The Engineer's decision as to matters referred to in this clause shall be binding upon the parties concerned.

(b) When the Engineer makes a decision under this clause, the Contractor shall immediately proceed with Work affected by the decision. Additions to or deductions from the Contract price shall be made only as provided for in the Contract, and no revisions to the completion time shall be made, unless approved by the Engineer.

(c) The Engineer may at reasonable times visit, enter and check at buildings, factories, workshops, works or sites wherever materials are being prepared, made or treated, or where other Work is being done in connection with the Contract. The Engineer may also take such samples as he may consider necessary.

21. SHOP DRAWINGS

21. (a) Shop Drawings will be reviewed only to check general arrangement and conformance with the design concept of the project and compliance with the Contract Documents.

(b) Where the Engineer requires Shop and Setting Drawings, the Contractor shall submit them in sufficient time to allow for examination by the Engineer and for any corrections that he may require to be made. The Contractor shall not commence Work on items covered by Shop Drawings (where such drawings have been requested) before the Engineer's review.

(c) The Contractor shall make changes in Shop and Setting Drawings as the Engineer requires consistent with the Contract and shall submit revised prints to the Engineer. When submitting Shop and Setting Drawings, the Contractor shall notify the Engineer of every change made from the Contract Documents.

(d) Review of Shop Drawings by the Engineer shall not relieve the Contractor from compliance with requirements of the Contract Documents, nor relieve him of responsibility for errors made in the Shop Drawings.

(e) The Contractor shall be responsible for confirming and correlating quantities and dimensions; selecting fabrication processes and techniques of construction; and coordinating the Work of Subcontractors.

(f) Prior to submission to the Engineer the Contractor shall review Shop Drawings. By this review the Contractor represents that he has determined and verified field measurements, field construction criteria, materials, catalogue numbers and similar data or will do so and that he has checked and co-ordinated each Shop Drawing with the requirements of the Work and of the Contract Documents. The Contractor's review of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person.

(g) Shop Drawings shall be properly identified by the name of the project, the E.O. number, the item and the area in which the item is to be used. Where options occur on the Shop Drawing, the option proposed to be used shall be marked. If applicable, the related Specification Section shall be indicated.

22. OWNERSHIP OF DOCUMENTS

22. Contract Documents, including Drawings, Specifications, models and similar items supplied by the Engineer are his property. Such Documents are not to be used on other work and, with the exception of the signed Contract Documents, shall be returned by the Contractor to the Engineer on the completion of the Work.

23. LIABILITY

23. The Contractor shall assume the defence of and shall indemnify and save harmless the Owner from claims:

(a) resulting from the prosecution of the Work, or

(b) resulting from any of the Contractor's operations, or

(c) caused by reason of the existence, location or condition of the Work, or

(d) caused by reason of any material, plant or labour used in the Work, or

(e) arising from an act of commission or omission on the part of the Contractor, or

(f) relating to inventions, copyrights, trademarks, patents (and rights to them) used in doing the Work, or in the use and operation of Work on completion, unless otherwise specified.

30. (a) Claims or alleged claims received by the Contractor shall be dealt with immediately by the Contractor. If a claim is settled to the satisfaction of the claimant, the Contractor shall submit to the Engineer a copy of the claimant's release.

30. INSURANCE CLAIMS

(b) If a claim or alleged claim is rejected by the Contractor and/or his insurance company, the Contractor shall report this fact in writing to the Engineer.

(c) Should 30 days elapse after the claim or alleged claim has been received by the Contractor, and the Contractor is not able to report settlement or rejection of the claim, he shall report to the Engineer the steps being taken with respect to the claim.

31. The Engineer may prohibit the Contractor from carrying on operations during hours of the day in which the Engineer, in his judgment, deems such operations to be a disturbance or nuisance to the public.

31. HOURS OF WORK

Such prohibition may be made notwithstanding prior consent, order, agreement or requirement in the Contract that stipulates maximum or minimum hours of Work.

32. (a) At monthly intervals, the Contractor and the Engineer shall make a valuation of the Work and materials supplied under the Contract. Should the Engineer wish to measure the Work or materials supplied, the Contractor shall assist in such measurements and furnish particulars required.

32. VALUATION

(b) The monthly valuations described in subsection (a) above shall not bind the Owner, the Contractor or the Engineer to final valuation of the Work to be done under the Contract, but shall be construed as approximations only for the purpose of Progress Certificates.

(c) The final valuation of the Work shall be prepared as soon as possible after the whole of the Work has been completed.

33. The Contractor shall be entitled to receive partial payments upon the certificate of the Engineer of the value of Work done and materials supplied.

33. PROGRESS CERTIFICATES

Unless otherwise specified, eighty-five per cent (85%) of the estimated value of the completed Work and material supplied will be certified, less amounts retained under Clause 36.

For Progress Certificates, the Engineer's decision as to the estimated value of completed Work and material supplied shall be final, but shall not be binding on him, the Contractor or the Owner in the establishing of the final value of the Work, nor shall it be taken as evidence as to ownership of, or payment for the Work.

34. Holdbacks held under the provision of the Mechanics' Lien Act will be released upon application by the Contractor, and will be subject to the requirements of the Act. The Contractor's applications shall be made in the forms included as Appendices 1 and 2 to these General Conditions. When the Engineer is satisfied that the Work meets the requirements of Substantial Completion in the Mechanics' Lien Act he will issue a Substantial Completion Certificate to establish a date for commencement of the holdback period.

34. SUBSTANTIAL COMPLETION AND HOLDBACK RELEASE

35. (a) When the Work required to be done under the Contract has been completed in every respect and is acceptable to the Engineer, a final valuation of the Contract will be prepared by the Contractor and the Engineer.

35. TOTAL COMPLETION CERTIFICATE

(b) The Contractor shall submit to the Engineer a statement indicating the Contractor's valuation of the Work according to records available to the Contractor. The Engineer will review this statement and either approve it or submit detail reasons for revisions that, in his opinion, should be made.

(c) Should the Engineer consider it advisable, the Engineer will prepare a final valuation of the Work and submit it to the Contractor who shall either approve it or submit detail reasons for revisions that, in his opinion, should be made.

(d) When the Engineer and Contractor have reached agreement as to the final value of the Work, the Engineer will issue a Total Completion Certificate, detailing the valuation of the Contract, and certifying its acceptance at a certain specific date, referred to as the "acceptance date."

(e) Should the Engineer and Contractor be unable to reach agreement as to the final value of the Work within a reasonable period, the Engineer will issue his Total Completion Certificate detailing his valuation of the Contract and certifying acceptance of the Work at a certain specific date, referred to as the "acceptance date."

41. The Contractor shall not assign the Contract, or any part of it without the written consent of the Owner, nor shall the Contractor assign monies due, or to become due, to him without the written consent of the Owner.

41. ASSIGNMENT

42. The Contractor shall employ a competent supervisor and necessary assistants who shall at all times, be in attendance at the place of the Work while Work is being performed.

42. SUPERINTENDENCE

The supervisor shall be satisfactory to the Engineer and shall not be changed except for good reason and only then after consultation with the Engineer.

The supervisor shall represent the Contractor at the place of the Work and directives given to him by the Engineer shall be held to have been given to the Contractor.

The Contractor shall provide the Engineer with the name, address and phone number of the supervisor and other responsible person(s) who may be contacted for emergency or other reasons.

APPENDIX 1 OF THE GENERAL CONDITIONS OF THE CONTRACT

APPLICATION FOR RELEASE OF SUBCONTRACTOR'S HOLDBACK

Owner:

Project:

EO: Contractor:

Subcontract:

Subcontractor:

1. We, the said Subcontractor hereby confirm that the Work under the said subcontract was completed on , that the subcontract price was $, and hereby request the issue of a certificate that such subcontract Work has been completed.

Date: _____ Signature: _____

SEAL:

2. We, the said Contractor hereby confirm that Work of the above subcontract has been complete in accordance with the Contract Documents and that the subcontract price was $, and hereby apply for a reduction in holdback with respect to the subcontract, in accordance with the provisions of the Mechanics' Lien Act.

Date: _____ Signature: _____

SEAL:

SECTION 01010 - GENERAL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Contract is for the construction of approximately 230 metres of road including sanitary and watermain extensions and storm sewer appurtenances in the Town of Pelham, Ontario.

1.02 LIMITS OF SITE

A. The limits of the site are -

1. The road or street allowances on which Work is to be performed.

2. Such additional land as indicated in the Contract.

3. Such additional land designated as easements indicated in the Contract.

4. Such areas of private property adjacent to road or street allowances on which the Contractor is directed, in writing, to enter to carry out Work.

1.03 SETTING OUT OF THE WORK

A. The Engineer will set such stakes as are necessary to mark the location, alignment, elevation and grade of the Work. Give adequate notice of the need for such setting out.

Carefully protect and preserve stakes, lot pins, marks and reference points and replace if destroyed or removed.

Provide grade stakes, masts, scaffolds, batter boards, straight edges, templates and other equipment necessary for laying out, and inspecting the Work.

Wherever necessary suspend Work temporarily to permit the Engineer to inspect and check the line and grade of any portion of the Work.

1.04 CONSTRUCTION SCHEDULE

A. Within 2 weeks after being awarded the Contract, submit proposed construction schedule to the Engineer for approval. In the schedule show proposed progress in weekly stages for the main sections and subsections of the Work.

PART 2 PRODUCTS

PART 2.01 TESTS

A. Where required by the Engineer, supply for testing, samples of materials to be used in the construction of the Work. Do not use materials until they have been so approved.

PART 2.02 CANADIAN MATERIALS

A. Unless otherwise specifically approved, use materials and equipment of Canadian manufacture in constructing the Work

PART 3 EXECUTION

PART 3.01 TRAFFIC

A. Do not perform Work on public right-of-ways without approval of the road authorities.

B. Perform traffic control on streets in accordance with the rules of the appropriate road authority. Enusre that flagmen wear fluorescent red or orange safety vests, arm bands and hats.

C. Streets may be closed to through traffic only with the written permission of the Road Authority.

Adequately mark detours on adjacent streets. Erect and maintain barricades on the closed streets and light at night. Inform the Road Authority when a road is re-opened to traffic.

D. On streets that are not officially closed, always maintain one lane of traffic in each direction. Should temporary detours be constructed, comply with the requirements of the road authority as to location, dimensions, strength, road markings, signing and other relevant details. Remove detours when no longer needed, and restore surfaces to the original condition.

E. Whether streets are officially closed or not, maintain reasonable access to adjacent properties for pedestrians and vehicles.

F. Maintain traffic signs in their original positions. Be sure that the signs are not obscured.

PART 3.02 NOTIFICATIONS

A. When streets are to be closed, or traffic restricted, notify the appropriate fire and police departments, giving at least 7 days notice of the closing or restriction.

B. If bus routes are affected, notify the bus company, giving at least 7 days notice.

C. When streets are to be re-opened, or restrictions removed, notify the fire, police and bus authorities.

PART 3.03 MUNICIPAL INSPECTORS

A. Municipal inspectors may be present during the construction of the Work. They have the power to order the Contractor to stop Work if the Work, in their opinion, is not being done in accordance with the set lines and grades or to the Drawings and Specifications.

Unless otherwise specified, the cost of municipal inspectors will not be charged to the Contractor.

PART 3.04 USE OF HYDRANTS

A. Keep fire hydrants accessible and free of obstructions.

B. Fire hydrants may be used as a source of water only with the approval of the water authority, and subject to its rules and conditions.

PART 3.05 INCLEMENT WEATHER

A. Make adequate protection and take precautions at times of inclement weather.

B. Inclement weather or extra Work caused by such weather will not be accepted as reason for additional payment.

PART 3.06 MUD AND DUST

A. Keep streets and other construction areas clean. If it is necessary to haul wet material, use suitable watertight trucks.

B. Control dust by the use of water or calcium chloride, or both.

PART 3.07 OTHER CONSTRUCTION

A. Other construction may be proceeding at the same time near the Work of this Contract. Extend cooperation and free access to other companies and employees who may be Working in the area.

PART 3.08 RAILWAYS

A. Carry out Work on or near railway property to the satisfaction and requirements of the railway authority and conform to the regulations of the Canadian Transport Commission. Pay railway costs and charges except that inspection and flagmen provided by the Railway Authority will be paid for by the Owner.

PART 3 EXECUTION (Cont'd)

PART 3.09 ADJACENT STRUCTURES AND UTILITIES

A. Perform temporary and permanent support and temporary relocation and replacement of underground or overhead utilities as detailed in the General Conditions.

B. Permanent relocation of underground or overhead utilities will be carried out by others, if necessitated by coincidence of lines or grades, or both.

PART 3.10 TEMPORARY ACCESS

A. Where necessary for access, provide and maintain suitable safe, temporary roads, walkways and bridges. Remove temporary access facilities and restore disturbed areas, after the Work of the Contract has been completed.

PART 3.11 CLEAN-UP

A. On a daily basis as the Work progresses and on completion of the Work, clean-up and remove the rubbish and debris from the site. Remove excess material that is not required to be left on the site by the conditions of the Contract.

SECTION 02550 - SITE CLEARING, EXCAVATING, BACKFILLING AND RESTORATION OF TRENCHES

PART I GENERAL

1.01 INTENT

A. This Section covers the Work for site clearing, excavating, backfilling and restoration for sewers and watermains from 600 mm beyond the exterior wall of structures. It also covers the site clearing, excavating, backfilling and restoration for valve chambers, manholes and catchbasins.

B. Work included is as follows -

1. Existing utilities
2. Site clearing
3. Stripping toposil
4. Excavating
5. Sheathing and shoring
6. Backfilling
7. Restoration
8. Railway crossings

C. Related Work specified elsewhere is as follows -

1. Section 02560 - Sewers
2. Section 02570 - Watermains

1.02 EXISTING UTILITIES

A. Contact the various utility companies prior to commencing Work and become informed of the exact location of utilities and protect them during construction and assume liability for damage to utilities.

B. Utilities that require relocation will be the responsiblity of the Utility Company concerned at no expense to the Contractor. Cooperate with the the utility companies and always provide them free access to their plant.

C. Where existing pipes, ducts, or other underground services intersect the pipe trench support the pipe trench to the approval of the Engineer and the Utility Company.

D. Where existing overhead pole lines are adjacent to the excavation, temporarily support them to the approval of the Engineer and the Utility Company concerned.

1.03 EXISTING DRAINAGE

A. Maintain operation of existing septic tank and tile field installations until sewer system is operational.

1.04 MEASUREMENT FOR PAYMENT

A. The Engineer will -

1. Measure in place timber sheathing left in the trench on the written order of the Engineer prior to backfilling of the trench. The Engineer will not measure sheathing specified on the Drawings to be left in place.
2. Measure excavation for additional bedding on a cubic metre basis.

PART I GENERAL (Cont'd)

1.05 BASIS FOR PAYMENT

A. Conditions

1. Unless otherwise specified, include temporary access, site clearing, earth excavation, shoring, sheathing, support of existing utilities, dewatering, testing of material, backfilling, removal of surplus excavation, restoration and other labour, equipment and materials necessary for the complete installation of the Work, in unit prices for sewers, watermains, manholes, and catchbasins.

PART 2 PRODUCTS

2.01 MATERIALS -

- Conform to latest edition of reference standards.

- Where MTC specifications are referred to comply also with supplements to those specifications.

A. Granular Materials

1. Granular 'A', 'B' and 'D' in accordance with MTC Form 1010.

2. Granular Bedding Material - Meet with the following gradation requirements.

(A) Sieve Designation (Conforming to CGSB 8-GP-1d) | Percent Passing by Weight

150 mm	-
100 mm	-
26.5 mm	-
22.4 mm	100
16 mm	-
13.2 mm	-
9.5 mm	-
4.75 mm	25 - 100
1.18 mm	10 - 85
300 um	4 - 40
150 um	-
75 um	0 - 8
53 um	-

um = 1 micron = 1/1000 millimetre (mm)

3. Crushed Slag - Do not use as bedding for cast iron pipe or fittings.

4. Crushed Stone - produce from bedded or massive rock formation and from boulders. Break into fragments to conform to the following gradation requirements.

(A) Sieve Size | Percentage Passing by Weight

26.5 mm	100
19 mm	90 - 95
4.75 mm	5 - 10

B. Hot Mix Asphalt

1. Hot mix asphaltic concrete - MTC Form 310.

C. Topsoil

1. Use existing topsoil wherever suitable and as approved by the Engineer. Before re-using the topsoil clean out foreign matter and stones over 50 mm in size.

2. Imported Topsoil - Medium loan from a meadow or farm area known to be free from weeds.

PART 2 PRODUCTS (Cont'd)
PART 2.01 MATERIALS (Cont'd)
C. (Cont'd)

3. Notify the Engineer at least 3 days before starting topsoil stripping operations. Sources of supply will require the Engineer's approval before being brought on the job.

D. Fertilizer

1. Use complete commercial fertilizers, in compliance with the Canadian Fertilizer Act, not less than 60 percent urea-formaldehyde and the following percentages by weight -

Nitrogen	Phosphoric Acid	Potash
10	10	10 or
0	20	10

2. Superphosphate

Commercial superphosphate finely ground with a minimum analysis of 20 percent $P_{2}0_{5}$.

E. Sod

1. Use No. 1 nursery grown, 50 percent Kentucky blue, 50 percent merion blue sod, fully root permeated in a close mat, uniform in texture.

2. Cut sod by approved methods in accordance with the Nursery Sod Growers Association of Ontario. Cut pieces 1 sq. metre in area with a minimum of 20 mm soil portion.

PART 3 EXECUTION

3.01 SITE CLEARING

A. Remove trees, shrubs, roots, vegetation, loose surface rock, fences, and other obstructions on the line of the Work.

B. Carefully protect trees, fences, shrubs and other vegetation designated by the Engineer and save from injury during the construction operation.

3.02 TOPSOIL

A. If suitable for sodding and seeding, strip the topsoil from within the limits of excavation and from fill areas in advance of construction and stockpile in areas completely separated from subsoil and as designated by the Engineer.

B. Strip topsoil in such a manner as to prevent damage to the roots of trees designated to be saved.

3.03 EXCAVATING

A. Dig the trench to the alignment and depth required and only so far in advance of pipe laying as the Engineer will permit.

B. Minimum and maximum trench widths up to a point 300 mm above top of pipe, for single pipe -

1. Minimum

(A) 300 mm greater than the external diameter of pipe or 750 mm for earth excavation or 1 m for rock excavation whichever is greater, excluding an allowance for shoring.

2. Maximum

(A) Not more than 400 mm greater than the external diameter of pipe or 750 mm whichever is greater for pipe up to and including 850 mm dia., excluding an allowance for shoring.

PART 3 EXECUTION (Cont'd)

3.03 EXCAVATING (Cont'd)

B. (Cont'd)

(B) Not more than 600 mm greater than the external diameter of pipe for 900 mm dia. pipe and larger, excluding an allowance for shoring required to a point 300 mm above top of pipe.

C. The width of the trench at ground level is not to be less than the width at any depth in the trench. Fill overbreak and slides that have occurred during excavation with approved materials.

D. Where trench excavations are not kept within the design limits of the pipe, the Engineer may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.

E. Grade and shape the pipe trench and the specified bedding to give uniform and even bearing for the length of the pipe. Dig bell holes at each joint. Make corrections in the grade with compacted granular material acceptable to the Engineer, or with fill concrete.

F. Where the subgrade in its natural state is inadequate to support the pipe, the Engineer will give instructions as to the proper procedure, and such additional Work as ordered will be paid for as described in the Form of Tender.

G. Remove the subgrade where it has been adversely changed by construction operations and is not adequate to support the pipe. Replace with crushed stone or other approved material as directed by the Engineer.

H. Trench in existing roadways in a manner to prevent overbreak. Saw cut pavement in clean straight lines prior to the start of excavation.

3.04 SHEATHING AND SHORING

A. Supply, install and remove temporary sheathing and shoring where directed by the Engineer and in accordance with applicable safety regulations.

B. Drive sheathing to a sufficient penetration to effectively cut off any seepage of water into the base of the excavation which could create an upward seepage of water or a 'quick' condition at the base of the excavation. Leave sheathing in place until the trench has been backfilled to a minimum depth of 600 mm above the pipe. If there is danger of cave-in completely backfill the trench before removing sheathing.

C. Take special care to ensure that voids left by the sheathing and shoring are refilled with approved material.

D. Withdraw sheathing and shoring as the trenches are being backfilled, except where the Contractor, at his own request and expense, is permitted to leave the same in place. Sheathing left in place on written order of the Engineer will be an addition to the Contract.

E. Cut off sheathing left in place at least 1 m below the surface of the ground.

3.05 DEWATERING

A. Always maintain the excavation free of water.

B. Do not use sanitary sewers for the discharge of water from the trenches.

3.06 BACKFILLING

A. Backfill trenches from the top of the pipe bedding to the underside of surface restoration with site selected excavated material. Use backfill material free of roots, organic material and stone larger than 250 mm. Place backfill material in lifts not exceeding 150 mm. Compact to 95 percent Standard Proctor Density. Place backfill to 600 mm above top of pipe by hand.

B. If the Engineer decides that the site selected excavation material either wholly or partially is not suitable for backfill, then provide imported material of a type approved by the Engineer. Compact to 95 percent Standard Proctor Density.

C. Backfill from the top of bedding to the underside of restoration with Granular 'B' placed in lifts not exceeding 150 mm and compact to 95 percent Standard Proctor Density in trenches under roadways, driveways and parking lots.

3.07 COMPACTION TESTS

A. Where compaction of backfill is called for, the Engineer may order compaction tests by an independent testing company. Tests will be arranged for by the Engineer and paid for by the Owner.

1. Where tests show that the compaction does not meet the specified requirement, carry out further compaction in a manner directed by the Engineer, and pay for further testing to establish proof of the specified compaction.

2. For backfill compaction, tests will be made at every 0.5 max. depth, after each three 150 mm lifts have been placed.

3. Co-operate with the Engineer and Testing Company by scheduling the placing and compaction of backfill so that tests can be progressively taken.

3.08 DISPOSAL OF SURPLUS EXCAVATED MATERIAL

A. Remove surplus excavated material from the site.

3.09 RESTORATION

A. Roadways, Driveways and Parking Lots

1. Restore roadways, driveways and parking lots as follows unless shown otherwise on the Drawings -

(A) Paved roadways, driveways and parking lots

	Roadways (thickness)	Parking Lots and Driveways (thickness)
(1) H.L. 3	38 mm	25 mm
(2) H.L. 6	38 mm	50 mm
(3) Granular 'A'	305 mm	305 mm

2. Carry out asphalt work in accordance with MTC specification Form 310.

3. Carry out placing of Granular A & B in accordance with MTC specification Form 314.

B. Sidewalks, Curbs and Gutter

1. Restore existing sidewalks, curbs and gutters as directed by the Engineer.

2. Remove concrete sidewalks, curbs and gutters back to an existing expansion of contraction joint where practical or saw cut prior to restoration as directed by the Engineer. Provide 20 MPa concrete air-entrained and cured as directed by the Engineer.

C. Preparation of Subgrade for Sodding

1. Verify the subgrade and if required make adjustments to allow for topsoil and seeding or sodding to finish level with adjacent surfaces.

2. Scarify the backfill and disturbed areas to a minimum depth of 75 mm to produce an even, loose textured surface, free of stones, roots, branches larger than 75 mm in dia., and live weeds.

3. Have the finished subgrade approved by the Engineer prior to placing the topsoil.

D. Preparation of Finish Grade

1. Spread the topsoil evenly over the approved subgrade to a minimum of 100 mm. Compact to 80-95 percent Standard Proctor Density.

2. Work the fertilizer into the top 25 mm of the topsoil by discing, raking or harrowing to provide a smooth, fine textured finish surface, and firm against footprints.

3. Base quantities of fertilizer on the following minimum rates -

(A) 10 - 10 - 10 at 11 kg/100 sq. m. or

0 - 20 - 10 at 6.5 kg/100 sq. m with

(B) Superphosphate at 13.5 kg/100 sq. m.

4. Lay sod within 48 hours of working the fertilizer into the topsoil.

E. Laying sod

1. Lay sod as soon as possible after delivery.

2. Lay sods together so that there are no open joints or pieces overlapping. Lay sod smooth and flush with existing grade.

3. Immediately after laying sod spread sufficient water to saturate the sod and the upper 100 mm of topsoil.

4. After sod and soil has dried sufficiently to prevent damage, roll the area with a roller providing 72 kPa pressure to ensure a good bond between sod and soil and to remove minor depressions and irregularities.

5. Water with sufficient amounts to ensure continued healthy and vigorous growth.

3.10 RAILWAY CROSSINGS

A. Perform Work at railway crossings to conform to the general order and regulation of the Canadian Transport Commission and the local railway authority.

B. The cost of inspection and flagmen provided by the railway authority will be paid for by the Owner.

C. Install the steel liner crossing the railway tracks by boring and jacking or tunnelling as detailed on the Drawings. Submit to the railway authority details of boring head arrangement. Do not proceed until the submission has been approved. Proceed with the Work at a time acceptable to the Railway Authority and provide the advance notice required.

D. Install the main in the steel liner in accordance with the Drawings.

SECTION 02560 - SEWERS

PART 1 GENERAL

1.01 INTENT

A. This Section covers sewer Work, manholes and catchbasins from 600 mm beyond the exterior walls of structures.

B. This Section covers sewer Work from 600 mm beyond the exterior walls of structures.

C. This Section covers sewer Work including -

1. Pipe
2. Manholes and catchbasins
3. Safety gratings
4. Sanitary sewer house service connections
5. Storm sewer house service connections
6. Line and grade
7. Bedding
8. Testing
9. Boring and jacking

D. Related Work specified elsewhere is as follows -

1. Section 02550 - Site Clearing, Excavating, Backfilling and Restoration of Trenches

1.02 TESTING

A. Supply test certificates in accordance with the appropriate specification, for the following materials -

1. Pipe

1.03 DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Replace materials found to be defective in manufacture or damaged in handling after delivery including the furnishing of material and labour required for the replacement of installed material found to be defective.

B. Handling

1. Load and unload mateials so as to avoid shock or damage.

C. Storage

1. Place materials in safe storage. Keep interior of pipes, and fittings clean.

1.04 MEASUREMENT FOR PAYMENT

A. The Engineer will -

1. Measure sewers along the centreline of constructions from centre to centre of manhole.
2. Measure catchbasin leads along the centreline of construction from the centreline of the main sewer to the centreline of the catchbasin.

PART I GENERAL (Cont'd)
1.04 MEASUREMENT FOR PAYMENT (Cont'd)
A. (Cont'd)

3. Measure house service connections along the centreline of construction from the centreline of the main sewer or manhole to the street line.

4. Count each type of manhole.

5. Count each type of catchbasin.

1.05 BASIS OF PAYMENT

A. Conditions

1. Unless otherwise specified include testing of materials, bedding and testing of pipes after installation and the requirements of Section 02550 - Site Clearing, Excavating, Backfilling and Restoration of Trenches.

2. The Engineer will measure the Work when completed and the Contract Price will be increased or decreased in accordance with the final measurement.

B. Items

1. Include in the unit price per lineal metre of sewer, the pipe and the complete installation of the pipe, including the connections to manholes, catchbasins, existing sewers or other facilities.

2. Include in the unit price for each sanitary sewer house service connection as outlined in the Form of Tender, the pipe and the complete installation of the service pipe, necessary fittings, connection to the main sewer, riser pipe, capping and marking the connection at the street line.

3. Include in the unit price for each type of catchbasin, the complete installation of the catchbasin including concrete, brickwork, reinforcing steel, goss traps if required, weepers, frame and grating as shown on the Drawings.

4. Include in the unit price for each manhole, the complete installation of the manhole including concrete, benching, brickwork, reinforcing steel, ladder rungs, drop and safety grating if required, frame and cover as shown on the Drawings.

5. Include in the unit price per lineal metre of sewer installed by boring and jacking, the complete supply and installation of the pipe and liner and sand grouting.

PART 2 PRODUCTS

2.01 GENERAL

A. Tender on the basis of the type of material specified on the Drawings and in the Form of Tender.

2.02 MATERIALS

Conform to latest edition of reference standards.

A. Concrete sewer pipe

1. Concrete pipe -

(A) Non-reinforced Circular Concrete Pipe (up to and including 375 mm dia.) - CSA A257.1

2. Pipe Diameter and Class - As shown on the Drawings.

3. Fittings and Specials - In accordance with the specification for the type of pipe being used.

4. Portland Cement - type - 10

PART 3 EXECUTION (Cont'd)

3.02 FROZEN GROUND

A. Do not place Work on frozen ground. Should the bottom of the trench become frozen, remove and replace the frozen material with bedding material compacted to 95 percent Standard Proctor Density.

3.03 BEDDING

A. Sewer bedding - as specified on E-80416-L9M

B. Granular material - 'A' - conform to Section 02550.

C. Compact Granular Bedding Material to 95 percent Standard Proctor Density.

D. Compact material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of pipe where cover is less than 300 mm.

3.04 CONNECTIONS TO EXISTING FACILITIES

A. Connect sewers to existing manholes, catchbasins and other facilities as shown on the Drawings or as directed by the Engineer.

B. Obtain permission from the Engineer and the authority responsible for the existing facilities prior to making connections.

C. Connect to existing service pipes using suitable external rubber fittings fastened with mechanical stainless steel clamps.

3.05 PIPE LAYING

A. Lay, joint and test pipes and fittings in accordance with the manufacturer's instructions and in the manner hereinafter specified.

B. Lower pipe carefully into the trench. Before lowering and while suspended, inspect the pipe for defects. Remove foreign material from inside of the pipe.

C. Use temporary watertight bulkheads to prevent the flow of trench water, storm water, silt and sand within the pipe.

D. Do not deviate from line and grade except where changes in direction or the laying of pipes along a curve are limited by the pipe manufacturers tolerance.

E. Install concrete pipe only after a minimum number of days after the day of manufacture have elapsed, according to the following table -

	Days after Date of Manufacture	
Pipe Dia.	Leave Plant	Install
up to 1,500 mm	3	4
1,500 mm and over	4	5

F. Where storm and/or sanitary sewers intersect, backfill the trench of the lower pipe with 20 MPa concrete up to the grade of the higher pipe. Fill the lower trench from wall to wall for a length along the trench not less than 600 mm greater than the nominal dia. of the higher pipe. Place the concrete by forming with boards across the trench at the time of laying the lower pipe.

3.06 MANHOLES

A. Proceed with the construction of manholes at the same time as the pipe laying operation.

B. Install precast manholes in accordance with E-STD-2-2.

C. Set covers at slope and height compatible with pavement or final grade levels.

D. Parge brickwork inside and outside with 13 mm thickness of sand cement mortat.

3.07 CATCHBASINS

A. Proceed with construction of catchbasins at same time as pipe laying.

B. Install precast catchbasins in accordance with E-STD-2-15.

C. Set covers at slope and height compatible with pavement or final grade levels.

D. Parge brickwork inside and outside with 13 mm thickness of sand cement mortar.

3.08 HOUSE SERVICE CONNECTIONS

A. Lay house service connections from the main sewer to the edge of the street allowance as shown on E-STD-2-14.

B. Use recommended cutting tools to cut opening in main sewer for service connections.

C. Where the main sewer is 450 mm or less in dia., connect the house drain by using approved 'T' or 'Y' junctions. Where the main sewer is 450 mm or less in dia., connect the house drain by using approved 'Y' junctions.

D. For sanitary house connections from the main to the streetline, use asbestos cement pipe.

E. Lay sewer connections with a minimum fall of 6 mm per 300 m or 2%. Grades at the streetline will be set by the Engineer.

F. If sanitary service pipes are excavated below the grade of the storm sewer, backfill the service trench beneath and for 300 mm either side of the storm pipe with 20 MPa concrete up to the grade of the storm sewer.

G. Before backfilling, have the invert elevation of every sewer service instrument checked and accepted by the Engineer.

H. Place a marker of 50 mm x 100 mm lumber 2.5 m long at each sewer service as soon as it is installed. Have markers project 1.3 m above ground, and identified by painting the top 300 mm with red paint.

I. If risers are required, support them in the walls of the main sewer trench, or encase them in concrete. Include the price for risers in the Tender Price per lineal metre of service pipe. Provide risers when the sewer depth exceeds 4 m.

J. Backfill service pipes with selected fine material tamped in place by hand to a depth of 300 mm over the pipes before machine backfilling.

K. No additional payment will be made for extra excavation necessary, hand work, concrete on intersecting pipes, for excessive depth, for risers, or for extra length to service lots on corners. Include items mentioned above in the Tender Price per service, based on the depths and lengths indicated.

3.09 CATCHBASINS AND LEADS

A. For catchbasin leads for road drainage catchbasins, use 250 mm and 300 mm dia., concrete pipe. The basin will not require goss traps.

3.10 CLEANING AND TESTING OF SANITARY SEWERS

A. Flush and clean sewers and manholes prior to testing. Carry out testing in the presence of the Engineer.

Supply water for cleaning and testing.

B. Inspect manholes and pipe for defects and signs of leakage. Repair visible leaks or faults as approved by or as directed by the Engineer.

C. Carry out testing from manhole to manhole as the Work progresses.

PART 3 EXECUTION (Cont'd)

3.10 CLEANING AND TESTING OF SANITARY SEWERS (Cont'd)

D. Do not proceed with construction of new sewers when three sections of complete sewers have not been tested or have been tested and are unacceptable.

E. After backfilling test sewers for infiltration and/or exfiltration as directed by the Engineer and carry out repairs as necessary and re-test until the works pass the leakage tests. Permissible leakage is as outlined in the following table -

1. Test	Permissible Leakage
Infiltration Test -	0.15 litre/hr/mm dia. per 100 m of sewer
Exfiltration Test - in all cases except when infiltration testing is required.	0.18 litre/hr/mm dia. per 100 m of sewer

2. Permissible leakage may be increased by 25 percent provided that the leakage is offset by leakage measurement in adjacent sections such that the total leakages are within the amount allowable for the combined sections.

F. Method of Exfiltration Test for Sewers -

1. Isolate section of sewer to be tested at its outer limits by temporarily plugging the inlets of two manholes.

2. Fill pipe amd manholes with water to provide a minimum net positive head, taking into account existing ground water table, of 1 m above the crown of the pipe in the upstream manhole. Optionally, the pipe may be filled not higher than the above level, up to 24 hours prior to time of testing, to permit the normal absorption into the pipe walls to take place. Do not exceed 3 m max. head in downstream manhole.

3. Test by letting the water stand in the manholes for 1 hour and observing the drop of level at the end of the period.

4. The drop in water level in the manholes at the end of the test will be a measure of leakage from the sewer.

G. Method of Infiltration Test for Sewers -

1. Isolate the section of sewer to be tested at its upper limits by temporarily plugging the outlet of the upstream manhole.

2. Construct a temporary dyke in the inlet pipe of the downstream manhole. The measurement of infiltration may be determined by timing the flow of water into a calibrated container, or over a weir, or by other method acceptable to the Engineer.

3. Do not start until steady state conditions have been established to the satisfaction of the Engineer.

H. No part of the Work will be accepted until the sewers are clean and free from sand, earth, mud, or other obstructions and have successfully passed the infiltration or exfiltration tests. When required by the Engineer pass a test ball of 50 mm less in diameter than the sewer from manhole to manhole.

I. Furnish labour, tools, and equipment necessary to clean and test the sewer.

J. The alignment of sewers between manholes may be tested at each section as laid. When required by the Engineer shine a strong light through the pipe from manhole to manhole. If less than one-half of the full diameter of the pipe at the light source is visible from the far end, re-align the pipes when ordered by the Engineer.

PART 3 EXECUTION (Cont'd)

3.11 CLEANING AND INSPECTION OF STORM SEWERS

A. Clean catchbasins prior to acceptance.

3.12 STEEL LINER PIPE

A. Install the steel liner crossing the railway tracks by boring and jacking as detailed on the Drawings. Submit to the railway authority details of boring head arrangement. Do not proceed until the submission has been approved. Proceed with the Work at a time acceptable to the Railway Authority and provide the advance notice required.

B. Install the main in the steel liner in accordance with the Drawings. Provide bulkheads at both ends of liner and pressure grout in accordance with standard procedures for this work. Steel liner to have minimum yield strength of 241.3 MPa (35,000 p.s.i.).

C. Perform Work at railway crossings to conform to the general order and regulation of the Canadian Transport Commission and the local railway authority.

D. The cost of inspection and flagmen provided by the railway authority will be paid for by the owner.

E. Include all costs associated with the supply and installation of the steel liner and sewer inside the liner in the price tendered in the Form of Tender.

SECTION 02570 - WATERMAINS

PART I GENERAL

1.01 INTENT

A. This section covers watermain Work including -

1. Pipe
2. Fittings, specials and joints
3. Hydrants
4. Valves, valve boxes and valve chambers
5. Service connections
6. Line and grade
7. Bedding
8. Testing
9. Disinfecting
10. Boring and jacking

B. Related Work specified elsewhere is as follows -

1. Section 02550 - Site Clearing, Excavating, Backfilling and Restoration of Trenches

1.02 CERTIFICATES OF TESTING

A. Provide test certificates in accordance with the appropriate specification for the following materials -

1. Pipe
2. Fittings
3. Valves
4. Hydrants

1.03 AFFIDAVIT OF COMPLIANCE

A. Provide the Owner with an affidavit stating that the following material is in accordance with the appropriate specification. Provide this affidavit prior to the delivery of the material to the site.

1. Pipe
2. Fittings, specials and gaskets
3. Valves
4. Hydrants

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Replace materials found to be defective in manufacture or damaged in handling after delivery including the furnishing of material and labour required for the replacement of installed material found to be defective.

B. Handling

1. Load and unload materials so as to avoid shock or damage.

2. Handle pipe and fittings so that the coating and lining will not be damaged. If, however, the coating or lining is damaged, then repair in a satisfactory manner.

C. Storage

1. Place materials in safe storage. Keep interiors of pipes, fittings, and other accessories clean. Store valves and hydrants so as to protect them from damage by freezing.

1.05 MEASUREMENT FOR PAYMENT

A. The Engineer will -

1. Measure watermains along the centreline of construction, straight-through bands, fittings, specials, valve and valve chambers.

2. Measure service connections in the horizontal plane along the centreline of the pipe from the centre of watermains to the street line.

3. Count complete hydrant sets.

4. Count complete valves and valve boxes.

5. Count complete valves and valve chambers.

6. Count complete connections to existing mains.

1.06 BASIS FOR PAYMENT

A. Conditions

1. Unless otherwise specified, include testing of materials, thrust blocks, anchor blocks, bedding, insulation, testing and disinfecting the pipes after installation and the requirements of Section 02550 Site Clearing, Excavating, Backfilling and Restoration of Trenches,

2. The Engineer will measure the Work when completed and the Contract price will be increased or decreased in accordance with the final measurement.

B. Items

1. Include in the unit price per lineal metre for watermains the complete supply and installation of the pipe and necessary fittings.

2. Include in the unit price for each hydrant the complete supply and installation of the pipe from the main, connection to the main, secondary valve and valve box, hydrant, crushed stone backfill and blocking of the hydrant as shown on the Drawings.

3. Include in the unit price for each valve and valve box the complete supply and installation of the valve and valve box as shown on the Drawings.

4. Include in the unit price per lineal metre of pipe, complete supply and installation of the service pipes as specified including connections to main and curb stops.

5. Include in the unit price for main stops the complete supply and installation of the main stop including connection to watermain and service pipe.

6. Include in the unit price for curb stops the complete supply and installation of curb stops including connections to service pipe.

7. Include in the unit price for curb boxes the complete supply and installation of box.

PART 2 PRODUCTS

2.01 GENERAL

A. Tender on the basis of the type of pipe specified in the Form of Tender.

2.02 MATERIALS

A. Asbestos Cement Pipe

1. Pipe - AWWA C400

2. Pipe diameter and class - 150 mm, Class 150

3. Supply pipe in standard lengths. Supply short lengths machined as required to install fittings and valves in the correct locations.

4. Joints - 'Ring-Tite', 'Fluid-Tite', or approved equal.

5. Rubber rings used to seal the joints of the pipe - ASTM D1869

B. Cast Iron Fittings and Specials

1. Cast Iron Fittings - AWWA C110 (ANSI A21.10).

2. Fittings - cement lined - AWWA C104(ANSI A21.10).

3. Pressure Rating of Fittings - 0.862 MPa

4. Fittings - 'Ring-Tite' or 'Fluid-Tite' ends

5. Rubber gaskets for fittings - AWWA C111 (ANSI A21.11)

C. Gate Valves

1. Gate Valves - AWWA C500

2. Gate Valves - non-rising spindle, double disc parallel seat, mechanical joint ends. Valves - open counter clockwise unless specified otherwise and be equipped with 'O' rings.

D. Valve Boxes

1. Valve Boxes - See E-STD-1-7 Emco or approved equal

2. Depth of trench from top of pipe to finish grade - 1.7 m

E. Hydrants

1. Hydrants - AWWA C502

2. Hydrants - Crane "McAvity M-67" or Darling Century

3. Bury Depth - 6'0"

4. Hydrants - slide gate, shut off, two piece barrel with flange at ground line, 6 in. main valve, two 2 1/2 in. dia. hose nozzles - CSA B89.2 (Ontario thread), 6 in. inlet connection with mechanical joints, 1 in. square operating and cap nut. Paint yellow and open counter clockwise.

F. Corporation Service Fittings

1. Corporation Main Stops, Curb Stops, and Curb Boxes - AWWA C800.

2. Service Connections - made by means of an approved saddle.

3. Corporation Main Stops -

(A) 25 mm, 32 mm, 38 mm and 50 mm water service -

(1) Emco 56-73850-1, Canadian Brass CC102 or approved equal

PART 2 PRODUCTS (Cont'd)
2.02 MATERIALS (Cont'd)
F. Corporation Service Fittings (Cont'd)

4. Curb Stops

(A) 25 mm, 32 mm, 38 mm and 50 mm -

(1) Ford B44 Series, Mueller Mark II Oriseal H10283 with 110 Compression adapters, Mueller H15209, or approved equal

5. Curb Boxes - minimum and maximum extension of the curb box is 1.5 m to 1.8 m

6. Copper Pipe - seamless soft copper water tube - ASTM B-88, type 'K'.

7. Service Boxes - to suit valve or curb stop, with No. 304 stainless steel road and 6 mm x 63 mm cotter pins.

PART 3 EXECUTION

3.01 LINE AND GRADE

A. Supply, erect and maintain batter boards and site rails to ensure accurate line and grade of pipes. Always have at least 3 batter boards in use, placed not more than 15 m apart. Obtain Engineer's approval for alternative methods.

B. On straight lines, lateral deviation in excess of 150 mm will not be tolerated. On straight grades, grade deviation in excess of 80 mm will not be tolerated.

C. For vertical or horizontal bends do not deviate the pipe lines more than 300 mm from line or more than 150 mm from grade as the case may be.

3.02 FROZEN GROUND

A. Do not place Work on frozen ground. Should the bottom of the trench become frozen, remove and replace the frozen material with bedding material compacted to 95 percent Standard Proctor Density.

3.03 BEDDING

A. Watermain Bedding - as specified on E-80416-L7M

B. Granular Material - 'A'. conform to Section 02550

C. Compact granular bedding material to 95 percent Standard Proctor Density.

D. Compact the material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of the pipe where cover is less 300 mm.

E. Do not use crushed slag produced from iron blas furnace slag for cast iron pipe fittings or valves.

3.04 CONNECTION TO EXISTING WATERMAINS

A. Connect new mains to existing mains as shown on the Drawings.

B. Obtain permission from the Engineer and the authority responsible for the existing mains prior to making connections to an existing main. Valves on the existing system will be operated only by the watermain authority. Notify affected water useers in advance of interruption of service.

C. Provide temporary water service for interruptions longer than 3 hr.

3.05 PIPE LAYING

A. Lay, joint and test pipes and accessories in accordance with the manufacturers instructions and in the manner hereinafter specified, in the presence of and subject to the Engineer's approval.

B. Use temporary water tight bulkheads to prevent the flow of trench water, storm water, silt and sand within the pipe.

C. Carefully lower pipe into the trench. Beford lowering and while suspended, inspect the pipe for defects. Remove foreign material from the inside of the pipe.

D. Support bends, tees and dead ends by 20 MPa concrete thrust blocks to undisturbed ground as detailed on E-80416-L8M. Arrange thrust blocks to transfer the full thrust of the deflection at test pressure without exceeding the gearing capacity of the ground.

E. Construct anchor blocks of 20 MPa concrete a shown on the Drawings.

3.06 VALVE AND VALVE BOXES

A. Install valves and valve boxes plumb, centered over the operating nut and supported in place during backfilling with the cover flush with the finished grade.

B. Do not backfill until valves or valve boxes have been inspected by the Engineer, or the inspector having jurisdiction.

3.07 HYDRANTS

A. Install hydrants plumb with the nozzles parallel with the watermains, and with the pumper nozzles (if any) facing the curb. Ensure that no portion of the hydrant or nozzle cap is within 150 mm of the back of the curb or the edge of the sidewalk.

B. Set hydrants to the established grade with nozzles at least 150 mm above the ground.

C. Do not backfil until hydrants have been inspected by the Engineer.

3.08 WATER SERVICE CONNECTION

A. Use standard waterworks equipment for installing corporation main stops. Do not cross threads of corporation main stops during insertion and apply a maximum torsion of 360 N. Leave corporation main stops in the open position. On thinner wall pipe use full circle saddle. Use a cutting and tapping tool of a type recommended by the pipe manufacturers and insert the stop. Take care that no undue stress is applied to the pipe when tapping the main and inserting the main stop, that may result in a fracture. Tap for service connection while the main is under pressure.

B. Install service boxes and curb stops at the street line with the box in the centre of the sliding adjustment and the top set to the finished grade. Set curb stop on blocking.

C. Install service connections in a trench separate from the sewer connection and clear of other utilities.

D. Lay service connections from the watermain to the curb stop in an evenly graded trench with Class 'B' bedding as detailed in standard Drawing E-80416-L7M. Do not splice service connections.

E. Install a 50 mm x 100 mm timber marker beside each service box. Drive marker 1.0 m into the ground and let it project 1.0 m above the ground with the top 300 mm painted orange.

3.09 TESTING

A. Clean out valved Section of pipe or part thereof by flushing at scouring velocities prior to testing. Operate valves and hydrants during flushing under the supervision of the operating authority.

B. Subject the section of pipe under test to a pressure of 1 MPa. By means of pumping out of a suitable container of known volume maintain the pressure at 1 MPa for one hour and record the amount of water used in this period.

C. Determine the allowable leakage from A.W.W.A. C 603, Table 1. The data for Table 1 are based on 150 psi and represent a leakage of approximately 30 U.S. gpd per mile per inch of pipe diameter for pipe in 13 ft. lengths.

1. For metric convert to litres/hr.

3.11 STERILIZING WATERMAINS

A. Flush the main prior to chlorination with sufficient volumes to produce scouring velocities in the mains. Operate all valves and hydrants during this flushing under the supervision of the operating authority.

B. Dissolve chlorinous compounds such as 'pittchlor' or 'hth' in water to produce a solution.

C. Introduce the solution at one end of the system being sterilized until water taken off at the remote end(s) tests at a level of 50 mg/litre.

D. Allow the chlorinous solution to remain in the mains for 24 hr. at which point flush the system clean of the chemical.

Give the Engineer at least 2 days notice of the date when disinfection of the system is to start so that the arrangements can be made for others to take samples and test the chlorine residual.

3.12 STEEL LINER PIPE

A. Install the steel liner crossing the railway tracks by boring and jacking as detailed on the Drawings. Submit to the railway authority details of boring head arrangement. Do not proceed until the submission has been approved. Proceed with the Work at a time acceptable to the Railway Authority and provide the advance notice required.

B. Install the main in the steel liner in accordance with the Drawings. Provide bulkheads at both ends of liner and pressure grout in accordance with standard procedures for this work. Steel liner to have minimum yield strength of 241.3 MPa (35,000 p.s.i.).

C. Perform Work at railway crossings to conform to the general order and regulation of the Canadian Transport Commission and the local railway authority.

D. The cost of inspection and flagmen provided by the railway authority will be paid for by the owner.

E. Include all costs associated with the supply and installation of the steel liner and watermain inside the liner in the price tendered in the Form of Tender.

SECTION 02590 - ROADS AND SURFACE WORKS

PART 1 GENERAL

1.01 INTENT

A. This Section covers the Work for roads and surface works including -

1. Site clearing
2. Grubbing
3. Stripping and stockpiling of topsoil
4. Excavation and grading
5. Compaction
6. Granular courses
7. Curb and gutter
8. Sidewalk and pavement
9. Existing utilities
10. Existing drainage
11. Removal of asphalt pavement, concrete pavement, concrete curb and gutter and sidewalk
12. Calcium chloride
13. Concrete sidewalk
14. Concrete curb and gutter
15. Asphaltic concrete
16. Adjustment of cast iron frames and valve boxes
17. Placing topsoil
18. Fertilizer
19. Sod
20. Railway crossings
21. Restoration

1.02 TESTING

A. Supply test certificates in accordance with the appropriate specification, for the following materials -

1. Granular 'A'
2. Asphalt and concrete

B. Provide mix designs for asphalt and concrete at least two weeks prior to use.

1.03 EXISTING UTILITIES

A. Contact the various utility companies prior to commencing Work and become informed of the exact location of all utilities, protect them during construction and assume all liability for damage to utilities.

B. Utilities that require relocation will be the responsiblity of the Owner, including costs. Cooperate with the utility companies and always provide them with free access to their plant.

C. Where existing overhead pole lines are adjacent to the excavation, temporarily support them to the approval of the Engineer and the Utility Company concerned.

1.04 EXISTING DRAINAGE

A. Maintain temporary and permanent flow in sewers, drains, gutters, ditches, watercourses, house and inlet connections.

1.05 MEASUREMENT FOR PAYMENT

A. The Engineer will measure items in the units as detailed in the Form of Tender. Measurements will be taken in the horizontal plane except for seed, sod and rip-rap.

1.06 BASIS OF PAYMENT

A. Conditions

1. The Engineer will measure the Work when completed and the Contract price will be increased or decreased in accordance with the final measurements.

2. No additonal payment will be allowed for difficulties resulting from relocating of utilities by others not being done until after road excavation, placing of granular base, or paving.

B. Items

1. Include in the unit prices for items the associated Work as follows -

(A) Excavation of Roads

(1) Excavate to the lines and grades as set out. Payment will not be made for overbreak of rock or over excavation.

(2) Haul excess material from site.

(B) Strip Topsoil

(C) Remove Asphalt Pavement

(1) Excavate, load and haul from site

(D) Remove Concrete Curb and Gutter

(1) Excavate, load and haul from site

(E) Remove Concrete Sidewalk

(1) Excavate, load and haul from site

(F) Provide Granular 'A' and 'B' courses

(1) Supply, load, weigh, haul, place and compact to 100 percent Standard Proctor Density, and fine grade

(G) Provide Calcium Chloride

(1) Supply and apply as directed

(H) Provide Concrete Sidewalk

(1) Including 150 mm Granular 'A' base compacted to 100 percent Standard Proctor Density

(2) Pliable impervious underlay

(3) Expansion joint material

(4) Formwork, concrete, finishing and surface sealing

PART 1 GENERAL (Cont'd)
1.06 BASIS OF PAYMENT (Cont'd)
B. Items (Cont'd)

(I) Provide Concrete Curb and Gutter

(1) Expansion joint material

(2) Formwork, concrete finishing and surface curing

(J) Provide Asphalt

(1) Provide Marshall mix design

(2) Adjust cast iron frames, valve boxes to final grades

(3) Trim existing asphalt to make joints straight and square

(4) Supply, place and compact asphaltic cement concrete

(K) Place Topsoil

(1) Load, haul, spread and fine grade

(L) Provide Sod

(1) Fertilize, wire and stake where required, supply, place, roll, water and maintain

(M) Grader Rental

(1) As directed

(2) 100 H.P. min.

(3) This item applies only to grading items not covered by earth excavation or other unit prices

(N) Saw Cutting Existing Pavement

(1) Cut minimum of 50 mm

(2) Cut in clean straight lines as directed

PART 2 PRODUCTS

2.01 GENERAL

A. Granular Materials

1. Granular 'A', 'B' in accordance with MTC Form 314.

B. Portland Cement Concrete

1. Produce in accordance with CSA-A23

2. Strength - 25 MPa or other strength as approved by the Engineer

3. Maximum aggregate size - 19 mm

4. Air entraining agent - Comply with ASTM-C260. By volume, 5 percent to 6 percent entrained air at placement

C. Hot Mix Asphaltic Concrete

1. H.L. 6 base course - MTC Form 310

2. H.L. 3 surface course - MTC Form 310

D. Topsoil

1. Topsoil, free of wood and non-organic material

PART 2 PRODUCTS (Cont'd)
2.01 GENERAL (Cont'd)

E. Fertilizer

1. Use complete commercial fertilizers, in compliance with the Canadian Fertilizer Act, not less than 60 percent urea-formaldehyde and the following percentages by weight -

Nitrogen	Phosphoric Acid	Potash
10	10	10 or
0	20	10

2. Superphosphate

Commercial superphosphate finely ground with a minimum analysis of 20 percent P205.

F. Sod

1. Use No. 1 nursery grown, 50 percent Kentucky blue, 50 percent Merion blue sod, fully root permeated in a close mat, uniform in texture.

2. Cut sod by approved methods in accordance with the Nursery Sod Growers Association of Ontario. Cut pieces 1 sq. metre in area with a min. of 20 mm soil portion.

G. Expansion joint filler - ASTM D1751

H. Curing compound - ASTM C309, type 2 (white)

PART 3 EXECUTION

3.01 CLEARING

A. Carefully protect rrees, shrubs and other vegetation designated to be saved during construction. Carefully carry out designated 'spot' or selective clearing.

B. Cut and dispose of trees, brush, vegetation, windfalls timber, fences and surface litter.

C. Clear areas beyond the street lines or on easements only where specifically directed.

3.02 GRUBBING

A. Remove and dispose of stumps, roots, embedded logs, loose surface boulders and masonry, and surface debris.

3.03 STRIPPING AND STOCKPILING TOPSOIL

A. Strip topsoil within the limits of excavation and fill areas before grading, prevent damage to roots of trees and vegetation to be saved, stockpile in regular trapezoidal sections to a max. height of 3 m.

3.04 REMOVALS

A. Remove existing asphalt, concrete pavement, concrete sub-base, curbs gutters and sidewalks as required for the new work. Dispose of removed materials off the site, or in an area designated by the Engineer, or at municipal landfill site at

3.05 EXCAVATION AND GRADING

A. Make cuts and fills employing excavating, compacting of subgrade, filling, loading, hauling and fine grading. Cross-sections on the Drawings show the limits of excavation, filling, sideslopes, toe of slope and limit of cut locations. Dispose of surplus excavated material off the site.

B. Soils on the site wil be considered 'earth' except rock. Boulders and masonry exceeding 0.75 cu. metre in volume will be termed 'rock'. Bury rock and boulders up to 0.25 cu. metre in volume - not less than 1.2 m below top of subgrade. Dispose of rock and boulders between 0.25 cu. metre and 0.75 cu. metre, as earth, and rock and boulders which re-appear during grading.

3.05 EXCAVATION AND GRADING (Cont'd)

C. Excavate soft spots in subgrade. Fill with Granular 'A' or select excavated material and compact to 95 percent Standard Proctor Density.

D. Fine grade road subgrade to specified cross-section and compact to 95 percent Standard Proctor Density.

E. Maintain grading tolerance for subgrade at plus or minus 30 mm.

3.06 COMPACTION ON SUBGRADE AREAS

A. During construction of the underground utilities, compact trenches to subgrade elevations at 95 percent Standard Proctor Density.

B. Comapct subgrade and fill areas on roac allowances to 95 percent Standard Proctor Density.

3.07 GRANULAR COURSES

A. Supply, weigh, place, grade and compact to 100 percent Standard Proctor Density, Granular 'A' courses to the depths indicated on the Drawings. Maintain optimum moisture content.

B. Maintain grading tolerance for Granular 'A' to plus or minus 6 mm.

C. Unless otherwise directed by the Engineer, do not place Granular 'A' course until after curbs and gutters are constructed. Place Granular 'A' course in the same construction season as the asphalt surface.

3.08 COMPACTION TESTS

A. Where compaction of sub-grade, granular base course and fill is called for, the Engineer may order compaction tests by an independent testing company. Tests will be arranged for by the Engineer and paid for by the Owner.

1. Where tests show that the compaction does not meet the specified requirement, pay the costs for further compaction tests by an independent testing company. Tests will be arranged for by the Engineer and paid for by the Owner.
2. For fill compaction, tests will be made at every 460 mm max. depth, after two 230 mm lifts have been placed. Granular courses will be tested at depths as directed by the Engineer.
3. Cooperate with the Engineer and testing company by scheduling the placing and compaction of fill and granular courses so that tests can be progressively taken.

3.09 SETTING MANHOLES, CATCHBASINS AND VALVE CHAMBERS

A. Adjust cast iron frames and valve boxes to finish grades of roads and curbs, sidewalks or sod before the task is completed. Where brick and concrete chimneys are adjusted, maintain the ladder rung pattern, with the largest from the top not to exceed 380 mm. For masonry adjustments use sound mortar construction. Firmly bed castings in mortar.

B. Make slope castings parallel to slope of finished grade.

3.10 CONCRETE CURB AND GUTTER AND SIDEWALK

A. Carry out excavations, setting of forms to the lines and grades.

B. Compact granular base courses under forms to 100 percent Standard Proctor Density.

C. Use flexible forms on curves with radius less than 60 m.

D. See Drawings for concrete sub-sections.

E. Have concrete workmanship conform to CSA A23.

F. Place pliable impervious membrane on granular subgrade.

G. Do not pour concrete until forms and subgrade have been inspected and approved.

PART 3 EXECUTION (Cont'd)
3.10 CONCRETE CURB AND GUTTER AND SIDEWALK (Cont'd)

H. Provide 12 mm thick expansion joints, cut to full cross-section at 6 m intervals, at each point of tangent, at the centre of each driveway and at catchbasins.

I. Mark sidewalks at 1.5 m intervals transversely, strike the joint to a penetration of 20 percent of the sidewalk thickness, mark curb and gutter only at the expansion joints, and round marked joints to 6 mm.

J. Finish exposed surfaces with a uniform wood-float or broom finish, and correct surface irregularities before final set.

K. Apply a curing compound, after initial set has occurred.

L. Protect the Work until final set has occurred.

M. Provide steel reinforcing to concrete curb and gutter at catchbasins as indicated on the Drawings.

3.11 ASPHALTIC CONCRETE

A. Quality Control

1. Maintain paving mixture at plus or minus 0.3 percent of asphaltic cement content.

B. Advance Preparations

1. Give 48 hr. notice of each intention to pave.

2. Paint tops of cast iron castings with fuel oil.

3. Review the fine grade of the Granular 'A' surface, scarify, grade and recompact if necessary.

4. Paint joints between the asphalt and the gutters and cast iron castings with hot liquid asphalt cement.

C. Paving

1. Use a maximum screen 4 m wide for laying base course and 3 m wide for laying the surface course.

2. MTC Form 310 governs the laying of the base course and the surface course.

3. Provide thickness of base and surface courses as shown on the Drawings.

4. Where surface course will not be laid, ramp cast iron castings and valve boxes with asphalt.

5. Leave an unpaved strip 600 mm wide on each side, where surface course will not be laid and where curb and gutter has not been constructed.

6. Weigh materials as in MTC Form 318.

3.12 SEEDING AND SODDING

A. Spread and grade topsoil (from stockpiles) on boulevards and other areas where sodding is shown on the Drawings.

SECTION 02590-A - COLD-MIX ASPHALT

PART 1 GENERAL

1.01 INTENT

A. This special provision governs the production, placing and compaction of a cold-mixed, open-graded bituminous mixture.

1.02 MEASUREMENT FOR PAYMENT

A. Asphalt Emulsion

1. The quantity of emulsion used in the mixture will be measured in litres. The measured quantity will, for payment purposes, be converted to the volume which it would occupy at a temperature of 16°C.

B. Course Aggregate

1. The quantity of coarse aggregate used in the mixture will be measured in tonnes.

C. Choke Aggregate

1. The quantity of choke aggregate applied to the road will be measured in tonnes.

1.03 BASIS OF PAYMENT

A. Asphalt Emulsion

1. Payment at the contract unit price per litres will be payment in full for supplying asphalt emulsion as required in the mixture.

B. Coarse Aggregate

1. Payment at the contract unit price per tonne of coarse aggregate shall be payment in full for supplying coarse aggregate, handling, hauling, mixing with emulsion, placing, rolling and brooming, and for all other operations necessary to complete the work in accordance with this specification and for which payment is not otherwise provided.

C. Choke Aggregate

1. Payment at the contract unit price per tonne will be compensation in full for supplying, handling, hauling, spreading, rolling and for all other operations necessary to complete the work in accordance with this specification and for which payment is not otherwise provided.

PART 2 PRODUCTS

2.01 Asphalt Emulsion

A. The bituminous material used for mixing shall meet the requirements of CMS-2 Emulsion, Table 1, as specified in the 1975 Annual Book of ASTM Standards.

2.02 Aggregates General

A. Aggregates of the type and quality specified shall be in accordance with the provisions of MTC Form 1000, "Material Specification for Aggregate - General". Sufficient material to complete the work shall be stockpiled prior to commencing the paving operation.

2.03 Coarse Aggregates

A. Coarse aggregate for mixing shall meet the gradation and physical requirements of an H.L.4 stone as detailed in MTC Form 1003, Section 1003.06.01 "Gradation Requirements for Coarse Aggregate", and Section 1003.06.02 "Physical Requirements for Coarse Aggregate".

2.04 Choke Aggregate

A. The aggregate used for choke material shall meet the requirements of MTC Form 304, Section 304.02.03 for Class 1 or Class 3 aggregate.

PART 2 PRODUCTS (Cont'd)

PART 2.04 COMPOSITION OF MIXUTRE

A. The mix proportion shall be determined by the Contractor using established laboratoty test methods for each source of aggregate.

The test results shall be submitted to the Engineer, one week prior to the production of the mixture on the contract.

The test methods shall include:

(A) Test methods employed

(B) Proposed emulsion content

(1) percentage by weight
(2) litres per tonne of aggregate

(C) Proposed residual asphalt content percentage by weight

No mix shall be supplied under the contract until the proposed mix formula has been approved by the Engineer.

The allowable tolerance of the residual asphalt content as determined by the extraction test shall be $\pm$ .3 percent of the mix formula.

The allowable upper limit of the proposed emulsion content (in litres per tonne of aggregate) as determined in Section #4 (Composition of Mixture) shall be (+) 10%. The Engineer will not make payments for emulsion used in excess of this limit.

PART 3 EXECUTION

3.01 PROCEDURE

/ The mixture shall be mixed and placed using a Midland Mix Paver. The mixture shall be compacted with a steel wheeled roller meeting the Class "A" requirements, MTC Form 310, Section 310.04.07. The choke stone shall be rolled using a self-propelled pneumatic-tired roller as per MTC Form #310.04.07, Class C.

B. Work can only proceed when the minimum ambient temperature is 16°C and rising.

The aggregate and emulsion shall be sufficiently mixed so that the bituminous material is uniformly distributed throughout and all aggregate particles are uniformly coated.

The Mixer Paver shall be guided by an approved method such as a stringline set from the staked alignment. This means of control shall be established on each side of the road.

The mixture shall be mechanically spread by the Mix Paver at a uniform depth and crossfall (2%) as required. The finished surface of the pavement shall be tested with a 3 m straight edge laid parallel with the centre line of the pavement. Any area exceeding a 7 mm variation from the surrounding area shall be satisfactorily corrected or removed and replaced at the Contractor's expense.

Breakdown rolling shall be delayed until surface breaking of the emulsion has occurred.

The Contractor will be responsible to cover all emulsion runout on the sides of the road with choke aggregate to prevent the pickup and tracking of the emulsion by private vehicles, only when directed by the Engineer.

Following breakdown rolling, the choke aggregate will be mechanically spread uniformly across the width of the fresh mat. Sufficient choke will be applied to prevent pickup by traffic. The final rolling with a self-propelled pneumatic-tired roller shall key in the choke aggregate and remove any marks remaining from breakdown rolling.

Traffic shall not be allowed on the fresh mat until the choke has been applied and final rolling is complete.

The exposed vertical face at the centreline edge of pavement shall be free of choke aggregate to ensure a good bond at the longitudinal joint. Contamination of the exposed face by the choke aggregate will necessitate removal or spraying with emulsion of the contaminated area.

When a second course is required, loose choke material, if used, shall be broomed from the surface of the binder course prior to placing the surface course. No bituminous mixture shall be placed over a previous course less than 24 hours after final compaction of the latter.

Any area determined to be unacceptable by the Engineer shall be removed and replaced by the Contractor at his expense.

Any aggregate spilled in front of the Mix Paver shall be immediately removed.

Requirements for CMS-2 cationic emulsified asphalt

Type	Medium-Setting	
Grade	CMS-2	
	min	max
Test on emulsions:		
Viscosity, Saybolt Furol at 77°F (25°C), s		
Viscosity, Saybolt Furol at 122°F (50°C), s	50	450
Settlement,[1] 5-day, %		5
Storage stability test,[2] 24-h, %		1
Classification test[3]		
or		
Demulsibility,[4] 35 ml 0.8% sodium dioctylsulfosuccinate, %		
Coating, ability and water resistance:		
Coating, dry aggregate		good
Coating, after spraying		fair
Coating, wet aggregate		fair
Coating, after spraying		fair
Particle charge test		positive
Sieve test, %		0.10
Cement mixing test, %		
Distillation:		
Oil distillate, by volume of emulsion, %		12
Residue, %	60	
Tests on residue from distillation test:		
Penetration, 77°F (25°C), 100 g, 5 s	100	250
Ductility, 77°F (25°C), 5 cm/min, cm	40	
Solubility in trichloroethylene, %	97.5	

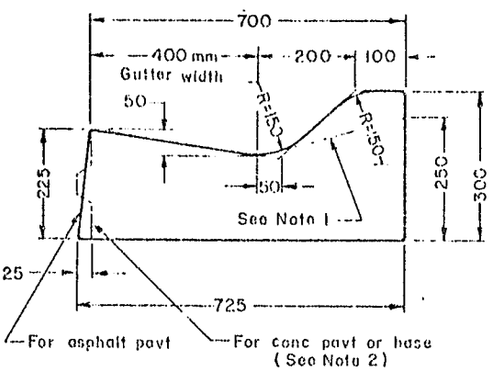
[1] The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days time; or the purchaser may require that the settlement test be run from the time the sample is received until the emulsified asphalt is used, if the elapsed time is less than 5 days.

[2] The 24-h storage stability test may be used instead of the 5-day settlement test.

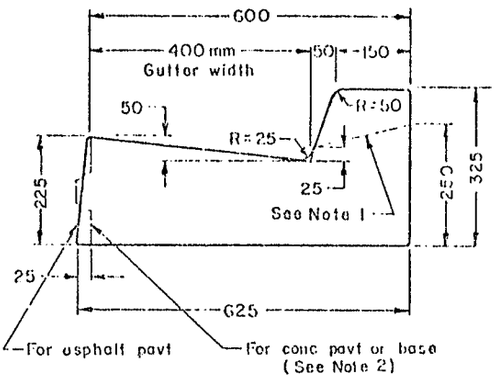
[3] Material failing the classification test will be considered acceptable if it passes the demulsibility test.

[4] The demulsibility test shall be made within 30 days from date of shipment.

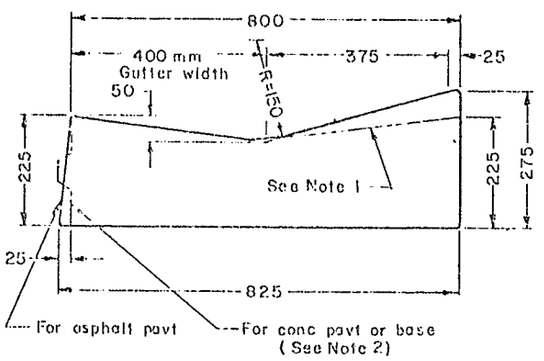
TABLE 1



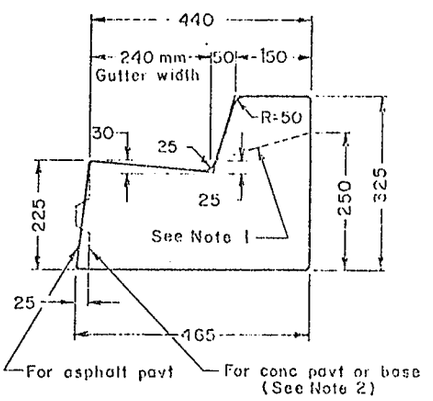
Type A : 0.156 m^3/m



Type B : 0.143 m^3/m



Type D : 0.172 m^3/m



Type G : 0.109 m^3/m

NOTES:

1 Dropped curb at entrances length as shown on the plans or as directed by the Engineer.

2 When curb & gutter is adjacent to concrete pavement or base, this Standard to be used in conjunction with DD-514-C

A Top edges of front and back of curb gutter to be rounded with edging tool, except where front edge abuts concrete pavement with longitudinal joint.

B The length of transition from one type to another shall be the greatest of:
- a 50 x difference in overal curb heights
- b 25 x difference in gutter widths
- c 2.0 m

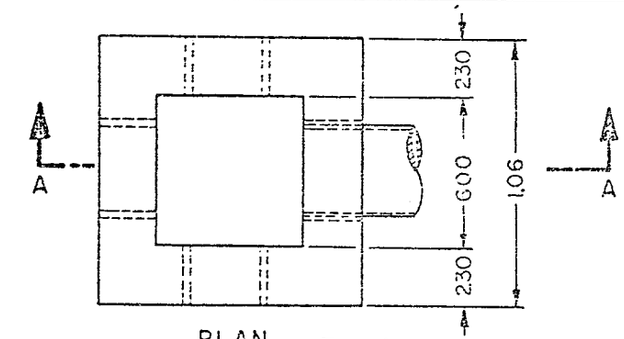
C Minimum compressive strength of concrete to be 20 MPa at 28 days.

D All dimensions are in millimetres or metres unless otherwise specified.

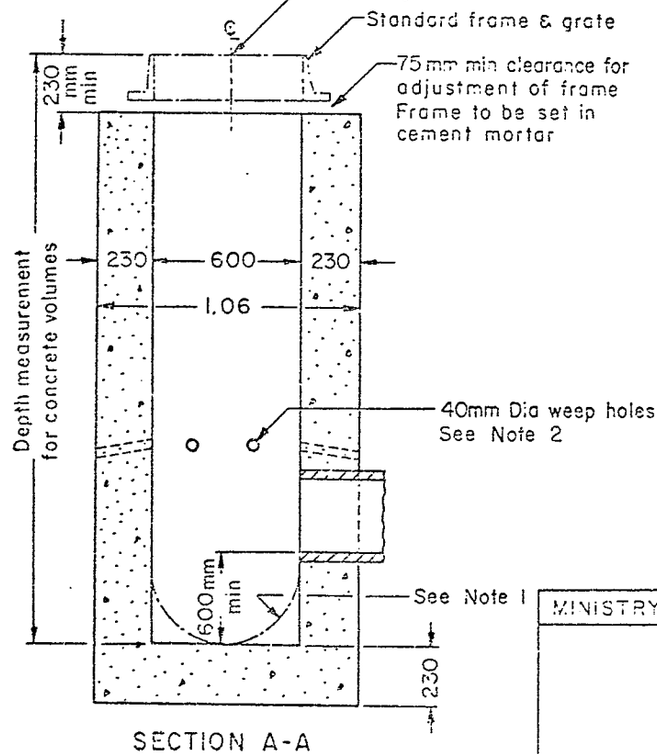
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO	No DD-601		
	Date	1979 09 01	Rev 1

CONCRETE CURB AND GUTTER

Director Design and Construction Branch



PLAN



SECTION A-A

CONCRETE VOLUMES (m^3)										
DEPTH (m)	TENTHS OF ONE METRE									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
1	0.85	0.92	1.00	1.08	1.15	1.23	1.30	1.38	1.46	1.53
2	1.61	1.69	1.76	1.84	1.92	1.99	2.07	2.14	2.22	2.30
3	2.37	2.45	2.53	2.60	2.68	2.76	2.83	2.91	2.98	3.06
4	3.14									

NOTES:

1 To permit use of collapsible forms, semi-circular bottom may be employed at Contractor's option.

2 Weep holes shall be placed so that the bottom of the weeper on the inside and the top of the weeper on the outside are level.

A Class of concrete: 20 MPa.

B Porous backfill to be placed to a minimum thickness of 300mm on all sides.

C All dimensions are in millimetres or metres unless otherwise specified.

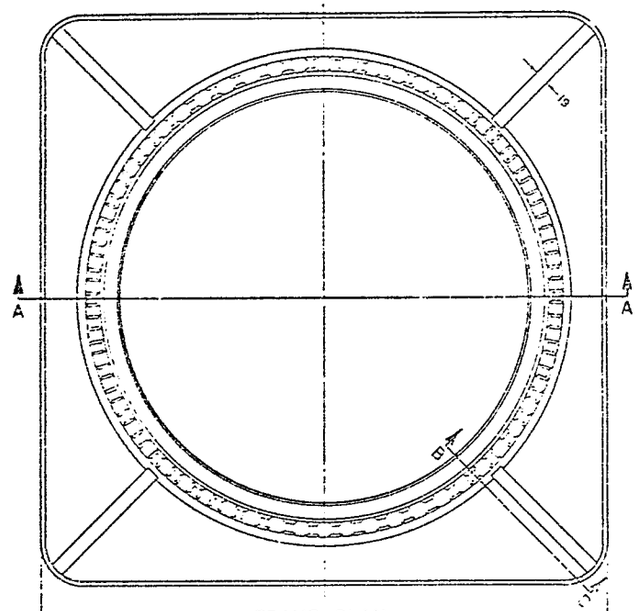
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO | No DD-702-A

600 x 600 mm CATCH BASIN

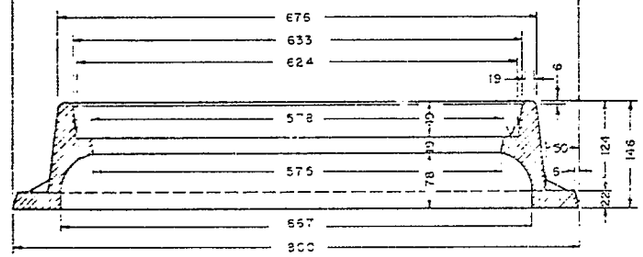
DEPTH 4.0 m MAX

Date | 1979 01 01 | Rev

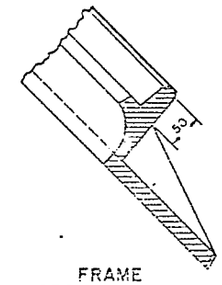
Director Design and Construction Branch



FRAME PLAN



FRAME SECTION A-A



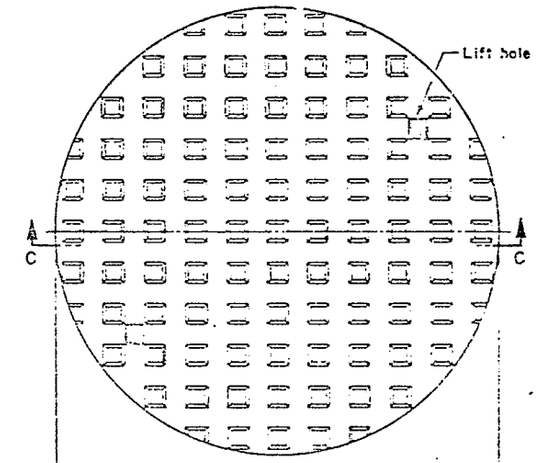
FRAME
SECTION B-B

NOTES:

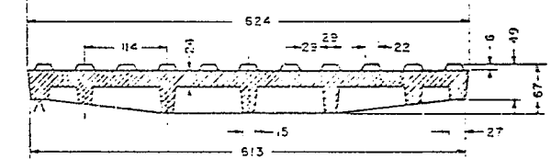
A Allowable tolerances:
Dimensions 305 mm or less — ± 3 mm
Dimensions over 305 mm up to and including 1 m — ± 6 mm

B Marking:
The initials or mark of the manufacturer are to be distinctly cast in raised letters on both frame and grate.

C All dimensions are in millimetres or metres unless otherwise specified.

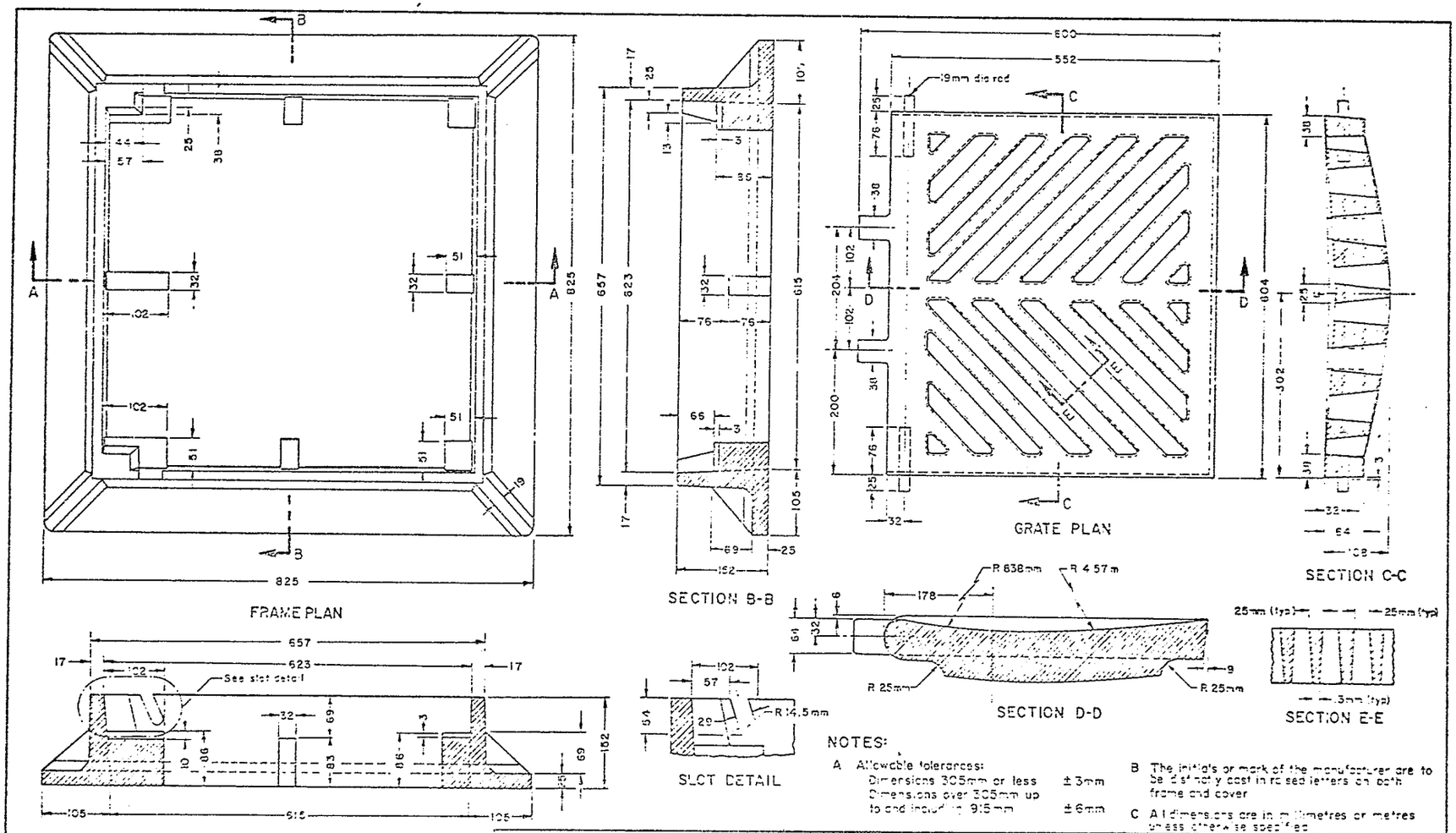


COVER PLAN



COVER SECTION C-C

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO	No DD-704-B
MANHOLE FRAME AND CLOSED COVER	Date 1979 01 01 Rev
	Director Design and Construction Branch



NOTES:

A Allowable tolerances:

Dimensions 305mm or less	±3mm
Dimensions over 305mm up to and including 915mm	±6mm

B The initials or mark of the manufacturer are to be distinctly cast in raised letters on both frame and cover

C All dimensions are in millimetres or metres unless otherwise specified

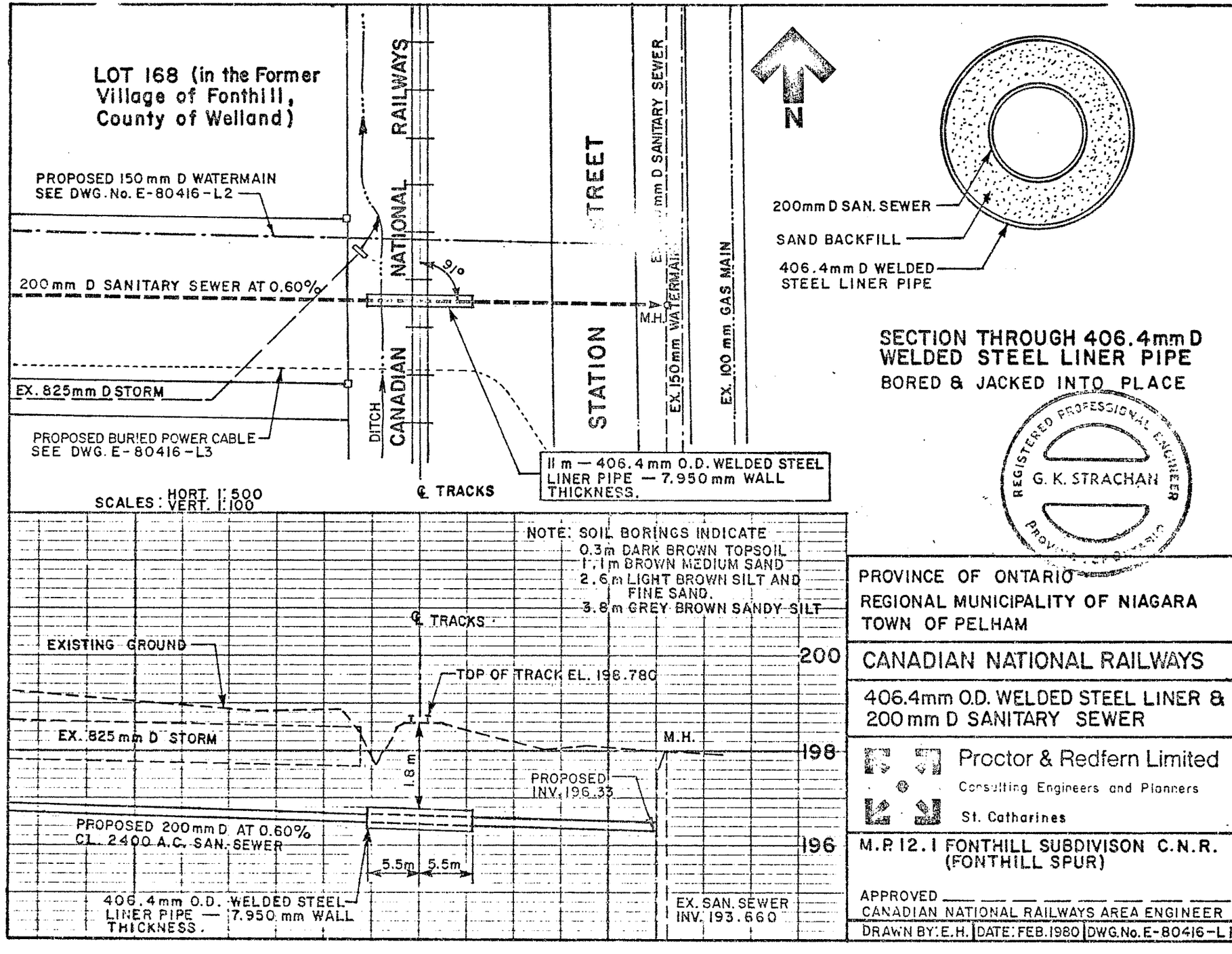
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO | No DD-713-B

DEPRESSED CATCH BASIN FRAME AND GRATE

DIAGONAL OPENINGS

Date | 1979 01 01 | Rev |

Director Design and Construction Branch



PROVINCE OF ONTARIO
REGIONAL MUNICIPALITY OF NIAGARA
TOWN OF PELHAM

CANADIAN NATIONAL RAILWAYS

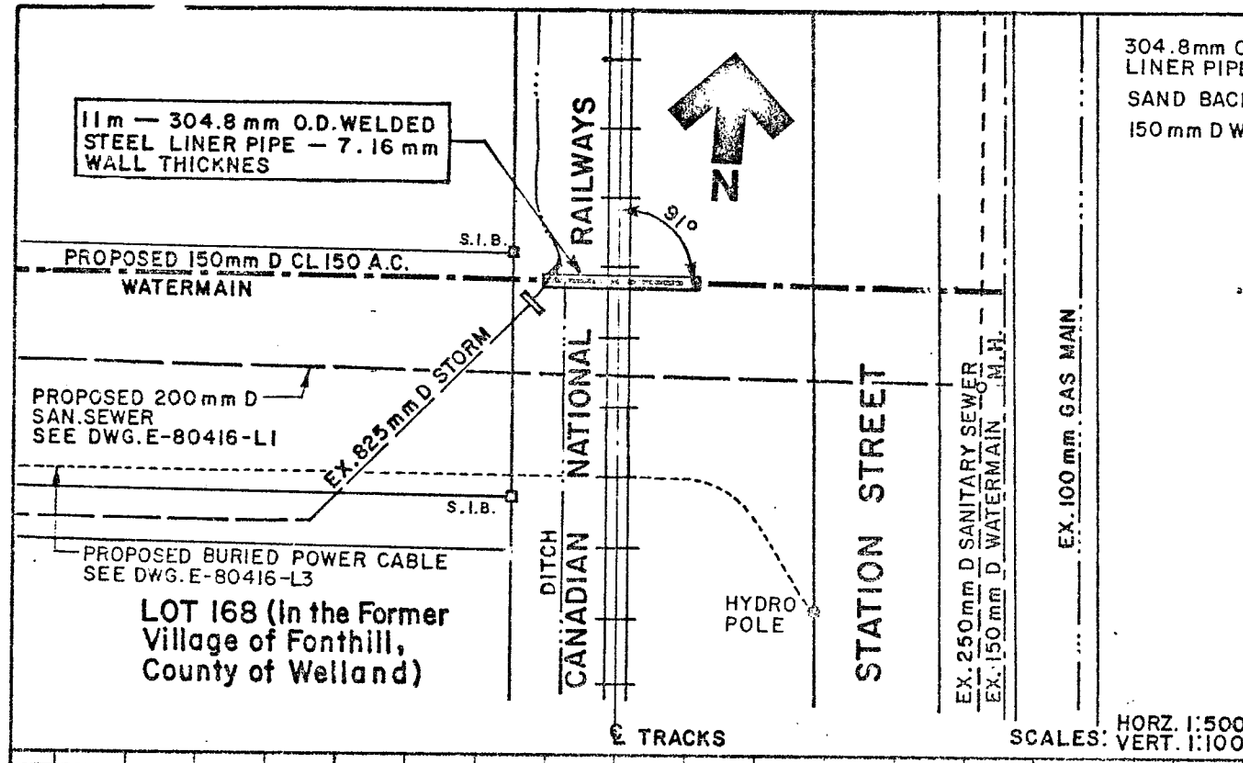
406.4mm O.D. WELDED STEEL LINER & 200 mm D SANITARY SEWER

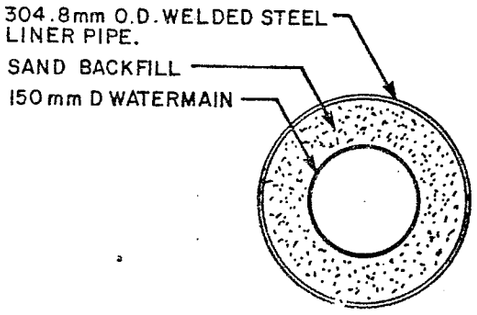
Proctor & Redfern Limited
Consulting Engineers and Planners
St. Catharines

M.P. 12.1 FONTHILL SUBDIVISON C.N.R. (FONTHILL SPUR)

APPROVED _____
CANADIAN NATIONAL RAILWAYS AREA ENGINEER

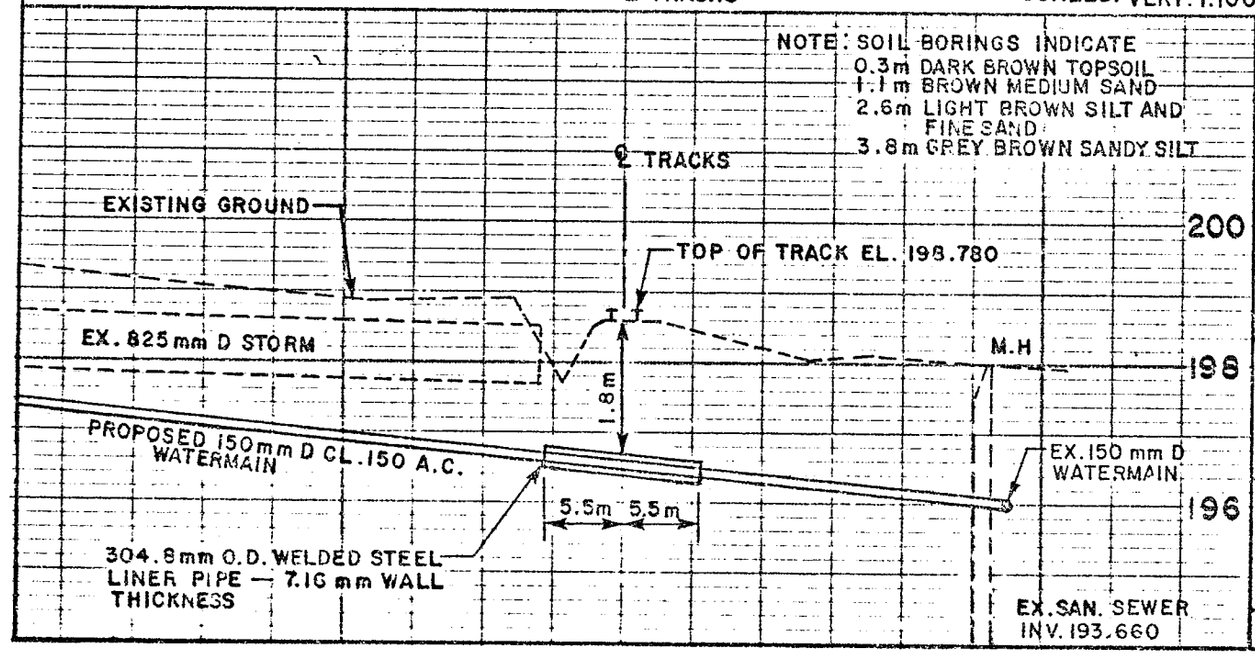
DRAWN BY: E.H. | DATE: FEB. 1980 | DWG. No. E-80416-L1





SECTION THROUGH 304.8mm D WELDED STEEL LINER PIPE
BORED & JACKED INTO PLACE

REGISTERED PROFESSIONAL ENGINEER
G. K. STRACHAN
PROVINCE OF ONTARIO



PROVINCE OF ONTARIO
REGIONAL MUNICIPALITY OF NIAGARA
TOWN OF PELHAM

CANADIAN NATIONAL RAILWAYS

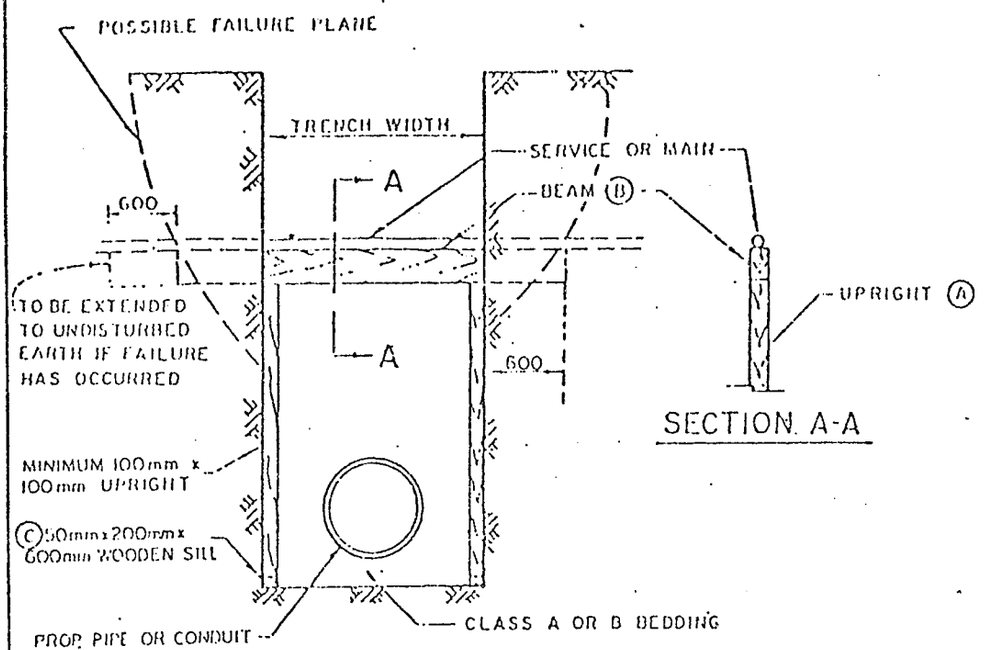
304.8mm O.D. WELDED STEEL LINER & 150mm D WATERMAIN

Proctor & Redfern Limited
Consulting Engineers and Planners
St. Catharines

M. P. 12.1 FONTHILL SUBDIVISON C.N.R. (FONTHILL SPUR)

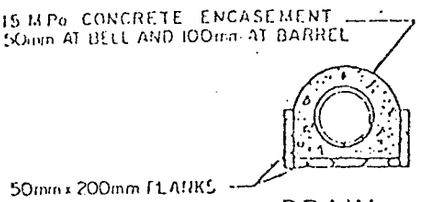
APPROVED _____
CANADIAN NATIONAL RAILWAYS AREA ENGINEER

DRAWN BY: E.H.	DATE: FEB. 1980	DWG. No. E-80416-L2



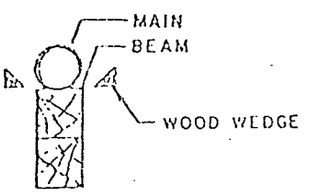
SECTION A-A

CROSS SECTION



DRAIN

CONC. ENCASED WHERE REQUIRED



SERVICES & MAINS

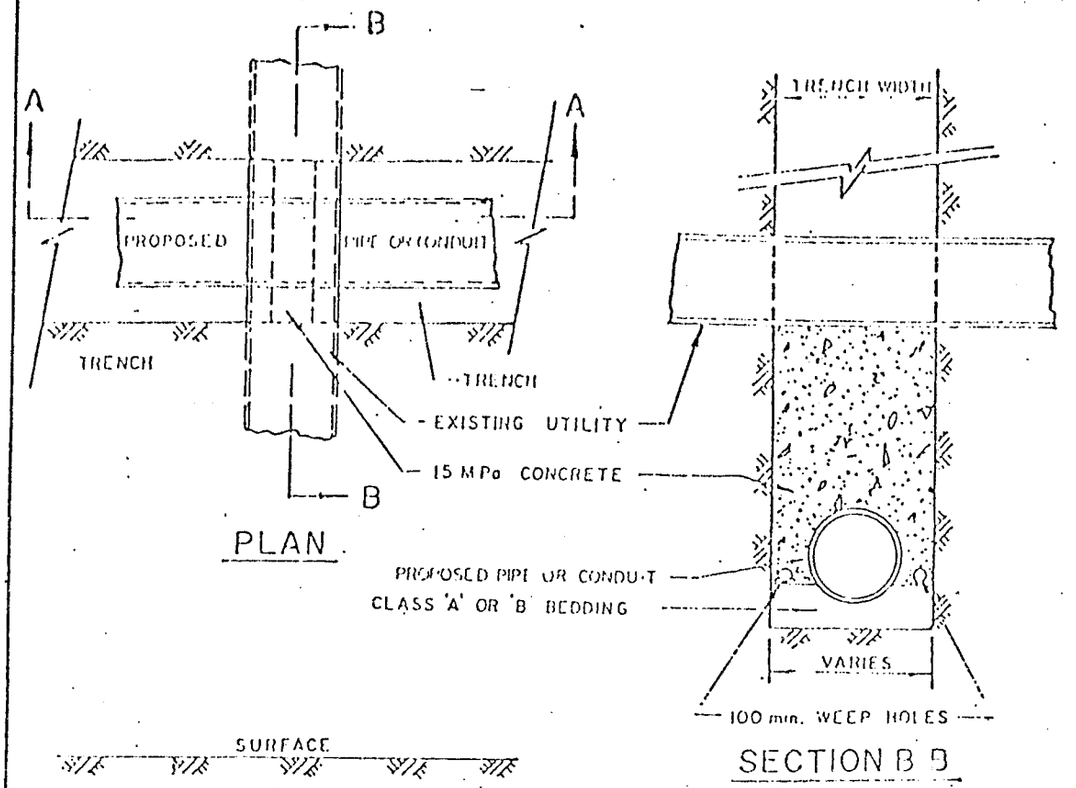
SIZE OF PIPE SUPPORTED	(A) UPRIGHT	(B) BEAM	(C) SILL
38,50 & 75	100 x 100	1/150 x 150	50 x 200 x 600
100 & 125	150 x 150	2/150 x 150	50 x 200 x 600
150 & 200	200 x 200	2/200 x 200	50 x 200 x 600
250 & 300	300 x 300	2/300 x 300	50 x 200 x 600

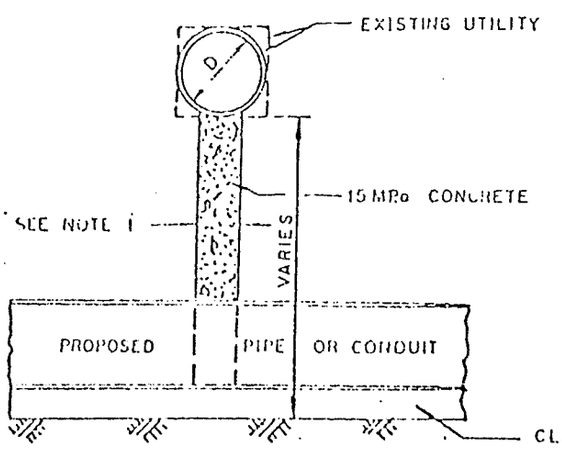
NOTES:

1. WHERE THE WIDTH OF TRENCH EXCEEDS 2 m METHOD OF CONSTRUCTION IS TO BE SPECIFIED BY THE SUPERVISING ENGINEER.
2. THE CONTRACTOR IS REQUIRED TO MAINTAIN ALL SERVICES & MAINS ENCOUNTERED DURING CONSTRUCTION AND SUPPORT THEM AFTER CONSTRUCTION OF THE PIPE.

DIMENSIONS IN mm EXCEPT AS NOTED

REVISIONS		
APPROVED BY	TYPICAL DETAILS FOR SUPPORTING SERVICES AND MAINS OTHER THAN WATER UP TO 300 mm	Proctor & Redfern Limited Consulting Engineers and Planners Toronto St. Catharines DRAWING NO E-80416-L3M REV 0





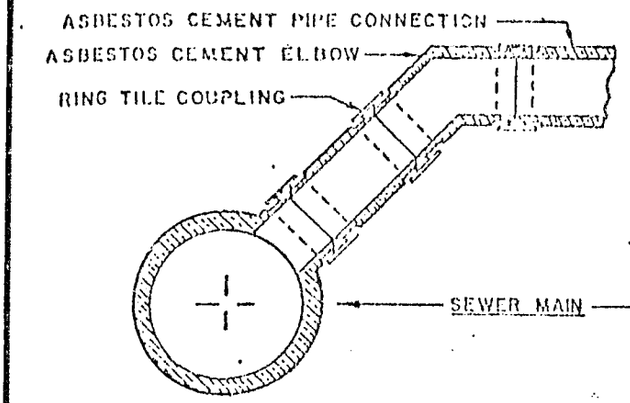
SECTION A-A

NOTES

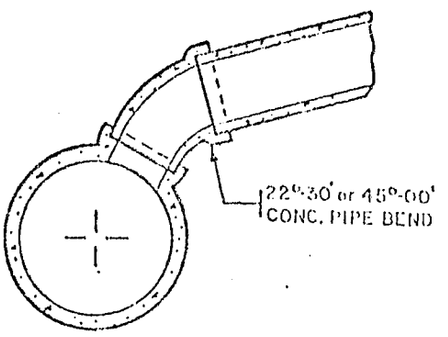
1. WIDTH OF CONCRETE TO BE MIN. 300 mm WHERE A WATERMAIN IS BEING SUPPORTED WIDTH OF CONCRETE SHALL BE D + 150 mm.
2. CONCRETE ENCASED STEEL MAINS SHALL BE SUPPORTED WITH CONCRETE TO UNDERSIDE OF MAIN. TAR PAPER IS TO BE USED BETWEEN THE TWO CONC. SURFACES.
3. WATERMAINS AND GASMAINS SHALL HAVE A BEARING BLOCK OR PLATE OF MIN. DIMENSION 75 mm x 200 mm WITH WEDGES BETWEEN THE PIPE OR CONDUIT AND THE CONCRETE SUPPORT.

DIMENSIONS IN mm EXCEPT AS NOTED

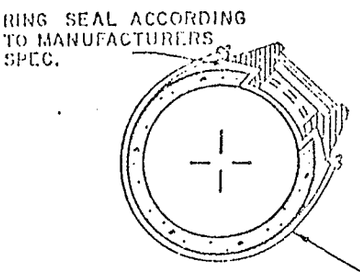
REVISIONS		
APPROVED BY	TYPICAL DETAIL FOR SUPPORTING UTILITIES LARGER THAN 300 mm	Proctor & Redfern Limited Consulting Engineers and Planners Toronto St Catharines
		DRAWING NO. E - 80416 - L4M REV. 0



FACTORY INSTALLED TEE FOR ASBESTOS CEMENT CONNECTIONS

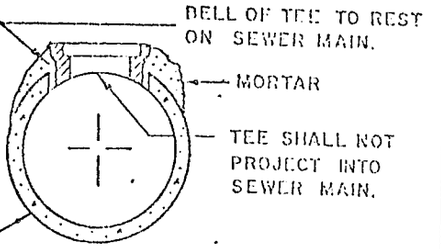


FACTORY INSTALLED TEE FOR VITRIFIED TILE OR CONC. CONNECTIONS

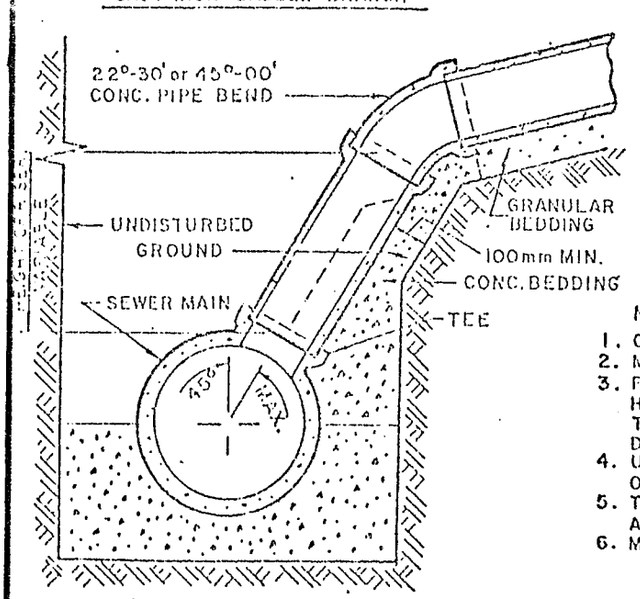


CAST-IRON SADDLE BRANCH

NOTE:
CAST IRON SADDLE BRANCH IS DESIGNED TO RECEIVE ASB. CEM. PIPE. FOR V. CLAY OR PLASTIC USE PROPER ADAPTOR.



FIELD INSTALLED TEE FOR CONCRETE CONNECTIONS



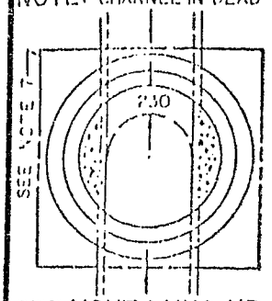
RISER DETAIL

NOTES:
1. CONCRETE TO BE 15 MPa AT 28 DAYS.
2. MORTAR TO BE 1:3 MORTAR MIX.
3. FOR RISER DETAIL, CONCRETE BEDDING TO HAVE MINIMUM WIDTH OF 0.60m. BEDDING TYPE OTHER THAN SHOWN, TO BE AS DIRECTED BY ENGINEER.
4. USE FACTORY INSTALLED "TEE'S" UNLESS OTHERWISE REQUIRED OR DIRECTED.
5. THE USE AND LOCATION OF ELBOWS TO BE AS DIRECTED BY THE ENGINEER.
6. MIN. DIA. OF CATCHBASIN LEAD TO BE 200 mm.

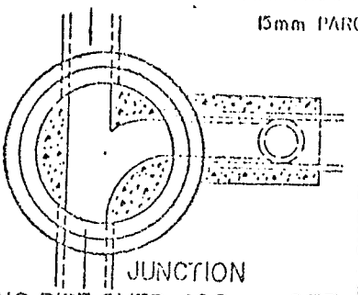
DIMENSIONS IN mm EXCEPT AS NOTED.

	APPROVED	SCALE: N.T.S.
SEWER CONNECTIONS		REVISION DATE: DRAWING NO. E-80416-L5M

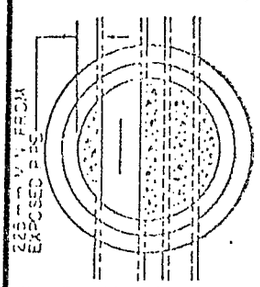
NOTE: CHANNEL IN DEAD END MANHOLE TO FINISH 230mm FROM UPSTREAM WALL



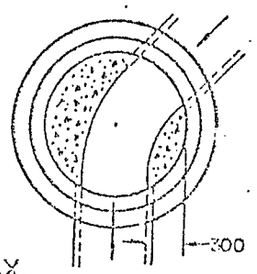
STRAIGHT RUNS UP TO 800 mm



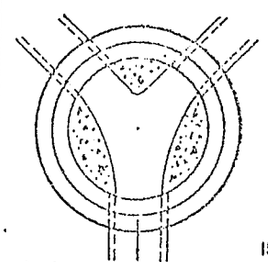
JUNCTION NO PIPE OVER 400 mm SEE STANDARD Nº330 FOR DROP CONNECTION DETAIL



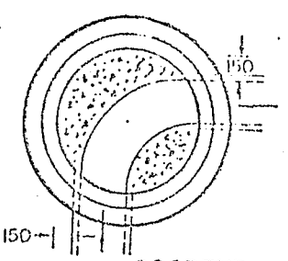
ON DUAL SYSTEM MAX. 250mm & 400mm



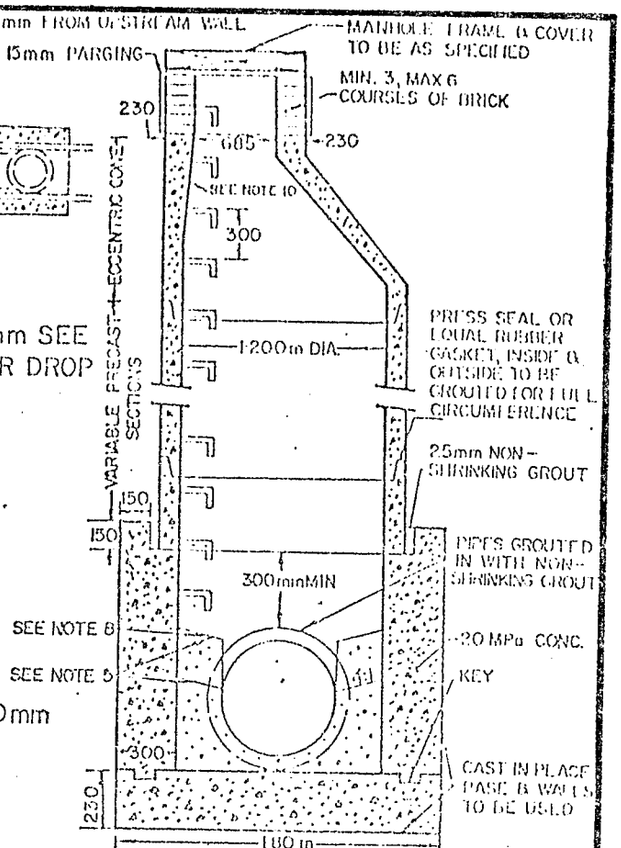
45° BEND MAX. 600mm



'Y' CONNECTION INLETS MAX. 400mm OUTLETS MAX. 500mm



90° BEND INLET MAX. 400mm. OUTLET MAX. 500mm

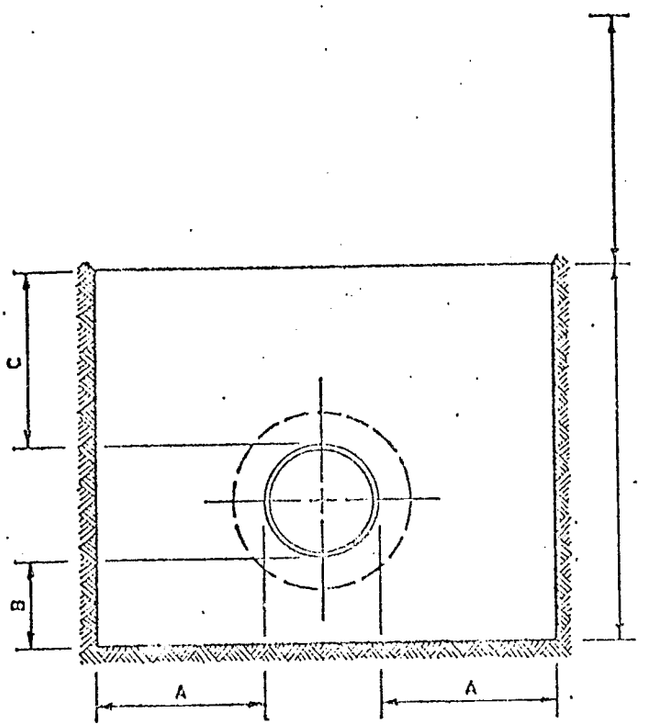


PRECAST FLAT TOP

1. FOR CAST IN PLACE BASE, CONCRETE TO BE 20MPa AT 28 DAYS
2. PRECAST MANHOLE SECTIONS SHALL BE EQUAL TO A.S.T.M. SPECIFICATIONS C-478
3. STEPS; FIRST STEP TO BE 75mm BELOW FRAME; LAST STEP TO BE 300mm ABOVE BENCHING OR 600mm ABOVE INVERT
4. PARGING MIX ON ALL BRICKWORK TO BE 1:3 MORTAR MIX APPLIED 15mm THICK.
5. TOP OF BENCHING TO BE SLOPED NO GREATER THAN 4:1 (HORIZONTAL TO VERTICAL) NOR LESS THAN 8:1 (HORIZONTAL TO VERTICAL)
6. ALL JOINTS AND LIFTING HOLES IN MANHOLE SECTIONS TO BE COMPLETELY FILLED WITH A 1:3 MORTAR MIX AND POINTED BEFORE BACKFILLING.
7. OUTSIDE OF CAST IN PLACE SECTIONS MAY BE SQUARE OR CIRCULAR.
8. FOR STORM SEWERS, BENCHING TO CROWN UNLESS OTHERWISE SPECIFIED.
9. FOR JUNCTION CHAMBER, THE INVERT DROP SHALL BE DETERMINED IN EACH CASE.
10. OUTSIDE TAPER WHEN LADDER IS USED INSTEAD OF STEPS.

DIMENSIONS IN mm EXCEPT AS NOTED

		SCALE: N.T.S.
	SEMI-PRECAST MANHOLE 800 mm DIA. PIPE AND SMALLER MAXIMUM DEPTH 8 m	REVISION DATE
		DRAWING NO. E-80416-L6M



NOTES

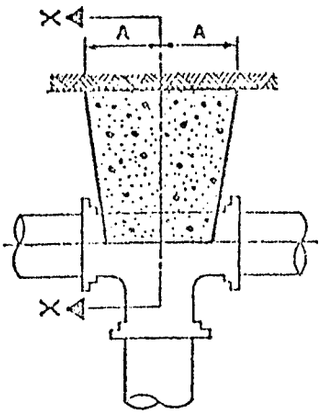
1. TRENCH BOTTOM FOR WATERMAINS TO BE EXCAVATED TO SHAPE BY HAND OR OVER EXCAVATED & FILLED WITH COMPACTABLE MATERIAL. THIS APPLIES FOR WATER SERVICES AS WELL AS WATERMAINS.

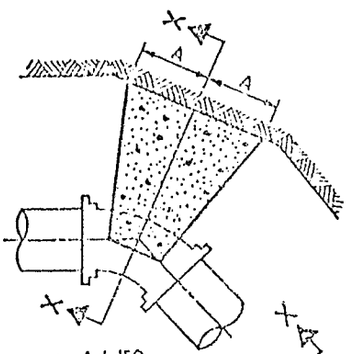
DIMENSION	WATERMAINS	SERVICES
A	230 mm MIN.	230 mm MIN.
B	SEE NOTE	SEE NOTE
C	300 mm MIN.	100 mm MIN.

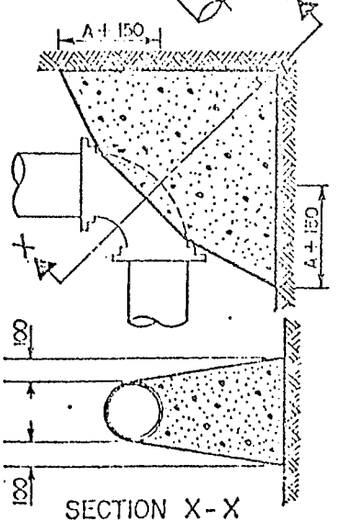
ALL DIMENSIONS ARE EXPRESSED IN mm UNLESS OTHERWISE NOTED.

WATERMAIN AND WATER SERVICES
BEDDING DETAILS

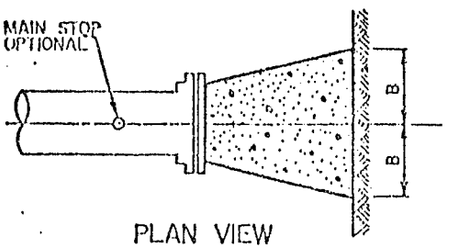
SCALE: N.T.S.
REVISION:
DATE:
DRAWING NO.
E-80416-L7M



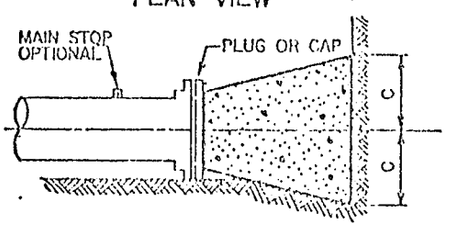




SECTION X-X



PLAN VIEW



ELEVATION VIEW

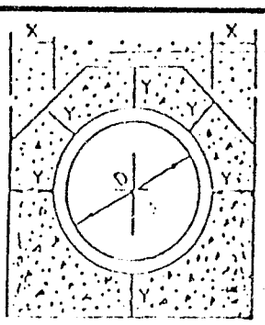
MINIMUM DIMENSIONS			
SIZE OF PIPE	A	B	C
100	150	150	150
150	230	230	200
200	230	300	200
250	300	380	250
300	380	450	300
350	450	550	380
400	500	600	450

NOTES

1. ALL CONCRETE TO BE 20 MPa.
2. ALL CONCRETE BLOCKING TO BE POURED AGAINST UNDISTURBED GROUND.
3. CLEARANCE OF 80 mm TO BE MAINTAINED FROM FACE OF BELL TO CONCRETE.
4. POLYETHYLENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.
5. THIS BLOCKING DESIGN APPLIES ONLY WHERE 1030 kPa PRESSURE IS NOT EXCEEDED.

ALL DIMENSIONS ARE EXPRESSED IN mm UNLESS OTHERWISE NOTED.

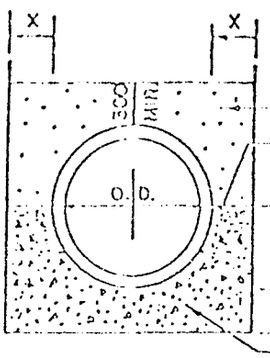
	APPROVED	SCALE: N.T.S.
		REVISION
CONCRETE THRUST BLOCKS TEES, PLUGS & HORIZONTAL BENDS 400 mm DIAMETER WATERMAINS & SMALLER		DATE:
		DRAWING NO. E-80416-L8M



REMAINDER OF BACKFILL PLACED IN LAYERS AND THOROUGHLY CONSOLIDATED.

CONCRETE 20 MPa

CONCRETE ENCASEMENT



DENSELY COMPACTED GRANULAR MATERIAL

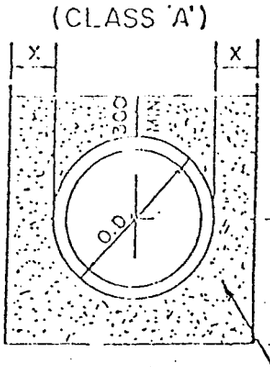
O.D./8 (150 mm MIN.)

O.D./2

O.D./4 (150 mm MIN., 300 mm MAX.)

CONCRETE 15 MPa

CONCRETE CRADLE (CLASS 'A')



O.D./2

O.D./4 (150 mm MIN., 300 mm MAX.)

COMPACTED GRANULAR 'A' MATERIAL

GRANULAR BEDDING (CLASS 'B')

D	X MIN.	X MAX.	Y
UP TO 900mm	150mm	DEPTH ≤ 4m - 380mm; >4m ≤8m-510mm	150mm
1000mm TO 3000mm	200mm		200mm

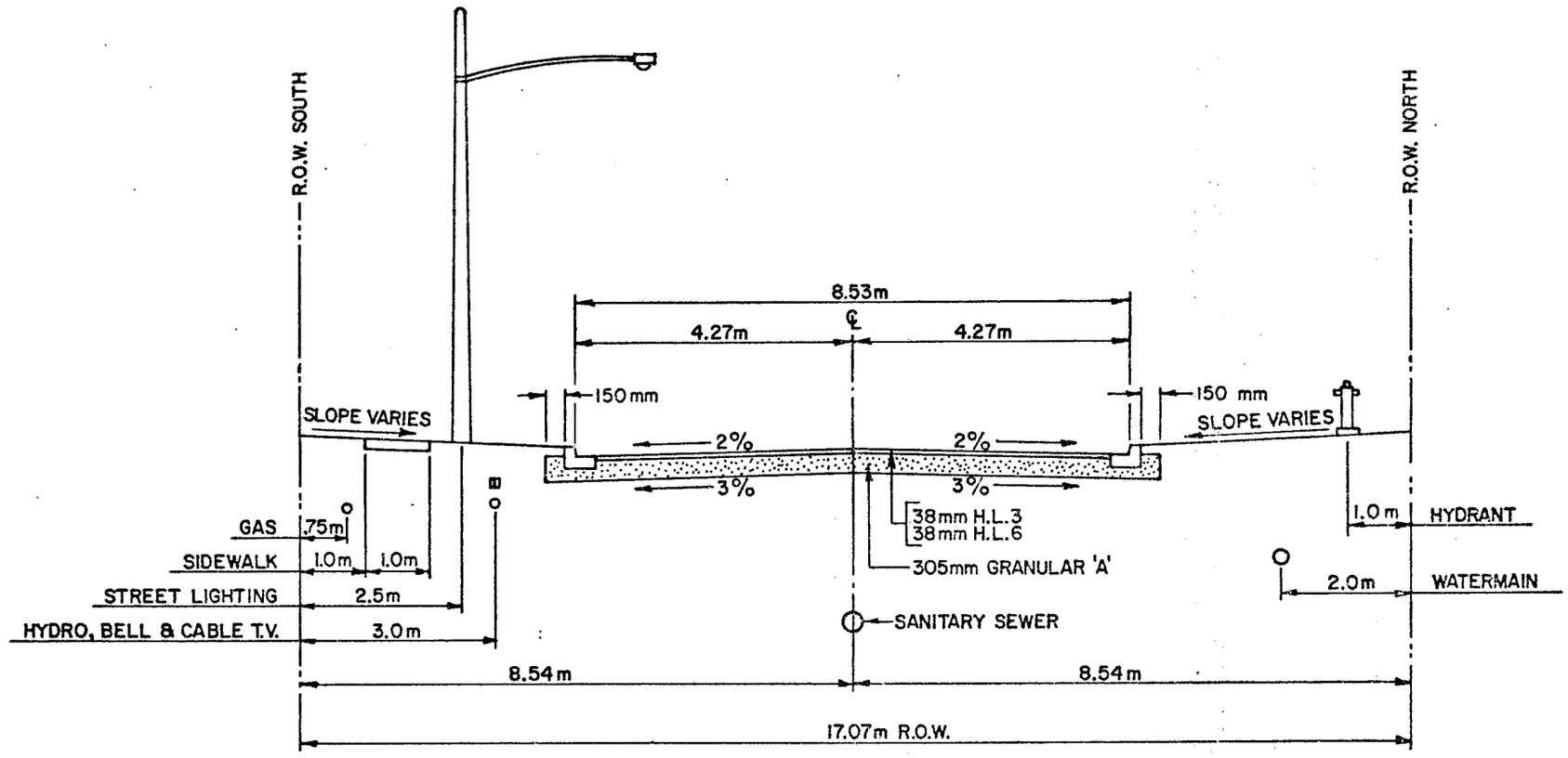
NOTES: 1. BACKFILL HANDPLACED TO 600 mm ABOVE TO OF PIPE & CAREFULLY TAMPED IN 150 mm LAYERS, REMAINING TO BE PLACED IN LAYERS & THOROUGHLY CONSOLIDATED ACCORDING TO SPECIFICATION.

2. COMPACTION – 95% PROCTOR DENSITY MINIMUM
BOND BREAKER IF SPECIFIED

3. WHERE SHEATHING IS USED A BOND BREAKING MATERIAL IS REQUIRED BETWEEN CONCRETE BEDDING AND SHEATHING.

DIMENSIONS IN mm EXCEPT AS NOTED

REVISIONS		
APPROVED BY	BEDDING FOR SEWER PIPES	Proctor & Redfern Limited Consulting Engineers and Planners Toronto St Catharines DRAWING NO E-80416-L9M



TYPICAL ROAD CROSS-SECTION

No.	Revisions	Date	Initial

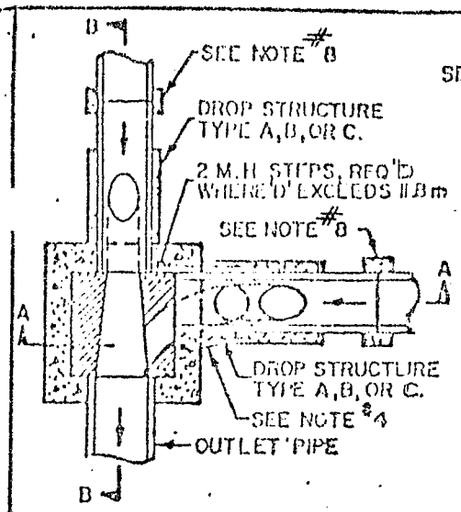
Town of Pelham

Municipal Square Extension

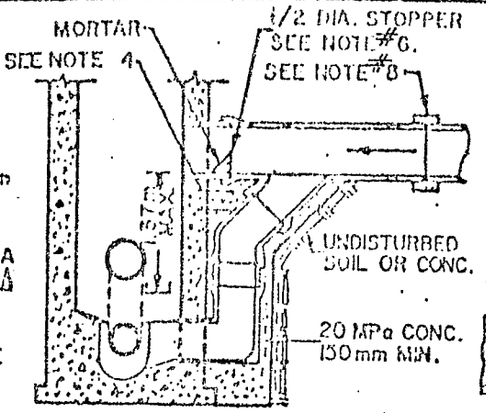
Proctor & Redfern Limited
Consulting Engineers and Planners
Toronto

Scale: 1:100 Date

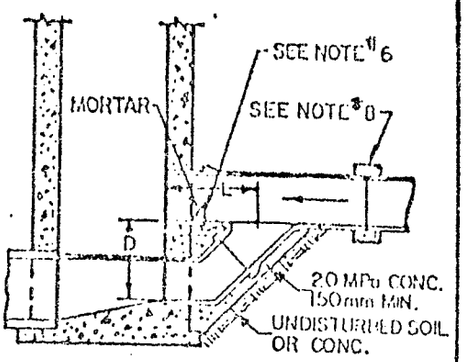
Dwn. By L.V. Ckd. By | Field Book | Drawing No. E-9041S-L10M | Rev. 0



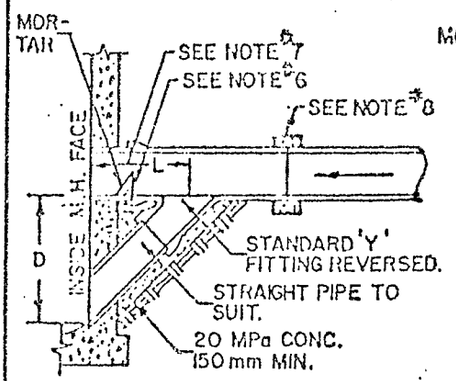
PLAN



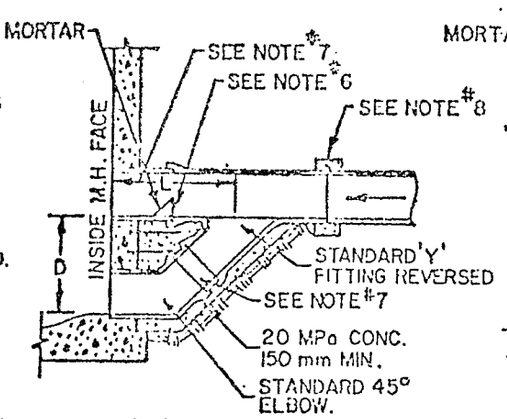
SECTION A-A



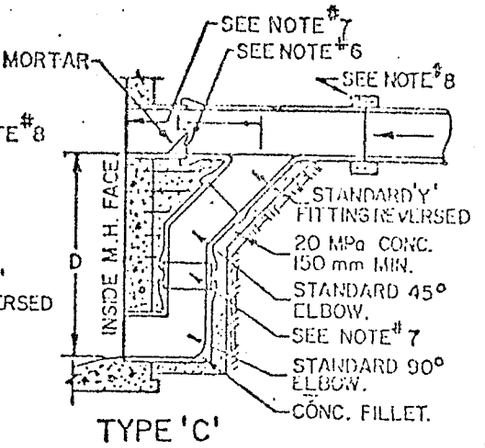
SECTION B-B



TYPE 'A'



TYPE 'B'



TYPE 'C'
PREFERRED

TABLE OF MINIMUM DIMENSIONS AND MAXIMUM VELOCITIES

DROP PIPE (mm)	TYPE 'A'		TYPE 'B'		TYPE 'C'		MAX. VELOCITY m/sec.	
	'D'	'L'	'D'	'L'	'D'	'L'	NO STOPPER	STOPPER
200	.915	.815	.610	.760	1.22	1.07	1.42	3.78
250	1.02	.840	.650	.815	1.30	1.07	1.55	4.05
300	1.09	.865	.710	.915	1.45	1.14	1.71	4.11
400	1.17	.915	.915	1.14	1.91	1.22	1.92	4.18
450	1.30	.990	.990	1.22	2.06	1.30	2.16	4.27
550	1.42	1.04	1.07	1.30	2.21	1.45	2.35	4.45
600	1.52	1.09	1.14	1.37	2.44	1.52	2.53	4.60
700	1.63	1.14	1.22	1.45	2.51	1.60	2.70	4.72
750	1.73	1.22	1.30	1.52	2.67	1.68	2.83	5.00

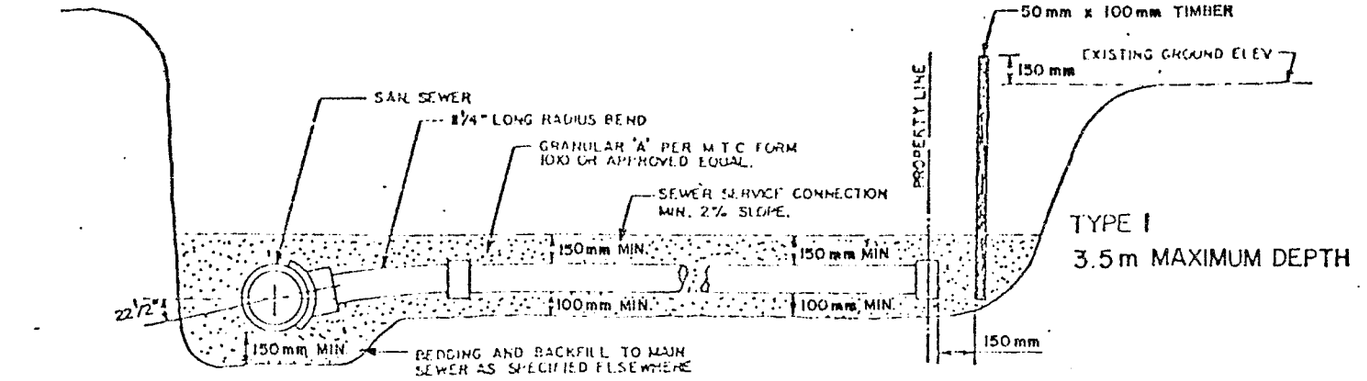
DIMENSIONS IN METRES

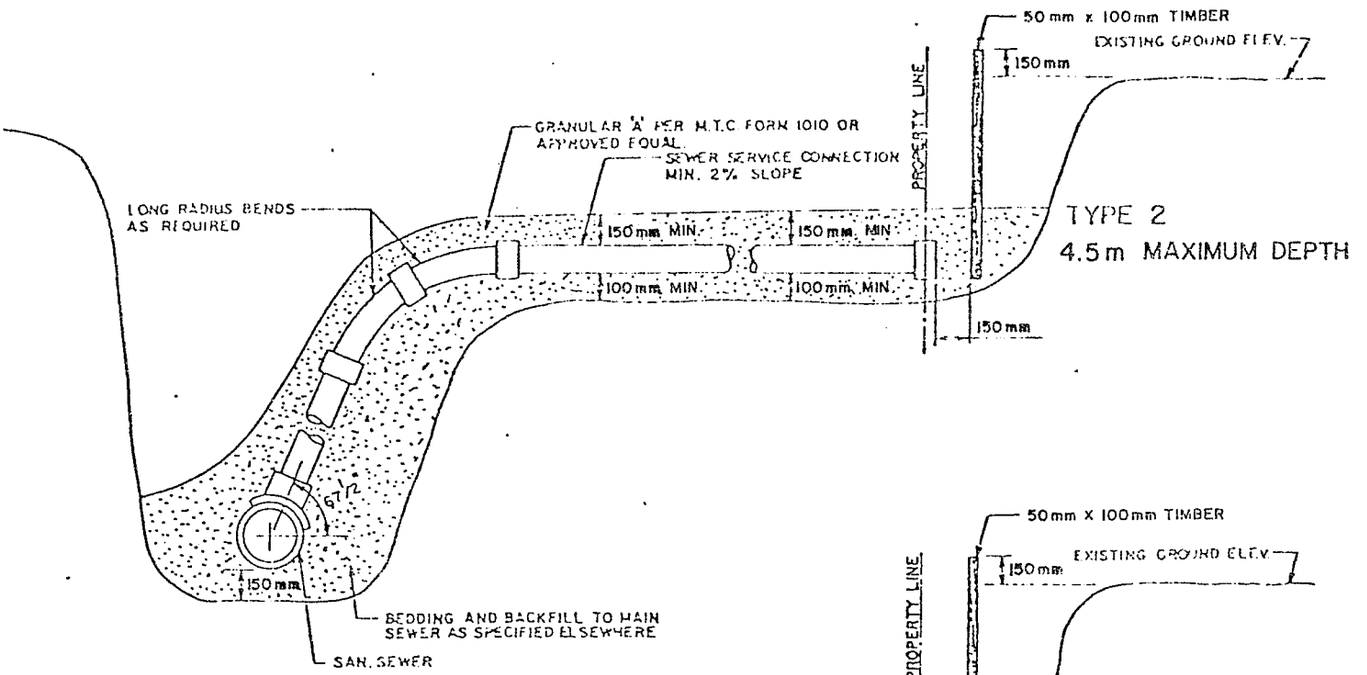
NOTES:

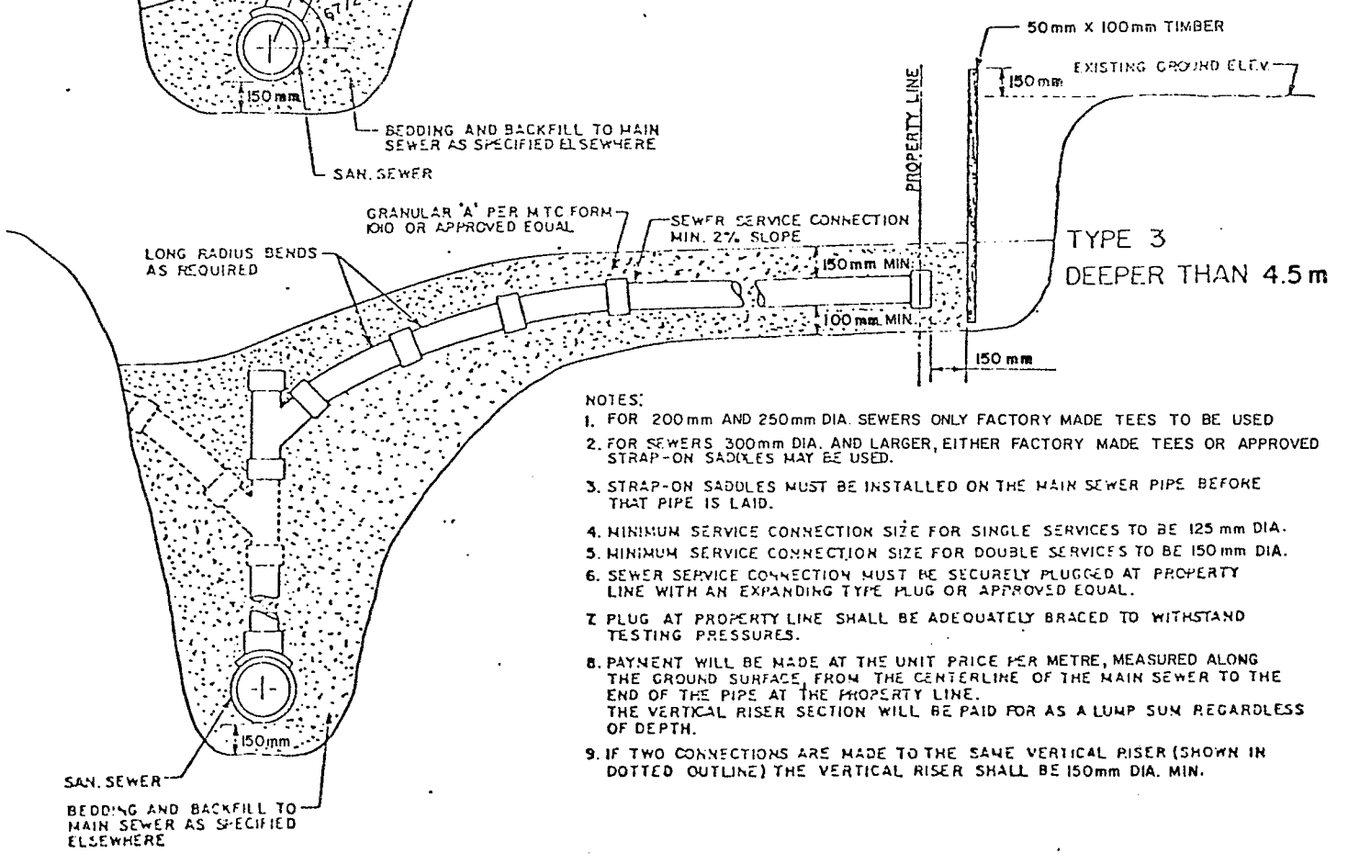
1. DROP PIPE TO BE ONE SIZE SMALLER THAN INLET.
2. DROP PIPE TO HAVE CROWN LEVEL WITH OUTLET PIPE AND BENCHED TO CROWN.
3. DROP PIPE TO BLEND WITH FLOW.
4. DROP STRUCTURE TO BE ENCASED IN A MINIMUM OF 150 mm OF 20 MPa CONCRETE AND DOWELLED TO MANHOLE WITH 12 mm DIA. DOWELS, 450 mm LONG, EITHER SIDE OF DROP PIPE AND AT 300 mm C TO C.
5. MAXIMUM VELOCITIES SHOWN IN TABLE INDICATE MAXIMUM VELOCITY IN INCOMING PIPE WITH NO OVERSHOOTING.
6. WHEN USED ON STORM SEWERS OR SANITARY SEWERS 400 mm DIA. OR LARGER, A 1/2 DIA. CONCRETE STOPPER MAY BE INSERTED IN THE INVERT OF THE MAIN LINE AS INDICATED.
7. ADJUSTMENT IN 'D' AND 'L' TO BE MADE WITH PLAIN END STRAIGHT PIPE.
8. WHERE 'Y' FITTING JOINS FIRST PIPE, A 300 mm WIDE BY 150 mm THICK 20 MPa CONCRETE COLLAR IS TO BE CONSTRUCTED.
9. ALL CONCRETE IN DROP STRUCTURE TO BE 20 MPa AT 28 DAYS.
10. MINIMUM DIMENSIONS BASED ON USE OF STANDARD CONCRETE FITTINGS AS PER LATEST INFORMATION BY SUPPLIERS.
11. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURERS PERMISSIBLE VARIATIONS.

DIMENSIONS IN mm EXCEPT AS NOTED

VISIONS		
APPROVED BY	DROP STRUCTURES FOR MANHOLES	Proctor & Redfern Limited Consulting Engineers and Planners Toronto St. Catharines DRAWING NO. E-80416-L11M REV. 0







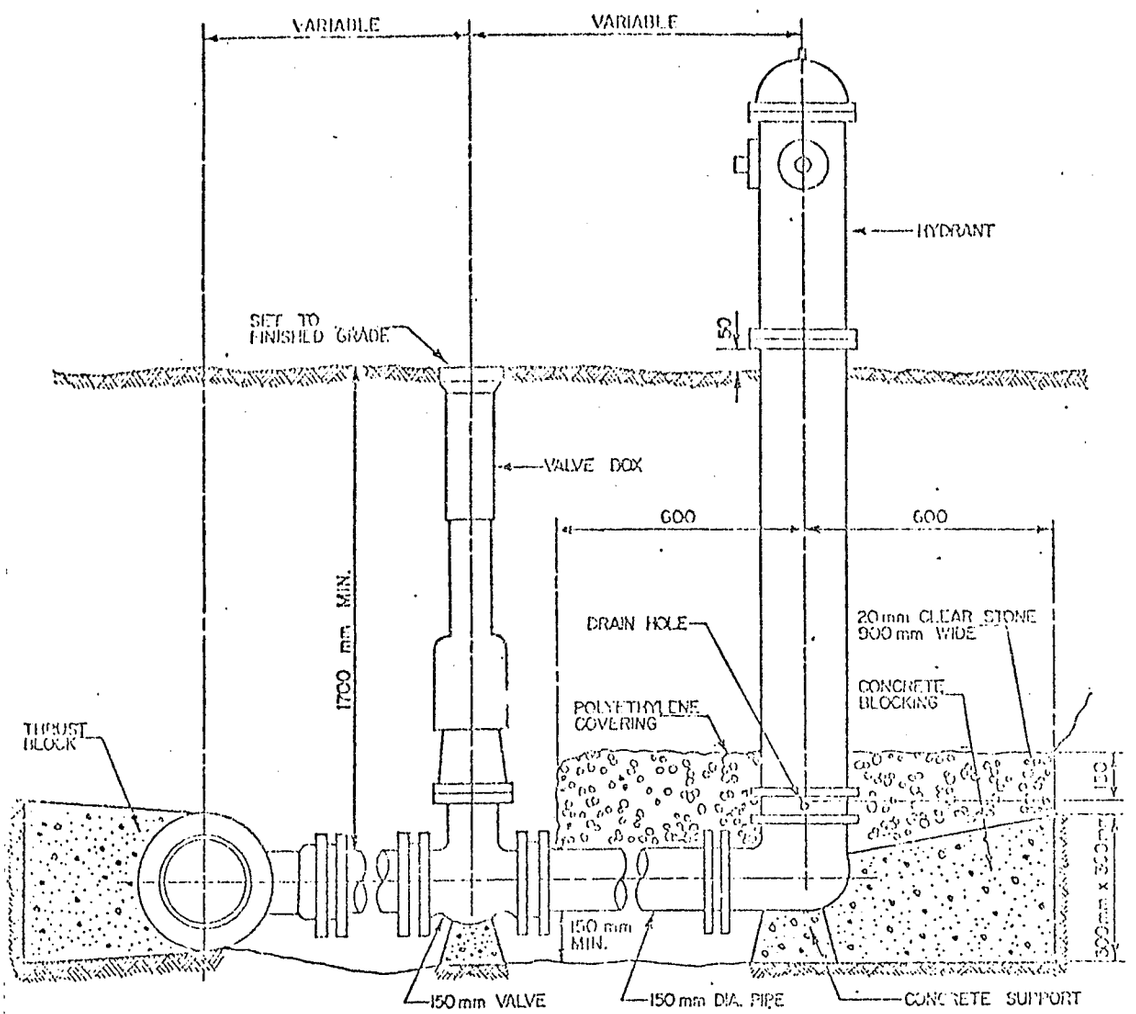
NOTES:

1. FOR 200 mm AND 250 mm DIA. SEWERS ONLY FACTORY MADE TEES TO BE USED
2. FOR SEWERS 300 mm DIA. AND LARGER, EITHER FACTORY MADE TEES OR APPROVED STRAP-ON SADDLES MAY BE USED.
3. STRAP-ON SADDLES MUST BE INSTALLED ON THE MAIN SEWER PIPE BEFORE THAT PIPE IS LAID.
4. MINIMUM SERVICE CONNECTION SIZE FOR SINGLE SERVICES TO BE 125 mm DIA.
5. MINIMUM SERVICE CONNECTION SIZE FOR DOUBLE SERVICES TO BE 150 mm DIA.
6. SEWER SERVICE CONNECTION MUST BE SECURELY PLUGGED AT PROPERTY LINE WITH AN EXPANDING TYPE PLUG OR APPROVED EQUAL.
7. PLUG AT PROPERTY LINE SHALL BE ADEQUATELY BRACED TO WITHSTAND TESTING PRESSURES.
8. PAYMENT WILL BE MADE AT THE UNIT PRICE PER METRE, MEASURED ALONG THE GROUND SURFACE, FROM THE CENTERLINE OF THE MAIN SEWER TO THE END OF THE PIPE AT THE PROPERTY LINE.
   THE VERTICAL RISER SECTION WILL BE PAID FOR AS A LUMP SUM REGARDLESS OF DEPTH.
9. IF TWO CONNECTIONS ARE MADE TO THE SAME VERTICAL RISER (SHOWN IN DOTTED OUTLINE) THE VERTICAL RISER SHALL BE 150mm DIA. MIN.

SANITARY SERVICES TO NEW SANITARY SEWERS

N.T.S.

E-80416-L12M



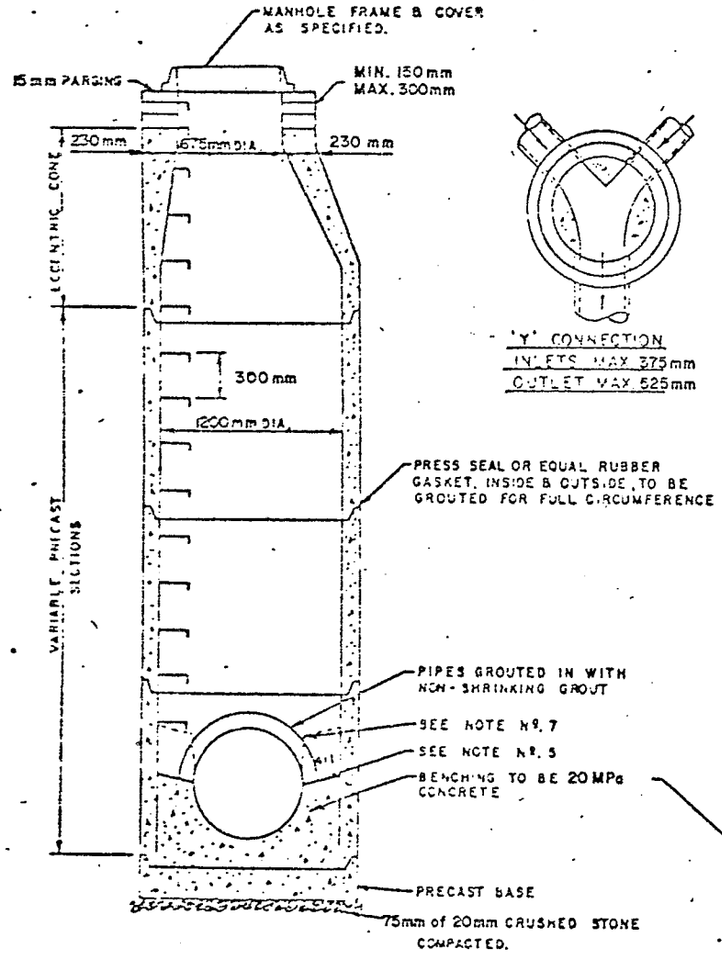
NOTES

1. ALL CONCRETE TO BE 20MPa.
2. ALL CONCRETE BLOCKING TO BE POURED AGAINST UNDISTURBED TRENCH WALL.
3. POLYETHYLENE BOND BREAKER TO BE USED BETWEEN CONCRETE AND FITTINGS.
4. STEEL TIE ROD TO BE USED WHEN SPECIFIED BY ENGINEER. CORROSION PROTECTION SHALL BE BRUSH APPLIED QUALITY MASTIC COATING EQUAL IN PERFORMANCE TO TC. MASTIC AS MANUFACTURED BY THE TAPECOAT CO. OF CANADA LTD.

HYDRANT INSTALLATION

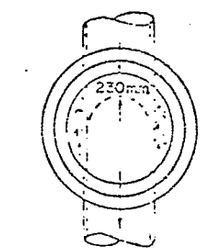
N.T.S.

E-80416-L13M

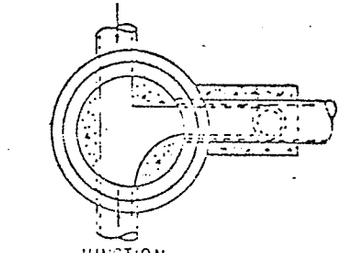


NOTE: Channel in dead end manhole to finish 230mm from upstream wall.

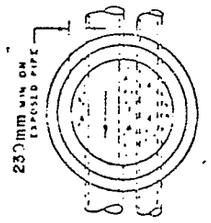
'Y' CONNECTION
INLETS MAX 375mm
OUTLET MAX 525mm



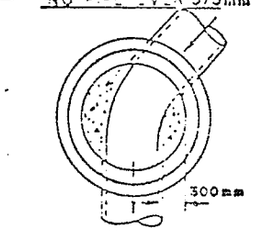
STRAIGHT RUNS UP to 750mm



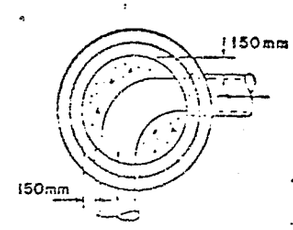
JUNCTION
NO PIPE OVER 375mm



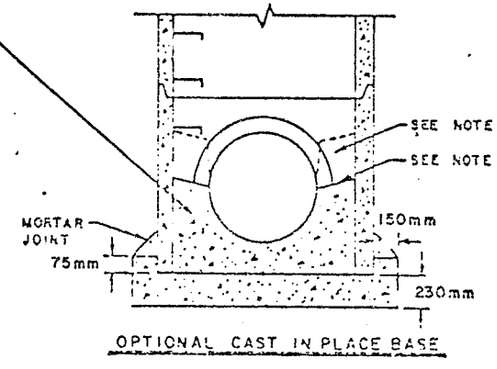
ON DUAL SYSTEM
MAX. 250 & 375mm



45° BEND
MAX. 600mm



90° BEND
INLET MAX 375mm
OUTLET MAX 525mm



OPTIONAL CAST IN PLACE BASE

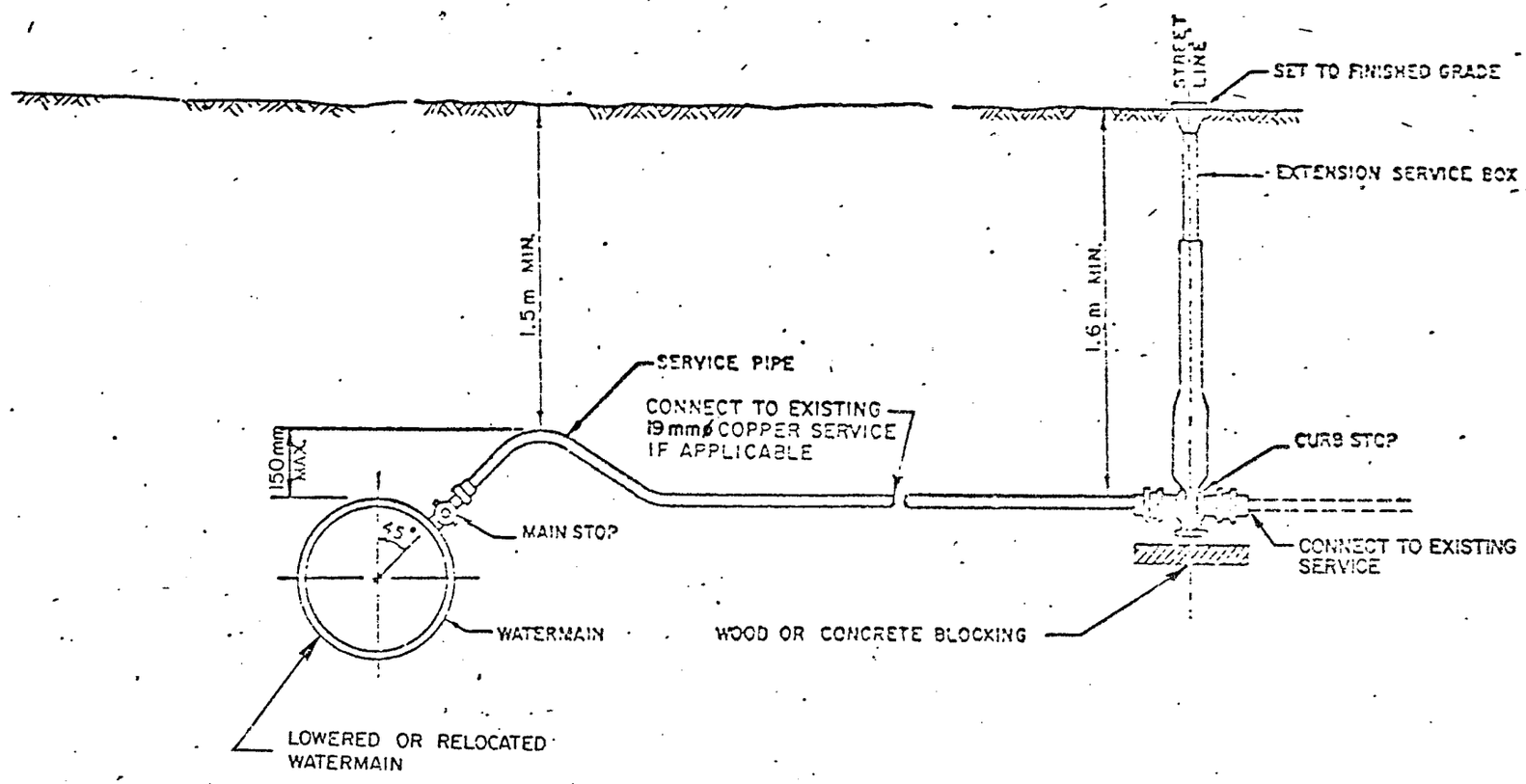
NOTES

1. For cast in place base, concrete to be 20 MPa at 28 days.
2. Precast manhole sections shall be equal to A.S.T.M. specifications C-478.
3. Steps. First step to be 75 mm below frame.
   Last step to be 300 mm above benching.
4. Parging mix on all brickwork to be 1:3 mortar mix and applied 15 mm thick.
5. Top of benching to be sloped no greater than 8:1 (horizontal to vertical).
6. All joints and lifting holes in manhole sections to be completely filled with a 1:3 mortar mix and pointed before backfilling.
7. Where used or applicable to storm sewer, benching shall be to crown.
8. Pipes entering precast sections on manhole must not enter at joints.
9. For drop manholes use in conjunction with E-80416-L11M

1200mm DIAMETER SANITARY PRECAST MANHOLE

APPROVED

DRAWING NO. E-80416-L14M



NOTES:

1.) CONNECT MAIN STOP TO H.D.P.E. WATERMAIN AS PER MANUFACTURERS RECOMMENDATIONS.
2.) CONNECT ALL EXISTING 19mm D COPPER SERVICES TO THE LOWERED OR RELOCATED WATERMAIN.
3.) WHERE EXISTING WATER SERVICE IS NOT 19mm D COPPER, INSTALL COMPLETE SERVICE AND CONNECT AT PROPERTY LINE.

WATER SERVICE

E-80416-L15M

REVISIONS

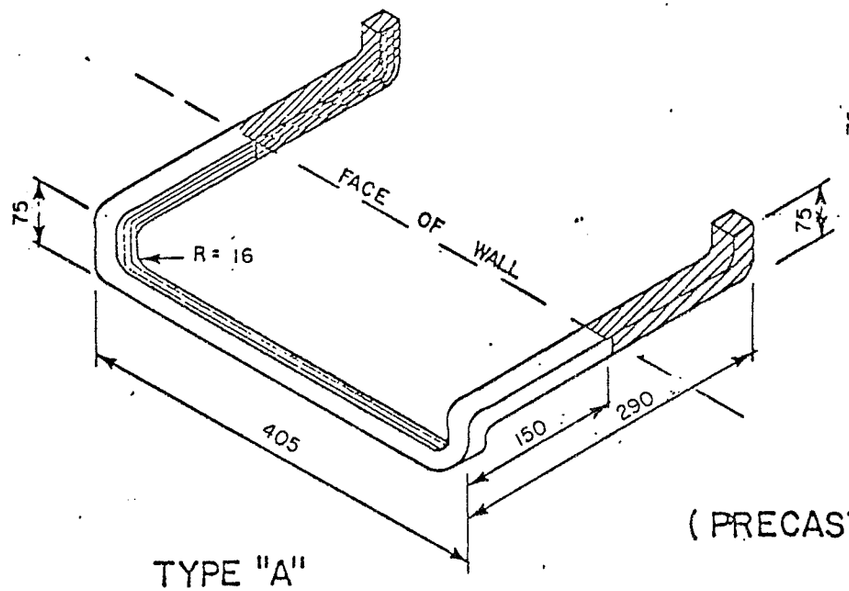
APPROVED BY

ALUMINUM SAFETY LADDER RUNGS

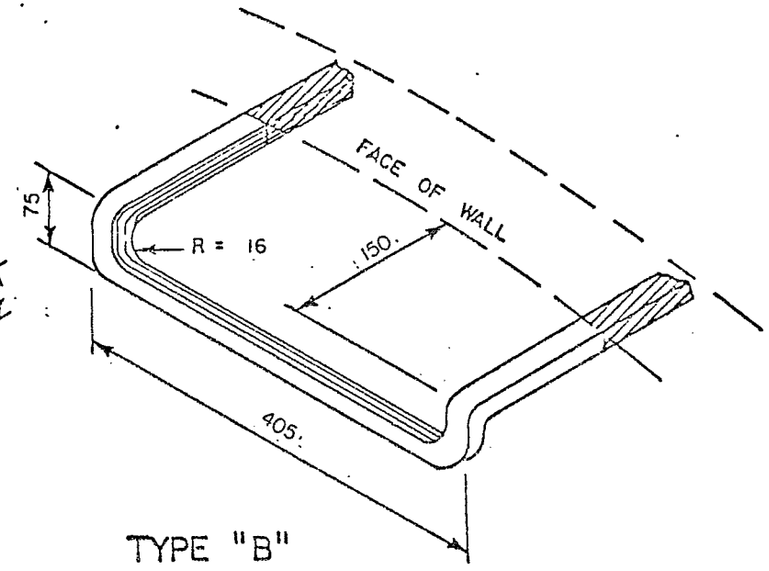
Proctor & Redfern Limited
Consulting Engineers
Toronto

DRAWING NO E-STD.-2-10M

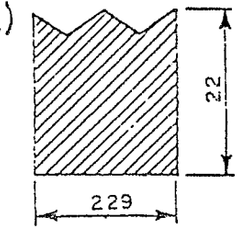
REV.



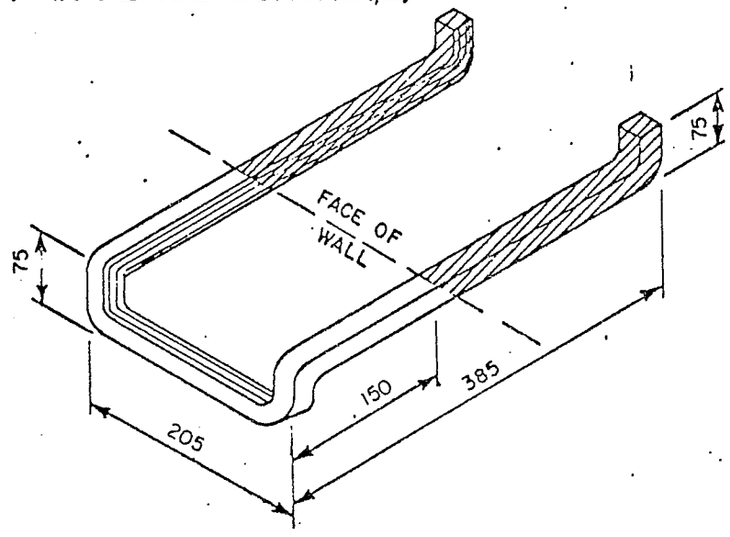
TYPE "A"
(CAST IN PLACE CONCRETE)



TYPE "B"
(PRECAST CONCRETE)



SECTION THROUGH
ALUMINUM STEPS



TYPE "C"
(MASONRY)

NOTES:

1. MATERIAL FOR STEPS TO BE ALUMINUM ALLOY 65 ST 4 (ALUMINUM CO. OF CANADA SPECIFICATION)
2. ALL ALUMINUM IN CONTACT WITH CONCRETE OR BRICKWORK TO HAVE 2 COATS FLINTKOTE C-12 STATIC ASPHALT PAINT OR APPROVED EQUAL
3. CONTRACTOR TO SUPPLY SHOP DRAWING SHOWING PIPE MANUFACTURERS METHOD OF SECURING STEPS IN PRECAST UNITS
4. LADDER RUNGS TO BE SPACED 300 CENTER TO CENTER ON FACE OF WALL