SECTION 330507 - TRENCHLESS INSTALLATION OF UTILITY PIPING

This section specifies pipe-jacking excavation or tunnel excavation, primary casing pipes or tunnel liners, and secondary inverts, carrier pipes, or duct for installation of distribution facilities for various products, including communications data, water, sewage, gas, oil, and steam in congested and confined or deep areas, in unstable soils, and in places where conventional excavation is economically prohibitive, socially disruptive, or unsafe.

This section may be used for conveyance of various products, with or without casing. Without casings, jacked pipe or tunnel will also serve as carrier pipe.

Edit general excavation methods here for additional or more specific pipe jacking excavation, including open hand shield, full-face Tunnel Boring Machine (TBM), cutter boom or road header shield, excavator shield, slurry machine, earth pressure balance machine, air-pressurized shield, and MicroTunnel Boring Machine (MTBM).

Carefully coordinate requirements for conduit carrying flammable or explosive products or highly volatile substances under pressure.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Casing and jacking pipe.

Steel tunnel liner.

Carrier pipe.

Excavation for approach trenches and pits.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this section, with designations, numbers, and complete document titles.

* + - * 1. American Association of State Highway and Transportation Officials:

AASHTO HB-17 - Standard Specifications for Highway Bridges.

AASHTO M133 - Standard Specification for Preservatives and Pressure Treatment Processes for Timber.

AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

* + - * 1. American Railway Engineering and Maintenance-of-Way Association:

AREMA - Manual for Railway Engineering.

* + - * 1. American National Standards Institute

ANSI A10.16 - Safety Requirements for Tunnels, Shafts, and Caissons - American National Standard for Construction and Demolition Operations

* + - * 1. ASTM International:

ASTM A36 - Standard Specification for Carbon Structural Steel

ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/ 105/90 ksi Minimum Tensile Strength, General Use

ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High- Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM C33 - Standard Specification for Concrete Aggregates

ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

ASTM C150 - Standard Specification for Portland Cement

ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe

ASTM C404 - Standard Specification for Aggregates for Masonry Grout

ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3)

ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).

ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

* + - * 1. American Welding Society:

AWS D1.1 - Material And Design, Fabrication, Inspection, And Qualification.

* + - * 1. National Utility Contractors Association:

NUCA - Guide to Pipe Jacking and Microtunneling Design.

* + - * 1. Occupational Safety and Health Administration

CFR - 29 CFR 1926 - LABOR

* + - 1. COORDINATION

Designer is responsible for determining the entity(s) with which the Work needs to be coordinated. It is anticipated that the Designer would complete initial coordination as part of the project design phases.

* + - * 1. Coordinate Work of this Section with [**New York** **State**] [**County**] [**City**] [**Town**] [**Village**] of <**Insert Agency/Municipality**> and utilities within construction area.
			1. PREINSTALLATION MEETINGS
				1. Convene meeting with the Director’s Representative a minimum [**one week**] [**<\_\_\_> weeks**] prior to commencing Work of this Section.
			2. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Submittals Package: Submit the following items specified below the same time as a package:

Written Drilling Procedure.

Quality Control Submittal.

* + - * 1. Product Data: Submit manufacturer information regarding tunnel liner plate, showing sizes, shapes, methods of attachment, connection details, and details of grout holes.
				2. Written Drilling Procedure: Describes in detail proposed method and entire operation but not limited to the following:

Size, capacity and arrangement of equipment, drawn to scale.

Location and size of drilling and receiving pits.

Dewatering and methods of removing spoils material.

Method of installing detection wire and pipe.

Type, location and method of installing locator station.

Method of fusion pipe segment and type of equipment.

Type of cutting head.

Method of monitoring and controlling line and grade.

Detection of surface movement.

Bentonite drilling mud.

Products information, material specifications, and handling procedures.

Material safety data sheet and special precautions required.

Method of mixing and application.

* + - * 1. Shop Drawings:

Indicate details of casing, jacking head, sheeting, and other falsework for trenches and pits, and support for [**facility**], field sketches, and other details to complete Work.

Indicate relationship of proposed installation to [**facility**] [**natural features**] over installation, angle of installation, right-of-way lines, and general layout of built facilities.

Indicate cross-section(s) from field survey, showing installation in relation to actual profile of [**ground**] [**facility**].

Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignments.

* + - * 1. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

Contractor’s Qualifications Data:

Firm name, address, and phone number.

Period of time that the firm has been in the business of performing horizontal directional drilling.

Names and addresses of 5 similar projects completed by the firm. Include the name and phone number of contact person.

Field Supervisor Qualifications Data:

Name of the person supervising the horizontal directional drilling.

Period of time that the person has performed/supervised horizontal directional drilling.

Names and addresses of three similar projects that the person has worked on during the past three years.

Include separate paragraphs for additional certifications.

Include following paragraph when contractor is responsible for designing products or assemblies. List affected products when section specifies more than one product.

* + - * 1. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for tunnel liner.

Designer is responsible for identifying and providing specific reference to any permit(s) required to be obtained by the Contractor. It is anticipated that the Designer would complete initial coordination as part of the project design phases.

* + - * 1. Submit [**New York** **State**] [**County**] [**City**] [**Town**] [**Village**] of <**Insert Agency/Municipality**> occupancy permit for installations [**along**] [**under**] public throughways and lands.
				2. Submit emergency response procedures to handle situations when conduit is compromised and jeopardizes safety or integrity of installation.

Include following paragraph when requesting written verification of check for voids and joint integrity.

* + - * 1. Submit written report results of [**visual check**] of entire length of [**casing**] [**liner**] prior to installation of [**carrier**] [**concrete invert**] to verify that there are no voids or defective joints.
				2. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
				3. Qualifications Statements:

Coordinate following subparagraphs with requirements specified in qualifications article.

Submit qualifications for installer and licensed professional.

Welders: Qualify procedures and personnel according to AWS D1.1.

* + - 1. CLOSEOUT SUBMITTALS
				1. Project Record Documents: Record actual locations of casing or tunnel liner, carrier pipe, and invert elevations.
				2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
				3. Contract Closeout Submittals

Reproducible as-built drawings showing dimensions, accurate locations, and depth of burial at 100 ft intervals. Marked-up contract drawings will not be acceptable.

Issue a written report at the conclusion of the installation phase, stating whether or not specifications and approved manufacturer’s installation recommendations.

Furnish a signed report to the Director’s Representative.

* + - * 1. The submittal will not relieve the Contractor of complete responsibility to the successful performance of the intended installation procedure.
			1. QUALITY ASSURANCE

Include this article to specify compliance with overall reference standards affecting products and installation included in this section.

* + - * 1. Perform Work according to AREMA, NUCA, [**AND**] guidelines.
				2. Obtain occupancy permit when boring, jacking, or tunneling under or within rights-of-way of [**state**] [**county**] [**municipal**] highways and railroads.

In following paragraph insert "New York State of Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to [**New York** **State**] [**County**] [**City**] [**Town**] [**Village**] of <**Insert Agency/Municipality**> standards.

Include following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**copy**] [**<\_\_\_>copies**] of each standard affecting Work of this Section on Site.
				2. Pre-Installation Conference: Before the work is scheduled to commence, a conference will be held at the Site for the purpose of reviewing the Contract Documents and discussing requirements for the Work. The Contractor shall notify the Director’s Representative to coordinate the scheduling of the pre-installation conference. The conference shall be attended by related trade Contractors (if any), their qualified installers and Field Supervision.
			1. QUALIFICATIONS

Coordinate following paragraphs with requirements specified in submittals article.

* + - * 1. Installer: Company specializing in performing Work of this Section with minimum [**three**] years' [**documented**] experience [**and approved by manufacturer**].
				2. Welders: AWS qualified within previous 12 months for employed weld types.
				3. Licensed Professional: [**Professional engineer**] experienced in design of specified Work and licensed in the State of New York.
				4. Contractor and Field Supervisor Qualifications

Contractor: The firm performing the Work of this Section shall have been regularly engaged in performing horizontal directional drilling for a minimum of 10 years, and shall have completed 5 similar projects of size and complexity over the last 5 years.

Field Supervisor: The person supervising the Work of this Section shall have been regularly engaged in performing horizontal directional drilling for a minimum of 5 years and shall have supervised 3 similar projects of size and complexity over the last 3 years.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
				2. Handling: Support casing and carrier pipes with nylon slings during handling.
				3. Storage:

Store products according to manufacturer instructions.

Use wooden shipping braces between layers of stacked pipe.

Stack piping lengths no more than three layers high.

Store field joint materials in original shipping containers.

* + - * 1. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide temporary end caps and closures on piping and fittings and maintain in place until installation.

Protect piping [**system pieces**] [**systems**] from entry of foreign materials and water by installing temporary covers, completing sections of Work, and isolating parts of completed system.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
				1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. PROJECT CONDITIONS
				1. Complete HDD so as not to interfere with, interrupt, or endanger surface and activity thereon.
				2. Do not use HDD in rock stratum or subsoil consisting of boulders and underground obstructions that impede the process.
				3. Follow applicable ordinances, codes, statutes, rules, and regulations of State of New York, and applicable regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A10.16-1995 (R2001), “Safety Requirements for Tunnels, Shafts, and Caissons.”
1. PRODUCTS
	* + 1. CASING AND JACKING PIPE
				1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8755&mf=04&src=wd):

Southland Pipe & Supply CO., (800) 886-9764, PO Box 1628, Bessemer, Alabama 35020.

H & L Pipe & Steel, (303) 287-1700, 5680 Pecos Street, Denver, Colorado, 80221.

Valiant Steel & Equipment, (770) 417-1235, Mechanicsville Road, Peachtree Corners, Georgia 30071.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Paragraph below is used in lieu paragraphs 1. and 2. above. Preference is to specify specific project materials. In following subparagraph insert "New York State Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

Furnish materials according to [**New York State**] [**County**] [**City**] [**Town**] [**Village**] of <**Insert Agency/Municipality**> standards.

Insert descriptive specifications below to identify project requirements and to eliminate conflicts with products specified above.

Following two paragraphs specify common steel and concrete casing and jacking pipe choices. Centrifugally cast fiberglass-reinforced polymer mortar pipe, ductile iron, PVC, and vitrified clay pipe may also be considered for use.

* + - * 1. Steel Casing Pipe:

Comply with ASTM A53.

Minimum Yield Strength: [**35,000**] [**42,000**] psi.

Minimum Wall Thickness: 0.375 inch.

Welded Joints:

Comply with AWS D1.1.

Full circumference.

* + - * 1. Concrete Casing Pipe:

Pipe:

Comply with ASTM [**C76**] [**C361**], Class V wall.

Loading: Type C.

Type: [**Reinforced**] [**Nonreinforced**].

Joints:

Comply with ASTM C443.

Joints: Butt.

Collar Bands: [**Steel**] [**or**] [**fiberglass-reinforced pipe**].

Sealing Ring: Elastomeric material.

* + - * 1. Performance and Design Criteria:

Casing Pipe and Tunnel Liner: Leakproof.

Loading:

Highways:

Earth cover.

H-20 live loading, according to AASHTO HB-17.

Impact loading according to AASHTO HB-17 [**plus 50 percent**].

Railways:

Earth cover.

Comply with AREMA - Manual for Railway Engineering.

Impact loading according to AREMA guidelines [**plus 50 percent**].

Bracing, Backstops, and Jacks: Of sufficient rating for continuous jacking without stopping except to add pipe sections, and to minimize tendency of ground material to freeze around casing pipe.

* + - 1. STEEL TUNNEL LINER
				1. Comply with AREMA guidelines.
				2. Plates:

Material: Structural steel.

Comply with ASTM A1011.

Minimum Grade: 40.

* + - * 1. Bolts and Nuts Used with Lapped Seams:

Minimum Diameter: 5/8 inch.

Bolts for Plate Thicknesses Greater Than or Equal to 0.209 Inches: Comply with ASTM A449.

Bolts for Plate Thicknesses Less Than 0.209 Inches: Comply with ASTM A307, Grade A.

Nuts: Comply with ASTM A307, Grade A.

* + - * 1. Bolts and Nuts Used with Four-Flanged Plates:

Comply with ASTM A307, Grade A.

Thread: Coarse.

Diameter:

Plate Thicknesses up to and Including 0.179 Inch: Minimum 1/2 inch.

Plate Thicknesses Greater Than 0.179 Inch: Minimum 5/8 inch.

* + - 1. CARRIER PIPE
				1. Site Water Distribution System Piping: As specified in Section [**331416 - Site Water Utility Distribution Piping**].
				2. Sanitary Sewage System Piping: As specified in Section [**333100 - Sanitary Sewerage Piping**].
				3. Storm Drainage Piping: As specified in Section [**334200 - Stormwater Conveyance**].
			2. MATERIALS

Select bedding and cover material type based on project conditions, and specify those materials in Section 310000.

* + - * 1. Soil Backfill for Trench Approaches and Pits to Finish Grade:

Refer to Section [**310000 – Earthwork Materials**].

* + - * 1. Filling and Sealing Grout at Pipe Ends: Concrete grout fill per [**ASTM**] standards.
				2. Pressure-Grout Mix: One part Portland cement and six parts mortar sand, mixed with water to consistency applicable for pressure grouting.
				3. Mortar Sand: Comply with [**ASTM C33**] [**ASTM C404**].
				4. Portland Cement:

Comply with [**ASTM C150**].

Type: [**I**] [**V**].

* + - * 1. Joining Method:

Water Pipe: Refer to Section 331416 – Site Water Utility Distribution Piping.

Sanitary Sewer Pipe: Refer to Section 333100 – Sanitary Sewerage Piping.

When joining HDPE pipe at ends of directional drilling runs fusion bond to adjacent pipe section using butt fusion.

Mechanical couplings are not permitted for joining of directional drilled pipe sections.

* + - * 1. Drilling Fluid:

Bentonite drilling mud compatible with environment.

Waste oil or environmentally non-compatible polymers cannot be part of composition.

* + - * 1. Detection Wire: TW, THW, THWN, or HMWPE insulated copper, 10 gage or thicker wire.
				2. Locator Station.

Underground, Flush Mounted:

Tube minimum 15 inches long with minimum inside diameter of 2-1/2-inches made of non-corrosive material, schedule 40 PVC, HDPE, or equal.

Factory attached cast iron or high-impact plastic collar with ribs to prevent rotation when removing locking lid after locator station is set in concrete.

Light blue cast iron or high-impact plastic locking lid that will withstand AASHTO H-20 traffic loads and ultra-violet rays.

Mark locking lid to identify pipeline with permanent identification such as P.S. Locator.

Terminal block made of high dielectric material which is made of phenolic resin, plastic, micarta, Lexan or Bakelite for each locator station. Terminal block furnished with two 3/16-inch threaded studs, nuts, and washers made of nickel-plated brass.

Manufacturers: C.P. Test Services, Inc., Model Mini; Handly, Industries, Model T2IS2, or equal.

Manhole Mounted:

Waterproof enclosure made from cast aluminum, galvanized steel, high-impact plastic: Lexan, Gyrlyn, or equal.

Light blue schedule 40 PVC pipe or schedule 40 galvanized steel with outside diameter of at least 3/4-inch to mount enclosure.

Use similar materials for pipe and enclosure to fasten enclosure onto pipe following manufacturer's instructions.

Manufacturers:

Cott Manufacturing Company, Model Finklet or Finkplate, 2 leads

Gerome Manufacturing Company, Inc., Model Testox Series 300, 2 leads

Or equal.

* + - 1. ACCESSORIES
				1. Timber Supports and Insulators:

Description:

Furnish notches to accommodate fastening.

Treat notches at time of pipe installation.

Wood Preservative or Pressure Treatment: [**Creosote; AASHTO M133**].

Species: [**Redwood**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Steel and Plastic Supports and Insulators:

Bands: [**14-gage stainless steel**] [**Polyethylene**].

Flange Bolts: 5/16-inch stainless steel.

Liner: Heavy-duty PVC.

Skids: [**Polyethylene**] [**or**] [**phenolic**].

* + - * 1. Steel Strapping: Comply with ASTM A36/A36M.
				2. Tunnel Liner Coating: [**Zinc**] [**Bituminous**].
			1. FABRICATION - STEEL TUNNEL LINER
				1. Description: Fabricate plates to fit cross-section of tunnel and for connection by bolts on both longitudinal and circumferential seams or joints for erection from inside.
				2. Grout Holes:

Description: To permit grouting as erection of liner plates progresses.

Diameter: [**2 inches**] [**As indicated on Drawings**].

* + - * 1. Plates:

Cold-form plates to provide pattern of corrugations or panels in skin section, which, along with circumferential flanges, develop effective sectional properties as shown in AREMA guidelines.

Width: [**16**] [**18**] inches.

Length: Adequate to obtain circumferential wall coverage in two or more multiples equivalent to 6, 12, 14, or 16 inches of diameter.

Maximum Weight of Single Plate without Bolts: 90 lb..

* + - * 1. Plate Joints:

Description:

Drill plates for bolting on both longitudinal and circumferential seams or joints.

Fabricate to permit complete erection from inside.

Circumferential Flanges: Furnish bolt spacing not greater than 9-1/2 inches center-to-center and in multiples of plate length such that plates having same curvature are interchangeable and to permit staggering of longitudinal seams.

Longitudinal Flanges:

Four-Flanged Plates: Three bolts in 16 inches of plate width.

Two-Flanged Plates: Four bolts per foot in lapped seams.

* + - * 1. Coatings:

Liner is expendable if steel liner plates are used to maintain tunneled opening until carrier pipe is installed and back-packed. If steel liner plates compose finished structure, consider using corrosion-resistant coatings. Designer of record to provide design of coatings.

Galvanized Liner Plates: <**\_\_\_\_\_\_\_\_**>.

Bituminous Coating: <**\_\_\_\_\_\_\_\_**>.

1. EXECUTION
	* + 1. EXAMINATION
				1. Verify that connection [**to existing piping system**], sizes, locations, and invert elevations are as indicated on [**Shop**] Drawings.
			2. PREPARATION
				1. Identify required lines, levels, contours, and datum locations.
				2. Underground Utilities: Refer to Section 023313.

Locate and mark-out existing, underground utilities along directional drill path. Perform Level A locator service in all project areas.

Determine vertical orientation and depths of utility lines along directional drill path.

* + - * 1. Pit Preparation

Excavate pits following contract documents are as specified by the Director’s Representative.

Dewater pits as required and as directed.

* + - * 1. Establish elevations of [**casing**] [**tunnel**] with not less than <**\_\_\_\_\_\_\_\_**> feet of cover.
				2. Maintain access to existing [**facilities**] and other active installations requiring access.
			1. OPERATION
				1. General.

Determine drilling length and equipment pull strength for type of soil encountered.

Provide method to control line and grade.

Provide and maintain instrumentation that accurately locates pilot hole.

Drill pilot hole along path following Drawings to these tolerances:

Vertical alignment plus or minus 0.5 foot. Vertical path of pilot hole must not establish new high points not shown on Drawings.

Horizontal alignment plus or minus 1.0 foot.

Include electronic monitoring of horizontal and vertical drilling head location. Obtain accuracy range within 1 inch of actual position of pipeline. Record position readings at maximum of 10-foot intervals.

At completion of pilot hole drilling, furnish tabulations of horizontal and vertical alignment to Director’s Representative.

When water is encountered.:

Provide and maintain dewatering system of sufficient capacity to remove water. Refer to Section 312319.

Keep excavation free of water until backfill operation is in progress.

Perform dewatering in manner that removal of soils particles are held to minimum.

Dewater into sediment trap.

Maintain close observation to detect settlement or displacement of surface and adjacent facilities.

Notify Director’s Representative immediately if settlement or displacement is detected.

Maintain safe conditions and prevent damage.

* + - * 1. Drilling Operation.

Drilling Fluids.

Maintain drilling fluid in bore hole to increase stability of surrounding soil and reduce drag on pulled pipe.

Dispose of drilling fluid and other spoils at location following laws, ordinances, rules, and regulations of local jurisdiction.

Transport excess fluids and other spoils to disposal site, at no additional cost to the contract.

Minimize drilling fluid at locations other than entry and exit points. Immediately clean up any drilling fluids that inadvertently surface.

Provide clean water for drilling, at no cost to the contract, and as directed by the Director’s Representative.

Pilot Hole Drilling.

Angle entry hole so that the curvature of pilot hole does not exceed allowable radius of HDPE pipe.

Be able to make turn of up to 90 degrees and maintain curvature not to exceed allowable bending radius of HDPE pipe.

Alignment adjustment and restarts:

Follow pipeline alignment on Drawings within tolerances specified herein. Before adjustments, notify Director’s Representative for approval.

Notify Director’s Representative when forward motion of operation is stopped by an obstruction.

Abandon in place with drilling fluid, unless Directors’ Representative directs otherwise.

Upon the Director’s Representative’s approval, attempt second installation at approved location or excavate at point of difficulty and install HDPE pipe by trench methods specified in Section 310000.

Withdrawals, abandonments, and restarts are at no additional costs to the Contract when HDD is provided as an option of installation of pipe.

Exercise caution including, but not limited to, locating utilities, drilling downholes (test pits) to observe drill stems or reamer assembly to clear other existing utilities at locations following drawings.

Keep the number of boring pits to a minimum.

* + - 1. INSTALLATION
				1. Pits or Approach Trenches:

Excavate approach trenches or pits [**according to installation plan**] [**, as indicated on Shop Drawings**] [**, and**] as Site conditions require.

Ensure that [**casing**] [**tunnel**] entrance faces as near perpendicular in alignment as conditions permit.

Establish vertical entrance face at least 1 foot above top of [**casing**] [**tunnel lining**].

Install excavation supports as specified in Section [**315000 – Excavation Support and Protection**].

* + - * 1. Casing Pipe:

Boring:

Push pipe into ground with boring auger rotating within pipe to remove soil.

Do not advance cutting head ahead of casing pipe, except for distance necessary to permit cutting teeth to maintain clearance for pipe.

Arrange machine bore and cutting head to be removable from within pipe.

Arrange face of cutting head to provide barrier to free flow of soft material.

If unstable soil is encountered during boring, retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.

Grout to fill voids if voids develop greater than OD of pipe by approximately 1 inch.

If boring is obstructed, relocate jack or tunnel as directed by Director’s Representative.

Jacking:

Construct adequate thrust wall normal to proposed line of thrust.

Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.

Drilling and Jacking:

Use oil-field-type rock roller bit or plate bit made up of individual roller cutter units solidly welded to pipe.

Turned and push pipe for its entire length by drilling machine to give bit necessary cutting action.

Inject high-density slurry (oil field drilling mud) to head as cutter lubricant.

Inject slurry at rear of cutter units to prevent jetting action ahead of pipe.

Mining and Jacking: Use manual hand-mining excavation from within casing pipe as casing is advanced with jacks, allowing minimum ground standup time ahead of casing pipe.

* + - * 1. Tunneling:

Consider using following paragraph for installation of tunnel liner plates in tunnels constructed by conventional tunnel methods, that is, excavated by full-face, heading-and-bench, or multiple-drift procedures. Revise these requirements for liner plates used with construction procedures using full or partial shield, tunneling machine, or other piece of equipment exerting force upon liner plates for purpose of propelling, steering, or stabilizing equipment.

Liner Plates:

Advance excavation for tunnel lining in increments sufficient for erection of one ring of liners.

Install liner plates immediately after each increment of excavation.

Excavate to minimize voids behind liner plates.

Force-grout voids immediately, using pressure as necessary to completely fill voids.

Excavate to lines, grades, dimensions, and tolerances as indicated on Drawings to accommodate initial support and permanent lining.

Tunnel Linings:

Do not damage lining or coating.

Ensure that edges are clean and free of material capable of interfering with proper bearing.

Install liner plates and bolts according to liner plate manufacturer instructions, and replace liner plates or bolts not meeting these requirements.

Use liner plates for full length of tunnel of one type only, using either flanged or lapped-seam type of construction.

Place concrete invert.

* + - * 1. Pressure Grouting: Pressure-grout annular space between casing pipe and surrounding earth.
				2. Installing HDPE Pipe

Provide a swivel to reaming assembly and pull section of pipe to minimize torsional stress on pull section after drilling pilot hole.

Hold reaming diameter to 1.5 times outside diameter of HDPE pipe being installed.

Protect pull section as it proceeds during pull back, so it moves freely and is not damaged.

Pull detection wire along with HDPE pipe. Extend wire into locator station at each end of the HDPE pipe.

When connecting to adjacent pulled or non-pulled section of HDPE pipe, allow pull section of pipe to extend past termination point. Make tie-ins the next day after pull back of HDPE pipe.

Test pit pipe installation to verify horizontal and vertical alignment at Director’s Representative’s direction.

One test pit every 500 feet along length of pipeline, if not within environmentally sensitive and/or protected area.

Director’s Representative may order additional test pits for each test pit that reveals pipeline installation is not in compliance with the Contract Documents at no additional cost to the Contract.

Replace portions of pipeline not in compliance with the Contract Documents at Director’s Representatives direction and at no cost to the Contract.

Supports:

Support pipeline within casing such that no external loads are transmitted to carrier pipe.

Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.

Grout ends of casing to seal.

* + - * 1. Installing Locator Station

Location Stations:

When HDPE pipe is connected to another type of pipe material, continue detector wire over connecting pipe, so locator station is installed out of paved area.

In areas scheduled to be improved identify and protect station locations immediately after installation.

Space 3 stakes equally around the station.

Extend at least 4 feet above existing grade.

Detection Wire.

Install detection wire without splices unless specified on the plans.

Terminate detection wire inside locator box using proper sized crimp type connection on wire ends.

Neatly coil slack wire in test station below terminal board.

Locate wires on top and along HDPE pipe.

Allow adequate slack and support to protect wires from damage during backfilling operations.

Test each detection wire for continuity after backfill is completed.

If test for continuity is negative, repair or replace at Director’s Representative’s direction.

After continuity is verified, connect each detection wire to terminal block in locator station.

* + - 1. TOLERANCES
				1. Excavation: Do not overcut excavation by more than 1 inch greater than OD of casing pipe.
				2. Casing Pipe Vertical and Horizontal Alignment: Plus or minus 3 inches prior to installation of carrier pipe.
				3. Pipe Bells: Minimum 1/2-inch clearance to casing.
			2. FIELD QUALITY CONTROL
				1. Perform field testing of HDPE pipe following Section 331413 for water and 333100 for sanitary sewer.

Select test standards referenced in following paragraph as appropriate for fill materials and project requirements.

Consult geotechnical report to select compaction test method appropriate to fill materials being used and project requirements.

* + - * 1. Compaction Testing:

Comply with [**ASTM D1557**] [**ASTM D698**] [**ASTM D6938**].

If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

Testing Frequency: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than [**days**] [**hours**] on Site for technical assistance during following periods of [**casing**] [**tunnel**] installation:

Unloading of [**casing**] [**tunnel**] materials and components.

Prior to commencing excavation and during excavation.

* + - 1. CLEANING
				1. Remove temporary facilities for [**casing**] [**tunnel**] installation and [**jacking**] [**tunneling**] operations.
			2. MAINTENANCE AND RESTORATION
				1. Restore grades to original levels where settlement or damage due to performance of the Work has occurred. Correct conditions contributing to settlement. Remove and replace improperly placed or poorly compacted fill materials.
				2. Restore pavements, walks, curbs, lawns, and other surface features damaged during performance of the Work to match the appearance and performance of existing corresponding features as closely as practicable.
				3. Topsoil and seed or sod damaged lawn areas.
			3. PROTECTION
				1. Protect plant life, lawns, [**rock outcroppings,**] and other features of final landscaping.
				2. Protect bench marks, survey control points, [**existing structures,**] [**fences,**] [**sidewalks,**] [**paving,**] [**and**] [**curbs**] from excavating equipment and vehicular traffic.

END OF SECTION 330507