DERRY-LONDONDERRY EXIT 4A
13065

May 19, 2020

S P E C I A L P R O V I S I O N

SECTION 671 – TRENCHLESS PIPE INSTALLATION – HORIZONTAL DIRECTIONAL DRILLING

671.__ – __ Inch ___ Conduit, _____, Directional Bore

For this project, this work will be subsidiary to Item 614.74221 – 4" 2-Duct HDPE Conduit, SDR 13.5 for conduit to be installed under active roadways.

Description

1.1 General Description of Work. This work shall consist of furnishing, installing and testing conduits of the size and type specified, including sweeps, bends, joints, hangers, pull boxes, special fittings, plastic warning tape, trace wire and other appurtenances, as shown on the plans or as ordered. This work shall also include the disposal of discarded or excess materials and the restoration of disturbed surfaces when not otherwise included under other items in the contract.

1.1.1 The DESIGN-BUILD TEAM shall furnish all materials, labor, tools and equipment, and perform all operations, testing, and incidentals necessary to install conduit using directional drilling, reaming and pipe pulling methods, as outlined herein and on the plans.

1.2 Reference Drawings and Information. Neither the NHDOT nor the OWNER guarantees the accuracy or completeness of existing conditions shown on the NHDOT project construction plans for this work. Sufficient investigations shall be made by the DESIGN-BUILD TEAM so that the DESIGN-BUILD TEAM is knowledgeable of existing conditions prior to tendering a bid.

1.3 General Requirements. The DESIGN-BUILD TEAM shall assume all responsibility for his methods of construction, the stability and accuracy of the drilled and reamed hole and pits constructed by him, and all costs for damages resulting from any failure thereof. The DESIGN-BUILD TEAM shall be solely responsible for the safety of the pits and related structures and personnel engaged in underground construction throughout the duration of the work.

1.3.1 The DESIGN-BUILD TEAM's methods and schedule shall consider the overall project requirements, anticipated ground conditions and water conditions. The DESIGN-BUILD TEAM's selection of inadequate, inappropriate, or inefficient equipment and methods will not be cause for adjustments to the Contract Price or Contract Time.

1.3.2 The general dimensions, arrangement, and details for the drilled holes and pits to be constructed shall be as indicated on the plans, or as directed.

1.3.4 Methods of excavation, equipment, and procedures for the horizontal directional drilling operation and pits shall be selected by the DESIGN-BUILD TEAM to provide adequate working space and clearances for the work to be performed.

1.3.5 Pit excavation methods, ground water control, and pit support techniques shall be selected by the DESIGN-BUILD TEAM.

1.4 Safety. The DESIGN-BUILD TEAM shall become familiar with, and shall at all times conform to all applicable State and Federal regulations regarding "General Construction Safety" and "Trench Construction Safety" and other applicable requirements.

1.4.1 Horizontal Directional Drilling Equipment machine safety requirements will include a common grounding system to prevent electrical shock in the event of a high voltage, underground cable strike. The grounding system will connect all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operators booth, worker grounding mats, and any other interconnected equipment to a common ground. The drill will be equipped with an "electrical strike" audible and visual warning system that will notify the system operators of an electrical strike.

1.4.2 Operators of the drill will wear electrical shock protection equipment and operate from common grounded mats as required.

Materials

2.1 General - The DESIGN-BUILD TEAM shall provide the following materials for the installation of conduit, related services, and appurtenances.

2.2 Conduit Installed By Directional Drilling.

2.2.1 Material Type: The following material standards are to be interpreted as the minimum in place standards. Use materials that are appropriate for the stresses generated by the selected equipment and field conditions. It is not intended to portray that the use of materials with these minimum material standards will retain their required properties if the stress limits are exceeded for which they were designed during installation. Ensure that the appropriate material is used to retain compliance once it is installed.

Minimum Material Standards for HDD Installation

Material Type	Non-Pressure Pressure	Pressure
Polyethylene (PE)	ASTM D 2447	ASTM 2513 ASTM D 2447
High Density Polyethylene (HDPE)	ASTM D 2447 ASTM D 3350 ASTM F714	ASTM D 2447 ASTM D 3350 ASTM F714 ASTM 2513
Polyvinyl-Chloride (PVC)	ASTM F 789	N/A
Steel	ASTM A139 Grade B (1)	AWWA C200 API 2B(2)

(1) No hydrostatic test required
(2)Dimensional tolerances only

2.2.3 Delivery Storage and Handling. When lifting with slings, only wide choker slings capable of safely carrying the load shall be used. Wire rope or chain shall not be used to handle pipe.

2.3 Drilling Fluids. The DESIGN-BUILD TEAM must use a high quality bentonite drilling fluid, or equivalent, to ensure hole stabilization, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and the product pipe. Oil-based drilling fluids or fluids containing additives that can contaminate the soil or ground water will not be considered acceptable substitutes. Composition of the fluid must comply with all federal and local environmental regulations.

2.3.1 Drilling fluids must be mixed with potable water to ensure no contamination is introduced into the soil during the drilling, reaming, or the pipe installation process. Recycled gray water, if approved for use by NHDOT or other controlling agency, is an acceptable alternative to potable water.

2.3.2 Disposal of drilling fluids shall be the responsibility of the DESIGN-BUILD TEAM and shall be conducted in compliance with all relative environmental regulations, right-of-way and workspace agreements, and permit requirements.

2.3.3 Drilling fluid returns can be collected in the entrance pit, exit pit, or a spoils recovery pit. The DESIGN-BUILD TEAM shall immediately clean up any drilling fluid spills or overflows from these pits. The DESIGN-BUILD TEAM shall maximize recirculation of drilling fluid surface returns that are not contaminated. DESIGN-BUILD TEAM shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse. DESIGN-BUILD TEAM may specify standards for solids control and cleaning equipment performance or for treatment of excess drilling fluid and drilled spoil.

2.3.4 The DESIGN-BUILD TEAM shall replace the slurry in the annulus around each casing pipe with a weak cement grout after the casings have been pulled in to place.

2.4 Backfill Soils. Backfill pits and “pot-hole” excavations with Gravel 304.2. Compact in 12-inch, maximum, lifts to at least 95 percent AASHTO T-180 maximum dry density.

2.5 Submittals.

2.5.1 Submittals for Approval.

2.5.1.1 Pipe. Each pipe product lot shall be tested for melt index, density, carbon content, dimensional data and ring tensile strength. Prior to the first shipment of pipe, submit certified test reports that the pipe for the Contract was manufactured and tested in accordance with the Standards specified herein. Submit one twelve-inch-long sample of each diameter and

type of HDPE pipe proposed for use in the HDD operations. Submit shop drawings for all joints that will be made by means other than heat fusion.

2.5.1.2 Drilling Fluids - Submit product data on all drilling fluids, grouts and additives.

2.5.1.3 Qualifications. Qualifications of the DESIGN-BUILD TEAM showing that all directional drilling operations will be performed by a competent driller with a minimum of five (5) years of relevant experience. Completed projects with details of the types of pipe installations, OWNER contact names and telephone numbers must be included. Submit resumes for all personnel performing heat fusion joining. Personnel performing heat fusion joining shall have adequate training and experience in the procedure, demonstrated by at least twelve months applicable experience.

2.5.1.4 Work Plan and Methods. Submit for review and approval a detailed work plan and schedule of activities required to perform all directional drilling, including any proposed variation from the methods and techniques stipulated in this Specification. Information in this work plan should include but not be limited to the following:

- Designed directional drill path indicating compliance with the project design criteria
- Method for directional drilling indicating the following:
- Plan showing the following:
    - Work zone equipment configuration at the end of the bore(s), staging areas, storage areas, and the location of slurry, cuttings and pit spoil handling areas.
    - Equipment list including make and model number and specifications (catalog cuts) of all major equipment proposed for use on the project. The DESIGN-BUILD TEAM is responsible for the final determination of the drill rig size based on the length and depth of the actual runs, the subsurface conditions expected, etc.
    - Boring procedure, tooling for drilling, method to control slurry, design of entrance and exit pits and method to verify that installed conduit is acceptable.
    - Materials list including bentonite, bentonite additives and cement grout materials proposed for use on the project along with material detail sheets for all other materials used on the site, utility product pipe data sheets showing HDPE type and all dimensions and tolerances and water source for drilling operations.
    - Steering and tracking equipment, procedures and proposed locations of ground based tracking coils or other equipment requiring surface or subsurface access.
    - Methods, procedures and equipment to collect and manage disposal of contaminated cuttings, slurries and soils generated during the work.

2.5.1.5 Method(s) for erosion and sediment control shall be coordinated with the project's overall erosion and control plan.

2.5.2 Submittals for Documentation. The DESIGN-BUILD TEAM, at the completion of each part of the work, shall furnish the as-built locations of the installed casings and appurtenances referenced to NHDOT'S Construction Base Line and Bench Marks. The as-built locations shall be to an accuracy of plus or minus 0.10 feet (0.03 m) in plan and elevation.

Construction Requirements

3.1 General. The DESIGN-BUILD TEAM shall furnish all casing and carrier pipe, fittings, services and related material and appurtenances, labor, tools and equipment, slurry and other materials; and perform all operations and incidentals necessary for complete HDD excavation, pipe fabrication, pipe installation, backfill, and testing as outlined herein and on the plans.

3.1.1 The DESIGN-BUILD TEAM shall be responsible for the layout of the work. NHDOT will provide control points as described in Section 105.08.

3.1.3 Utility lines and structures indicated on the plans that are to remain in service shall be protected by the DESIGN-BUILD TEAM from damage due to his operations. Where utility lines or structures not shown on the plans are encountered, the DESIGN-BUILD TEAM shall report them to the OWNER before proceeding with the Work. The DESIGN-BUILD TEAM shall bear the cost of repair or replacement of any utility lines or structures that are broken or damaged by his operations.

3.1.4 All utilities in close proximity to the drill pilot bore, back ream, or product pipe installation must be exposed through a "pot-hole" or other opening, in accordance with state, and local utility laws and regulations, to verify, through visual inspection, that the drill, reamer, or HDD casing pipe has caused no damage to the utility and maintains adequate clearance.

3.1.5 Consequential damages resulting from the DESIGN-BUILD TEAM not locating the facilities as shown on the plan are the responsibility of the DESIGN-BUILD TEAM.

3.1.6 Any deviations from the locations shown on the plans require the ENGINEER's approval. Any discrepancies with locations shown on the plans will be brought to the ENGINEER's attention.

3.1.7 All work covered by this section shall be performed in accordance with the applicable federal and state codes and laws, which pertain to such work and supplemental regulations, which are contained in these specifications. The DESIGN-BUILD TEAM shall comply with all applicable Federal, State and Local laws and regulations relating to material handling and disposal. The work shall conform to all applicable Federal, State and Local laws and regulations of the Occupational Safety and Health Administration (OSHA). In case of conflict between these specifications and any federal or state codes or laws, the most stringent shall govern.

3.2 Horizontal Directional Drill Casing Pipe Installation.

3.2.1 The pipeline crossings will be installed by Guided Horizontal Drilling, a technique for installing pipes below ground using a surface-mounted drill rig that launches and places a drill

string at a shallow angle to the surface and has tracking and steering capabilities. The drill string creates a pilot borehole in an essentially shallow arc, which may subsequently be enlarged to a larger diameter during a secondary operation. Subsequent operations could include multiple hole enlargements in steps and pullback of the casing pipe. Tracking of the initial bore path is accomplished by a manually operated overhead receiver of a remote tracking system or by other electronic guidance system located in the drill head and transmitting location information through a wire to the drill operator's console. Steering is achieved by controlling the orientation of the drill head which has a directional bias and pushing the drill string forward, without rotation, with the drill head oriented in the desired direction. Continuous rotation of the drill string allows the drill head to drill a straight path. The procedure uses fluid jets or mechanical cutting or both with a low, controlled flow rate of drilling fluid to minimize the creation of voids during the pilot hole drilling and back-reaming operations. The drilling fluid, typically consisting of bentonite clay and water mixture, stabilizes the drilled hole, removes cuttings, cools the drill bit and electronics, and lubricates the hole for the drill bit, drill string, and product pipe. The resultant slurry surrounds the pipe, typically filling the annulus between the pipe and the drilled hole.

3.2.2 Furnish equipment of adequate capacity and power to install conduit by directional drilling methods. Supplement each rig with the necessary auxiliaries, appurtenances, tools and other equipment required for proper operation. The alignment(s), profiles, sizes and lengths of the utility casings are shown on the plans and specified herein.

3.2.3 Do not start work prior to receiving the ENGINEER's written approval. Approval, if granted, will be based on acceptability of the proposed work plan and any variations to provide satisfactory installation of the utilities and avoiding damage. Approval will remain in force only as long as all conditions set forth in the approval are met and satisfactory results are obtained. In the event that unsatisfactory results and/or damage occurs, the DESIGN-BUILD TEAM will stop work and modify his methods and submit them for review and approval.

3.2.4 Shore entrance and exit pits as necessary to meet OSHA requirements.

3.2.5 Perform all work within the designated right-of-way limits shown on the contract plans.

3.2.6 Protect any existing underground utilities during this work.

3.2.7 Visually inspect the most accessible point immediately downstream of the pipe crossing, when the drill is under a body of water. Changes in water turbidity or color must be reported at the time of observation.

3.2.8 Exercise special care and handling during delivery and distribution of utility pipe to avoid damage. Damaged pipe will be rejected and replaced at the DESIGN-BUILD TEAM's expense. Store water supply pipe prior to use in such a manner as to keep the interior free from dirt and foreign material. Thoroughly clean any pipe that becomes contaminated before it is incorporated into the work.

3.2.9 The alignment of the utility lines must conform to the following requirements:

3.2.9.1 Choose the final ground entry and exit angles such that the casings can be installed along the alignment and profile indicated on the contract plans and to the depths indicated. Ground entry and exit angles shall be as listed on the contract drawings, plus or minus 2 degrees.

3.2.9.2 The entrance points and exit points shall be approved by the ENGINEER and physically located in the field by the DESIGN-BUILD TEAM for review by the ENGINEER.

3.2.9.3 The actual exit points shall be no more than 5 feet left or right of the target exit point locations nor 10 feet short or 20 feet beyond the target exit point locations. The constructed bore paths shall be within 5 feet left or right of the design bore paths and no greater than 5 feet above or 10 feet below the design bore paths.

3.2.9.4 Limit the longitudinal pull so as to prevent any damage of the conduit. Continuously monitor the longitudinal pulling forces during pullback of conduit. The DESIGN-BUILD TEAM shall limit the longitudinal pull so as not to exceed 72% of the specified minimum yield strength (SMYS) of the pipe.

3.2.10 Direct all drilling operations using steering and tracking systems capable of producing the required alignment. The control system shall provide an angle of inclination reading and the direction in which the cutting tool is pointing. Provide access to the ENGINEER at all times to all measuring or gauging devices used for the drilling operations including drilling logs maintained by the DESIGN-BUILD TEAM.

3.2.10.1 During the drilling operation the DESIGN-BUILD TEAM is required to maintain the following records on a continuous basis:

3.2.10.1.1 Drilling pressure vs. time of day and station of drill head.

3.2.10.1.2 Quantity of drill fluid used vs. time of day and station of drill head.

3.2.10.1.3 Amount of drilling fluid in the system at the start of the operation.

3.2.10.1.4 The time, station of drill head, quantities of water and Bentonite that are added to the system.

3.2.10.1.5 The time, station of drill head and quantities of waste that are removed from the system.

3.2.10.1.6 A computation of the current drill hole and pit volume, the amount of drilling fluid in the system, the amount of fluid added to the system, the amount of waste removed from the system, the amount of fluid lost for each section of pipe installed.

3.2.11 Adequately support the utility pipes on rollers during the pullback into the pre-drilled hole. Rollers and cradles shall be of the type that will prevent damage to the utility pipe and in sufficient number to prevent overstressing during the pullback procedure. Pullback equipment shall be adequate for the length(s) and depth(s) of the runs and for the soil types encountered. A 14-1 gauge tracer wire shall be pulled with the casings and electric and telecommunications conduit pipes.

3.2.12 Pull an additional length of pipe through the entrance pit upon pull back and expose it. The ENGINEER will examine the pipe for scratches, scores, gouges, cuts and other forms of damage. Gouges and scratches shall not exceed ten (10) percent of the wall thickness of the pipe. If gouges and scratches which exceed ten (10) percent of the wall thickness of the pipe are found, the DESIGN-BUILD TEAM shall pull an additional 40 feet of casing pipe through the bore. The additional 40 feet of casing pipe shall then be cutoff and disposed of properly.

3.2.13 Pull an adequate sized tracer wire with the casing pipes.

3.2.14 Take necessary precautions to prevent bentonite break out or other leakage.

3.2.15 Supply water for mixing drilling fluid.

3.2.16 Supply portable mud tanks or construct temporary mud pits to contain excess drilling fluids during construction. Upon completion, dispose of any cuttings and excess drilling fluids in a manner consistent with local and State regulations.

3.2.17 In the event that the drill hole must be abandoned before completion of the installation, fill abandoned drill holes with grout to prevent subsidence. Progress new drill holes at the DESIGN-BUILD TEAM's expense.

3.2.18 During construction, maintain the site in a neat and orderly condition. At the completion of work, remove all temporary structures erected and materials required for temporary access, drill and pipe staging areas, platforms and drilling fluids. Restore the area to the approximate original conditions.

3.3 Erosion Control. Provide adequate protection from erosion from any of the dewatering operations utilized during the course of the construction. Any damage, disruption or interference to newly constructed work or existing properties, buildings, structures, utilities and/or other work resulting directly or indirectly from dewatering operations conducted under this Contract shall be remedied by the DESIGN-BUILD TEAM, at no cost to the OWNER or NHDOT.

3.4 Treatment of Dewatering Operations Discharges. Provide such additional treatment devices as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip-rap, silt fences or other requirements. The treatment devices shall be later removed and/or filled in with acceptable backfill material, and restored to original conditions once they are no longer needed, at the Design-Build Team's expense.

3.5 Carrier Pipe Installation:

3.5.1 After the casing pipe has been installed and cleaned of dirt and debris, the carrier pipes and conduits shall be pulled into position inside the casing pipe.

3.5.2 Adequately support the utility carrier pipes or conduits on rollers during the pullback into the casings. Rollers and cradles shall be of the type that will prevent damage to the carrier pipe and in sufficient number to prevent overstressing during the pullback procedure. Pullback equipment shall be adequate for the length(s) and depth(s) of the runs. 14-1 gauge tracer wires shall be pulled inside the electrical, telecommunications and fire alarm conduits.

3.5.3 After the carrier pipe has been tested for leakage, bulkheads shall be constructed at each end of the casing pipe.

3.6 Pressure and Leakage Testing for Water and Sewer Pipe. The DESIGN-BUILD TEAM shall furnish all necessary equipment and labor for, and perform, pressure testing and leakage tests on the water and sewer carrier portions of the pipelines in accordance with Sections 611 and 612.

3.7 Pressure and Leakage Testing for Conduit Pipe.

3.7.1 All conduits shall be adequately cleaned to remove all dirt and debris along the full length of the conduit run.

3.7.2 All conduits shall be ball mandrel tested through the entire length of the conduit run.

3.7.3 Ball mandrels shall be sized at 95 percent of the inside diameter of the conduit being tested.

3.7.4 The DESIGN-BUILD TEAM shall furnish all necessary equipment and labor for, and perform, low air pressure testing and leakage tests on the conduit in accordance with ASTM F 1417. The conduit shall be capable of sustaining the test pressure of five pounds per square inch (psi) over a ten-minute period with no more than 0.5 pound per square inch drop in pressure

3.7.4.1 Conduits not meeting the Specification test requirements must be repaired or replaced and retested at the DESIGN-BUILD TEAM’s expense.

3.7.4.2 Explosive failure of the conduit could occur during the low pressure testing. All personnel shall maintain a safe distance from the conduit while it is pressurized.

3.7.5 All conduits shall be temporarily capped at both ends to prevent infiltration of dirt and debris after cleaning and testing.