



Liberty Utilities

September 4, 2012

Randall S. Knepper  
Director of Safety  
New Hampshire Public Utilities Commission  
21 S. Fruit Street, Suite 10  
Concord, NH 03301

**Subject: DG 11-040  
Liberty Utilities Settlement Agreement  
Gas Safety Requirements and Conditions  
Attachment J  
Number 12 - Cast Iron Encroachment Policy  
(Via Electronic Mail)**

Dear Mr. Knepper:

Under the Settlement Agreement, Liberty Utilities is required to submit a Cast Iron Encroachment Policy for Safety Division review. Any change from the existing National Grid PBWK 5010 policy dated July 2004 must be identified and the consent of the Safety Division must be obtained for any incremental changes reflected in the new policy. It is noted that PBWK 5010 was a rewrite of the EnergyNorth Procedure Section 9.4.2. Replacement and/or Protection of Cast Iron Pipe dated June 1994.

Attached is the first draft of the Liberty Utilities policy.

The changes from PBWK 5010 are as follows:

- New header, procedure format, title and numbering system
- Added sections on Definitions, References, Operator Qualifications
- Revised sketches

There are no intended incremental changes in this policy.

Unless we hear otherwise from you, this policy will become effective on October 1, 2012.

Sincerely,

A handwritten signature in black ink that reads "Leo T. Cody". The signature is written in a cursive style and is enclosed within a large, hand-drawn oval shape.

Leo T. Cody  
Program Manager, Compliance & Quality

Cc: C. Brouillard, R. MacDonald, T. Deppmeyer, R. Johnson

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### 1.0 PURPOSE

The purpose of this document is to provide criteria and guidelines to determine whether a Cast Iron main in close proximity to third party construction excavations requires remedial measures or replacement.

### 2.0 SCOPE

This document covers the policies concerning the general maintenance, protection, and the handling of Cast Iron pipe involved in third party construction, including:

1. 4in. to 8in. CI mains exposed and undermined by third party construction.
2. 4in. to 8in. CI mains parallel or adjacent to third party construction.
3. 4in. to 8in. CI mains involved in road construction excavations.

### 3.0 DEFINITIONS

Angle of Influence (AOI) – Means a 45 degree angle above the horizontal starting from the bottom edge of the trench nearest the main.

Determine – Means to make an appropriate investigation using scientific or other definitive methods, reach a decision based upon sound engineering judgment, and be able to demonstrate, substantiate, and document the basis for the decision.

Low Pressure Cast Iron Pipe – Means a distribution line in which the gas pressure in the pipe is substantially the same as the pressure provided to the customer.

Shallow Trench – Means an excavation that is 5 feet or less in depth.

Deep Trench – Means an excavation that is greater than 5 feet in depth, but no more than 20 feet deep.

Third party construction – Means construction performed by municipal sewer or water departments, electric or communications utilities, or any agency other than Liberty Utilities or its contractors.

Type 1 Soil – Medium to very dense sand and gravel above the water table, and medium to stiff clay as defined in the Cornell Study by Thomas O'Rourke.

Type 2 Soil – Very soft to medium clay and organics, and very loose to loose sand above the water table as defined in the Cornell Study by Thomas O'Rourke.

### 4.0 REFERENCES

Federal Code 49CFR192.755: Protecting Cast Iron Pipelines

New Hampshire Code of Administrative Rules Chapter Puc 500 Rules for Gas Service

PHMSA Advisory Bulletin – ADB 2012-05 entitled Cast Iron Pipe dated 03/23/2012

Gas Operating Procedure DAMG-5020

T.D. O'Rourke Memo dated October 13, 2008 on Public Works Encroachments

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**5.0 RESPONSIBILITY**

**5.1 Operator Qualification Required Tasks**

5.1.1 Personnel involved with Cast Iron pipe involved in third party construction shall be Operator Qualified, per Operator Qualification Plan, for the following tasks:

- Task # 18 – Conducting Gas Leak Surveys
- Task # 19 – Patrolling and Inspecting Pipelines
- Task # 20 – Investigate Leak/Odor Complaints
- Task # 21 – Line Locating and Markout
- Task # 22 – Inspection of Third Party Excavations for Damage Prevention/Cast Iron Encroachment

**6.0 PROCEDURE**

**6.1 General – Cast Iron Pipe**

At any time during normal operations when a Cast Iron pipe main is exposed due to Liberty Utilities in house construction activity (includes contractor work), the main shall be properly inspected and findings documented.

Whenever an unsealed Cast Iron joint is exposed for any reason, the joint shall be sealed using a Company approved sealing method other than repacking the joint.

All requests for third-party excavations on streets where Cast Iron piping exists will be considered a priority and investigated promptly.

All visits to sites to inspect Cast Iron pipe for involvement shall be documented. When such a location request is received, a designated field representative(s) will inspect the location, review the records, and make a determination of Cast Iron involvement and record findings.

The information will be submitted to the designated Supervisor for review and their concurrence.

If Cast Iron main is not involved near third party excavations, the date, name of personnel, and the reason(s) why replacement of the Cast Iron main is not necessary, shall be documented in the comments section and stored within the FDC unit.

If a Cast Iron main is exposed or will be exposed and/or subject to undue stress, replacement of Cast Iron is required. If at all practical replace the affected Cast Iron in order of the following priority:

- a. Priority I - Prior to Third Party Construction
- b. Priority II - During Construction
- c. Priority III - Following Construction

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When it becomes known that a third party excavation is going to take place in the vicinity of the Company's Cast Iron piping, every effort must be made to replace the Cast Iron facilities prior to the start of the third party construction.

If circumstances beyond the control of the Company preclude the replacement of the facilities prior to the start of third party construction, work is to commence the first regular work day the Company is granted access to the site.

Precautionary measures are to be taken to protect the Company's facilities from damage prior to, during and following third party excavation.

## **6.2 Procedure For Priority I - Prior To Third Party Construction**

6.2.1 Gas Engineering should work with municipal agencies and other utilities to review proposed construction within the service territory for conflicts with or encroachment of the Company's gas delivery system. Gas Engineering shall contact the appropriate municipal or utility authority or its agent responsible for the design, and/or construction, to discuss and; negotiate design alternatives that minimize or eliminate the anticipated conflict(s) or encroachment. If a conflict or encroachment can not be avoided, the Engineer should initiate a work order to replace the company facility and notify the appropriate field supervisor of the construction details. When appropriate, the Engineer shall act as a liaison between the contractor/design consultant and Company personnel.

6.2.2 Gas Engineering or Field Operations shall prepare a work order(s) for replacement of the Company's Cast Iron facilities in conflict with the third party construction.

6.2.3 Field Operations shall submit a request for the applicable construction permits.

6.2.4 Appropriate Field Operations and/or Gas Engineering personnel should attend pre-construction meetings and be prepared to:

- a) Determine Company's construction schedule.
- b) Explain precautions to be taken by excavator to avoid damage to Company facilities including use of one-call system to arrange for mark or stakeout of facilities.
- c) Learn the identity of the contractors'/excavators' authorized field representative.

6.2.5 Replace or remove Cast Iron pipe 8 inches or less in diameter in conflict with planned excavation activities.

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### 6.3 Procedure for Priority II - During Construction

6.3.1 Whenever a Cast Iron main, 8 inches or less in diameter, requires replacement due to an undermined condition as defined in Section 6.5, the following is required.

6.3.1.1 If the main requires support and protection use the support options illustrated in Sketches # 6a, 6b, 6c, or other methods evaluated and approved by Gas Engineering.

6.3.1.2 If at any time during the foreign construction the Cast Iron main is in imminent danger of failure, action must be immediately taken to eliminate the hazard.

6.3.1.3 Replacement activities shall commence as soon as practicable after the foreign contractor completes work at the location of the undermined main and allows access for a time period sufficient to complete the gas main replacement.

6.3.1.4 If the Cast Iron main cannot be retired promptly, even if replacement activities have commenced, consideration should be given to provide venting to minimize the potential hazard.

6.3.1.5 Once construction begins, a daily leakage survey of the location shall be performed until replacement is completed. In addition, the location will be periodically checked for depressions, and where the Cast Iron main is exposed, the excavation, shoring, and Cast Iron main support will be checked by qualified personnel. Depressions due to settlement near the Cast Iron main, trench collapse, washouts, shoring or support deficiencies shall be immediately reported. Immediate action must be taken to eliminate any of those conditions.

6.3.2 Whenever a Cast Iron main 8 inches or less in diameter requires replacement due to 1:1 slope condition (parallel or adjacent to excavation but not undermined), the following is required.

6.3.2.1 Every effort will be made by the Liberty Utilities supervisor to replace, as soon as possible, all gas mains 8 inches and less in diameter that must be replaced according to Section 6.5. Replacement will commence as soon as access to the excavation area is allowed by the third party contractor, where practicable. However, in those instances where immediate replacement is not possible:

- i. If field observations indicate that the integrity of any gas main is jeopardized due to soil conditions or construction deficiencies, Liberty Utilities supervisor will suspend any third party construction and will take prompt corrective action to avoid gas main failure, including cutting and capping of main and/or replacement.
- ii. For Shallow Trench Construction Refer to sketch # 3 in Section 6.7 Typical

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Conditions. Main replacement shall commence as soon as practicable after the contractor allows access to the excavation area.

- iii.* For Deep Trench Construction Refer to sketch # 4 in Section 6.7 Typical Conditions. For any Cast Iron gas main 8 inches or less in diameter which falls within the three foot exclusion zone, replacement shall commence as soon as practicable after the contractor allows access to the excavation.
- iv.* For excavations greater than 20 feet in depth involve Gas Engineering.

6.3.2.2 If the excavation is adequately protected by structural shoring (sheeting) against movement of the Cast Iron main and sheeting remains in place, the main need not be replaced.

#### **6.4 Procedure for Priority III - Following Construction**

6.4.1 The designated Supervisor shall ensure that the affected pipeline is inspected as deemed necessary. These inspections may include leakage surveys and shall be recorded.

6.4.2 Based on on-site inspections, identify and replace any Cast Iron pipe that became encroached during construction. After appropriate re-evaluation, replace any facilities that were identified but not completed prior to start of foreign construction. This work is to commence as soon as possible after the Company is granted access to the site.

6.4.3 Continue daily leakage surveys until all affected encroached Cast Iron facilities have been retired from service and abandoned.

6.4.4 The designated Supervisor shall ensure that all paperwork has been completed, including limits of main replacement, and retained per company policy.

#### **6.5 Cast Iron Main Replacement Criteria**

6.5.1 Any Cast Iron pipe, eight inches or less in diameter, exposed and undermined by an excavation 36 inches or greater in width, the purpose of which is for work other than normal gas operation and maintenance work being performed on the exposed Cast Iron main, shall be replaced by steel or plastic pipe provided the excavation width exceeds those listed in Table A.

6.5.2 Any Cast Iron pipe eight inches or less in diameter that will be or has been subjected to heavy equipment loading (in excess of 30,000 lbs.), severe ground vibration or other outside forces which may occur as a result of road reconstruction shall be replaced entirely within the reconstruction zone. A Cast Iron main greater than 8

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inches in diameter will be reviewed by Gas Engineering to determine if the bending stresses involved may interfere with the pipe integrity.

6.5.3 For right angle exposed crossings, the length replaced shall be at least the width of the excavation plus twice the distance from the top of the main to the bottom of the trench. For exposed crossings at other than right angles, the length of the replacement shall be increased so that all Cast Iron pipes will be removed from within the trench settlement area under the gas main, assuming an angle of influence of the earth in the trench sides of 45 degrees. Refer to the sketches in Section 6.7 Typical Conditions.

6.5.4 Replacements shall extend approximately equally on both sides of said excavations. Refer to Sketch # 5 in Section 6.7 Typical Sections for extent.

6.5.6 If an excavation is made parallel or adjacent to any Cast Iron main and said excavation is not adequately protected by structural shoring (sheeting) which will protect the Cast Iron main against movement, the Cast Iron main shall be replaced by steel or plastic pipe if more than half the pipe diameter lies above a line projected at an angle above the horizontal equal to the angle of influence for the solid conditions being encountered, starting from the bottom of the excavation at the side nearest the main. Refer to the sketches # 3 and # 4 in Section 6.7 Typical Conditions.

6.5.7 If the excavation is adequately protected by structural shoring (sheeting) against movement of the Cast Iron main and the sheeting remains in place, the main need not be replaced. If any portion of a Cast Iron main 8 inches or less in diameter becomes exposed and undermined during the excavation operation, that portion must be replaced by steel or plastic pipe.

6.5.8 Cast Iron greater than 8 inches in diameter that is exposed, undermined, or adjacent to trench construction might be of sufficient strength where replacements are not required. It will, however be required for Gas Engineering to perform the necessary stress calculations and evaluations to determine if replacement is not required.

6.5.9 Replacement of Cast Iron mains should also be considered if the following conditions prevail:

- i.* The pipe condition has deteriorated beyond repair i.e. graphitization.
- ii.* Soil stability has been impacted in the vicinity of the Cast Iron pipe due to water or sewer break or other related conditions.
- iii.* Maintenance history of the Cast Iron pipe.
- iv.* The main passes through a catch basin or other substructure.
- v.* A Cast Iron pipe that has 24 inches or less of cover below the final grading refer to sketch # 2 in Section 6.7 Typical Conditions to determine extent of replacement.

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- vi. For small excavations (less than 8 feet long) adjacent to the Cast Iron pipe refer to sketch # 5 in Section 6.7 Typical Conditions to determine extent of replacement.

## 6.6 Procedure for Liberty Utilities In House Activity

6.6.1 At any time during Company's normal operation with a Cast Iron main is exposed due to in house activity (includes contractor work) it is the responsibility of the Field Supervisor to see that the main is properly inspected and documented on the Exposed Pipe form within Field Data Capture unit or on the Main Field Record.

**Table A**

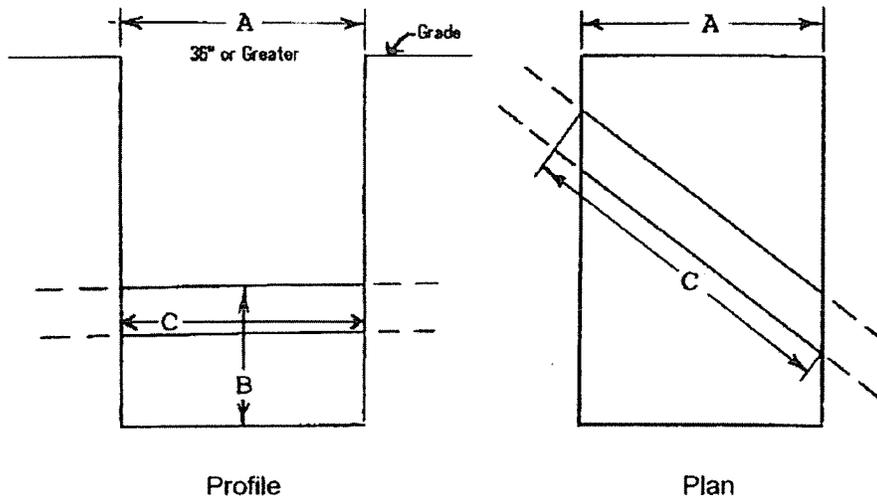
Replacement Criteria for Cast Iron Mains		
Pipe Size	Depth of Cover	Maximum Allowable Excavation Width*
3 or 4 inches	30 to 48 inches	3 feet
6 inches	30 to 48 inches	4 feet
8 inches	30 to 40 inches	5.5 feet
3 or 4 inches	48 inches or more	4 feet
6 inches	48 inches or more	6 feet
8 inches	48 inches or more	8 feet

\* Developed from "Evaluation of Cast Iron Pipeline Response at Excavated Crossings," January, 1989 by Cornell University School of Civil Engineering Report 89-1 for NY Gas Group.

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## 6.7 Typical Conditions (Sketches)

### Sketch # 1 – Replacement of Cast Iron Mains at Crossing Excavations



MINIMUM LENGTH OF PIPE TO BE REPLACED SHALL BE:

Note: units must be consistent

$$R = C + 2 ((B \times C) / A)$$

R = Pipe to be replaced; 1st – multiply (B x C)

A = Trench width; 2nd – divide that product by A

B = Distance from top of main to bottom of trench; 3rd – multiply by 2

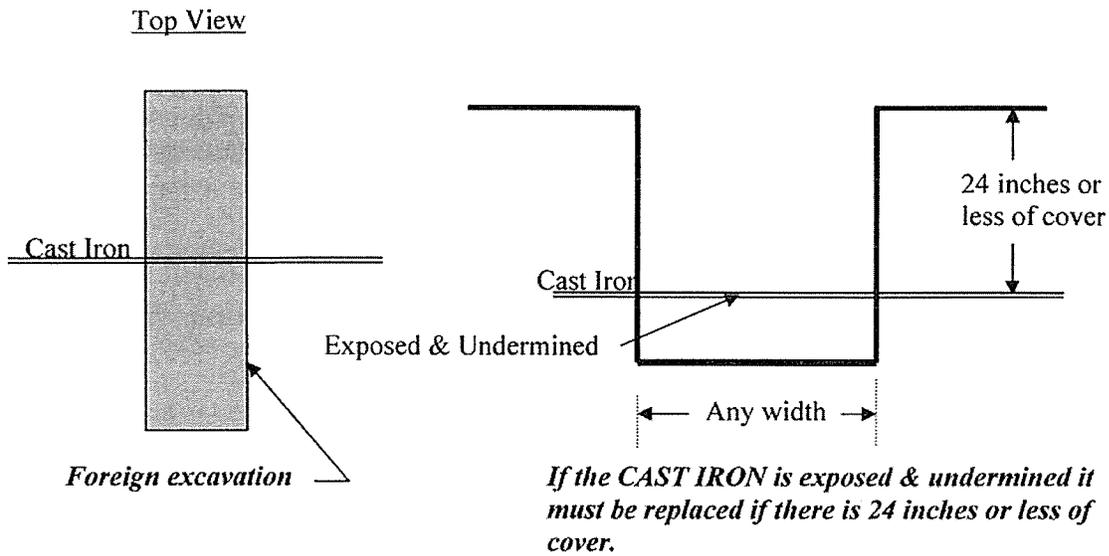
C = Length of exposed pipe; 4th – add C

Note: units must be consistent

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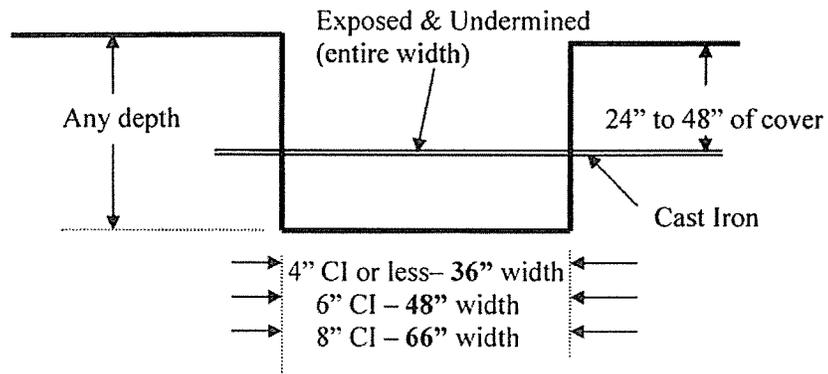
**Sketch # 2** - Construction Running Cross Trench to Cast Iron Mains

a) Cast Iron Pipe 24" or less of cover



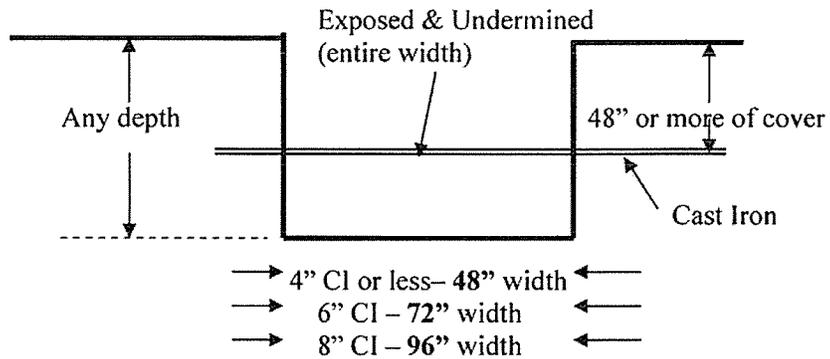
**NOTE: On Shallow excavations, if the trench is properly compacted, the pipe does not need to be replaced.**

b) Any depth excavation, with our Cast Iron greater than 24" deep but less than 48", the Cast Iron is encroached if the trench widths exceed the following:

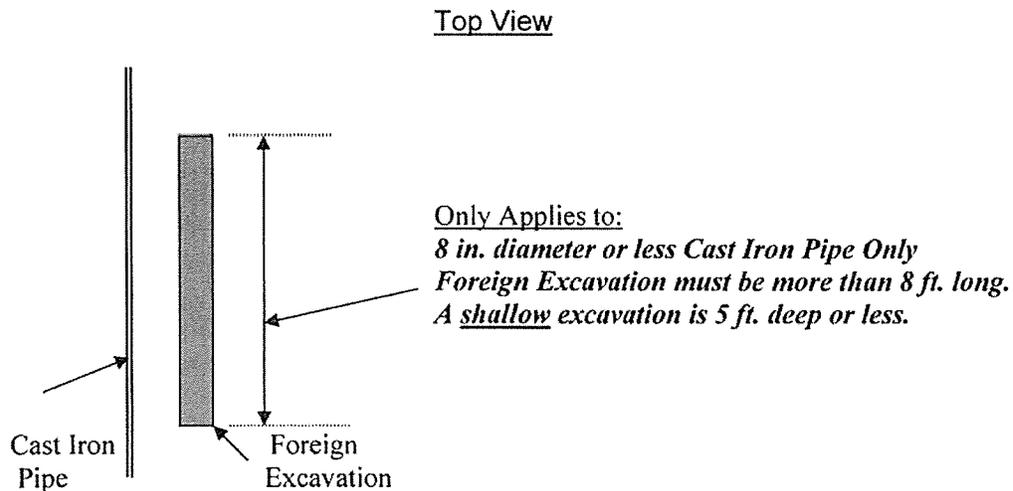


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c) Any depth excavation, with our Cast Iron 48" or deeper, the Cast Iron is encroached if the trench widths exceed the following:

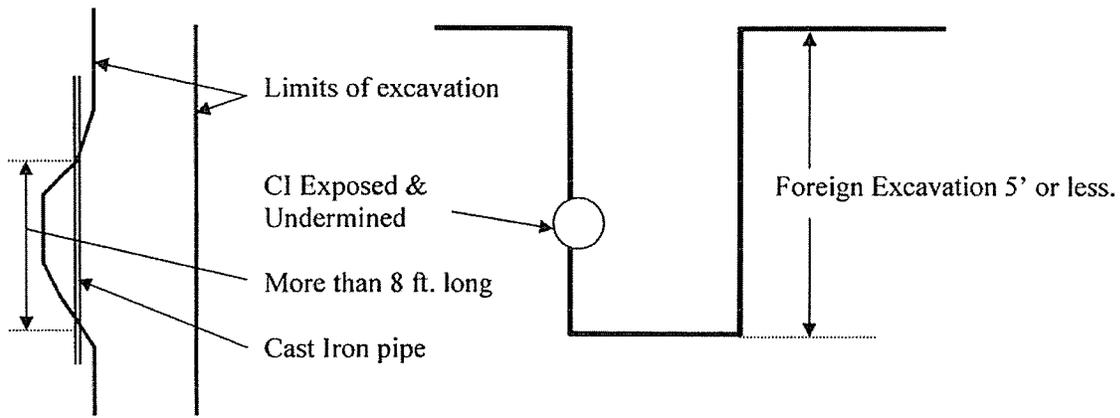


**Sketch # 3** - Construction Running Parallel or Adjacent to Cast Iron Mains - Shallow Trench Construction

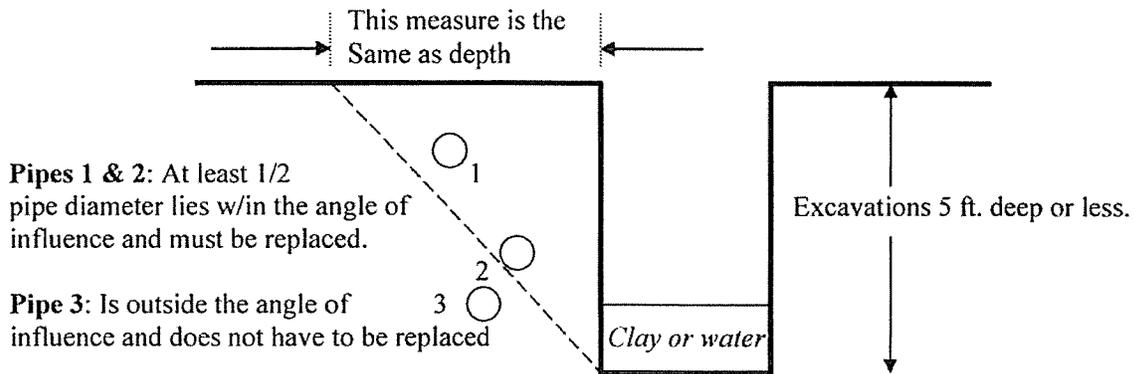


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- a) Cast Iron is encroached if it is **exposed & undermined** in the SHALLOW foreign excavation (more than 8 feet long).



- b) The Cast Iron is encroached if the centerline of the pipe lies within the angle of influence and the bottom of the excavation is either **below the water table** (water seeps into the bottom of the excavation from the ground, not due to rain), or is in **Soft Clay**.

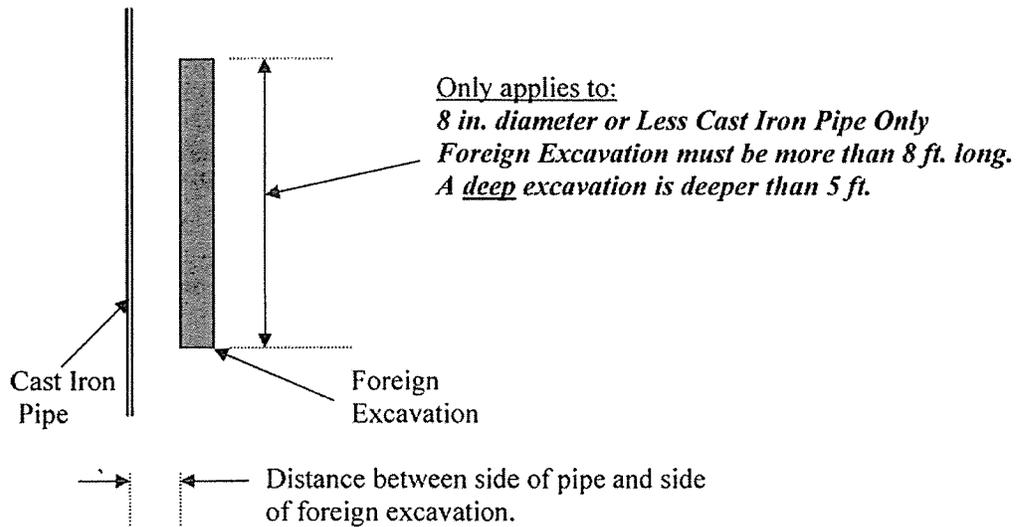


**NOTE: If the excavation is NOT soft clay or below the water table neither pipes 1, 2, or 3 need to be replaced.**

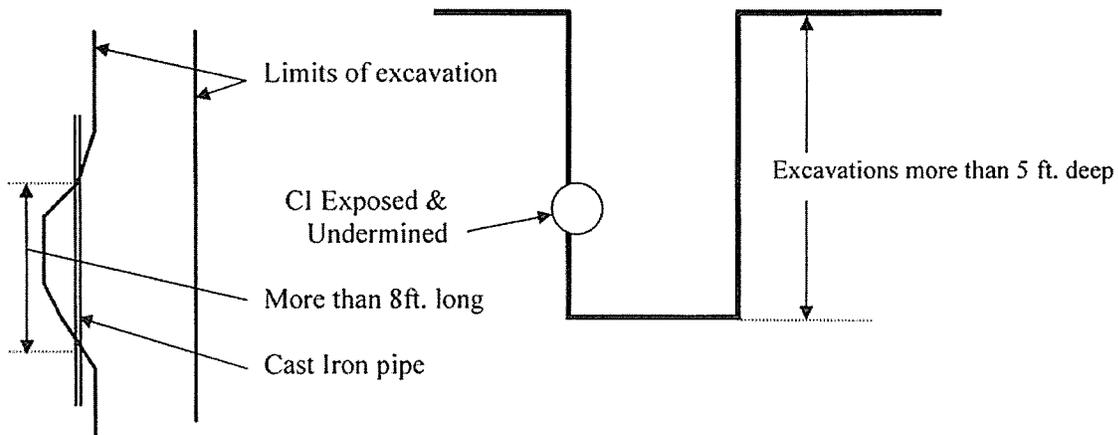
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**Sketch # 4** - Construction Running Parallel or Adjacent to Cast Iron Mains - Deep Trench Construction

Top View

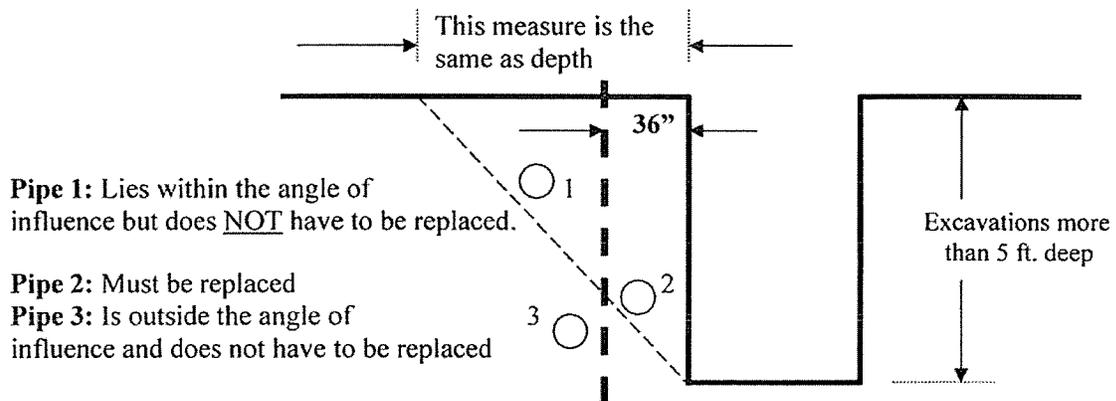


- a) Cast Iron is encroached if it is **exposed & undermined** in the DEEP foreign excavation (more than 8 ft. long).



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b) Cast Iron is encroached if the centerline of the pipe lies within the angle of influence **and any part of the pipe is within 36" of the excavation** (provided shoring is not left in place).



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**Sketch # 5** – Excavations Parallel to or Adjacent to Cast Iron Mains – Extent of Replacement

**USE THE FOLLOWING STEPS TO DETERMINE IF A MAIN SEGMENT ADJACENT TO AN EXCAVATION MUST BE REPLACED:**

Step 1 - Determine the depth of the excavation (d).

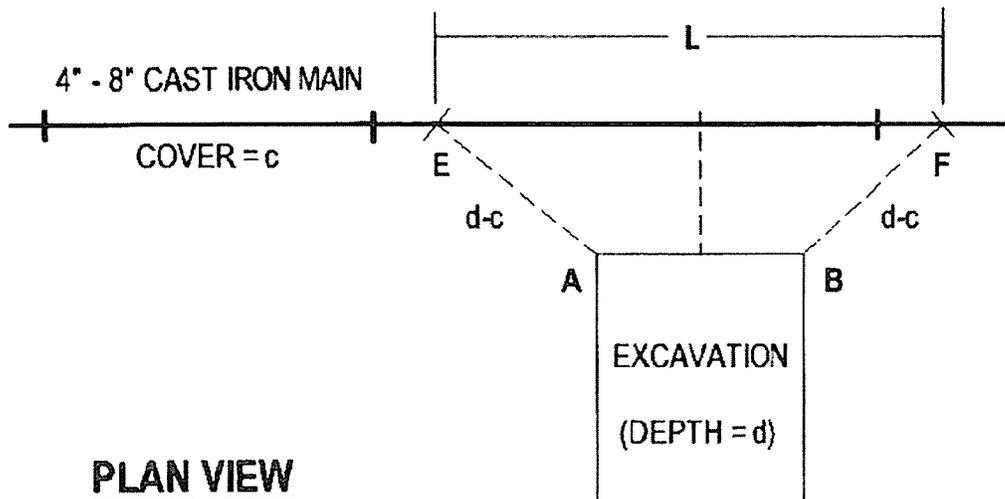
Step 2 - Determine the depth of the main (c).

Step 3 - Subtract c from d, (d minus c).

Step 4 - Using a string or tape, trace an arc from point A equal in length to (d minus c) to point E, where the arc intersects the main. Repeat same at points B and F.

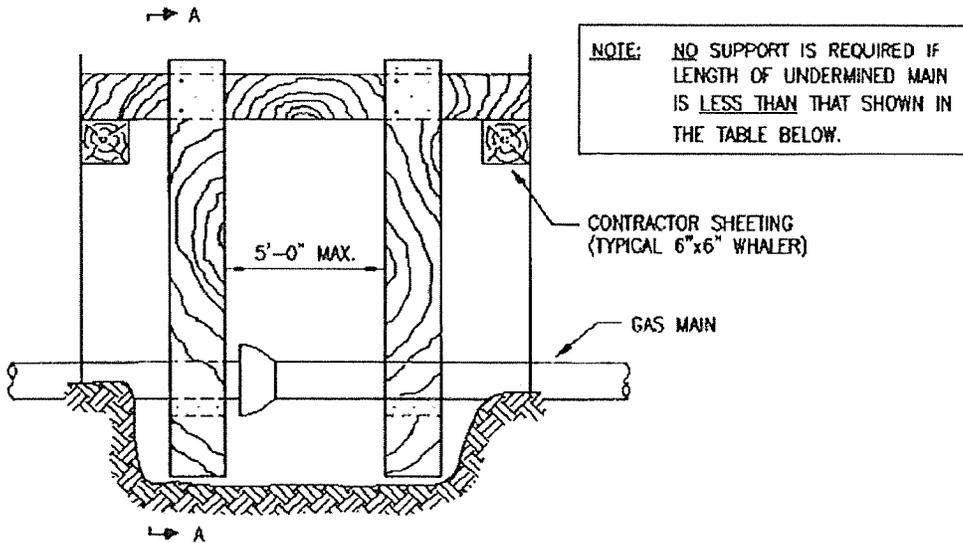
Step 5 - Determine the Length of Replacement "L" between E and F.

Step 6 - If "L" is 8' or less, 4" CI need not be replaced. If "L" is 10' or less, 6" & 8" CI need not be replaced.

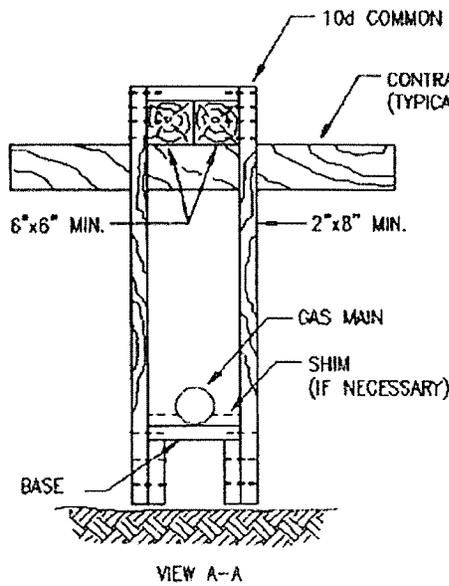


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**Sketch # 6a** – Temporary Support of Cast Iron Mains Undermined by Foreign Construction



**NOTE:** NO SUPPORT IS REQUIRED IF LENGTH OF UNDERMINED MAIN IS LESS THAN THAT SHOWN IN THE TABLE BELOW.

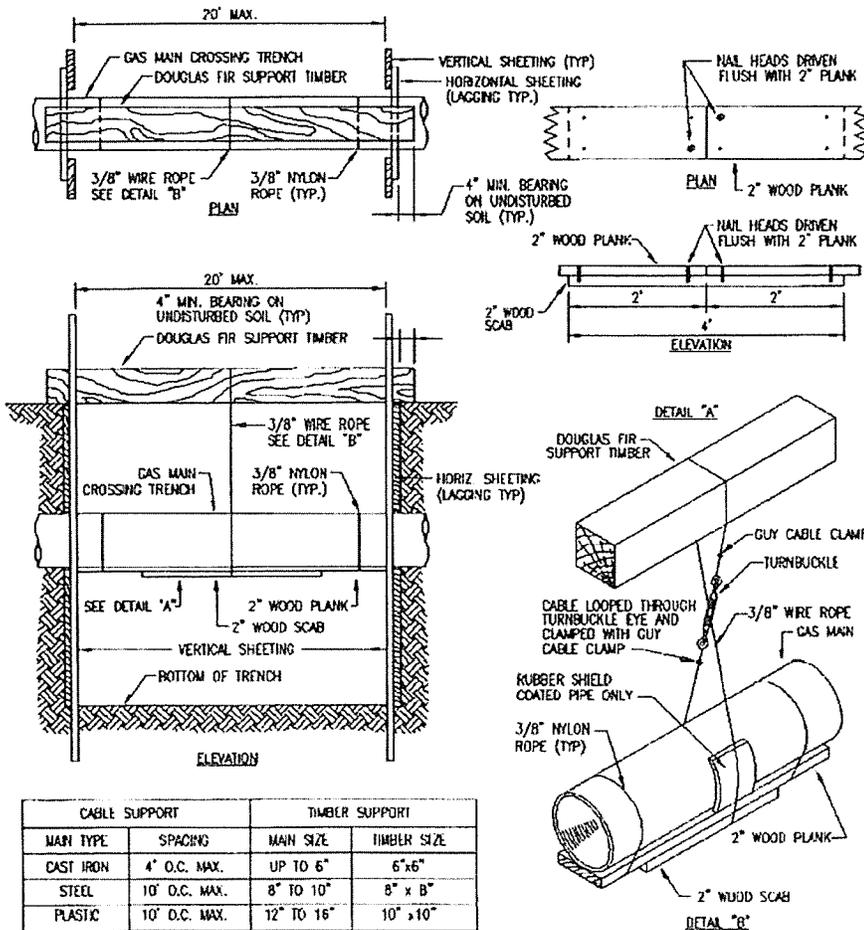


MAXIMUM ALLOWABLE UNSUPPORTED UNDERMINED LENGTH	
NOM. PIPE SIZE	LENGTH
4"	4.6 FT
6"	5.6 FT
8"	6.6 FT
10"	7.5 FT
12"	8.5 FT
GREATER THAN 12" CONSULT ENG. DEPT	



**Sketch # 6b** – Temporary Support of Cast Iron Mains Undermined by Foreign Construction

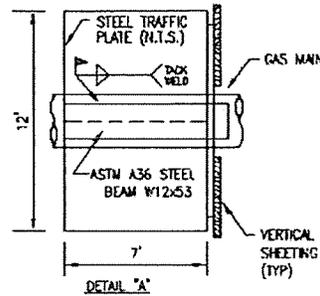
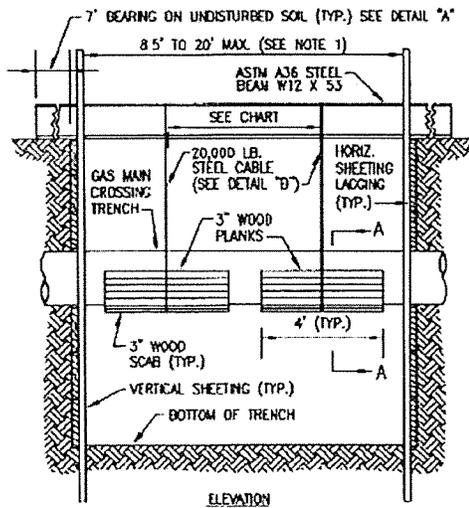
SUPPORT REQUIREMENTS FOR GAS MAINS AND SERVICES CROSSING EXCAVATION GREATER THAN 4'-0" WIDE AT ANY ANGLE



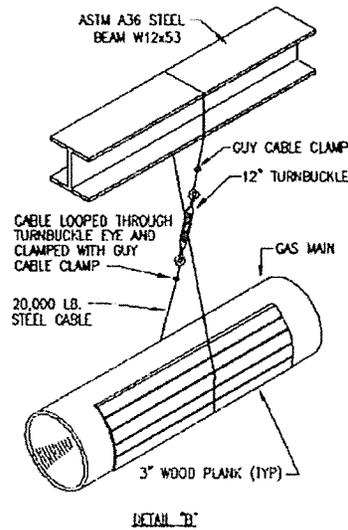
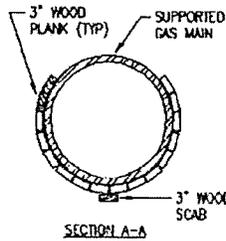


**Sketch # 6c** – Temporary Support of Cast Iron Mains Undermined by Foreign Construction

SUPPORT REQUIREMENTS FOR GAS MAINS OVER 16" DIAMETER UP TO AND INCLUDING 48" DIAMETER CROSSING EXCAVATION AT ANY ANGLE



CABLE SUPPORT	
MAIN TYPE	SPACING
CAST IRON	4' D.C. MAX.
STEEL	10' D.C. MAX.



**NOTES:**

- NO SUPPORT IS REQUIRED FOR GAS MAINS OVER 16" DIA. UP TO AND INCLUDING 48" DIA. CROSSING TRENCHES LESS THAN 8.5' WIDE.
- UNDERMINE A MAXIMUM OF 8.5 LF OF CAST IRON GAS MAIN AT A TIME AND INCLUDING 48" DIA. CROSSING TRENCHES LESS THAN 8.5' WIDE.
- SET STEEL CABLE OVER 3" WOOD PROTECTIVE PLANKS AND PLACE AN ADDITIONAL 3" SCAB ON THE BOTTOM OF THE GAS MAIN.
- ADJUST STEEL CABLE UNTIL DEAD WEIGHT OF THE UNDERMINED GAS MAIN HAS BEEN TAKEN UP BY THE OVERHEAD STEEL BEAM SUPPORT.
- ALL SUPPORTS AND STEEL CABLES CAN BE REMOVED ONLY AFTER THE REQUIRED BACKFILL (AROUND AND BELOW GAS MAIN) HAS BEEN COMPACTED IN ACCORDANCE WITH NEW YORK CITY STANDARDS AND AT THE DIRECTIONS OF THE ENGINEER.



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**7.0 REVISION HISTORY**

Date	Rev #	Description	Lead/Author
09/03/2012	0	Initial version of Document	Robert J Johnson