

4.4 HORIZONTAL DIRECTIONAL DRILLING

4.4.01 Description

- A. This section includes requirements for using the horizontal directional drilling (HDD) method of installing underground pressure pipe. This method is also commonly referred to as directional drilling, directional boring, or guided horizontal boring.

4.4.02 Quality Assurance

- A. Qualifications
 - 1. The Directional Drilling Contractor or Subcontractor shall have a minimum of 5-years' experience constructing water, wastewater, or reclaimed water pipes using the HDD method. Experience shall include pipelines of the same or larger diameter and the same or greater lengths as those included in the project.
 - 2. The Contractor's operations shall be in conformance with the most recent edition of the Plastic Pipe Institute "Handbook of Polyethylene Pipe" and the pipe manufacturer's requirements.

4.4.03 Shop Drawings and Submittals

- A. The Contractor shall provide shop drawings and submittals to the County which are specific to the HDD method. These shall be provided to the DPU for review and acceptance prior to construction, and shall be comprised of the following:
 - 1. A detailed Work Plan
 - 2. Pipe
 - 3. Joining procedure
 - 4. Training and experience of directional boring machine operator(s)
 - 5. Specifications for directional drilling equipment, including maintenance and calibration records
 - 6. Any/all proposed deviations from design
- B. The Contractor must submit a Work Plan which details the procedures and schedule to be used to execute the HDD installation. At a minimum, the Work Plan shall include the following:

1. A description of all tools and equipment to be used
 2. A description of the proposed route(s) by which the work area(s) will be accessed
 3. A list of the personnel who will be performing the work, including their qualifications and relevant experience
 4. A list of any/all Subcontractors
 5. An environmental protection plan specific to the HDD operation
 6. Contingency plans for possible problems which may arise during the work
- C. Equipment
1. The Contractor shall submit specifications on directional drilling equipment to be used and shall ensure that the equipment will be adequate to complete the work. Equipment submittals shall include but not be limited to the following:
 - a. Drilling rig
 - b. Mud system
 - c. Down-hole tools
 - d. Guidance system
 - e. Rig safety systems
 - f. Data logger
- D. Records
1. Redline drawings shall be maintained by the Contractor throughout the work. Any deviation from the approved plans shall be noted on the redline drawings, including the nature and extent of the deviation.
 2. Fusion results for all field joints shall be provided to DPU for review prior to acceptance of the work.

4.4.04 Equipment

- A. The directional drilling equipment shall consist of the following:

1. A directional drilling rig of sufficient capacity to perform the bore and pullback operations.
 2. A drilling fluid mixing and delivery system of sufficient capacity to complete the installation,
 3. A guidance system to accurately guide boring operations.
 4. A vacuum truck of sufficient capacity to handle the drilling fluid volume.
- B. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in proper working order for continuous drilling operations.

4.4.05 Drilling System

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push, and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground, if required, to withstand the pulling, pushing, and rotating pressure required to properly complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. The rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

4.4.06 Pipe

- A. Pipe shall be High Density Polyethylene (HDPE) in accordance with these Standards.
1. Installation Curvature
 - a. The radius of curvature of the installed pipeline shall not be less than two times the minimum radius as defined by the pipe manufacturer for the size and thickness of the pipe being installed.

4.4.07 Tracer Wire

- A. Tracer wire shall be installed with the pipe in accordance with requirements of the pipe manufacturer, the tracer wire manufacturer, and Sections 4.5, 4.6, and 5.3.24.B of these Standards.

4.4.08 Drilling Fluids

- A. Drilling fluids shall consist of a mixture of potable water and gel-forming colloidal material such as bentonite or a polymer surfactant mixture producing a slurry of custard-like consistency.

4.4.09 Personnel Requirements

- A. Responsible representatives of the Contractor and Subcontractor(s) shall be present at all times during directional drilling operations. A responsible representative as specified herein is defined as a person experienced in the type of work being performed and who has the authority to represent the Contractor and the drilling Subcontractor in a routine decision-making capacity concerning the manner and method of carrying out the Work.
- B. The Contractor and Subcontractor(s) shall have a sufficient number of competent workers on site at all times to ensure the utility placement is made in a timely, satisfactory manner. Adequate personnel for carrying out all phases of the directional drilling operation (where applicable: tunneling system operators, operator for removing spoil material, and laborers as necessary for various related tasks) must be on the job site throughout the HDD operation.
- C. A competent and experienced supervisor representing the Contractor or Subcontractor who is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the project site during the directional drilling operation.

4.4.10 Work Plan

- A. The Work Plan must be comprehensive, realistic, and based on actual working conditions for the particular Project. The Work Plan shall document the requirements to complete the Project.
 - 1. Calibration records for guidance equipment shall be included in the Plan.
 - 2. Specifications for any drilling fluid additives that the Contractor intends to use or might use shall be submitted with the Plan.

4.4.11 Installation

- A. Erosion and sediment control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits. The Contractor is responsible for off-site disposal of drilling mud in accordance with local, state, and federal requirements.

- B. No added chemicals or polymer surfactants shall be used in the drilling fluid without written consent of the Director, after a determination is made that the chemicals to be added are not harmful or corrosive to the system and are environmentally safe.
- C. Pilot Hole: Pilot hole shall be drilled along the bore path with no deviations greater than ± 1 -foot in the horizontal plane and ± 1 -foot in the vertical plane. In the event that the pilot does deviate from bore path more than ± 1 -foot, the Contractor shall notify the Design Engineer and the Inspector. The Design Engineer or DPU may require the Contractor to pullback and re-drill from the location along bore path before the deviation. The Contractor shall submit any proposed deviations from the design bore path with the submittals.
- D. Reaming: Upon successful completion of pilot hole, the Contractor will ream borehole to a minimum of 25% greater than the outside diameter of the pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.
- E. Pullback: After successfully reaming borehole to the required diameter, Contractor shall put the pipe through the borehole. In front of the pipe shall be a swivel and barrel reamer to compact bore hole walls. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pullback operations, the Contractor shall not apply more than the maximum safe pipe pull pressure at any time. A break away link rated below the maximum safe pull force shall be utilized. Pullback duration shall be limited to 12 hours maximum for each drill.
- F. The pipe entry area shall be graded to provide support for the pipe to allow free movement into the borehole. The pipe shall be guided in the borehole in such a manner as to prevent deformation of, or damage to, the pipe.
- G. If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped. The installation shall not continue until the Department and the Design Engineer have been consulted and the issue addressed.
- H. The pipe shall be pulled back through the borehole using the wet insertion construction technique. The pipe shall be installed full of water.
- I. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, movement, or distortion of surface features.
- J. A boring log shall be kept with horizontal and vertical location of the installation. The horizontal location of the bore shall be marked in the field during the bore at a minimum of 50-foot increments and at

directional changes. These marks shall include the bore depths. The contractor shall locate and record these marks in accordance with the requirements for Record Drawings contained in these Standards.

4.4.12 Inspection

- A. Fusion joining shall include a processor or electronic data recording device capable of reading and storing the input parameters and the fusion results for later download to a record file. The Contractor shall provide this information to the Department prior to acceptance of the work.

4.4.13 Field Testing

- A. Acceptance testing of the directionally drilled pipe shall be in accordance with DPU Standards for pressure pipe.

END OF SECTION 4.4