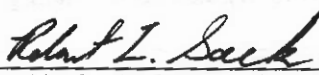


To: SUPERSEDED BY EI 07-016 & EI 07-017 EFFECTIVE 11/10/08		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 04-014
Title: TRENCHLESS INSTALLATION OF CASING			
Distribution: ☐ Manufacturers (18) ☐ Surveyors (33) ☐ Local Govt. (31) ☒ Consultants (34) ☒ Agencies (32) ☒ Contractors (39) ☐ _____ ()		Approved:  Robert L. Sack, Deputy Chief Engineer, Technical Services Division	
		12 MAR 04 Date	

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of September 9, 2004.
- Superseded issuance(s): This EI does not supersede any previous issuances.
- Disposition of issued materials: The information transmitted by this issuance will reside in the Special Specifications directory of the Toolbox Server.

PURPOSE: The purpose of this EI is to issue a new special specification for the installation of a casing via trenchless methods.

TECHNICAL INFORMATION:

- Actions by Designers: The designer shall consult with the Regional Geotechnical Engineer (RGE) to ensure adequate subsurface explorations are progressed to verify the feasibility of installing the proposed casing via trenchless methods. The designer and the RGE shall discuss the subsurface conditions (type of soil, groundwater elevation, obstructions, existing utilities, etc.), length of bore, sensitivity of existing aboveground structures, etc., with respect to the proposed casing type and diameter, to determine the appropriateness of utilizing the special specification.

The specification will pay for the trenchless installation of casing, and for instances where a utility is to be installed in the casing, any work involved in the placement of the utility carrier pipe in the casing except for the utility carrier pipe itself, which shall be paid for under its respective item. The designer shall consult with the Regional Utilities Engineer (RUE) to discuss the location and type of casing with consideration to the type of utility to be installed.

For an installation under a railroad, the designer shall consult with the Rail Agreements Section of the Design Services Bureau to identify the appropriate additional items for the track support system:

Item 675.77---23 M – Furnishing and Removing Temporary Track Support System.

Item 675.7701--23 M – Furnishing, Installing, and Removing Temporary Track Support System.

The designer shall consult with the Regional Landscape and Environmental Review Units to discuss potential impacts the trenchless installation may have on existing vegetation and cultural resources and identify watercourses, wetlands, etc., which may require protection from the cuttings and pit spoil handling areas and final placement areas of the trenchless installation method.

The proposed casing length, type, and size shall be indicated in the contract documents. Some trenchless methods are unsuitable for some diameters. In general, the special specification may be appropriate for installing casing with a diameter up to 900 mm (36 NPS).

● **PIN Approval:** The trenchless installation of casing special specification is to be approved on a project-by-project basis. Designers will need to send their request for approval to DQAB and the Geotechnical Engineering Bureau through their special specification (SS) coordinator as per HDM Chapter 21. For an installation under a railroad, designers will also need to send their request for approval to the Rail Agreements Section of the Design Services Bureau.

The special specification is organized by casing size, NPS (XX). Some typical casing sizes:

Item 650.50XXNN17 M (XX)=	Casing Diameter (NPS)
04	100 mm
06	150 mm
08	200 mm
10	250 mm
12	300 mm
24	600 mm
36	900 mm

The special specification is also serialized (NN) to account for different installation locations. The designer should discuss the subsurface conditions with the Regional Geotechnical Engineer and review the proposed number of crossings. The serialized number of crossings may be reduced based on similar subsurface conditions.

IMPLEMENTATION:

- Special specification 660.78----10 M – Utility Relocation by Directional Drilling, is disapproved.
- The following two special specifications will remain active:
 Item 660.78XX--10 M – HDPE Pipe by Directional Drilling (NPS).
 Item 663.50----17 M – Installing Water Supply Utilities by Directional Drilling.

These special specifications are for direct utility installations and include specific requirements relating to the utility type.

TRANSMITTED MATERIALS:

Attached is the following special specification:

- Item 650.50XXNN17 M- Trenchless Installation of Casing Under Highway.
- Item 650.51XXNN17 M- Trenchless Installation of Casing Under Railroad.

BACKGROUND: The specification was created to provide flexibility to a Contractor, given a situation where the traditional open-cut-trench method is not permitted or where the trenchless installation of casing is more efficient, less disruptive, etc. The generic specification requires the Contractor to submit the method of trenchless installation, which may include Auger Boring, Slurry Boring, Microtunneling, or Horizontal Directional Drilling Method.

1. Auger Boring (AB)¹: A technique that forms a bore hole from a drive shaft to a reception shaft by means of a rotating cutting head. Spoil is transported back to the drive shaft by helical wound auger flights rotating inside a steel casing that is being jacked in place simultaneously. AB may provide limited tracking and steering capability. It does not provide continuous support to the excavation face. AB is typically a 2-stage process (i.e., casing installation and product pipe installation).

2. **Slurry Boring (SB)¹:** A technique that forms a bore hole from a drive shaft to a reception shaft by means of a drill bit and drill tubing (stem). A drilling fluid (i.e., bentonite slurry, water, or air pressure) is used to facilitate the drilling process by keeping the drill bit clean and aiding with spoil removal. It is a 2-stage process. Typically, an unsupported horizontal hole is produced in the first stage. The pipe is installed in the second stage.
3. **Microtunneling (MT)¹:** A remotely controlled, guided-pipe jacking process that provides continuous support to the excavation face. The guidance system usually consists of a laser mounted in the drive shaft communicating a reference line to a target mounted inside the MT machine's articulated steering head. The MT process provides ability to control excavation face stability by applying mechanical or fluid pressure to counterbalance the earth and hydrostatic pressures.
4. **Horizontal Directional Drilling (HDD)¹:** A 2-stage process that consists of drilling a small-diameter, pilot directional hole along a predetermined path and then developing the pilot hole into a suitable bore hole that will accommodate the desired utility and then pulling the utility into place. The HDD process provides the ability to track the location of the drill bit and steer it during the drilling process. The vertical profile of the bore hole is typically in the shape of an arc entrapping drilling fluid to form a slurry pathway rather than an open hole. This entrapped slurry provides continuous support to the bore hole.

REFERENCE: The definitions for the trenchless installation methods were taken from, and described further in, the following:

¹ National Cooperative Highway Research Program, NCHRP Synthesis 242.
Trenchless Installation of Conduits Beneath Roadways, A Synthesis of Highway Practice.
Transportation Research Board, National Research Council.
National Academy Press, Washington DC, 1997.

CONTACT: Questions or comments regarding this issuance should be directed to Randy Romer of the Geotechnical Engineering Bureau at (518) 457-4714, romer@dot.state.ny.us.

ITEM 650.50XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER HIGHWAY
ITEM 650.51XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER
RAILROAD

DESCRIPTION

This work shall consist of furnishing and installing a casing by trenchless installation methods in accordance with the contract documents and as directed by the Engineer. Acceptable methods of trenchless installation include Auger Boring, Slurry Boring, Microtunneling, or Horizontal Directional Drilling. Pipe Ramming or Soil Compaction methods will not be allowed. For an installation under a railroad, methods which leave an uncased bore hole through the embankment will not be allowed.

Definitions

Auger Boring (AB): A technique that forms a bore hole from a drive shaft to a reception shaft by means of a rotating cutting head. Spoil is transported back to the drive shaft by helical-wound auger flights rotating inside a steel casing that is being jacked in place simultaneously. AB may provide limited tracking and steering capability. It does not provide continuous support to the excavation face. AB is typically a 2-stage process (i.e., casing installation and product pipe installation).

Slurry Boring (SB): A technique that forms a bore hole from a drive shaft to a reception shaft by means of a drill bit and drill tubing (stem). A drilling fluid (i.e., bentonite slurry, water, or air pressure) is used to facilitate the drilling process by keeping the drill bit clean and aiding with spoil removal. It is a 2-stage process. Typically, an unsupported horizontal hole is produced in the first stage. The pipe is installed in the second stage.

Microtunneling (MT): A remotely controlled, guided pipe-jacking process that provides continuous support to the excavation face. The guidance system usually consists of a laser mounted in the drive shaft communicating a reference line to a target mounted inside the MT machine's articulated steering head. The MT process provides ability to control excavation face stability by applying mechanical or fluid pressure to counterbalance the earth and hydrostatic pressures.

Horizontal Directional Drilling (HDD): A 2-stage process that consists of drilling a small diameter pilot directional hole along a predetermined path and then developing the pilot hole into a suitable bore hole that will accommodate the desired utility and then pulling the utility into place. The HDD process provides the ability to track the location of the drill bit and steer it during the drilling process. The vertical profile of the bore hole is typically in the shape of an arc entrapping drilling fluid to form a slurry pathway rather than an open hole. This entrapped slurry provides continuous support to the bore hole.

MATERIALS

Provide casing of sufficient length and type and size as indicated on the contract documents.

Provide grout meeting the following requirements to fill any abandoned borings.

Portland Cement, Type 1 or Type 2	§701-01
Water	§712-01
Bentonite (Optional) Bentonite Additives	There are no material requirements for bentonite except that it shall be supplied in powdered form.

Furnish equipment of adequate capacity and power to install the casing by trenchless installation methods. Supplement each rig with the necessary auxiliaries, appurtenances, tools, and other equipment required for proper operation.

ITEM 650.50XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER HIGHWAY
ITEM 650.51XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER
RAILROAD

CONSTRUCTION DETAILS

A. General

1. Clear all drill hole(s) and path locations in accordance with New York State Department of Public Service Rule 753 Protection of Underground Facilities. For an installation under a railroad, additionally contact the railroad company to identify the location of railroad underground facilities and the company's additional requirements pertaining to the method of installation.
2. Install casing of the length(s), size(s), and type(s) specified in the contract documents to the alignment(s) and profile(s) shown on the plans. For an installation under a railroad, work shall be carried out under the joint supervision of the Department and the railroad company, as per §105-09 Work Affecting Railroads.
3. Submit for review and approval a detailed work plan and schedule of activities required to perform all trenchless installations, including any proposed variation from the methods and techniques stipulated in this Specification or shown on the plans (See A. General 4.). Information in this work plan must include, but not be limited to, the following:
 - a. Qualifications of the Contractor showing that all trenchless installation operations will be performed by a competent driller who has successfully installed casing on two projects in the past five (5) years, of similar size and type shown on the plans, via the proposed trenchless method. Completed projects with details of the types of installations, owner contact names, and telephone numbers must be included.
 - b. Designed drill path indicating compliance with the project design criteria.
 - c. Method for trenchless installation indicating the following:
 - i. Plan showing the work zone equipment configuration at the ends of the bore(s), staging areas, storage areas, location of slurry, cuttings and pit spoil-handling areas, and final placement areas.
 - ii. Equipment list including make and model number and specifications (catalog cuts) of all major equipment proposed for use on the project. The Contractor 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.
 - iii. Boring procedure, tooling for drilling, water source for drilling operations, method to control slurry, verification that size and type of casing can withstand installation stresses and method to verify that installed casing is acceptable. For methods that do not provide continuous support to the excavation face, include details on the mechanical device that will prevent the cutting head from protruding ahead of casing and the need for a protective shield at the head of casing.
 - iv. Design of entrance and exit pits including shoring elements, type, depth, bracing size, etc. All flexible wall-system designs that are part of the construction submittal shall be stamped by a licensed and currently registered New York State Professional Engineer and shall be done in accordance with the procedures contained in the appropriate Departmental publication which is current on the date of advertisement for bids. This publication is available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau (D.G.E.B.).
 - v. Materials list including bentonite and bentonite additives proposed for use on the project, along with material safety data sheets for all other materials used in the trenchless installation method.

ITEM 650.50XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER HIGHWAY
ITEM 650.51XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER
RAILROAD

- vi. Steering and tracking equipment, procedures and proposed locations of ground-based tracking coils or other equipment requiring surface or subsurface access.
- d. In the event of abandoning a boring, method for grouting, including grout mix design.
- e. For instances where a utility is to be installed in the casing, method of installation and identification of the material to be placed between the casing and the utility carrier pipe. The material shall be nonconductive and retain its insulating properties during long-term submergence in water.
- 4. Do not start work prior to receiving the Engineer's written approval. Approval, if granted, will be based on the decision of the Director, Geotechnical Engineering Bureau (D.G.E.B.), as to the acceptability of the proposed work plan and any variations to provide satisfactory installation of the casing and avoid damage to the surrounding area and/or structure(s)/utilities. Installation of casing under railroads shall be jointly approved by the Department and the railroad company. The Engineer will forward the proposed work plan to the D.G.E.B., and to the Chief Engineer of the railroad company if appropriate, for review. The D.G.E.B. requires twenty (20) working days from the date of receipt of the proposed work plan in the Bureau to perform the review. The railroad company requires fifty (50) working days from the date of receipt of the proposed work plan in the company to perform the review. 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 Contractor will stop work, modify the methods of installation, and submit them for review and approval.
- 5. Shore entrance and exit pits as necessary to meet OSHA requirements and be in compliance with the submitted design required by this Specification, A. General 3.c.iv.
- 6. Survey the existing ground surface along the proposed path of casing installation prior to the start of work to set baseline data. Establish points to determine presence/extent of ground movements.
- 7. Perform all work in the presence of the Engineer's Inspection Staff.

B. Installation

- 1. The alignment of the casing must conform to the following requirements:
 - a. Choose the ground entry and exit angles such that the casing can be installed along the alignment and profile indicated on the contract plans.
 - b. The entrance point(s) and exit point(s) shall be approved by the Engineer and physically located in the field.
 - c. The exit point shall be no more than 0.3 meters left or right of the location marked in the field.
 - d. The vertical depth, as specified in the contract documents, is the depth to which the casing shall be installed.
 - e. Continuously monitor the longitudinal forces during advancement of the casing to prevent any damage.
- 2. a. Direct all drilling operations using steering and tracking systems capable of producing the required alignment within an allowable accuracy of $\pm 1\%$ of the bore length. Maintain the grade within 25 mm throughout the bore length. 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 Contractor, as per §105-11B Inspection of Work.

ITEM 650.50XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER HIGHWAY
ITEM 650.51XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER
RAILROAD

- b. Adequately support the casing on rollers during its advancement into the predrilled hole. Rollers and cradles shall be of the type that will prevent damage to the casing and in sufficient number to prevent overstressing during the advancement procedure.
 - c. Pull an adequate-sized tracer wire with the casing.
 - d. Take necessary procedures to prevent bentonite leakage.
 - e. Supply water for mixing drilling fluid.
 - f. Supply portable mud tanks or construct temporary mud pits to contain excess drilling fluids during construction. Upon completion of the casing installation, dispose of any cuttings and excess drilling fluids in a manner consistent with local and State regulations.
3. Closely monitor the trenchless installation process, including depth, flow rates, and pressure of drilling fluids, to eliminate ground movements. If ground movements occur, stop work and immediately stabilize the area of concern. If it is determined during the installation process that the proposed lines and grades for the casing cannot be achieved, stop work. The Contractor shall then modify the methods of installation and submit them for review and approval as stated in this Specification, A. General 4. Corrective stabilization actions are at the Contractor's expense.
 4. In the event that the drill hole must be abandoned before completion of the installation, fill the abandoned drill hole with grout to prevent subsidence. Start pumping from the farthest point of progression of the abandoned drill hole back to the surface to eliminate encapsulating voids. The progression of the abandoned drill hole and grout placement will be at the Contractor's expense. The location of the new drill hole shall be approved by the Engineer prior to advancement.
 5. Rail hangers shall be installed as per the Temporary Track Support System item prior to the trenchless installation operation if required by the railroad company. The rail hangers will not be removed by railroad forces until all ground movements of the embankment, as a result of the trenchless installation operation, have been stabilized by the Contractor to the satisfaction of the railroad company.
 6. For larger diameter casings, several passes with progressively larger tools may be necessary before the hole is sufficient for the proposed casing to be installed.
 7. For instances where a utility is to be installed in the casing, place the utility carrier pipe within the casing such that they are electrically insulated from each other.

C. Trenchless Installation Records

After completion of the casing installation(s), submit to the Engineer the installation records detailing the As-Built location of the casing(s).

METHOD OF MEASUREMENT

This work will be measured as the number of meters of each size casing satisfactorily installed in accordance with the contract documents and as directed by the Engineer.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment (including dewatering if required) necessary to satisfactorily install a casing by trenchless installation methods including progressing through all subsurface conditions (earth and rock) and any obstructions encountered (boulders, concrete, etc.), grouting of abandoned bores, stabilizing ground movements, performing and supporting temporary excavations and entrance and exit pits (including access and set-up), site restoration and, for instances where a utility is to be installed in the casing, any work

ITEM 650.50XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER HIGHWAY
ITEM 650.51XXNN17 M – TRENCHLESS INSTALLATION OF CASING UNDER
RAILROAD

involved in the placement of the utility carrier pipe in the casing except for the utility carrier pipe itself, which shall be paid for under its respective item. Rail hangers (if required) shall be furnished, installed, and removed as called for in the Temporary Track Support System item included in the contract documents. This work will be paid for under its respective item.

No partial or final payment for trenchless installation of casing under railroad will be made until the work has been approved by the respective railroad company.

Costs incurred by the railroad company to correct settlement or upheaval of the railroad tracks resulting from the casing installation and occurring within one year from the date of work is completed, will be reimbursed to the railroad company directly by the State at no cost to the Contractor.

Surveying for the presence/extent of ground movements during the trenchless installation shall be paid for under its respective item number.

NOTE: XX denotes casing size, NPS.

NN denotes serialized pay item, see §101-02 Definition of Terms, Specifications.