

**NOVEMBER 2, 2018**  
**REPLACEMENT OF CULVERT AT MP 65.60 NEW HAVEN MAINLINE OVER**  
**UNNAMED STREAM**  
**FEDERAL AID PROJECT NO. N/A**  
**STATE PROJECT NO. N/A**  
**TOWN OF MILFORD**

**ADDENDUM NO. 1**

This Addendum addresses the following questions and answers contained on the “CT DOT QUESTIONS AND ANSWERS WEBSITE FOR ADVERTISED CONSTRUCTION PROJECTS”:

Question and Answer Nos. 3, 4, and 5

**SPECIAL PROVISIONS**  
**NEW SPECIAL PROVISION**

The following Special Provision is hereby added to the Contract:

- **ITEM NO. 0202126A – ROCK EXCAVATION – JACKING PIPE**

**REVISED SPECIAL PROVISIONS**

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- **SECTION 1.05 – CONTROL OF THE WORK**
- **ITEM NO. 0686011.48A – JACKING 48” R.C.PIPE (CLASS V) - 0’-20’ DEEP**

**CONTRACT ITEM**  
**NEW CONTRACT ITEM**

<b><u>ITEM NO.</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>UNIT</u></b>	<b><u>QUANTITY</u></b>
<b><u>0202126A</u></b>	<b><u>ROCK EXCAVATION – JACKING PIPE</u></b>	<b><u>C.Y.</u></b>	<b><u>3</u></b>

The Bid Proposal Form has been revised to reflect these changes.

The Detailed Estimate Sheet does not reflect these changes.

There will be no change in the number of calendar days due to this Addendum.

The foregoing is hereby made a part of the contract.

**ITEM #0202126A – ROCK EXCAVATION – JACKING PIPE**

Work under this item shall conform to the requirements of Section 2.02, supplemented and amended as follows:

**2.02.01-Description:** Delete this section and replace with the following:

Rock excavation shall consist of the removal and satisfactory disposal, in the manner herein required, of all rock in definite ledge formation and boulders, or the portion of boulders, 1 c.y. or more in volume within the limits of the removal necessary for the installation of concrete pipes using a jacking operation.

**2.02.03-Construction Methods:** Add the following:

When rock is encountered during a pipe jacking operation, the Contractor shall notify the Engineer of its presence and allow for measurements necessary to identify its limits and the removal limits necessary for the pipe installation. The Contractor shall remove the rock to the limits required in a controlled manner acceptable to the Engineer. All such excavation shall be performed from within the bore without impact to railroad operations. Excavation methods by the use of drilling, splitting, wedging or other approved methods not involving the use of explosives shall be utilized.

**2.02.05-Basis of Payment:** Delete this section and replace with the following:

The removal of rock within the limits of excavation necessary for pipe installation using jacking methods shall be paid for at the Contract unit price per cubic yard for “Rock Excavation – Jacking Pipe”. The price shall include all equipment, tools and labor incidental to the completion of the excavation and the disposal of surplus or unsuitable material in accordance with the provisions of the plans and of these specifications.

## **SECTION 1.05 - CONTROL OF THE WORK**

*Replace Article 1.05.02 with the following:*

### **1.05.02—Contractor Submittals, Working Drawings, Shop Drawings, Product Data, Submittal Preparation and Processing - Review Timeframes, Department’s Action:**

**1. Contractor Submittals:** The plans provided by the Department show the details necessary to give a comprehensive idea of the construction contemplated under the Contract. The plans will generally show the location, character, dimensions, and details necessary to complete the Project. If the plans do not show complete details, they will show the necessary dimensions and details, which when used along with the other Contract documents, will enable the Contractor to prepare working drawings, shop drawings or product data necessary to complete the Project.

The Contractor shall prepare submittals as Portable Document Format (PDF) files. The Contractor is also required to acquire, maintain access and use the Department’s document management system for delivery of submittals. The format, digital signing requirements, delivery processes and document tracking procedures shall be performed in accordance with this specification and the [Contractor’s Digital Submission Manual](#) (CDSM).

The submittals shall be sent to the Department’s reviewer(s), sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods as specified herein (including any necessary revisions, resubmittal, and final review), and acquisition of materials, without causing a delay of the Project.

**2. Working Drawings:** When required by the Contract or when ordered to do so by the Engineer, the Contractor shall prepare and submit the working drawings, signed, sealed and dated by a qualified Professional Engineer licensed to practice in the State of Connecticut, for review. The drawings shall be delivered sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods specified herein (including any necessary revisions, resubmittal, and final review).

There will be no direct payment for furnishing any working drawings, procedures or supporting calculations, but the cost thereof shall be considered as included in the general cost of the work.

a. Working Drawings for Permanent Construction: The Contractor shall supply to the Assistant District Engineer a certificate of insurance in accordance with 1.03.07 at the time that the working drawings for the Project are submitted.

The Contractor’s designer, who prepares the working drawings, shall secure and maintain at no direct cost to the State a Professional Liability Insurance Policy for errors and omissions in the minimum amount of \$2,000,000 per error or omission. The Contractor’s designer may elect to obtain a policy containing a maximum \$250,000 deductible clause, but if the Contractor’s designer should obtain a policy containing such a clause, they shall be liable to the extent of at

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least the deductible amount. The Contractor's designer shall obtain the appropriate and proper endorsement of its Professional Liability Policy to cover the indemnification clause in this Contract, as the same relates to negligent acts, errors or omissions in the Project work performed by them. The Contractor's designer shall continue this liability insurance coverage for a period of

- (i) 3 years from the date of acceptance of the work by the Engineer, as evidenced by a State of Connecticut, Department of Transportation form entitled "Certificate of Acceptance of Work," issued to the Contractor; or
- (ii) 3 years after the termination of the Contract, whichever is earlier, subject to the continued commercial availability of such insurance.

b. Working Drawings for Temporary Construction: The Contractor shall submit drawings, calculations, procedures and other supporting data to the Assistant District Engineer.

**3. Shop Drawings:** When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and deliver shop drawings to the Designer for review. Review timeframes and submission locations are as specified herein.

There will be no direct payment for furnishing any shop drawings, but the cost thereof shall be considered as included in the general cost of the work.

**4. Product Data:** When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and deliver product data.

The Contractor shall submit the product data in a single submittal for each element or group of elements of construction.

The Contractor shall mark each copy of the product data submittal to show applicable choices and options. Where product data includes information on several products that are not required, copies shall be marked to indicate the applicable information. Product data shall include the following information and confirmation of conformance with the Contract to the extent applicable: manufacturer's printed recommendations, compliance with recognized trade association standards, compliance with recognized testing agency standards, application of testing agency labels and seals, notation of coordination requirements, Contract item number, and any other information required by the individual Contract provisions.

There will be no direct payment for furnishing any product data, but the cost thereof shall be considered as included in the general cost of the work.

**5. Submittal Preparation and Processing – Review Timeframes:** The Contractor shall allow 30 calendar days for submittal review by the Department, from the date receipt is acknowledged by the Department's reviewer. For any submittals marked with "Revise and Resubmit" or "Rejected," the Department is allowed an additional 20 calendar days for review of any resubmissions.

An extension of Contract time will not be authorized due to the Contractor's failure to transmit submittals sufficiently in advance of the work to permit processing.

The furnishing of shop drawings, working drawings or product data, or any comments or suggestions by the Designer or Engineer concerning shop drawings, working drawings or product data, shall not relieve the Contractor of any of its responsibility for claims by the State or by third parties, as per 1.07.10.

The furnishing of the shop drawings, working drawings and product data shall not serve to relieve the Contractor of any part of its responsibility for the safety or the successful completion of the Project construction.

- 6. Department's Action:** The Designer or Engineer will review each submittal, mark each with a self-explanatory action stamp, and return the stamped submittal promptly to the Contractor. The Contractor shall not proceed with the part of the Project covered by the submittal until the submittal is marked "No Exceptions Noted" or "Exceptions as Noted" by the Designer or Engineer. The Contractor shall retain sole responsibility for compliance with all Contract requirements. The stamp will be marked as follows to indicate the action taken:
- a. If submittals are marked "No Exceptions Noted," the Designer or Engineer has not observed any statement or feature that appears to deviate from the Contract requirements. This disposition is contingent on being able to execute any manufacturer's written warranty in compliance with the Contract provisions.
  - b. If submittals are marked "Exceptions as Noted" the considerations or changes noted by the Department's Action are necessary for the submittal to comply with Contract requirements. The Contractor shall review the required changes and inform the Designer or Engineer if they feel the changes violate a provision of the Contract or would lessen the warranty coverage.
  - c. If submittals are marked "Revise and Resubmit," the Contractor shall revise the submittals to address the deficiencies or provide additional information as noted by the Designer or Engineer. The Contractor shall allow an additional review period as specified in 1.05.02-5.
  - d. If submittals are marked "Rejected," the Contractor shall prepare and submit a new submittal in accordance with the Designer's or Engineer's notations. The resubmissions require an additional review and determination by the Designer or Engineer. The Contractor shall allow an additional review period as specified in 1.05.02-5.

**Article 1.05.06—Cooperation with Utilities (Including Railroads) – is supplemented as follows:**

Add the following after the last paragraph:

**“Special Requirements Regarding Work in Metro-North territory:”**

Description:

This section covers authority, definitions, regulatory requirements, traffic regulation and coordination of the Contractor's work schedule with the operation of train service, construction equipment and safety requirements for working within railroad right-of-way, and provisions for storage of materials and equipment and worker safety rules. Subsequent to the Engineer's Pre-construction meeting and prior to commencement to contract activities, a working on the railroad meeting will be held by the Engineer to emphasize these Specifications.

#### Permission to Enter Upon Railroad Property

Permission is hereby granted to the Contractor to enter property of the State, under the custody and control of the Department and managed by Metro-North Railroad (hereinafter called "Railroad"), a public benefit corporation and subsidiary of Metropolitan Transportation Authority (hereinafter called "MTA"). The purpose of this permission shall be solely for those outlined in this contract and under the following terms and conditions:

- I. Location and Access. Permission is hereby granted to the Contractor and its subcontractor(s), if any, to enter the property within the Project Limits identified on the Contract Plans (hereinafter called the "Property").
- II. Liability. The Contractor covenants and agrees to at all times indemnify, protect and save harmless the "Additional Insureds", as defined under Article V, from and against any and all losses, damages, detriments, suits, claims, demands, costs, and charges which the "Additional Insureds" may directly or indirectly suffer, sustain, or be subjected to by or on account of the Contractor's entry upon, occupancy or use of the Property, or the conduct thereon of the Contractor, its subcontractors, officers, employees, agents or invitees, whether such loss or damage be suffered or sustained by the "Additional Insureds" directly or persons (including employees of "Additional Insureds" or Corporations who may seek to hold the "Additional Insureds" liable therefore), and whether attributable to the fault, failure or negligence of the "Additional Insureds" or otherwise.
- III. Consideration. The Contractor will pay to the Railroad, the sum of Zero Dollars (\$0.00) for the right to enter upon the Property.
- IV. Terms of Permit. The Railroad reserves the right to revoke this permission at any time. Unless subsequently modified, this shall begin with Notice to Proceed and shall end at Contract Completion Date at which time it shall expire automatically. Under no circumstances shall this temporary permission be construed as granting the Contractor any rights, title or interest of any kind or character in, on, or about the land or premises of MTA or Railroad thereafter. The Permittee agrees to notify the Railroad when use of the Property or work is completed.
- V. Definitions of Terms and Permissible Abbreviations:

Authority of the Railroad Engineer - This supplements Article 1.05.01 in that all contract work upon or affecting railroad property, right-of-way or facilities, shall also be subject to the

approval of the Senior Director, Capital Programs of the Railroad or his duly authorized representative, through coordination with the Engineer.

Additional Insureds - Those individuals or entities appearing under Article 1.03.07, Paragraph 15 of the Specifications.

Conductor/Flagman - A Railroad employee qualified on the Rules of the Operating Department and qualified on the physical characteristics of the portion of the railroad involved. He/she is the contact employee qualified to obtain the use of track. Each conductor/flagman will have the proper flagging equipment, up-to-date Railroad Operating Rules, Timetables and Safety Rules.

Coordination of Work - This supplements Article 1.05.06 in that the Contractor shall be responsible for the coordination of the work of his sub-contractors with respect to the railroad property, right-of-way or facilities.

Groundman - Class "A" employee of the Railroad's Power Department authorized to de-energize/re-energize and ground high tension power lines.

Horizontal Clearance Point - A point 10 feet from the centerline of a track.

Obstruction - An entering of the traffic envelope, also referred to as fouling.

Occupancy - Any use of track other than direct crossing.

On or Adjacent to - shall be interpreted to include space on, above and below the railroad right-of-way operated by the Railroad, as well as space on, above, and below adjacent property which the Railroad determines to affect the safe operations of service.

Qualified Railroad Employee - For the purpose of these specifications, a Qualified Railroad Employee is a Railroad employee qualified to remove track or tracks from service.

Railroad - Whenever the term "Railroad" is used without further qualification, it shall be taken to mean Metro-North Railroad.

Right-of-Way - The limits of railroad property on either side of tracks.

The Safety Rules - All work shall be performed in accordance with rules, regulations, procedures, and safe practices of the Railroad, FRA, OSHA, NESC and all other government agencies having jurisdiction over this project.

Track - The space between the rails plus not less than 4 feet outside each rail.

Traffic Envelope - The area encompassed by the vertical and the horizontal clearance points.

Vertical Clearance Point - A point 22 feet and 6 inches above the top of a running rail unless otherwise authorized by the Railroad.

Use of Track - Obtaining permission from the proper authority of the Railroad for track occupancy.

## **1 – Requirements for Performing Work on or Adjacent to the Railroad Right-of-Way**

### **(a) General**

- (1) The Contractor should note that the proposed work involves construction operations on or adjacent to property owned by State and operated by the Railroad. In working near an operating railroad, great care must be exercised and the Railroad's safety rules must be strictly observed.
- (2) If while completing the work covered by this contract, the tracks or other facilities of the Railroad are endangered, the Contractor shall immediately do such work as directed by the Railroad through the Engineer to restore safety. Upon failure of the Contractor to carry out such orders immediately, the Railroad may take whatever steps as are necessary to restore safe conditions. The cost and expense to the Railroad of restoring safe conditions, or of any damage to the Railroad's trains, tracks or other facilities caused by the Contractor's or subcontractor's operations, shall be considered a charge against the Contractor and shall be paid for by him, or may be deducted from any monies due or that may become due him under this contract.

### **(b) Rules and Regulations**

- (1) Railroad traffic shall be maintained at all times, and the Contractor shall conduct all of his operations on or adjacent to the Railroad right-of-way fully within the rules, regulations, and requirements of the Railroad. The Contractor shall be responsible for acquainting himself with such requirements as the Railroad may demand. The Contractor shall include in his bid any expenses occasioned by delay or interruption of his work by reason of the operation or maintenance of the Railroad facilities.
- (2) The Contractor shall obtain verification of the time and schedule of track occupancy from the Railroad before proceeding with any construction or demolition work on or adjacent to the Railroad right-of-way.
- (3) All work to be done on or adjacent to the Railroad right-of-way shall be performed by the Contractor in a manner satisfactory to the Railroad and shall be performed at such times and in such manner as not to interfere with the movement of trains or traffic upon the tracks of the Railroad. The Contractor shall use all necessary care to avoid accidents, damage, delay or interference with the Railroad's trains or property.



- (4) If deemed necessary by the Railroad, it may furnish or assign an inspector who will be placed on the work during the time the Contractor or any subcontractor is performing work under the contract on Railroad property.
- (5) Before proceeding with any construction or demolition work on or adjacent to the Railroad Right-of-Way, a pre-construction meeting shall be held at which time the Contractor shall submit plans, engineering computations, and a detailed description of his methods and procedures for accomplishing the specific construction work required under this contract, including methods of protecting Railroad traffic. When the submission contains engineering computations, the entire submittal package shall be prepared and stamped by Connecticut registered Professional Engineer for approval of the Railroad. Such approval shall not serve, in any way, to relieve the Contractor of his responsibility for the adequacy and safety of his methods and procedures for conducting the work.
- (6) The Contractor shall conduct his work and handle his equipment and materials in such manner that neither fouls a live track or wire line without the written permission of the Railroad.
- (7) Equipment shall be considered to be potentially fouling the track when located in such a position that its failure, with or without load, brings the equipment within the traffic envelope. No equipment shall be placed in this position without prior approval of the Railroad.
- (8) **Equipment of the Contractor to be used:**
  - (A) Equipment of the Contractor to be used adjacent to the tracks shall be in first-class condition so as to fully prevent failures of defective equipment that might cause delay in the operations of trains or damage to Railroad facilities. His equipment shall not be placed or put into operation adjacent to tracks without first obtaining permission from the Railroad. Under no circumstances shall any equipment or materials be placed or stored within 25 feet from the near rail of a track in operation, unless approved, in advance, by the Railroad.
  - (B) High rail equipment of the Contractor to be used on the tracks shall be subject to prior approval of the Railroad. The equipment must be inspected and approved in advance at the Railroad's facility by Railroad inspectors. The equipment inspection must be renewed every three months. All high rail equipment must meet current FRA regulations and Metro-North Railroad requirements.
  - (C) On track vehicles shall be equipped with a Railroad approved tow bar and coupler. Multiple vehicles shall move in tandem and coupled when directed by the Railroad. Movement of on track vehicles shall proceed only under the direct supervision of a Qualified Railroad Employee.

- (9) Materials and equipment belonging to the Contractor shall not be stored on Railroad property without first having obtained permission from the Engineer and Railroad. Such permission will be on the condition that the Engineer and Railroad will not be liable for damage to such materials and equipment from any cause. The Contractor shall keep the tracks adjacent to the site clear of all refuse and debris that may accumulate from his operations and shall leave the Railroad property in the condition existing before the start of his operations.
- (10) The Contractor shall coordinate with the Engineer and the Railroad in order to determine the type of protection required to insure safety and continuity of Railroad traffic incidental to the particular methods of operation and equipment to be used on the work.
- (11) The Railroad will require protection during all periods when the Contractor is working on, or over, the right-of-way of the Railroad, or as may be found necessary in the opinion of the Railroad. When protection is required, refer to Paragraph 1(g).
- (12) It shall be expressly understood that this contract includes no work for which the Railroad is to be billed by the Contractor, and it shall be further understood that the Contractor is not to bill the Railroad for any work which he may perform, unless the Railroad gives a written request that such work be performed at its expense.
- (13) Upon completion of the work, and before final payment is made, the Contractor shall remove from within the limits of the Railroad's right-of-way, all machinery, equipment, surplus materials, falsework, rubbish and temporary buildings, and other property of the Contractor/sub-contractor, and shall leave the right-of-way in a condition satisfactory to the Railroad.
- (c) **Railroad Protective Services** - will be provided in accordance with the Roadway Worker's Protective Act, Title 49, Part 214, Sub-part C. Railroad protective services will also be performed to insure safe operations of trains when construction work would, in the Railroad's opinion, be a hazard to Railroad operations.
- (d) **Definition of Hazard** – the Railroad has furnished the statements quoted below, explaining when they consider a hazard to operations exists:
- “Protective services will be required whenever the Contractor is performing work on or adjacent to the Railroad tracks or right-of-way, such as excavating, sheeting, shoring, erection and removal of forms, handling materials, using equipment which by swinging or by failure could foul the track, and when any other type of work being performed, in the opinion of the Railroad, requires such service.”
- (e) **Contractor Requirements for Work Affecting the Railroad**

- (1) All matters requiring Railroad Company approval or coordination shall be directed to the Engineer or a duly authorized representative thereof, for forwarding to the Railroad Engineer.
- (2) Detailed plans and appurtenant data and calculations for any operation which, in the opinion of the Railroad, affect the Railroad, must be submitted to the Engineer or a duly authorized representative thereof, for forwarding to the Railroad Engineer for approval prior to commencement of the work. All submissions shall comply with the submission requirements outlined in above Paragraph 1(b)(5).
- (3) Permissible Track Outages - are identified in the SECTION 1.08 – PROSECUTION AND PROGRESS – Article 1.08.04 – “Limitation of Operations” - Contractor Requirements for Work Affecting the Railroad contained within the General Provisions of the Contract. The times identified are the times that the track may be removed from service. **If power outages are required, that do not include substations, the de-energizing/re-energizing and grounding of the wires will subtract approximately forty-five minutes from the start and forty-five minutes at the end of the indicated outage period for a total of up to ninety minutes. If a substation is involved in the power outage request, the de-energizing/re-energizing and grounding of the wires will subtract approximately one hour and fifteen minutes from the start and one hour and fifteen minutes at the end of the indicated outage period for a total of up to two hours and thirty minutes.**
- (4) The Contractor shall maintain a minimum of 1 foot level shoulder from ends of ties to maintain lateral track support for all excavations and shall not excavate any slope steeper than 1 (vertical) on 2 (horizontal) from the edge of the shoulder. Sheeting shall be required on all excavations where the side of the excavation is intercepted by the Railroad live load influence line. The live load influence line is defined as a line originating at the bottom edge of tie and extending downward at a slope of 1 (vertical) on 1½ (horizontal). Such excavations must be designed to withstand, in addition to all common loads such as soil pressure and hydrostatic pressure, a railroad live load of Cooper E-80.
- (5) The Contractor shall be required to design and install protective scaffolding over the right-of-way where, at the sole discretion of the Railroad, such scaffolding is necessary to protect the Railroad from possible falling debris; paint or other materials; to protect personnel working about the right-of-way or to provide a platform for personnel, materials and/or equipment. Said scaffolding shall be designed for live load of 200 pounds per square foot applied uniformly over the entire structure and a 2 kips concentrated load placed anywhere on the structure. The two loads are not to be applied simultaneously for design purposes.
- (6) All excavation area shall be located by the Contractor and inspected by the Railroad for the purpose of determining conflicts with underground facilities. Exploratory trenches, a minimum of 3.5 feet deep and 15 inches wide in the form of an “H” with

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outside dimensions matching and outside of sheeting dimensions are to be hand dug, as directed by the railroad. In some locations, excavations may exceed 3.5 feet in depth. Specialty excavations such as screw anchors, cat pole foundations, etc. will require additional trenching to ensure all possible conflicts are located. These trenches are for exploratory purposes only and are to be backfilled and compacted immediately. All work outlined above must be done in the presence of a Railroad inspector.

- (7) Cavities adjacent to sheet piling, created by driving of sheet piling, shall be filled with sand and any disturbed ballast must be restored and compacted immediately.
- (8) Sheet piling shall be cut off at top of tie during construction and at 3 feet below bottom of tie after construction prior to completion of back filling.
- (9) Plans and calculations for sheeting and scaffolding must be submitted to the Engineer for forwarding to the Railroad for approval prior to construction. All submissions shall comply with the submission requirements outlined in above Paragraph 1(b)(5).

**(f) Requirements for Erection, Demolition and Other Rigging Operations On or Adjacent to Railroad Right-of-Way**

The Contractor will be required to furnish the following information to the Engineer or a duly authorized representative thereof, for forwarding to the Railroad Engineer for approval prior to the start of any rigging operation over or adjacent to the Railroad right-of-way:

- (1) Plan view showing locations of cranes, boom length and rigging operating radii, with delivery or disposal locations shown.
- (2) Crane rating sheets showing crane(s) to be adequate for 150% of the lift. Crane and boom nomenclature is to be indicated.
- (3) Plans and computations showing weight of pick.
- (4) Location plan showing obstructions, indicating that the proposed swing is possible.
- (5) Plans showing locations and details of mats, planking or special decking as may be required by the Railroad.
- (6) Written statement from crane owner giving the date of last crane condition and safety inspection and the results of said inspection.
- (7) Data sheet listing number, type, size and arrangement of slings, spreader bars or other connecting equipment. Include copies of catalog or information sheets of specialized equipment. All such equipment shall be shown as adequate and capable of safely carrying 150% of the calculated loading.

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- (8) A complete procedure is to be included, indicating the order of lifts and repositioning or rehitching of the crane(s).
- (9) Temporary support of any components or intermediate stages is to be shown.
- (10) A time schedule of the various stages must be shown, as well as a schedule for the entire lifting procedure.
- (11) All erection, demolition and rigging plans and calculations submitted to the Railroad. All submissions shall comply with the submission requirements outlined in above Paragraph 1(b)(5).
- (12) Operations directly on or adjacent to the operating right-of-way will be performed only at times and under conditions specified by the Railroad's representative and in compliance with the Roadway Worker's Protective Act as stated in Paragraph 1(c).

**(g) Ordering Protective Personnel**

The Railroad will furnish Protective Service Personnel (conductors, flagmen, groundmen, inspectors, maintenance and/or other railroad personnel deemed necessary) to protect the operation of train traffic during the Contractor's construction activities. Railroad Protective Services will also be provided in conformance with the Roadway Worker's Protective Act as stated in Paragraph 1(c). There will be no charge to the Contractor for Railroad Protective Services provided. The providing or failing to provide Protective Services shall not relieve the Contractor from liability or payment for any damage caused by his or his subcontractor's operations conducted in their absence.

- (1) The Contractor must obey all instructions from Railroad representatives on the job site promptly. Failure to follow instructions shall be deemed sufficient cause for closing the job site to the Contractor and its employees.
- (2) The Railroad will, at its sole discretion, determine the need for and the availability of protective personnel. The Railroad will provide protective personnel to the extent possible considering its operational and maintenance priorities. The Railroad does not guarantee that protective personnel will be available to meet the Contractor's preferred schedule. Further, no work will commence until the assigned Railroad representative affirmatively advises the Contractor that the necessary protective personnel are stationed and that he may proceed.
- (3) The assessment of the need for protective services will be based upon a weekly Railroad Construction Coordination Meeting. At these meetings, the Contractor shall provide a Bi-weekly Schedule that will begin on the following Saturday. Based on that schedule, the Railroad will determine the Protective Services required for the two-week period. Protective Services will be reserved for the following week beginning

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on the Saturday and ordered for the second week of the schedule. It will be the Contractor's responsibility to perform work in accordance with the submitted schedule. Variations from the submitted schedule may result in additional and unnecessary costs to the Engineer, Railroad and Contractor.

- (A) Unless otherwise stated elsewhere in the contract, the Contractor shall base his operations on a 5 consecutive day work week. The hours of operation during this time shall remain constant. Multiple shifts may be worked.
- (B) The Contractor must demonstrate maximum use of Protective Service Personnel ordered. Failure to do so may result in the inability to consistently obtain services.
- (C) The Contractor shall be responsible for forwarding all Protective Service requests from his subcontractors and suppliers in his Bi-weekly schedule submittal.
- (4) Requests to cancel construction activities, and subsequently the scheduled Protective Service Personnel, will be also submitted at the weekly Railroad Construction Coordination Meeting. At these meetings, the previously scheduled Protective Services for the week beginning on the following Saturday may be cancelled. This will be the only time for cancellation. Once cancelled, no re-ordering of Protective Services for the following week will be allowed.
- (5) Weather conditions will be considered the only basis upon which the Railroad will accept the Contractor's cancellation of scheduled work and will only be recognized on items of work which have been clearly identified and determined to be weather dependent in the Contractor's schedule. Activities not presented on the Bi-weekly schedule at the weekly Railroad Construction Coordination Meeting will not be able to commence until it has been inserted into the schedule and presented at the next meeting.
- (6) Work that requires the support of Railroad personnel shall not be scheduled on the following days, unless the work is of an emergency nature:

Holiday's Observed:	*Independence Day	*Christmas Day
*New Year's Day	*Labor Day	*NewYear's Eve
*President's Day	*Thanksgiving Day	
*Good Friday	*Day Following Thanksgiving Day	
*Memorial Day	*Christmas Eve	

- \* The Saturday and Sunday preceding a Monday holiday.
- \* The Saturday and Sunday following a Friday holiday.
- \* The Friday and Monday preceding and following a weekend holiday.

- \* There will be additional restrictions regarding the granting of weekend track outages beginning Thanksgiving Holiday to the second weekend of January in order to accommodate extra trains during holiday season.

#### **(h) Requirements for Requesting Track Outages**

Track outages as described in the plans and specifications must be requested at the weekly Railroad Construction Coordination Meeting.

- (1) All procedures, material and equipment must be approved and on site prior to the Railroad accepting the track outage request(s). This applies to all track outage requests.
- (2) Track outages will be granted based on need for constructability not for convenience.
- (7) The Contractor must demonstrate the maximum use of track outages by coordinating his activities and work so that various elements and multiple activities are performed during approved outages. Failure to consistently utilize track outages may cause the inability to gain approval of future requests for outages.
- (8) No new continuous track outages may be initiated the weekend preceding or following these holidays:

Thanksgiving, Christmas and New Year's.

However, long-term continuous outages may extend through these periods.

#### **(i) Catenary and Transmission Systems/Power Outages**

- (1) Catenary and Transmission Systems - The Contractor shall assume that all the wires on the Railroad Company are energized at all times and must be governed by the restrictions imposed by the Railroad with respect to such electrical circuits. Should it become necessary, in the opinion of the Railroad Engineer to de-energize any wire or wires to insure safety of operation, such wires will be de-energized by the Railroad only during such period that will not interfere with the Railroad's operation. When the de-energizing and re-energizing of wires is deemed necessary, a representative of the Power Department of the Railroad must be on duty and present to arrange for the same. He will notify the Contractor in writing when the wires have been de-energized and also when said wires are to be re-energized.
  - (A) The Contractor is advised that the overhead electrification will remain in place for the duration of the entire project, except where called for on the drawings and in the specifications.

(B) Track rails of the Railroad are energized. Particular care must be taken to see that no contact is made between adjoining rails with any material, which is a good conductor of electricity when dry, or material of any nature when wet. Particular care is necessary when any work involving the use of chains, steel rods, cables, pipes, etc., is done. Since the Contractor shall assume the wires and rails of the Railroad will be energized at all times, the Contractor shall require all of his employees, sub-contractors, and others to sign a form similar to the form shown in the Contractor Requirements for Work Affecting the Railroad contained within the General Provisions of the Contract.

**(2) Power Outages**

(A) **Catenary Power Outages** - A catenary power outage must be scheduled concurrently with a track outage for the track and is restricted to the same periods as specified in the plans and specifications.

(B) **Railroad Power and Signal Distribution Feeder Outages** - Outages for feeders can be allowed only during off-peak hours. These outages should be requested at the weekly Railroad Construction Coordination Meeting. One set of power and signal feeders, either the north or south side of the railroad, must remain energized at all times.

NOTE: During peak hours (5:00 a.m. to 10:00 a.m. and 3:30 p.m. to 10:00 p.m., Monday through Friday) of railroad traffic, both the north and south sets of power and signal feeders must be energized.

**(j) Safety for Contractor's Employees Working on or Adjacent to the Right-of-Way of the Railroad**

**(1) Personal Protection Equipment**

(A) Approved hard hats, reflectorized vests, safety footwear, safety eyewear and appropriate clothing must be worn by all Contractor employees while on the Right-of-Way, in yard, shop facilities, construction/work sites and in the operating control cab of a moving locomotive or train. Any exclusion must be jointly approved by Railroad's department head and Director of Safety.

(B) Other protective equipment such as goggles, face shields, safety belts, floatation vests, gloves and respirators shall be issued by the Contractor when required. Protection devices for hearing conservation may be used when determined necessary and safe to do so.

**(2) Possession or Use of Intoxicants and Illegal Substances**



The use of intoxicants, alcohol, narcotics, marijuana, amphetamines, hallucinogens or other illegal substances while working within the Railroad Right-of-Way, is prohibited and is sufficient cause for immediate removal from the Railroad property. Contractor employees under medication before or while on duty, must be certain that such use will not affect the safe performance of their duties.

Every contractor or consultant that is performing MOW Activities must comply with its obligations under 49 C.F.R. Part 219 to ensure that all MOW employees are being randomly tested for drugs and alcohol. Failure of a contractor or consultant to timely comply with the FRA Regulations may subject that firm to civil penalties. In addition, the Railroad has stated that contractors or consultants who do not comply with the FRA regulations will not be able to work on railroad property.

The term maintenance-of-way (MOW) employee, as used in 49 C.F.R. Part 219, is defined in 49 C.F.R. § 214.7 as “any employee...of a contractor to a railroad, whose duties include inspection, construction, maintenance or repair of railroad track, bridges, roadway, signal and communications systems, electric traction systems, roadway facilities or roadway maintenance machinery on or near track or with the potential of fouling a track, and flagmen and watchmen/lookouts.” (collectively, MOW Activities).

The final rule, which is **effective June 12, 2017**, requires contractors and consultants employing MOW employees to submit a Part 219 Compliance Plan to FRA **prior** to the effective date. Please consult the following link to the model drug and alcohol plan prepared by the FRA for guidance.

<https://www.fra.dot.gov/eLib/details/L02814>

The final rule mandates, among other things, the establishment of a random testing pool to ensure a testing rate of 50% of MOW employees for drugs and 25% of MOW employees for alcohol on an annual basis. For more information related to the requirements, please refer to:

<http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=49:4.1.1.1.14>

### **(3) Surveying Equipment**

- (A)** Measuring tape must be non-metallic to avoid shunting the signal system electric circuits. This will occur when a metallic object is laid across the top of two rails of any track.
- (B)** Electrically rated fiberglass elevation rods must be used to avoid injury in the event contact is made with energized catenary or signal/communication lines. Elevations of catenary wires must be obtained by or under direct supervision of a qualified Railroad Groundman.

**(4) Conduct On or About Track**

- (A) Contractor employees must not enter the track envelope unless it is absolutely necessary in performance of their duty. If it is deemed necessary, then the Contractor employees must walk on tracks or cross tracks only when accompanied by or with permission from a Qualified Railroad Employee of the Railroad. Always use approved walkways when available; otherwise identify and take the shortest safe route after looking in both directions. If more than one track is to be crossed, stop and look before crossing each track.
- (B) The possession of an umbrella on or about tracks is prohibited.
- (C) Contractor employees must not rest any object on their shoulders while they are within the track fouling envelope.
- (D) Expect equipment to move on any track, in any direction, at any time. Contractor employees must look in both directions and have permission from a Qualified Railroad Employee before:
  - 1. Fouling track
  - 2. Crossing track
  - 3. Going between or around end of equipment or structure
  - 4. Moving out from between or under equipment of structure
  - 5. Getting on or off equipment
  - 6. Performing any other applicable operation
- (E) When required by a conductor/flagman or other Qualified Railroad Employee to vacate tracks, the Contractor employees must comply immediately.

**(5) Catenary Electric Systems**

- (A) All overhead wires must be considered energized (LIVE) at all times except when it is known they have been de-energized and properly grounded.
- (B) Until the wires are de-energized, properly grounded, and a Groundman has notified that the overhead wires are such, all Contractor employees must not approach within 10 feet of transmission systems wires, catenary system or signal power wires.
- (C) At the beginning of each tour of duty, the Groundman will instruct the Contractor foreman and each Contractor employee, in the crew, of the dangers surrounding them, calling their particular attention to any hazards to be avoided in performance of the work.

- (D) Whether due to inadequate knowledge of the English language or for any other reason, a Contractor employee who, in the opinion of the Groundman, does not understand the instructions given, shall not be permitted to work or observe, on railroad property, unless such employee is accompanied by a translator, at all times. It shall be the contractor's responsibility to provide the translator.
  - (E) When clearances have been obtained and the wires, equipment or apparatus properly grounded, the Groundman will indicate to the Contractor foreman and the crew the location of wires, equipment or apparatus from which power has been removed and the location of the grounding devices applied. The Groundman must obtain on standard form, the signature of the Contractor foreman indicating that he and the crew have been so instructed, and will confine their work within the limits as outlined to them by the Groundman.
  - (F) When the Groundman leaves his crew for any reason, he must notify the Contractor foreman and each person in the crew to stop all work in the vicinity of the wires, personally assuring himself that all persons have moved to a safe distance away from the work area before his departure. The Groundman will obtain the signature of the Contractor foreman on standard form, that he and the crew have been informed that the Groundman is leaving the gang and they will not resume work until advised to do so on return of the Groundman.
  - (G) When the clearances are to be released, the Groundman will inform the Contractor foreman and each person in the crew and will personally observe that all persons have moved to a safe distance from the wires, equipment or apparatus to be energized, before removing the grounding devices. The Groundman will obtain the signature of the Contractor foreman, on a standard form, stating that he and the gang have been advised that the wires, equipment or apparatus have been energized, and that they will remain at a safe distance from them until informed otherwise by the Groundman.
  - (H) The Groundman will inform the Contractor foreman if any Contractor employee on the job is unsafe and will not comply with instructions. If trouble is experienced with the Contractor foreman in maintaining safe working conditions, the Groundman will immediately notify his supervisor.
- (6) Aerial Catenary Construction by Qualified Contractor Employees**
- (A) Aerial catenary work addressed in this Section shall include all overhead wire work shown in the contract.
  - (B) Aerial catenary work by the Contractor shall be done in accordance with the Railroad's safety rules and in accordance with the National Electric Safety Code. Failure to comply with these rules could result in removal of "Qualified" privileges and or removal from the project.

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- (C) Due to the specialty nature of the work, limited construction periods available, and high quality of work required, the aerial catenary construction is to be done only by qualified Contractor employees (except as outlined in section (E)). Only Contractor employees that meet the requirements of the International Brotherhood of Electrical Worker's standards for Journeyman Lineman and who have successfully completed a Metro-North power orientation class shall be considered a Qualified Employee. The Power orientation class will be given periodically and will require less than one-half day to complete. Approval for qualification shall be determined by Metro-North and that approval shall not be unreasonably withheld.
- (D) Metro-North approved Journeyman Lineman shall be issued identification as workers qualified to perform aerial catenary work. Qualified Contractor employees shall work according to the Railroad's MN-290 Electrical Operating Instructions. Metro-North approved Journeyman Lineman are authorized and expected to work within 3 feet of 13.5 kV energized overhead catenary. Contractor employees shall not de-energize circuits, place initial grounds, or provide protection for others.
- (E) Apprentice Lineman shall be permitted to assist qualified Journeyman Lineman and work under their direct supervision within the following guidelines:
- i. The number of apprentice linemen allowed to work on the catenary will be one less than the total number of Metro-North Railroad Power Department Class "A" employees assigned to each contractor work operation. Additional groundmen will not be assigned to facilitate the use of Apprentices. (ex. 3-5 men crews are working a section of wire removal under the power outage protection of 2 Metro-North Railroad Power Department Class "A" employees, This contractor work operation may utilize one apprentice lineman.)
  - ii. No additional track or power outages shall be granted for the protection of apprentice Linemen.
  - iii. The Apprentice Linemen shall maintain an extended reach minimum approach distance of 10 feet to all railroad transmission wires, Catenary system, and signal power wires until such wires are de-energized, tested for potential, properly grounded, and proper protection afforded by a qualified Power Department Class "A" employee.
  - iv. The Contractor and his Safety Officer shall enforce the minimum approach distances and submit to the engineer a program to monitor and audit compliance of this procedure.

Apprentice Lineman are prohibited from coming closer than 10 feet from all overhead wires or circuits regardless of whether they have been de-energized or not.

## **(7) Safety Program and Plan**

- (A) Prior to the commencement of work the Contractor shall submit a “Working on the Railroad Safety Plan” that will include a Program which implements the plan. The submission shall be made to the Engineer or a duly authorized representative and forwarded to the Railroad for compliance with this specification. This plan is separate to the Health and Safety Plan required for other aspects of the project (i.e., lead, excavations, etc.).
- (B) Each employee of the Contractor, Subcontractor or others on site shall take and pass the Railroad Safety Training available on-line at [www.contractororientation.com](http://www.contractororientation.com) prior to being allowed to work on the project. In accordance with Section 3 below, there is no direct payment for all costs associated with this training process. Upon completing the on-line training, each employee will be able to print a temporary certification of completion. The temporary certificate will be valid only until the employee receives their photo ID card and sticker by mail in 7-10 business days. Until the ID card and sticker arrive, the employee must carry the temporary certificate and be prepared to present it at all times while on railroad property. All employees receiving this training will receive a Registered Hard Hat sticker that will identify them as a trained employee. No Contractor employees are permitted on the Railroad Right-of-Way without evidence of this training. Contractor employees shall be responsible for renewal of this training annually.
- (C) All contractor employees entering the railroad right-of-way must attend and acknowledge the daily job briefings prior to commencing any work. The qualified railroad employees will conduct the job briefings.
- (D) The Contractor shall hold "TOOL BOX" safety meetings for their employees at least once a week that will be documented and attendees listed.
- (E) The Contractor supervisor shall attend a monthly Railroad Safety Meeting.

## **2. Insurance Requirements – Metro-North Railroad**

The Contractor engaged in work on the project shall be required to comply with the requirements set forth under Article 1.03.07 – Insurance of the Standard Specifications, its supplements and special provisions contained herein.

## **3. Cost Associated with this Specification**

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- (a) There shall be no direct payment for compliance to this specification. All costs associated with any regulatory requirements, traffic regulation, specification administration, coordination, materials and incidentals required to fulfill the requirements of this specification will be considered as included in the general cost of the work and distributed in all items.
- (b) Any work, material's supplied, inspections and protective services by the Railroad as described in the plans and specification, expressly needed for the construction of the project, will be compensated to the Railroad by the Engineer under a separate agreement.”

## **ITEM #0686011.48A – JACKING 48” R.C. PIPE (CLASS V) – 0’ – 20’ DEEP**

**Description:** Work under this item will consist of furnishing and installing twin 48-inch Reinforced Concrete Pipes - Class V, by jacking, as shown on the plans and in conformity with these Special Provisions. Work under this item also includes the design, construction and removal of the jacking pit, reaction wall, and the receiving pit. Work under this item also consists of contact grouting of the pipe, and any soil stabilization ahead of the pipe jacking. All submittals that are required under this Special Provision are part of the work.

All work shall be performed in accordance with all local, state and federal regulations. In addition, work shall be performed in accordance with the current American Railway Engineering and Maintenance-of-Way Association’s (AREMA) Manual for Railway Engineering, Chapter 1, Section 4.15, “Earth Boring and Jacking Culvert Pipe Through Fills”. The Contractor shall be solely responsible for all damages resulting from ground movement associated with pipe jacking or the associated construction.

Monitoring for settlement of the tracks and movement of adjacent structures shall be performed in accordance with the Item “Settlement Monitoring Program” as supplemented herein.

### **Materials:**

**Pipe:** The pipe shall conform to the requirements of Article M.08.01-7 of the Standard Specifications, amended as follows. The pipe shall conform to the current requirements of ASTM C76 (AASHTO M 170), Class V, Wall C with joints sealed with continuous rubber ring gaskets. Outside pipe walls shall be straight. The pipe sections shall have grout holes, tapped for no smaller than 1.5-inch pipe, cast into the pipe during manufacture. Maximum spacing of contact grout holes shall not exceed ten (10) feet from center to center, with a minimum of one set of grout holes per pipe segment. Grout holes shall be installed in sets of three at the 12 o'clock, 4 o'clock, and 8 o'clock positions. Grout fittings and plugs shall meet the requirements of ASTM A53, Type E or S, Grade B. Plugs shall be recessed to maintain a smooth interior pipe surface.

Concrete pipe joints shall be sealed with rubber gaskets. The design of the joints and the physical requirements for rubber gaskets shall meet the requirements of ASTM C443. Joints shall be capable of being sealed so as to remain tight under all conditions of service. Details of joint formation shall follow the recommendations of the manufacturers of the joint material and of the pipe.

Concrete pipe shall be manufactured with tongue and groove joints which provide a smooth outside surface. The joint shall be detailed to be compatible with the Contractor’s jacking procedure to resist the axial forces imposed by jacking without damaging the pipe.

No pipe shall be ordered until written approval of the pipe submittal is received from the Engineer.

**Contact Grout:** The Contractor shall submit the grout mix proposed to completely fill the voids outside the pipe. All grout mix proportions shall be subject to review and acceptance by the Engineer.

### **Construction Methods:**

**Submittals:** Prior to the start of this work, the Contractor shall submit his Work Plan, Working Drawings, Calculations, and Contingency Plan in accordance with Article 1.05.02 of the Standard Specifications, Form 817. All work plans, working drawings, and calculations shall be signed and stamped by an Engineer licensed in the State of Connecticut.

#### 1. Qualifications

The Contractor shall submit written documentation as supporting evidence of the qualifications of the Subcontractor, hereinafter referred to as the Contractor, responsible for the pipe jacking, of the superintendent, and of the site safety representative. The documentation shall include descriptions of at least three similar pipe jacking installations performed by the Contractor within the last five years, along with project owner contact information. The documentation shall also include a list of all similar projects performed by the Contractor within the last five years for Connecticut municipalities or the Connecticut Department of Transportation. The jacking superintendent shall have at least five years' experience involving jacking construction. The Contractor's operator(s) shall have technical training in the operation of the proposed equipment and shall have completed at least two pipe jacking projects.

The jacking and receiving pits excavation support shall be designed by a Professional Engineer registered in the state of Connecticut.

Name and qualifications of personnel to be used for instrument installation. The qualifications shall show that the personnel have a minimum two years' experience in the installation of geotechnical instrumentation similar to that specified herein. The surveyor for monitoring surface control points shall be a land surveyor licensed in the state of Connecticut with previous experience surveying for the detection of surface deformations.

#### 2. Work Plan and Working Drawings:

A) Pipe Jacking: A detailed, description of the pipe-jacking equipment and procedures to be employed, including:

- 1) Methods for steering and for monitoring line and grade.
- 2) Manufacturer's literature describing details of the proposed jacking system.
- 3) Description of method and capabilities for controlling ground conditions at the tunnel heading and for controlling ground loss.



- 4) Estimation of the maximum jacking force required to complete the pipe installation.
- 5) Dimensions, strength, joint details and manufacturer's details of the pipe to be used.
- 6) Details for cushioning the pipe joints during jacking.
- 7) Drawings, and details for the pipe jacking shield or tunnel machine, including details of cutterhead, jacking propulsion system, safety systems, face support capabilities, and steering jack provisions for making line and grade corrections.
- 8) Details for supporting the face during tunneling and while tunneling operations are interrupted.
- 9) Manufacturer's product information, cutterhead design details, working arrangement drawings, specifications, and operating procedures.
- 10) Drawings and details showing excavation and mucking systems.
- 11) The machine manufacturer shall provide a written guarantee that the machine is capable of withstanding the anticipated loads and ground conditions. If the Contractor provides a shield that they have designed and built, then a Professional Engineer registered in the State of Connecticut shall review the design and certify that it is capable of withstanding the anticipated loads and ground conditions.
- 12) Arrangement and position of main jacks, thrust ring, jacking controls, and pressure gages.
- 13) Thrust block and jacking frame design and details, including reaction transfer calculations.
- 14) Details of pipe lubrication system and description of pipe lubricants to be used during pipe jacking, including manufacturer's literature.
- 15) Details of water control plan including temporary dewatering provisions, details for the control, treatment, and disposal of groundwater and construction water in compliance with local, state, and federal requirements.
- 16) Shop drawings of pipe material, joints, contact grout fittings and plugs, cushion materials, and fabrication tolerances.
- 17) Details of any Soil Stabilization work required in association with the jacking procedure.
- 18) Details for removing rock encountered during tunneling.

#### B) Jacking and Receiving Pits

1) Design and geometry of jacking pit excavation and support system, including details such as launching seals. The Contractor shall have sole responsibility for sizing the pit excavations, except where maximum sizing limits based on environmental constraints are noted on the Drawings. The size of the pits shall be adequate to construct all structures indicated and allow room for jacking pipe, equipment, and operations. The jacking pit and receiving pit walls shall be located as shown on the Drawings. The excavation support walls located closest to the railroad tracks shall be designed such that they do not move laterally more than one (1) inch during construction. The Contractor shall locate the jacking and receiving pits at the locations required to construct the pipeline between the stations indicated on the Drawings.

2) The portion of jacking and receiving pit walls located beneath the restricted excavation line, defined as 1V:2H lines sloped outward and downward from the track shoulder as shown on the drawings, shall be cut off and left in place. The exception to this requirement is when finished grade is less than 2' above the restricted excavation line, in which case the portion of walls more than 2' below finished grade shall be cut off and left in place.

3) Drawings indicating arrangement of supports and construction sequence for proposed support system(s). Show the elevation of struts, braces, or other supports as related to the depth of the excavation. Indicate sizes, shapes, and material specifications for all support elements, including lagging, if used.

4) Design of jacking and receiving pit walls for the pipe culvert shall be designed for all loads including railroad surcharge loads (including Cooper E80 train loading).

### C) Contact Grouting

1) Work Plan indicating contact grouting details, specifications of equipment, grouting procedures, sequences and injection pressures, monitoring and recording equipment, pressure gauge calibration data, methods of controlling grout pressure, method of transporting grouting equipment and materials within the pipe.

2) Details of grout mixes including proportions, admixtures, manufacturer's literature, and laboratory test data verifying the strength of the proposed contact grout.

3) Grouting Spoil Disposal Plan describing contact grouting spoil handling and disposal procedures. No grouting spoils of any kind shall be allowed to enter the drainage system. Removal and disposal is the responsibility of the Contractor and shall be performed using Best Management Practices and in accordance with applicable local, state, and federal regulations.

### 3. Calculations:

#### A) Pipe Jacking

1) Design calculations demonstrating that the pipe is capable of sustaining the maximum stresses to be imposed during jacking. The calculations shall consider maximum ground loads, live loads, jacking forces, eccentric forces due to steering and other loads that may be reasonably anticipated. Loads shall be shown and described. A minimum factor of safety of 3.0 shall be used.

2) Calculations demonstrating that the materials behind the thrust block will sustain the maximum planned forces developed by the main jacks.

3) When computer calculations are included with design calculations, the following documentations shall be furnished as a minimum:

--A synopsis of the computer program(s) stating briefly required input, method of solution, approximations used, second order analysis incorporated, specifications or codes used, cases considered, output generated, extent of previous usage or certification of program(s) and program(s) author.

--Identification by number, indexing and cross referencing of all calculation sheets, including supplemental "long-hand" calculation sheets.

--Fully identified, dimensioned, and annotated diagram of each member of structure being considered.

--Clear identification and printing of all input and output values, including intermediate values if such values are necessary for orderly review.

--Identification of the processing unit, input/output devices, storage requirements, etc., if such supplemental information is significant and necessary for evaluation of the submittal.

## B) Jacking and Receiving Pits

1) Design calculations demonstrating that the pit excavation support systems and working slabs are able to withstand earth pressures, hydrostatic pressures, bottom heave, equipment load, live loads, and other surcharge loads. Acceptable excavation support methods include the use of steel plates with steel rib supports, sheet piling and bracing, soldier piles and lagging, or other methods approved by the Engineer. Predrilled holes may be required to provide sufficient toe embedment for the lateral support system.

2) Design calculations demonstrating that each member or support element can support the maximum loads that can occur during construction with appropriate safety factors.

3) Design calculations demonstrating that the support system minimizes horizontal and vertical movements to protect adjacent structures/utilities from damage. Design support system to maintain the stability of the excavation against sliding or bottom heave. Employ wales, struts, and beams for bracing and lateral support as required for the excavation faces supported by soldier piles and lagging, liner plate, or sheeting systems. Provide struts with intermediate vertical and horizontal supports as required to prevent buckling. Provide timber lagging, precast concrete lagging, liner plates, or steel plates as required to retain soil between supports.

4) Design of a suitable groundwater control system for each pit excavation that extends below the groundwater level. System shall control groundwater inflows, drain the excavation, prevent piping or loss of ground, and maintain stability of excavations.

5) Design of a working slab for each pit bottom to provide stable support for construction operations and to resist hydrostatic uplift.

6) Design of break out framing and suitable launching seals, ground improvement and/or ground treatment provisions (if required as dictated by actual field conditions encountered), to maintain excavation support and to prevent groundwater inflow or loss of ground when breaking out or into pit excavations. Breakout plans shall indicate support installed and ground stabilization or treatment measures implemented to maintain excavation support and stability when breaking out of jacking pit and when holing through into receiving pit. Provide details of launching seals and ground improvement provisions to control groundwater inflows and minimize loss of ground when breaking into or out of pit excavations.

## 4. Schedule:

A schedule for pipe jacking identifying all major construction activities as independent items shall be provided by the Contractor. The schedule shall include as a minimum the following

activities: mobilization, groundwater control at jacking and receiving pits; pit excavation and sequence of installation for temporary excavation support; jacking equipment setup; pipe installation for each drive; contact grouting of pipe; site restoration and cleanup; and demobilization. The schedule shall also include the working hours for each activity, and a written description of the construction methods and equipment to be employed in completing each of the work activities shown on the schedule.

Reports and Records: Reports and records shall include:

- 1) Survey notes, records, and shift reports indicating thrust force, rate of advance, and line and grade deviation.
- 2) Monitoring data of horizontal deflections and vertical settlement of excavation supports.
- 3) Daily logs of grouting operations, including time of pumping, hole locations, pressures, volumes, and grout mix pumped.
- 4) The Contractor shall submit field notes and daily logs upon completion of the shift. Other reports and records shall be submitted no later than 8 hours after the shift to which they apply unless a longer time period is approved in writing by the Engineer.

#### 5. Contingency Plan:

The Contractor shall submit a plan indicating what the Contractor will do if settlement or heave greater than the allowable movement is measured or observed as addressed in the item "Settlement Monitoring Program". The plan shall include methods and procedures for ground improvement (if required), leveling the track bed below the railroad tracks if excessive settlement occurs, and procedures for contacting the Engineer, and other items. If required, ground improvement methods would require evaluation of subsurface conditions encountered during construction and approval by the Engineer. The Contractor shall also submit a work stoppage plan that outlines all requirements for stabilizing the work site during active jacking in the event that the Contractor is not able to continue advancing the pipe for any reason. This plan shall include details for securing the lead end of the pipe and any standby equipment required for the work stoppage.

#### **Equipment:**

Pipe Jacking Shield: The machine or shield used for pipe jacking shall be designed to sustain any ground loads which may be imposed upon it as well as any loads imposed by the thrust jacks, and steering mechanisms. The machine shall be capable of being controlled to the desired line and grade within the specified tolerances. The machine shall have a cutterhead or employ other excavation methods capable of excavating both natural soil and boulders, and improved ground material (if required to be in-place). Use of a roadhead or an electric excavator mounted inside of an open face shield is also acceptable. The machine shall also satisfy the following requirements:

- 1) The machine shall be capable of advancing through the geologic conditions described in the subsurface data provided. The machine shall also be capable of excavating, handling, and removing improved ground (if required prior to pipe jacking) of whatever strength and consistency.
- 2) The shield or tunneling machine shall be designed to minimize the loss of ground ahead of, and around the shield.
- 3) The machine shall be steerable in both vertical and horizontal directions to maintain line and grade within the specified tolerances. Provide steering jacks as required to correct line and grade deviations during jacking. If a rotary-type cutterhead is used, the cutterhead shall have a reversible drive system so that it can rotate in either direction to minimize rotation or roll of the pipe during installation.
- 4) The machine shall be equipped with suitable safety systems in accordance with applicable OSHA requirements for underground construction equipment.
- 5) The tail of the machine shall have gaskets to prevent material from moving into the tunnel through the joint between the tail skin and the pipe.
- 6) The jacking system shall be capable of continuously monitoring the jacking pressure, the rate of advancement, and the distance jacked. The jacking system shall develop a uniform distribution of jacking forces on the end of the pipe.

Contact Grouting: Equipment for mixing and injecting grout shall be adequate to satisfactorily mix and agitate the grout and force it into the grout holes, in a continuous flow at the desired pressure. Grout injection shall be performed with a progressing helical cavity type pump capable of continuously developing a uniform pressure of 14.5 psi at the grout hole connection with minimum pulsation.

Two pressure gauges shall be provided, one at the grout pump and one at the collar of each hole being grouted. The accuracy of the gauges shall be checked at least weekly with an accurately calibrated "test gauge". The "test gauge" shall not be used for actual grouting. The "test gage" shall "be stored on site in the Contractor's office. An adequate supply of spare pressure gauges shall be available on site at all times.

Suitable stop valves shall be provided at the collar of each hole for use in maintaining pressure as required until the grout has set.

The grouting equipment shall be provided with a flow meter to determine the volume of grout injected. The meter shall be calibrated in gallons to the nearest one-tenth of a gallon. The grouting equipment shall be maintained in satisfactory operating condition through the course of the work to ensure continuous and efficient performance during grouting operations.

Grout hoses shall have an inside diameter not less than 1.5-inch nor greater than 2.5-inch and shall be capable of withstanding the maximum water and grout pressures to be used.

Instrumentation: Instrumentation equipment not installed in the ground shall remain the property of the Contractor following completion of the work.

### 1) Surface Control Points

Surface control points shall be established as shown on the Drawings and described herein.

In paved areas, use inscribed marking or approved surveyor's nail (PK) driven flush with the surface of paved areas.

In non-paved areas, surface control points shall be established by driving a 3" by 3" by 2' (approximate dimensions) long timber stake flush with the ground. Each control point shall have a tag or marking indicating the pipeline station and offset from proposed pipe centerline.

Surface control points (settlement monitoring points) shall be established for each track at the intersection with the pipe culvert centerline (four points), and three additional locations on each side of the culvert at approximately 10' intervals (twenty four more points), as shown on the drawings. Settlement monitoring points for railroad tracks shall be mounted to steel rods driven into the ballast between cross ties or painted or similarly marked locations on the rail that adequately identify the monitoring point to allow for consistency in monitoring of the point using survey equipment and operators positioned without fouling a track. No markings shall be made on any part of the rail without approval of the Engineer.

Surface control points shall be established with a paint mark along the top of the jacking and receiving pit walls located closest to the Railroad (three control points per closest jacking and receiving pit wall). The purpose of these points is to measure horizontal movement of the wall.

### 2) Intermediate Control Points

Intermediate control points shall be established at the junction of each track centerline and the centerline of the proposed pipes as shown in the Drawings for a total of eight points.

The intermediate control points shall be established as shown on the Drawings by drilling a 3-inch diameter hole to within 5 feet of the proposed crown and installing a #8 rebar. The rebar shall be driven 1 foot below the bottom of casing into undisturbed soil. The remainder of the hole shall be cased with PVC pipe up to the ground surface. At least one centralizer shall be placed in the pipe.

## **Installation**

Pipe Jacking The pipes to be installed under the railway embankment shall be placed to the line and grade shown on the Drawings, using a jacking method. Jacking shall not begin until the following conditions have been met:

- 1) Required submittals have been made and the Engineer has completed review of all submittals.
- 2) Jacking pit excavation has been completed and supported in accordance with submitted Contractor design.
- 3) Pre-job safety conference has been conducted in accordance with OSHA requirements. Arrange this conference and inform the Engineer of the time and place of the conference not less than three working days in advance.

4) The Contractor's site safety representative shall prepare a code of safe practices and an emergency plan in accordance with OSHA requirements. Provide the Engineer with a copy of each prior to starting pipe jacking.

5) All Railroad requirements have been satisfied and copies provided to the Engineer.

Pipe installation shall be completed in accordance with the approved submittals. The pipe shall be installed between the limits indicated on the Drawings to the specified line and grade, utilizing methods that include due regard for the safety of workers, adjacent structures, utilities, and the public. Any damage shall be immediately repaired to the satisfaction of the agency or utility having jurisdiction, at no additional cost to the Department.

Adequate control of the elevation and direction of the pipe shall be provided by means of a device that can alter the direction of the pipeline heading. This device shall adequately alter the direction of the leading section or shield when measurements made during the jacking operations show that the pipe or shield is drifting off the required line and/or grade.

Soil stabilization shall be performed in advance of the jacking operation as required to stabilize the soils, control water, prevent loss of material and prevent settlement or displacement of embankment.

The materials to be used and the method of injection shall be prepared by a Registered Professional Soils Engineer, or by an experienced and qualified company specializing in this work and submitted for approval to the Engineer before the start of work. Proof of experience and competency shall accompany the submission.

The following conditions shall be met by the Contractor:

1) Unless otherwise approved by the Engineer, pipe jacking shall be conducted continuously, on a 24 hour basis until the leading edge is beyond the limits of live load influence. Monitoring shall be performed during all pipe jacking work. At any interruption of the jacking operation, the heading shall be completely bulk-headed to the satisfaction of the Engineer as well as any other requirements of the work stoppage contingency plan.

2) The contractor shall comply with all Railroad requirements and regulations including but not limited to:

--Participation and proof of completion in a current Metro-North on-line safety orientation class of all persons entering Railroad property.

--Railroad safety rules.

--Drainage, water discharge, grouting spoils and tunneling spoils disposal. The contractor shall also comply with sedimentation control requirements shown on the drawings and contained in the project permit.

--The presence of any Railroad personnel required during construction such as Flagmen/Groundmen or engineers.

Each pipe section shall be jacked as the excavation progresses in such a way that leaves no length unsupported unless approved otherwise by the Engineer. Pipes shall be jacked into place without damaging the pipe or the interior lining. In the event a section of pipe is damaged during the jacking operation, the pipe shall be jacked through to the receiving pit and removed. Other methods of repairing the damaged pipe may be used, subject to approval by the Engineer.

A lubrication system using bentonite and/or polymers shall be provided as necessary to minimize pipe friction.

The axial forces from the thrust jacks shall be distributed to the pipe uniformly through a ring of cushion material to prevent damage to the ends of the pipe. The cushioning material shall prevent contact between joint surfaces.

At a minimum, the thrust force, rate of advance, distance along the drive, deviation from line and grade, and steering jack adjustments shall be monitored and recorded within the first 12 inches and within the last 12 inches of each pipe segment installed.

The thrust block shall be properly designed and constructed to provide the required resistance to the forces developed by the main jacks. The thrust block shall be constructed normal to the pipe alignment and designed to support the maximum obtainable jacking pressure developed by the main jacking system.

Where boulders or other large obstructions are encountered which prevent the advancement of the pipe while it is being jacked, such obstructions shall be cut or otherwise broken off to the plane of the outer surface of the pipe. When such cutting or breaking off of the obstruction is not practicable, the obstruction may be completely removed by such methods as proposed by the Contractor and approved by the Engineer.

Blasting under this item will not be allowed for any purpose.

The Contractor shall not use water to aid in loosening the material, including large obstructions ahead of the pipe, to aid in removing material away from the front end of the pipe, nor for any other purpose in connection with the pipe installation.

The use of open trench method of excavation within the limits for jacking shown on the Drawings will not be permitted.

Where voids are unavoidably created outside the pipe during the advancement of the pipe or due to removal of material at the front of the pipe, such voids shall be immediately filled with damp sand, damp sand-clay or other suitable material, rammed into place.

The jacking pit, receiving pit, and the pipe shall be kept relatively dry during the progress of the jacking work.



Adequate provisions shall be made to assure that no voids will be left outside the pipe during the jacking work or after the work has been completed. Immediately upon completion of the jacking operation the pipeline shall be contact grouted. The grout holes shall subsequently be cleaned and suitably plugged.

The Contractor shall control settlement or heave above the pipeline so that the following limit is not exceeded:

Existing railroad tracks: 0.25-inch horizontal or vertical

Monitoring shall be in accordance with the item "Settlement Monitoring Program" supplemented with additional requirements herein. If the above settlement or heave limit is exceeded, pipe jacking shall stop, the face of pipe jacking shall be bulk-headed, Metro-North and the Engineer shall be notified and a meeting held to review the Contractor's contingency plan (required by this Specification) and actions to be taken by the Contractor. The contingency plan shall then be implemented, with any necessary modifications required by Metro-North and the Engineer, at no additional cost to the Owner.

Control of Line and Grade The Contractor shall use local benchmarks to furnish and maintain all reference lines and grades for the pipe installation. The Contractor shall also use these lines and grades to establish the exact location of the pipe using a laser guidance system on the tunneling machine.

The Contractor shall submit to the Engineer copies of field notes used to establish all lines and grades and provide 24 hours advance notice to allow the Engineer to check laser set up prior to beginning pipe jacking. The Contractor shall be fully responsible for the accuracy of the work and any corrections, if required. The Contractor shall use an acceptable laser system to monitor line and grade continuously during pipe jacking operations. Laser supports shall be independent of working slab, jacking frame and thrust block to avoid movement of the laser during jacking. The Contractor shall stop pipe jacking operations and reset laser immediately if movement of laser occurs during the Work. The Contractor shall monitor line and grade continuously during pipe jacking operations and record deviation with respect to design line and grade at least once per 5 feet and submit records to the Construction Manager as requested. The Contractor shall control line and grade of the pipe to within the following specified tolerances:

Design line: 4 inches

Design grade: 2 inches

When the excavation is off line or grade, make the necessary corrections, and return to the plan alignment at a rate of not more than 1-inch per 25 feet.

If the pipe installation exceeds the specified tolerances, correct the installation; all corrective work shall be performed at no additional cost to the Owner, and is subject to the approval of the Engineer.

Once per shift, the line and grade shall be checked by the Contractor's surveyor. Provide the Engineer with equipment to check the line and grade, as requested. Said checking shall not substitute for the Contractor's own line and grade control responsibilities.

Temporary Excavation Support at Jacking and Receiving Pits Jacking and receiving pits shall be located according to the Contractor's design submittal unless otherwise approved by the Engineer. Location of the excavation supports shall be within 4 inches of those shown on the submitted working drawings.

Install excavation support in accordance with submittals that have been reviewed and accepted by the Engineer. The Contractor shall not proceed with excavation to the next level until bracing has been installed and tightly blocked or shimmed to provide proper support of the excavation. If, in the opinion of the Engineer, support deflections indicate that the support system requires modification to prevent movements exceeding allowable, the Contractor shall submit a redesign and revised Working Drawings and calculations to the Engineer at no additional cost to the Department.

Perform all excavation regardless of the type or nature or conditions of the material encountered at no additional cost to the State. Method of excavation used is optional. Use hand methods for excavation that cannot be accomplished with mechanical excavation equipment without endangering existing or new structures or other facilities.

The temporary excavation support walls located closest to the railroad embankment shall not move laterally more than one (1) inch. Surface control points established at the top of each jacking and receiving pit wall located closest to the Railroad shall be used to monitor lateral movement of temporary excavation support walls. Monitoring of these surface control points shall be made at the same frequency and to the same precision as all settlement monitoring points as required in the Item "Settlement Monitoring Program" and as supplemented herein.

Contact Grouting Contact grouting shall commence immediately, not to exceed 2 hours, following completion of pipe jacking. Contact grout shall be used to fill any voids outside the pipe. An attempt shall be made to hook up and pump grout at every port coupling unless variance is granted by the Engineer.

All material should be free of lumps when put into the mixer and grout mix shall be constantly agitated. Grout shall flow unimpeded and shall completely fill voids. Grout not injected after 90 minutes of mixing shall be discarded.

The locations of contact grout holes in the pipe are specified herein. Drilling grout holes through the pipe will not be permitted.

The grouting process shall be operated and controlled so that the grout will be delivered uniformly and steadily.

Grouting shall generally progress sequentially in an upgrade direction from one grout hole to the next grout hole in the sequence indicated in the approved submittals.

Inject grout through grout fittings to completely fill all voids outside the pipe. Grout pressure shall be controlled to avoid damage to the pipe. Remove plugs and clean out adjacent grout ports and install a valve to check for communication. Leave valves open and inject grout until communication is observed, then close valves until grout has set.

The sustained grouting pressure shall not exceed 14 psi at the grout hole collar connection unless approved otherwise by the Engineer.

All grouting operations are to be performed in the presence of the Engineer, Notify the Engineer at least 24 hours in advance of starting contact grouting operations.

No drilling or grouting spoils, runoff, or sediment of any kind shall be allowed to enter the drainage system. The Contractor shall provide for adequate disposal of all waste and wastewater from pipe grouting work and remove and properly dispose of all waste grout resulting from grouting operations in accordance with sediment and erosion control requirements shown on the Drawings and contained in the project permit, and with any applicable local, state, Railroad, and federal regulations. Grout spills shall be minimized and all cleanup of grout and waste materials shall be performed immediately to avoid damage to the pipe. The content of grout lines shall not be discharged into the tunnel. Removal and disposal shall be performed according to the approved grouting spoil disposal plan using Best Management Practices.

Recirculate grout mixes when any new mix is batched or after adding water, fluidifier, or sand to mix. Recirculate mix for at least two minutes prior to pumping grout into grout holes.

Instrumentation - Instrumentation shall be installed at the locations shown on the Drawings, and as approved by the Engineer. Installation shall be performed according to the schedule approved during the submittal process. In general, instrumentation and monitoring requirements shall be in accordance with the item "Settlement Monitoring Program" and as supplemented herein.

The Contractor shall install all surface control points at least two weeks prior to construction of the pipeline or jacking pits. The Contractor shall take two initial readings following installation and submit them to the Engineer. If baseline readings differ, the Contractor shall take additional readings as required to establish an adequate baseline, in the opinion of the Engineer.

The Contractor shall provide the Engineer with safe access to and assistance required for obtaining monitoring data, including adequate traffic control provisions. The Contractor shall notify the Engineer immediately of any damage to an instrument or if an instrument becomes non-functional for any reason. Replace or repair damaged or non-functional instruments or monitoring points within 24 hours of noting damage.

## 1) Control Points

Control points for monitoring settlement and heave shall consist of surface control points, and intermediate control points. Control points shall be placed prior to pipe jacking.

The Contractor shall establish all control points, and modify surface control point at the locations indicated on the Drawings during construction, as required for settlement and heave control and as required by the Engineer or site conditions. The survey measurements shall consist of determining the elevation of surface control points and the elevation and horizontal coordinates of other instrumentation elements with respect to the benchmark(s) approved by the Engineer. Elevations shall be determined to an accuracy of  $\pm 1/8$ -inch. A rotating laser level shall be used for monitoring surface control points during construction. The laser shall be set up outside of the zone of settlement. Radio communication shall be provided so that surveyors on the ground surface can communicate with the machine operator. Radio communication shall additionally be provided between surveyors and the Railroad as required by the Railroad.

Provide survey data for control points to the Engineer in the field immediately after measurements are made and in the daily monitoring report. Survey data shall be immediately compared to baseline and any previous survey data to determine the amount of settlement that has occurred.

Any points that have movements exceeding specified settlement limits shall be immediately brought to the attention of the Engineer. All survey information shall be provided immediately to the Railroad's field representative.

## 2) Monitoring Frequency

Location	Control Point Type	Monitoring Frequency	Notes
Railroad	Surface control points and Intermediate Control Points	Every two hours, and immediately prior to and Following train traffic during pipe Jacking.	Additional Monitoring if required by the Railroad
Jacking Pit/ Receiving Pit	Surface Control Points on Jacking and Receiving Pit walls	Twice Daily or as required by the Engineer	Additional monitoring required if significant movements are observed.

After completion of the pipeline, surface, and intermediate control points shall be read once weekly for four weeks. Surface control points at the jacking and receiving pits shall be read weekly until the headwall and end wall are constructed and the jacking and receiving pits are backfilled.

- 3) Removal of Instruments - Where directed by the Engineer, leave surface control points in place after project completion for continued monitoring by the Engineer. Remove or grout in place all other surface control points during the cleanup and restoration work, as required by the Engineer. Any damage to existing utilities or structures caused by the Contractor's operations shall be repaired by the Contractor, at no additional cost to the Owner.

**Method of Measurement:** JACKING 48" R.C. PIPE (CLASS V) – 0' – 20' DEEP will be measured for payment by the actual number of linear feet of pipe installed by jacking methods, completed and accepted, measured in place. Limits of the pipe jacking shall be as shown on the Drawings unless otherwise approved by the Engineer. Removal of soil ahead of and around the jacked pipe, contact grouting, design, construction, monitoring for lateral movement of jacking and receiving pit walls, advance soil stabilization, removal of jacking and receiving pits, and backfilling, shall be incidental to pipe jacking.

**Basis of Payment:** This work will be paid for at the contract unit price per linear foot of JACKING 48" R.C. PIPE (CLASS V) – 0' – 20' DEEP, complete in place, which price shall include: the design, construction, and removal of jacking and receiving pits; pipe jacking, pipe materials; dewatering; backfilling; submittals; final contact grouting; instrumentation, monitoring of for vertical and lateral movement, soil stabilization, and all materials, equipment, tools and labor incidental thereto. The contract unit price shall also include cutting off and leaving portions of jacking and receiving pits in place as required by the Engineer.

Payment for dewatering required for the jacking operation shall be paid for under the items “HANDLING WATER” or “HANDLING CONTAMINATED GROUNDWATER” as applicable.

Payment for the portions of jacking or receiving pit lateral support systems within the plan limits for temporary sheet piling (railroad) shall be paid for under the item “TEMPORARY SHEET PILING (RAILROAD)”.

Payment for the removal of rock in definite ledge formation and boulders, or the portion of boulders, 1 c.y. or more in volume within the limits of the removal necessary for the installation of the concrete pipes using jacking shall be paid for under the item “ROCK EXCAVATION-JACKING PIPE”.