

Special Specification 7273

Horizontal Direction Drilling



1. DESCRIPTION

Install a sanitary sewer by the directional drilling method.

2. MATERIALS

- 2.1. **Horizontal Directional Drilling (HDD) rig.** HDD rig is a mechanical drilling device used to create a horizontal borehole through which a pipe is installed.
- 2.2. **Directional Drilling.** The installation of a pipe by drilling a pilot bore from the entry pit to a pre-determined exit location. The drilling head is replaced with a reamer and the drilling string is pulled back to the entry hole, enlarging the hole while simultaneously pulling the pipe into place. The Contractor is responsible for the directional drilling method and equipment and must confirm that the drilling rig and mud mixing system have the capacity required to successfully complete the installation given the length of the crossing, product type, and the diameter. Soil and groundwater conditions must be considered.
- 2.3. **Drilling Unit.** An electrical strike safety package must be used unless underground electrical utilities are confirmed to not be in the area. The package must include warning sound alarm, grounding mats, and protective gear.
- 2.4. **Tracking System.** The operating range and degree of accuracy of proposed tracking system must be adequate to meet project conditions. Tracking and steering equipment must allow for continuous monitoring of the drilling head along the entire proposed alignment. Any expectation of poor contact in any section must be communicated to the Engineer before construction.
- 2.5. **Trained Operators.** Only trained operators are permitted to operate the drilling equipment. The manufacturer's operating instructions and safety practices must be followed.
- 2.6. **Pipe.**
- 2.6.1. **High Density Polyethylene Pipe (HDPE).** HDPE must meet PE4710 with Dimension Ratio (DR) determined by design calculations.
- 2.6.2. **PVC.** As determined by design calculations.
- 2.7. **Water.** Furnish water free of industrial waste and other objectionable material.

3. CONSTRUCTION

- 3.1. **Submittals and Requirements.** Contractor must submit complete methodology specific to each crossing, including equipment specifications and capabilities, size of pilot hole, number and size of pre-reams, use of rollers, baskets and side booms to suspend and direct pipe during pull back, type and capabilities of tracking system, and number of sections in which the pipe is to be installed. The submittal package must include:
- names of directional boring machine operator and directional boring machine navigational equipment operator,
 - manufacturer and type of directional drilling equipment proposed,
 - satisfactory documentation of worker's directional drilling qualifications,
 - proposed pad sizes, layouts, and locations,

- sequence of operation,
- location of directional drilling equipment and worksites, including verification of bore pit location,
- method of spoils transportation, surface storage and disposal location,
- identify critical utility crossings and special precautions proposed,
- provide means of accurately measuring location of pilot bore throughout bore using electronic detection system. Electronic detection equipment must be capable of achieving accuracy within 0.1 ft. at all points throughout the bore,
- number and duration of shift planned each day, and
- design calculations for review and approval to include data listed below. Calculations must be completed by a licensed engineer in the State of Texas to:
 - select appropriate pipe to carry forces resulting from pull-back of pipe through reamed hole, or other construction loads, and internal pressures,
 - configure directional drilling rig such that tension in pipe during pull-back is uniformly distributed and will not damage or permanently distort pipe,
 - account for loads from handling and storage, and
 - provide pipe with inside diameter conforming to minimum requirements of drawings

The Contractor must determine and document the proposed drill path including its horizontal and vertical alignments and the location of buried utilities and substructures along the path.

Contractor must submit for approval a drilling fluid management plan detailing proposed methods to control, collect, transport, and dispose of drilling fluids and spoils. Return and spoils are the drilling mud and cuttings collected in the entry and exit pits as well as any fluid which escapes from the borehole to the surface. The plan must contain a method of dealing with inadvertent returns or surface seepage of drilling fluids and spoils and a contingency plan in case of spills (i.e., drilling fluids, hydraulic fluids, etc.) including measures to contain and clean the affected area.

The Contractor must also be responsible for developing and maintaining emergency procedures for inadvertently boring into existing utilities including a live power line, natural gas line, water line, sewer line, or fiber-optic cables.

If a drilled hole beneath a man-made surface must be abandoned, the hole must be filled with grout to prevent future subsidence. The Engineer must be notified before the borehole is abandoned and the abandoned borehole must be identified on the as-built plans.

3.2. **Drilling and Back-Reaming.**

The Contractor must:

- prevent drilling fluids from entering the manholes, sanitary and storm sewers, other drainage systems, and any Waters of the United States including creeks and streams,
- a strict minimum bending radius guideline is imposed to avoid an excessively sharp bending radius and prevent damages to the pipe. The entrance angle of the drill string must be between 8° and 20° to the horizontal, with 12° considered optimal. The exit angle of the drill string must be between 5° to 10°,
- drilling mud must be used during drilling and back-reaming operations. Drilling mud pressure in the borehole should not exceed that which can be supported by the overburden to prevent heaving or hydraulic fracturing of the soil,
- the pilot hole must be back-reamed to accommodate and permit free sliding of the product inside the borehole. The Contractor must be responsible for selecting the appropriate reamer size,
- annular space around greatest diameter of pipe to be kept to a minimum to avoid surface settlement,
- do not leave unfilled reamed bore holes. Grout reamed bore holes not used for pipe placement with mixture approved by the Engineer. This applies to holes created by pulling pipe from the ground surface rather than from the pit, but may apply elsewhere,

- enough pre-reams must be used as to avoid heaving while enlarging the hole to the desired diameter,
- use pipe rollers, skates or other protective devices in the installation of pipes 6 in. in outside diameter or larger,
- pipe installation must be performed in a manner that minimizes the over-stressing and straining of the pipe,
- during pull-back operations, the pipe must be sealed with a cap or plug to prevent water, drilling fluids and other foreign materials from entering the pipe as it is being pulled back, and
- breakaway swivels must be used with the pulling head to limit the amount of force used during pull-back operation.

3.3. **Pipe Joining.**

3.3.1. **High Density Polyethylene.** Sections of pipe must be assembled and joined on the job site above ground. Joining must be accomplished by the butt-fusion method by qualified fusion technicians in strict conformance with the manufacturer's printed instructions. The joints must have a smooth, uniform, double rolled back bead made while supplying the proper melt, pressure and alignment. It is the sole responsibility of the Contractor to provide an acceptable butt-fusion joint. The Contractor must perform a leak test before pull back and all joints must be made available for inspection by the Engineer before insertion.

3.3.2. **PVC Pipe.** Sections of pipe must be assembled and joined on the job site above ground. Joining must be accomplished by the butt-fusion method in strict conformance with the manufacturer's printed instructions.

3.4. **Tie-Ins and Connections.** Trenching may be used to join sections at tie-ins of pipes installed by the directional boring method by:

- an additional pipe length, enough for joining to the next segment, must be pulled into the entrance pit. This length of the pipe must not be damaged or interfere with the subsequent drilling of the next leg. The Contractor must leave a minimum of 3 ft. of pipe above the ground on both sides of the bore hole, and
- polyethylene pipe, tie-ins and connections must only be made after a suitable time period to allow the pipe to recover. Recovery period must be equal to at least twice the pull-back time.

3.5. **Drilling Fluids Collection and Disposal Practices.** Excess drilling mud slurry must be contained in a lined pit or container pound at exit and entry points until recycled or removed from the site. Entrance and exit pits must be large enough to contain the expected return of drilling mud and spoils. Precautions must be taken to keep drilling fluids out of the streets, manholes, sanitary and storm sewers, and other drainage systems including streams and rivers. The Contractor must make all diligent efforts to minimize the amount of drilling fluids and cuttings spilled during the drilling operation and must provide complete clean-up of all drilling mud overflows or spills.

3.6. **Acceptance.** The Contractor must provide a set of as-built drawings including both alignment and profile from actual field readings. Raw data must be submitted upon Engineer's request. Pipe must be installed within the pre-specified alignment and grade tolerances as shown on the drawings or project specifications. All surfaces affected by the work must be restored to their pre-construction condition including backfilling, replacement of topsoil, seeding and fertilizer. The contractor must:

- not obstruct driveways or streets unless approved by the Engineer. All lane closures must be in conformance with Department standards and the TMUTCD, and
- drill pipe at a depth and grade shown on the drawings.

4. **MEASUREMENT**

This Item will be measured as the distance in feet along the ground of the centerline of the proposed pipeline and not actual drilled distance from entrance pit to exit pit. Trenches for joining sections at tie-ins of pipes must be subsidiary to the installation.

This is a plans quantity measurement Item and the quantity to be paid for will be that quantity shown in the proposal and on the "Estimate and Quantity" sheet of the Contract plans, except as may be modified by Item 9.2., "Plans Quantity Measurement." If no adjustment of quantities is required, additional measurements or calculations will not be required.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Horizontal Directional Drilling" of the type and size of pipe specified. This price will be full compensation for drilling, drill mud, pipe, exterior coating (if required), butt-fusion welding, hot gluing, flushing, pressure testing, water, all engineering services, plant, labor, material, and services for preparation of the site including removal of vegetation, location of all existing utilities along the proposed path, excavation of entry, exit, and slurry containment pits, full location map, surface restoration to existing conditions, replacement or reinstatement of existing utilities, backfill, compaction, and for all other materials, equipment, labor, tools, and incidentals necessary to complete the work.