

PIPE RAMMING

****From South Burlington IM SCRP(3)**

- xx. DESCRIPTION. This work shall consist of furnishing and installing cased tunnels by pipe ramming methods without open excavation as shown on the Plans and as directed by the Engineer.

For the purpose of this Section, pipe ramming is defined as the trenchless installation of a pipe by pushing a steel casing using a pneumatically or hydraulically powered driving device. Steel casings rammed in place shall be used as the finish product pipe.

- xx. MATERIALS. Steel pipe casing shall meet the following requirements:

- (a) Casing shall consist of smooth wall carbon steel conforming to ASTM A 139, Grade B and having a minimum yield strength of 241 MPa (35,000 psi).

A Type D Certification shall be furnished in accordance with Subsection 700.02.

- (b) Inside casing diameters are specified on the Plans. Pipe wall thickness shall be determined by the Contractor based on static and dynamic loads from traffic loading and anticipated ramming forces for selected pipe and driven pipe lengths. Pipe casing lengths shall be determined by the Contractor.

- (c) Casing shall have roundness such that the difference between the major and minor outside diameters shall not exceed 1% of the specified nominal diameter or 6 mm (0.25 inch), whichever is less.

- (d) Casing shall have an outside circumference within 1% of the nominal circumference within 13 mm (0.50 inch), whichever is less.

- (e) Casing shall have a minimum allowable straightness deviation in any 3 meter (10 foot) length of 3 mm (1/8 inch).

- (f) All casing shall be square cut with beveled ends for welding. Steel pipe joints shall be pressure fitted or welded.

- xx. QUALIFICATIONS. Not less than two weeks prior to beginning any pipe ramming, the Contractor shall submit certification of the following:

- (a) The pipe ramming contractor must have successfully completed five pipe ramming projects, or installed over 610 m (2000 feet) of steel casing in the last four years using pipe ramming equipment and materials of the type that meet the minimum requirements of the job specification.

10/5/2011

- (b) At least one of the projects must have been completed within one year prior to the date of work under this project. In addition, at least one project must have been in an area with geological and surface conditions similar to those described for this project.
- (1) Submit a complete description of projects for which actual work was performed by the pipe ramming contractor. This list is to include project locations, dates of projects, owner, owner's construction representative, owner's construction representative's current telephone number, type of equipment utilized, type and size of casing pipe used in pipe ramming operations, contract or subcontract amount, description of all litigation and/or unresolved claims in connection with these projects, and any other information relevant to the issue of the successful completion of the projects. Include projects where the pipe ramming contractor was a prime contractor or a subcontractor. If the pipe ramming contractor has not completed any such project(s) other than those which are in progress upon submittal of the information required herein, the pipe ramming contractor must demonstrate to the satisfaction of the Engineer that the cause of the lack of completion is unrelated to criteria determining qualification for this project.
 - (2) The project supervisor(s) and pipe ramming machine operator(s) shall have a minimum of three years experience and two years of pipe ramming experience, respectively, using similar type of equipment required for this project. Submit the names, resume, and experience summary of at least three project supervisors and three pipe ramming machine operators who will be available for this project. Two of the proposed project supervisors and two of the proposed machine operators must be assigned to this project.
 - (3) The pipe ramming contractor must clearly demonstrate that the methods and materials used have a proven track record of at least four years. The Contractor must supply certification from the pipe manufacturer meeting ASTM Standards of the casing pipe material to be used by the pipe ramming contractor, to include test results of the weld for the casing pipe. A description of projects, including project locations, dates of projects, owner, owner's construction representative, owner's construction representative's current telephone number, type and size of casing pipe material and methods of installation utilized, contract or subcontract amount, description of all litigation and/or unresolved claims in connection with these projects, and any other information relevant to the issue of the successful completion of the projects shall be provided.

10/5/2011

- xx. SUBMITTALS. The Contractor shall submit for approval, in accordance with Section 105, complete Working Drawings showing details of the proposed method of construction and the sequence of operations to be performed during construction. Working Drawings shall be prepared, stamped, and signed by a qualified Licensed Professional Engineer registered in the State of Vermont.

Working Drawings shall include, but not be limited to, the following:

- (a) A detailed description of the pipe ramming procedure, including construction techniques to install pipe in conformance with Contract Documents.
- (b) Manufacturer's literature describing in detail the pipe ramming system to be used. Detailed description of projects on which this system has been successfully used including the names, addresses, and telephone numbers of owner's representatives for these projects as well as length, diameter, and pipe material used.
- (c) Calculations and drawings indicating limits of access pits and any ground support to be utilized.
- (d) A groundwater stabilization scheme covering the excavations for starter and receiver ramming pits. Verify this plan to stabilize anticipated unstable soil conditions. Such verifications shall include all calculations and detailed drawings for methods of controlling groundwater.
- (e) Certification by the pipe ramming manufacturer of the thrust, condition, and operational characteristics of all equipment to be used for installing the specified pipes. The system shall include a safeguard to prevent caving beyond the outside diameters of the pipe.
- (f) Layout of pipe ramming and ancillary equipment at each ramming pit location.
- (g) Configuration of cutter head shoe and overcut.
- (h) Spoil removal system details.
- (i) Pipe lubrication system details.
- (j) Grade and alignment control system details.
- (k) Pipe jointing details.
- (l) Calculations demonstrating that the pipe selected has been designed to support the maximum anticipated earth loads and superimposed live loads, both static and dynamic, which may be imposed on the pipe. Determine the additional stresses imposed on the pipe during ramming operations and upgrade the quality and strength of the pipe and pipe joints to the

10/5/2011

extent necessary to withstand the additional stresses imposed by the ramming operation.

- (m) Detail of mucking system and soil disposal methods.
 - (n) Complete information on pipe ramming contractor's safety plan for personnel conducting the ramming operations and appurtenance installation. The plan shall include provisions for lighting and electrical safeguards.
- xx. RECORDKEEPING. The Contractor shall keep and maintain up to date at the construction site a complete set of field drawings for recording as-built conditions, which shall have marked or noted thereon all properly dated field information and recorded as-built conditions.
- xx. INSTALLATION.
- (a) Ramming Pits. Ramming pits shall be constructed at the locations indicated on the Plans. Construction techniques required to provide access for pipe ramming shall be such as to ensure the safety of all work activities. Acceptable excavation methods include the use of interlocked steel piling or open excavation.

Final dimensions of the ramming pits selected by the Contractor shall conform as a minimum with dimensions that requires and permits installation of the steel pipe casings.

The Contractor shall be required to properly support all excavations and to prevent all movement of soil, pavement, utilities or structures outside of the excavation. All pits shall conform to applicable local safety, VOSHA, trenching, and shoring standards.

If at any time the method being used by the Contractor for supporting any material or structure adjacent to any excavation is not safe in the opinion of the Engineer and/or applicable Federal, State or local inspection authorities, the Engineer will require the Contractor to provide additional bracing and support necessary to achieve the degree of safety required.

The ramming pits must be constructed to accommodate the installation of pipe casings and the ramming device. Install seals in the pit walls as required to control ground movement where the casing enters and exits the ground.

All work of or associated with excavating, shoring, bracing, and pipe ramming shall be executed so that settlement is minimized. The in-place casing shall have full bearing against the earth and no voids or pockets left in any portion of the work.

Before beginning construction, structures and other permanent objects shall be adequately protected. The repair of damage to permanent facilities due to negligence or lack of adequate protection on the part of the Contractor will be performed by the Contractor at no cost to the State.

Surface drainage shall be provided during the period of construction to protect the surrounding work area. Drainage structures that are indicated as being abandoned may be used to temporarily divert surface drainage during time of construction.

Concrete may be used for the bottom of the ramming pit and must meet all standards noted on the Workings Drawings submitted by the Contractor.

A temporary drainage structure shall be placed underneath ramming pits that are located within the unnamed tributary that runs parallel to the northbound I-89 lanes. The temporary drainage structure shall be adequately sized and included in each Working Drawing submitted by the Contractor.

- (b) Pipe Ramming. No pipe ramming work shall begin until the required Working Drawings have been approved in writing by the Engineer. The Contractor is responsible for the performance of the equipment and methods selected for all pipe ramming procedures. Invert elevations of existing drainage structures must be field verified before the ramming procedures begin.

Each pipe section shall be rammed forward as the excavation progresses in such a way to provide complete and adequate ground support at all times. Excavation ahead of the forward end of the pipe is prohibited, unless approved by the Engineer. Lubrication shall be applied to the external surface of the pipe to reduce skin friction. A hammer frame shall be positioned to develop a uniform distribution of ramming forces around the periphery of the pipe. Special care shall be taken by the Contractor to insure that the launch seal is properly designed and constructed. Special care should be taken when setting the pipe guardrails in the pit to ensure correctness of the alignment.

The Contractor shall be responsible for monitoring ground movements associated with the work and making suitable changes in the construction methods to control ground movements and prevent damage or detrimental movement to the work, traveling motorists, and adjacent structures and pavements.

All excavated material from pipe ramming and pit construction shall be disposed of off-site by the Contractor.

It is recommended that the first pipe to be rammed in place will be of the smallest diameter and with the shortest run to determine possible friction loads that may be associated with the ramming operation. This will provide the Contractor and Engineer a better insight of the project schedule and ease of construction.

- (1) Lubrication. A lubrication system shall be provided that injects an approved lubricant on the inside and outside of the pipe to lower the friction developed on the sides of the pipe during ramming. Spacing of lubricant points shall be at the Contractor's option with approval from the Engineer.

The over cut on the pipe shall not exceed 25 mm (one inch) without the approval of the Engineer. The annular space created by the over cut shall be filled with a lubricant that has proven suitable for the particular soil conditions.

- (2) Establishing Line and Grade. The Contractor shall establish the baseline and benchmarks indicated on the Plans. Baselines and benchmarks shall be checked at the beginning of the Contract period and any errors or discrepancies reported to the Engineer.

Use these baselines and benchmarks to furnish and maintain all reference lines and grades for the pipe installation. Use these lines and grades to establish the exact starting location of the pipe.

The Contractor shall submit to the Engineer copies of field notes used to establish all lines and grades; however, the Contractor remains fully responsible for the accuracy of the work and the correction of the work as required.

The excavation and run of rammed pipe shall be controlled such that the deviation from grade is below the design grade.

Invert elevations of existing drainage structures must be field verified to determine reasonable tolerances for the line and grade of each proposed pipe such that flow from existing drainage structures and flow facilitated by the grading of existing ground will be preserved.

After installation is complete, the Contractor shall provide the Engineer with access to both casing ends for visual inspection of the line and grade of the completed casing.

(c) Contractor's Records. The Contractor shall keep a record, independent of that which may be kept by the Engineer, of all pertinent data relative to the pipe ramming installation. This record shall be available for the Engineer's inspection until the completion of the project, and a copy shall be transmitted to the Engineer within three days of the completion of each pipe ramming installation. This record is to include for each pipe installed:

- (1) The position of the pipe in relation to the design line and grade.
- (2) The date, starting time, and finish time.
- (3) Inclination.
- (4) Advance rates.
- (5) Hammer strokes per minute.
- (6) Operating pressure.
- (7) Muck quantities removed.

xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Pipe Ramming) of the size and type specified to be measured for payment will be the number of meters (linear feet) of pipe installed in the complete and accepted work.

xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Pipe Ramming) of the size and type specified will be paid for at the Contract unit price per meter (linear foot). Payment will be full compensation for furnishing, transporting, handling, and placing the materials specified; constructing the ramming pits; pilot tube microtunneling; disposing of excess excavation from ramming operations; preparing and providing required submittals and records of installation; restoring each ramming pit site to its original condition to the satisfaction of the Engineer; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.640 Special Provision (Pipe Ramming) (X mm (X") Type)	Meter (Linear Foot)