

SECTION 555

DIRECTIONAL BORE

555-1 Description.

555-1.1 Scope of Work: The work specified in this Section documents the approved construction methods and procedures for directional boring, also commonly called horizontal directional drilling (HDD).

555-1.2 General: HDD is a trenchless method for installing a product that serves as a carrier pipe for transporting solids, liquids or gasses (under pressure or gravity flow), or serves as a conduit, casing, or duct for a carrier pipe, cable, or wire line products. It is a multi-stage process consisting of site preparation and restoration, equipment setup, and drilling a pilot bore along a predetermined path and then pulling the product back through the drilled space. When necessary, enlargement of the pilot bore hole may be necessary to accommodate a product larger than the pilot bore hole size. This process is referred to as back reaming and is done at the same time the product is being pulled back through the pilot bore hole.

Accomplish alignment of the bore by proper orientation of the drill bit head as it is being pushed into the ground by a hydraulic jack and determine orientation and tracking of the drill bit. In order to minimize friction and prevent collapse of the bore hole, introduce a soil stabilizing agent (drilling fluid) into the annular bore space from the trailing end of the drill bit.

Select or design drilling fluids for the site specific soil and ground water conditions. Confine free flowing (escaping) slurry or drilling fluids at the ground surface during pull back or drilling. Remove all residual slurry from the surface and restore the site to preconstruction conditions.

555-2 Construction Site Requirements.

555-2.1 Pedestrian Traffic: When and where installations temporarily disrupt use of a pedestrian way, provide a safe alternate route in accordance with the Design Standards, Index Nos. 600 and 660.

555-2.2 Site Conditions:

(a) Carry out excavation for entry, exit, recovery pits, slurry sump pits, or any other excavation as specified in Section 120. Sump pits are required to contain drilling fluids if vacuum devices are not operated throughout the drilling operation, unless approved by the Engineer.

(b) Within 48 hours of completing installation of the product, clean the work site of all excess slurry or spoils. Take responsibility for the removal and final disposition of excess slurry or spoils. Ensure that the work site is restored to pre-construction conditions or as identified on the plans.

(c) Provide MOT in accordance with the Design Standards and the MUTCD when and where the former is silent.

(d) Exposure of product shall be limited to 3 feet and 14 consecutive days unless approved by the Engineer.

555-2.3 Damage Restoration: Take responsibility for restoration for any damage caused by heaving, settlement, separation of pavement, escaping drilling fluid (frac-out), or the directional drilling operation, at no cost to the Department.

555-2.3.1 Remediation Plans: When required by the Engineer, provide detailed plans which show how damage to any roadway facility will be remedied. These details will

become part of the As-Built Plans Package. Remediation plans must follow the same guidelines for development and presentation of the as-built plans. When remediation plans are required, they must be approved by the Engineer before any work proceeds.

555-3 Quality Control.

555-3.1 General: Take control of the operation at all times. Have a representative who is thoroughly knowledgeable of the equipment, boring and Department procedures, present at the job site during the entire installation and available to address immediate concerns and emergency operations. Notify the Engineer 48 hours in advance of starting work. Do not begin installation until the Engineer is present at the job site and agrees that proper preparations have been made.

555-3.1.1 Product Testing: When there is any indication that the installed product has sustained damage and may leak, stop all work, notify the Engineer and investigate the damage. The Engineer may require a pressure test and reserves the right to be present during the test. Perform pressure test within 24 hours, unless otherwise approved by the Engineer. Furnish a copy of test results to the Engineer for review and approval. The Engineer is allowed up to 72 hours to approve or determine if the product installation is not in compliance with the specifications. The Engineer may require non-compliant installations to be filled with excavatable flowable fill.

555-3.1.2 Testing Methods: Testing may consist of one of the following methods and must always meet or exceed the Department's testing requirements:

(a) Follow the product manufacturer's pressure testing recommendations.
(b) Ensure carrier pipes installed without a casing meet the pressure requirements set by the owner. If the owner does not require pressure testing, the Engineer may require at least one test.

(c) A water tight pipe and joint configuration where the product is installed beneath any pavement (including sidewalk) and front shoulders is required. The Engineer will determine when and where water tight joint requirements will be applied to the ultimate roadway section for future widening. When a product is located elsewhere, the pipe and joint configuration must meet or exceed soil tight joint requirements. Conduct tests for joint integrity for one hour. The test for a soil tight joint allows up to 0.1 gallon of water leakage at a sustained pressure of 2 psi. The water tight joint criteria allows no leakage at all for a sustained pressure of 5 psi.

555-3.1.3 Failed Bore Path: If conditions warrant removal of any materials installed in a failed bore path, as determined by the Engineer, it will be at no cost to the Department. Promptly fill all voids with excavatable flowable fill.

555-3.2 Product Locating and Tracking: The method of locating and tracking the drill head during the pilot bore will be shown in the Plans. The Department recognizes walkover, wire line, and wire line with surface grid verification, or any other system as approved by the Engineer, as the accepted methods of tracking directional bores. Use a locating and tracking system capable of ensuring the proposed installation is installed as intended. If an area of radio signal interference is expected to exceed 5 feet, the Engineer may specify the use of a suitable tracking system. The locating and tracking system must provide information on:

- (a) Clock and pitch information
- (b) Depth
- (c) Transmitter temperature
- (d) Battery status
- (e) Position (x,y)

(f) Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility)

(g) Ensure proper calibration of all equipment before commencing directional drilling operation.

(h) Take and record alignment readings or plot points such that elevations on top of and offset dimensions from the center of the product to a permanent fixed feature are provided. Such permanent fixed feature must have prior approval of the Engineer. Provide elevations and dimensions at all bore alignment corrections (vertical and horizontal) with a minimum distance between points of 100 feet. Provide a sufficient number of elevations and offset distances to accurately plot the vertical and horizontal alignment of the installed product. A minimum of three elevation and plot points are required.

555-3.3 Product Bore Hole Diameter: Minimize potential damage from soil displacement/settlement by limiting the ratio of the bore hole to the product size. The size of the back reamer bit or pilot bit, if no back reaming is required, will be limited relative to the product diameter to be installed as follows:

Maximum Pilot or Back-Reamer Bit Diameter When Rotated 360 Degrees	
Outside Pipe Diameter Inches*	Maximum Bit Diameter Inches
<8	Diameter + 4
8 to 24	1.5 x Diameter
>24	Diameter + 12

*Use manufacturer's recommendation for pipe with restrained joints.

555-3.4 Drilling Fluids: Use a mixture of bentonite clay or other approved stabilizing agent mixed with potable water with a minimum pH of 6.0 to create the drilling fluid for lubrication and soil stabilization. Do not use any other chemicals or polymer surfactants in the drilling fluid without written consent from the Engineer. Certify to the Engineer in writing that any chemicals to be added are environmentally safe and not harmful or corrosive to the facility. Identify the source of water for mixing the drilling fluid. Any water source used other than a potable water source may require a pH test.

555-4 Drilling Operations:

555-4.1 Installation Process: Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring the drilling fluids such as the pumping rate, pressures, viscosity and density during the pilot bore, back reaming and pipe installation. Relief holes can be used as necessary to relieve excess pressure down hole. Obtain the Engineer's approval of the location and all conditions necessary to construct relief holes to ensure the proper disposition of drilling fluids is maintained and unnecessary inconvenience is minimized to other facility users.

To minimize heaving during pull back, the pull back rate is determined in order to maximize the removal of soil cuttings without building excess down hole pressure. Contain excess drilling fluids at entry and exit points until they are recycled or removed from the site or vacuumed during drilling operations. Ensure that entry and exit pits are of sufficient size to contain the expected return of drilling fluids and soil cuttings.

Ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, or federal regulatory agencies. When drilling in suspected contaminated ground, test the drilling fluid for contamination and appropriately dispose of it.

Remove any excess material upon completion of the bore. If in the drilling process it becomes evident that the soil is contaminated, contact the Engineer immediately. Do not continue drilling without the Engineer's approval.

When conditions warrant, as determined by the Engineer, back reaming for enlarging the bore diameter shall be accomplished by connecting the reamer to trailing drill stems at the exit pit of the pilot bore. The drill pipe shall remain in the bore hole until the final product is pulled into place. After the pilot bore is established, do not push anything from the entry pit to the exit pit.

The timing of all boring processes is critical. Install a product into a bore hole within the same day that the pre-bore is completed to ensure necessary support exists.

555-4.2 Boring Failure: If an obstruction is encountered during boring which prevents completion of the installation in accordance with the design location and specification, the pipe may be taken out of service and left in place at the discretion of the Engineer. Immediately fill the product left in place with excavatable flowable fill. Submit a new installation procedure and revised plans to the Engineer for approval before resuming work at another location. If, during construction, damage is observed to the FDOT facility, cease all work until resolution to minimize further damage and a plan of action for restoration is obtained and approved by the Engineer.

555-5 Documentation Requirements.

555-5.1 Boring Path Report: Furnish a Bore Path Report to the Engineer within seven days of the completion of each bore path. Include the following in the report:

- (a) Location of project and financial project number including the Permit Number when assigned
- (b) Name of person collecting data, including title, position and company name
- (c) Investigation site location (Contract plans station number or reference to a permanent structure within the project right of way)
- (d) Identification of the detection method used
- (e) Elevations and offset dimensions as required in 555-3.2

555-5.2 As-Built Plans: Provide the Engineer a complete set of as-built plans showing all bores (successful and failed) within 30 calendar days of completing the work. Ensure that the plans are dimensionally correct copies of the Contract Plans and include roadway plan and profile, cross-section, boring location and subsurface conditions as directed by the Engineer. The plans must show appropriate elevations referenced to a permanent FDOT feature (mast arm foundation, manhole inlet cover, head wall, etc). Plans must be same scale in black ink on white paper, of the same size and weight as the Contract Plans. Submittal of electronic plans data in lieu of hard copy plans is preferred and may be approved by the Engineer if compatible with the Department software. Specific plans content requirements include but may not be limited to the following:

- (a) The Contract plan view shows the center line location of each facility installed, or installed and placed out of service, to an accuracy of 1 inch at the ends and other points physically observed in accordance with the bore path report.
- (b) As directed by the Engineer, provide either a profile plan for each bore path, or a cross-section of the roadway at a station specified by the Engineer, or a roadway centerline profile. Show the ground or pavement surface and crown elevation of each facility installed, or installed and placed out of service, to an accuracy of within 1 inch at the ends and other exposed locations. On profile plans for bore paths crossing the roadway, show stationing of the crossing

on the Contract Plans. On the profile plans for the bore paths paralleling the roadway, show the Contract Plans stationing. If the profile plan for the bore path is not made on a copy of one of the Contract profile or cross-section sheets, use a 10 to 1 vertical exaggeration.

(c) If, during boring, an obstruction is encountered which prevents completion of the installation in accordance with the design location and specification, and the product is left in place and taken out of service, show the failed bore path along with the final bore path on the plans. Note the failed bore path as “Failed Bore Path - Taken Out of Service”. Also show the name of the utility owner, location and length of the drill head and any drill stems not removed from the bore path.

(d) Show the top elevation, diameter and material type of all utilities encountered and physically observed during the subsoil investigation. For all other obstructions encountered during a subsoil investigation or the installation, show the type of material, horizontal and vertical location, top and lowest elevation observed, and note if the obstruction continues below the lowest point observed.

(e) Include bore notes on each plan stating the final bore path diameter, product diameter, drilling fluid composition, composition of any other materials used to fill the annular void between the bore path and the product, or facility placed out of service. Note if the product is a casing as well as the size and type of carrier pipes placed within the casing as part of the Contract work.

555-6 Compensation.

No direct payment will be made for directional bore. Include the cost to perform this operation in the Contract price for the item being installed.