

SECTION 33 05 23 – TRENCHLESS UTILITY INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Providing casing pipes in the locations shown and according to details shown on Drawings.
- B. Products Installed but not Furnished under this Section:
 - 1. The carrier pipe shall be as specified under:
 - a. Section 22 11 13 Water Distribution Piping
 - b. Section 22 13 13 Sanitary Sewers

1.2 REFERENCES

- A. Reference Standards:
 - 1. AASTHO:
 - a. M167 Bituminous Coating.
 - b. M190 Bituminous Coating.
 - 2. American Railway Engineering (AREA):
 - a. Part 5, Pipelines.
 - 3. ASTM:
 - a. A 53, Grade B Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - b. A 106 Seamless Carbon Steel Pipe for High-Temperature Service.
 - c. A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - d. A 449 Quenched and Tempered Steel Bolts and Studs.
 - e. A 569 Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
 - f. C 76 Reinforced Concrete Sewer Pipe.
 - 4. Michigan Department of Transportation:
 - a. MDOT 8.08.03 Reinforcing Steel.

1.3 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01 33 00 Submittals, 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.

1.4 SCHEDULING

- A. CONTRACTOR shall notify MHOG at least 5 working days before beginning Work under this Section.

- B. CONTRACTOR shall notify the Livingston County Road Commission 5 days prior to beginning Work under this Section.
- C. CONTRACTOR shall notify ENGINEER 4 working days prior to beginning on any railway property. ENGINEER will notify Railroad on behalf of OWNER.

1.5 PROJECT CONDITIONS

- A. Safety Requirements: All operations shall be conducted so as not to interfere with, interrupt, or endanger the operation of roadways, or damage, destroy, or endanger the integrity of roadway.
- B. At all times when 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.

PART 2 - PRODUCTS

2.1 STEEL PIPE FOR USE UNDER ROADWAYS

- A. Steel pipe shall meet the requirements of MDOT. Pipe shall be ASTM A 53, Type E or S, Grade B, or ASTM A 160, Grade B or C, with a minimum yield strength of 35,000 psi.
- B. Steel pipe casing shall be smooth steel pipe fabricated in sections in accordance with AWWA C201. Lengths shall be as long as practical for site conditions.
- C. Joints shall conform to the requirements of AWWA C206. Joints between sections shall be completely welded to the preceding sections. Prior to welding joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- D. The ends of the steel pipe to be jacked shall be prepared for field welding at joints.
- E. The nominal outside diameter and wall thickness, in inches, for steel pipe shall be as shown below.

<u>Nominal Size</u>	<u>Wall Thickness</u>
12	0.188
14	0.250
16	0.250
18	0.250
20	0.250
24	0.250
30	0.312
36	0.312
42	0.438
48	0.500
54	0.563

2.2 STEEL PIPE FOR USE UNDER RAILROAD TRACKS

- A. Steel pipe shall meet the requirements of The American Railway Engineering Association. Pipe shall be ASTM A 53, Type E or S, Grade B, or ASTM A 160, Grade B or C, with a minimum yield strength of 35,000 psi.
- B. Minimal wall thickness for steel casing pipe based on a Cooper E80 shall be as shown below (in inches).

<u>Nominal Size</u>	<u>Wall Thickness</u>
12	0.188
14	0.250
16	0.281
18	0.312
20	0.344
24	0.407
30	0.469
36	0.531
42	0.625
48	0.688
54	0.781

2.3 CONCRETE PIPE

- A. Concrete jacking pipe shall be reinforced concrete pipe meeting the 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 uniformly distribute 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 1 part cement and 2 parts sand.

2.4 CARRIER PIPE SUPPORT

- A. Casing spacers are required for all carrier pipes. Casing spacers shall be plastic, fiberglass, stainless steel or carbon steel.
- B. Provide steel assemblies fabricated of steel beams, angles, and small-diameter pipe to guide and support large carrier pipe at required grade.
- C. Provide casing pipe spacers equivalent to INs manufactured by or approved equal.

PART 3 - EXECUTION

3.1 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 Division 2 which may apply. All excavated material, except that needed for backfill, shall be promptly removed and disposed of.
- B. Drainage: CONTRACTOR shall provide and maintain all facilities for collecting, conveying, and disposing of water in tunnels and shafts until the completion of Work as required in Section 31 23 19 Dewatering. 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 placing of concrete shall be required. CONTRACTOR shall maintain the groundwater table to a level 2 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.

3.2 INSTALLATION

- A. Casing pipe is to extend a minimum of 10 feet from the back of curb or edge of pavement when jacking under roadways unless otherwise noted by jurisdictional authority.
- B. 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 1 hour's time, any spare piece of equipment or material vital to the tunnel operation.
- C. 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.
- D. 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. Where voids are suspected, 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.
- E. Grouting Tunnel under Plates: Grouting shall start at the lowest hole in each grout panel and proceed upwards simultaneously on both sides. A threaded plug shall be installed in each grout hole as the grouting is completed at that hole. Grouting shall be kept as close to the headings as possible, using grout stops behind the liner plates as necessary. Grouting shall proceed as directed by ENGINEER, but in no event shall more than six lineal feet of tunnel be progressed beyond the grouting.
1. Grouting pressure shall be sufficiently high to fill all voids. Necessary grouting holes shall be installed as required to ensure complete filling of void spaces. A grout pipe with a control valve attached to the grout hole shall be inserted and securely caulked to the grout hole with a half coupling welded to the casing pipe. Grout shall consist of a mixture of Portland cement thoroughly mixed with mortar sand, with sufficient water to permit steady flow through the grout pipes. The mix shall be 2 parts of sand to 1 part of cement. If necessary to speed up setting of grout, approved admixtures of quick-setting cement shall be used as directed by ENGINEER.

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 pitted with a threaded plug.

3.3 CARRIER PIPE INSTALLATION

- A. Carrier pipes shall be installed as specified under:
 1. Section 22 11 13 Water Distribution Piping
 2. Section 22 13 13 Sanitary Sewers
- B. Pipe shall be the type and class as shown on Drawings. Joint restraint, where required, shall be provided.
- C. Pipe Placed in Casings: Under this Section, CONTRACTOR shall install tracer wire per 22 11 13, place the carrier pipe, fill the annular space between the casing and carrier pipe with flowable grout fill, place bulkheads, and complete all backfilling. All necessary skidding materials required to protect the carrier pipe shall be provided.
- D. 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.
- E. Casing Pipe under State (MDOT) or County Roads: All void spaces between the casing pipe and carrier pipe shall be filled with flowable grout fill. CONTRACTOR shall furnish grout fill holes as required to ensure complete filling of all void spaces. Grout pressure shall be controlled to prevent damage to the carrier pipe in accordance with AWWA C600 and shall not exceed 100 psi.
- F. Casing Pipe under Railroads: The void space shall be filled to the springline of the carrier pipe with flowable grout fill as specified above.
- G. Sealing Casing Pipe Ends:
 1. Casing ends seals shall be synthetic neoprene rubber pull-on type end seals with stainless steel bands, as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
 2. The annular space at ends of casing pipe shall be bulkheaded with a minimum 12-inch-thick solid masonry with a 1-inch fiberboard cushion between the masonry and carrier pipe.

3.4 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. ENGINEER shall provide reference points for use by CONTRACTOR.

END OF SECTION 33 05 23