County Roads: All void spaces between the casing pipe and carrier pipe shall be filled with sand meeting the requirements of MDOT Standard Specifications for natural sand 2NS or 1/8-inch pea stone. The sand or pea stone shall be placed by flushing or other methods approved by ENGINEER. CONTRACTOR shall furnish sand fill holes in the carrier pipe as required to ensure complete filling of all void spaces.

D. Casing Pipe under Railroads: The void space shall be filled to the springline of the carrier pipe with sand as specified above.

E. Sealing Casing Pipe Ends: The annular space at ends of casing pipe shall be bullheaded with a minimum 12-inch-thick solid masonry with a 1/2-inch fiberboard cushion between the masonry and carrier pipe

3.04 FIELD QUALITY CONTROL

A. CONTRACTOR shall provide all survey equipment and personnel necessary to maintain the casing or tunnel on correct alignment and grade during construction.

END OF SECTION