

Appendix E

Regulatory Approvals

**APPLICATION PROCEDURES FOR
PLACEMENT OF UNDERGROUND WATER
AND SEWER PIPELINES IN THE VICINITY OF
TRANSPORTATION FACILITIES UNDER THE
JURISDICTION OF ALBERTA TRANSPORTATION**

1. Application Procedures
2. General Construction Guidelines

April 10, 2001

1.0.0 APPLICATION PROCEDURE

Applications for crossing of highways under the jurisdiction of TRANS by sewer and/or water pipelines shall be submitted to the appropriate Regional Office of Alberta Transportation.

The applicant shall allow minimum 30 working days for the application processing.

Application for water and/or sewer crossing public roads other than highways within the boundaries of any Municipal District or County shall be submitted to the appropriate Municipality.

1.1.0 APPLICATION REQUIREMENTS

The application should clearly state the purpose of the application, the type of the facility, method of construction, and provide the legal land description, number of the highway involved, and particulars of the contact person responsible for the application. In case of sewer lines it should also state whether the line is for sanitary sewage or storm drainage.

Incomplete applications without proper documentation will be returned without review.

A copy of the permit issued shall be provided to the contractor and made available for verification at the construction site at all times.

No construction may be undertaken without a valid permit.

Only work covered by original permit can be performed at the site. Any additional work, variation or change from the proposal covered by the original permit requires additional approval(s).

Each of the drawings submitted with application shall have a number for reference purposes.

The application should contain a key plan showing proposed crossing location(s) and five copies of the crossing plan for each proposed crossing. Attached to the application and approval forms in Appendix "C" of this chapter is a sample crossing plan.

Each crossing plan shall include:

- 1) Key plan at a suggested scale of 1:10,000 indicating legal land description for the proposed crossing including appropriate section number, township, range;
- 2) Detail plan of the crossing at a minimum scale of 1:1000 showing: a dimensional tie along the centre-line of the highway or road to the known point, the proposed angle of the crossing and the pipeline alignment to a minimum distance of 50 metres on each side of the highway right-of-way;
- 3) Proposed surveyed cross-section of the crossing at a minimum horizontal scale of 1:200 and vertical 1:100.

The cross-section has to show:

- a) Width of the existing highway right-of-way,
 - b) Width of proposed highway right-of-way (if known),
 - c) Type of road surface, i.e. paved, gravelled or dirt,
 - d) Slope pipe below highway (minimum 1:120), and
 - e) Minimum depth of cover – (i) 1.4 metres for sewer, and (ii) 2.5 metres for water line throughout the highway right-of-way and within 30 metres each side of its right-of-way boundaries;
- 4) Profile along the centre-line of the highway or road for minimum distance of 400 metres in each direction from the crossing at a minimum horizontal scale of 1:5000 and vertical 1:200; and
- 5) Pipe specifications of pipeline at the crossing site, including:
- I. Carrier pipe specifications:
 - a) Outside diameter,
 - b) Wall thickness,
 - c) Maximum operating pressure,
 - d) Minimum yield strength of pipe, and
 - e) Fittings, if any.
 - II. Casing pipe specifications (cased crossings only):
 - a) Outside diameter,
 - b) Wall thickness, and
 - c) Minimum yield strength and information if a casing pipe is new or used.

2.0 GENERAL CONSTRUCTION GUIDELINES

2.01 CONSTRUCTION COMMENCEMENT AND COMPLETION

The applicant shall contact the appropriate TRANS Operation Manager or Development and Planning Technologist/Project Services Technologist at least two working days prior to commencement of construction to review the project.

The applicant shall contact the appropriate TRANS Operation Manager or Development and Planning Technologist/Project Services Technologist at least two working days prior to construction completion to allow for site inspection if required.

2.02 PARALLEL PIPELINE

No pipeline right-of way or easement shall be placed less than 30 metres parallel to a highway unless prior approval is obtained from the appropriate TRANS Operation Manager.

2.03 CROSSING UNDER PAVEMENT - METHOD OF CROSSING

The open cut method for pipeline installation at any highway is not permitted.

The crossing of highway and pavement surfaces shall be constructed by boring or jacking methods in such a manner that the road grade is not disturbed.

The proposed method of installation shall be shown on the plan of the crossing attached to the application.

2.04 MINIMUM DEPTH OF COVER ON THE HIGHWAY OR ROAD RIGHT-OF-WAY

The minimum depth of cover over the pipeline where it crosses the right-of-way of a highway or a road shall be 2.5 metres for water and 1.4 metres for sewer lines under the lowest point in the cross-section.

2.05 INTERSECTION ANGLE OF PIPELINE CROSSING OF THOROUGHFARE

The desirable angle of crossing is between 70 and 90 degrees, however other angles may also be accepted in special circumstances.

2.06 SLOPE OF PIPELINE CROSSING

The pipeline shall be placed from one end to the other with a maximum gradient of 1 in 120.

2.07 HORIZONTAL AND VERTICAL PIPELINE BENDS

No horizontal and/or vertical pipe bends are permitted throughout the right-of-way and within 30 metres of the right-of-way boundaries of a primary highway, unless approval is obtained from the appropriate TRANS Operation Manager.

2.08 CASED CROSSING

Where casing is required, it shall be continuous and inserted by boring or driving or other approved method.

2.09 DIAMETER OF CASING

The diameter of the casing shall be at least 5 centimetres greater (2") than the diameter of the carrier pipe. An exception to this is steel casing of polyethylene pipe, where the next size diameter of pipe may be used.

2.10 MINIMUM LENGTH OF CASING

The casing shall extend across full width of the highway right-of-way.

2.11 SEALED CASING

The casing shall be satisfactorily sealed to the carrier pipe at both ends.

2.12 CASING NOT TO CARRY OTHER UTILITIES

No cables of any kind shall be placed within the casing of any pipeline.

2.13 VENTING OF CASING PIPE

Vents shall not be placed within the limits of the highway right-of-way.

2.14 BORED OR AUGURED CROSSING

Casing shall be fitted into a bored or augured hole of such diameter as to provide a snug fit for the casing.

2.15 BORE SIZE

The bore size for heavy wall pipe shall be no more than one pipe size larger than the installed pipe. If the bore is larger than one pipe size, a pipe of the bore size shall be installed to form a cased crossing.

2.16 BORING IN NON-COHESIVE SOILS

Closed boring method shall be used in non-cohesive soil conditions.

2.17 DRAINAGE STRUCTURE

A pipeline shall not run through a culvert or drainage structure.

2.18 PIPELINE ATTACHMENTS TO BRIDGE STRUCTURES

No pipeline shall be attached to bridge structure without the written consent of the appropriate TRANS Regional Bridge Engineer.

2.19 OPEN EXCAVATION, MATERIAL AND EQUIPMENT STORAGE

No open excavation shall be constructed, nor shall any material or equipment be deposited or stored any closer than 6 metres of a bridge or earth retaining structure (without special consent of the appropriate TRANS Regional Bridge Engineer), and 4 metres from the shoulder break of a highway, or a toe of sideslope, whichever distance is greater.

2.20 BACKFILLING OF OPEN TRENCHES

The backfilling of all trenches in the highway right-of-way or within 6 metres of bridge pier or earth retaining structure shall be undertaken immediately after the installation has been placed and passed any necessary inspection. Backfill materials shall be thoroughly compacted with mechanical compactors and the owner of the pipeline will be held responsible for any settling in backfill for a period of three years after the completion of the work.

2.21 WASTE MATERIAL

All waste material shall be removed and all disturbed areas shall be levelled and trimmed in approved manner and re-seeded where necessary to restore the right-of-way to at least as good as original or better conditions.

2.22 WORK IN THE MEDIAN

No work shall be undertaken in the median of a divided highway unless approved by the appropriate TRANS Operations Manager.

2.23 WATER LINES – CONSTRUCTION MATERIALS

A heavy wall continuous steel or heavy wall continuous P.E. pipe shall be used for uncased water lines located beneath the road.

Should a cased plastic pipe be used it must be installed in an outer continuous casing and adequately supported at the point where it leaves the casing in order to prevent sheering.

2.24 MANHOLES

Manholes located within the highway right-of-way shall be placed flush with the adjacent ground.

2.25 MANHOLES IN THE ROADWAY SIDESLOPES

No manholes shall be placed in the sideslopes unless special approval is obtained from the appropriate TRANS Operations Manager.

2.26 MANHOLES IN THE MEDIAN

No manholes shall be located within the centre median of multi-lane highways unless a special permit is obtained from the appropriate TRANS Operations Manager.

2.27 CONSTRUCTION SAFETY

All reasonable precautions shall be undertaken during construction to protect and safeguard public safety and property owners. This includes barricading, signing and flagpersons as required, to protect and safeguard the lives and property of the travelling public and adjacent property owners. At no time shall the highway or public roadway be closed to traffic. Where normal traffic patterns are to be interrupted due to ditching or other operations, prior approval must be first obtained. Suitable signs shall be erected and if required, a flagperson(s) shall be used to direct traffic through the disruption area as approved by the appropriate TRANS Operations Manager.

No work is to be conducted during darkness or when there is reduced visibility.

2.28 CONSTRUCTION SIGNING

Attached to the application and approval forms is a drawing showing the typical signing requirements to be provided by the contractor during installation of the water/sewer lines parallel or across divided and undivided highways and public roadways. The signs are to be removed immediately following the construction completion. If the signing requirements are not met, the appropriate TRANS Operations Manager or his representatives have the right to halt all construction until proper signing is erected.

A GUIDE TO THE PIPE AND WIRE PROCESS

General Guidelines

1. Applications

- 1.1 Applications must have seven (7) copies of an acceptable plan attached. Plans must provide sufficient information to determine that installation will meet Railway Standards, General Order requirements and CSA Standards. They must be to scale or have all dimensions shown. They must clearly and accurately show Railway property lines. Refer to Appendix "C-1" for detail list of areas where Railway requirements exceed General Order or CSA Standards as well as a list of common omissions.

2. Agreement/Easement

- 2.1 When plans are approved by the Railway for installation, the Company will be sent appropriate documents with:
- i. Agreement/Easement for signing.
 - ii. Costs.
 - iii. Special conditions will be identified.
 - iv. Company responsibilities will be listed.
- 2.2. Acceptance by the Company will be by signing appropriate documents, and returning it with a cheque in the amount requested. If the Company is not incorporated, the signature should be witnessed.
- 2.3 When the Company's acceptance is received, the Railway will reply with a Letter of Acknowledgment with contact names and phone numbers of local CN personnel to make arrangements.

3. Installation

- 3.1 Installation can be done with Ten (10) working days' notice to the contacts listed on Letter of Acknowledgment. This notice will allow the Railway to arrange for flagging protection and signals location as required. See Appendix "B-1".
- 3.2 After installation, if there are no additional flagging charges, and payment was prepaid, the account will be closed. If additional charges are applicable, an invoice will be produced.

Construction, Operation and Maintenance of Crossings

1. The Company shall give the Railway at least ten (10) days' prior notice of its intention to do any construction or maintenance work. The determination of this notice period shall not include Saturdays, Sundays and statutory holidays. Should an emergency situation arise, the Company shall contact the Railway to make special arrangements. The Railway agrees to act reasonably in these situations.
2. Construction and maintenance by the Company of any crossing shall be subject to the supervision of the Railway or the Railway's appointed representatives.
3. Should any work be required to support or repair the tracks or facilities of the Railway or to protect train movements due to the construction, operation, maintenance or removal of crossings, such work shall be performed by the Railway and the Company shall reimburse the Railway for all reasonable costs associated with such work upon receipt of the Railway's account.
4. The Company shall maintain all Crossings under this Agreement in good order and condition in accordance with the applicable rules, requirements and specifications issued from time to time by the Canadian Standards Association and approved by Transport Canada. If at any time during the term of this Agreement, the Company neglects to do any restoration and Maintenance work required to keep any Crossing free from hazard, the Railway, after giving reasonable prior written notice to the Company specifying the nature of the work required, may itself carry out such work. The Company shall reimburse the Railway for all reasonable costs associated with this work upon receipt of the Railway's account.
5. The construction, operation and Maintenance of Crossings shall be carried out in a manner so as to minimize interference with Railway Property, facilities and operations. When any such work has been completed, Railway Property shall be restored by the Company to its former condition so far as practicable. The Company shall, at its expense, expeditiously and effectively, remedy any interference that does occur, or, should no appropriate remedy be found, remove such crossing and restore the Railway Property to good order and condition. Should the Company fail to correct such interference, the Railway reserves the right to do so at the Company's expense and the Company will reimburse the Railway upon receipt of the Railway's account therefore.
6. The Railway may impose other construction conditions at time of application.

FEE SCHEDULE FOR MASTER AGREEMENT APPLICATIONS

1. **Basic Application Fee - New Installations** **\$650**
 Rush application (Response back within two weeks, if Workload permits) **\$1,000**
2. **Agreement Fee starting at:** **\$1,200**
 For easements, \$1,200 applies to 3 m width by 30 m length
 Cost may increase due to location, width of easement.
3. **Flagging Protection and Signals Protection During Installation**

Minimum cost:	Flagging protection	\$700 Dependent on location
Minimum cost:	Signals protection	\$360

Additional costs for flagging and signals will be invoiced after completion of project if:

 - time on site was more than one day for either flagging or signals protection
 - a large number of hours were at overtime rates ,i.e. weekend installations.
 - 24 hour notice of project cancellation is not received. One additional day of flagging will be invoiced.
3. **Additional Review Fee** **\$100 per review**
 Covers applications with incomplete or substandard information that require resubmission and further review.
4. **Conversion Fee** **\$10 per crossing**
 This is a one-time fee covering the Railway's review of each crossing agreement currently in existence between the Railway and the Company to determine the sites eligible for inclusion under a Master Agreement. No charge will be assessed for conversion of sites where existing fee is "nil" and the crossing is not on land owned by the Railway (i.e. Public Road).
5. **Annual Administration Fee** **\$50 per crossing**
 The Company will be provided with one (1) invoice on inception and annually, indicating the total annual charge arrived at by multiplying the Annual Administration Fee and the number of sites in existence under this Agreement on inception and on each anniversary date of this Agreement. The amount determined and invoiced will be due and payable within thirty (30) days of the receipt of such invoice.

 No charge will be assessed for existing crossings where the fee is "nil" and the crossing is not on land owned by the Railway (i.e. Public Road). Fees will be applicable to any new crossings of this type.

6. **Additional Costs**

The Railway reserves the right to charge for additional costs incurred by the Railway as a result of specific applications. Without limiting the generality, this includes items such as open-cut installations, inductive coordination, charges for train delays and slow orders, consulting and inspection costs.

7. **Assignment Fee** **\$250**

Should the Company wish to assign any of its rights, interests or privileges it has under this Agreement, and should the Railway consent, this fee will be applicable to each assignment document prepared.

9. **Fee Review**

All fees and charges that may be imposed under this Agreement are subject to annual review and adjustment by the Railway.

FEE SCHEDULE FOR INDIVIDUAL AGREEMENTS

1. **Basic Application Fee - New Installations** \$650

Rush application (Response back within two weeks, if Workload permits) \$1,000

2. **Agreement Fee starting at** \$1,200

3. **Flagging Protection and Signals Protection During Installation**

Minimum cost: Flagging protection \$700
Dependent on location

Minimum cost: Signals protection \$360

Additional costs for flagging and signals will be invoiced after completion of project if:

- time on site was more than one day for either flagging or signals protection
- a large number of hours were at overtime rates ,i.e. weekend installations.
- 24 hour notice of project cancellation is not received. One additional day of flagging will be invoiced.

4. **Additional Review Fee** \$100 per review

5. **Additional Costs**

The Railway reserves the right to charge for additional costs incurred by the Railway as a result of specific applications. Without limiting the generality, this includes items such as open-cut installations, inductive coordination, charges for train delays and slow orders, consulting and inspection costs.

6. **Fee Review**

All fees and charges that may be imposed under this Agreement are subject to annual review and adjustment by the Railway.

FEE SCHEDULE FOR -EASEMENTS (ALBERTA AND MANITOBA ONLY)

1. **Basic Application Fee - New Installations** \$650

Rush application (Response back within two weeks, if Workload permits) \$1,000

2. **Easement Fee starting at:** \$1,200

3. **Flagging Protection and Signals Protection During Installation**

Minimum cost: Flagging protection \$700
Dependent on location

Minimum cost: Signals protection \$360

Additional costs for flagging and signals will be invoiced after completion of project if:

- time on site was more than one day for either flagging or signals protection
- a large number of hours were at overtime rates ,i.e. weekend installations.
- 24 hour notice of project cancellation is not received. One additional day of flagging will be invoiced.

4. **Additional Review Fee** \$100 per review

5. **Additional Costs**

The Railway reserves the right to charge for additional costs incurred by the Railway as a result of specific applications. Without limiting the generality, this includes items such as open-cut installations, inductive coordination, charges for train delays and slow orders, consulting and inspection costs.

6. **Fee Review**

All fees and charges that may be imposed under this Agreement are subject to annual review and adjustment by the Railway.

7. **Survey and Registration**

It is the Company's responsibility and expense to survey and register the easement document.

Standards Respecting Pipeline Crossings Under Railways

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1. SCOPE

1.1 These standards may be known as the "Pipeline Crossing Standards".

1.2 These standards are intended to ensure that pipeline crossings under Railways are installed, renewed and maintained in a safe manner. These standards apply to Railway Companies subject to the jurisdiction of the Minister of Transport pursuant to the Railway Safety Act.

2. GENERAL APPLICATIONS AND EXCLUSIONS

2.1 Pipeline Installation Procedures shall be in strict conformance with all Federal, Provincial and local safety regulations.

2.2 These standards do not include overhead cable crossings, overhead pipeline crossings, and underground cable crossings.

2.3 These standards do not apply to any pipe installed under a railway right-of-way prior to the date of approval of these standards, unless the pipeline crossing is to be reconstructed.

3. GENERAL CONDITIONS

3.1 No person shall commence the installation of any pipe under a railway without:

- a. submitting to the railway company detailed plans of the proposed installation in accordance with the requirements outlined in Appendix 'A'; and
- b. obtaining a written approval from the railway company that owns, operates or has control

of the railway.

3.2 No person shall commence the repair, maintenance or removal of any pipe under a railway without obtaining a written approval from the railway company that owns, operates or has control of the railway.

3.3 Every owner of a pipe installed under a railway, shall at all times maintain the pipe in good working order and condition, so that:

- a. the safety of railway operations is not threatened in any manner;
- b. the safety of the public, including the lives, well-being and health of people is safeguarded; and
- c. the environment is protected.

4. REQUIREMENTS FOR PIPELINES CROSSING UNDER RAILWAYS - GENERAL

For oil and gas pipelines crossing under railways, the requirements of C.S.A. Standard Z662-99, and subsequent revisions, will apply as modified and amended in Section 5 herein.

For steam, water, sewer or other non-flammable substance pipelines crossing under railways, the requirements of Section 6 shall apply.

The term "**Engineer**" used herein means the Chief Engineer of the railway company or his authorized representative.

General: Railway design loading applicable to all pipelines crossing under railways shall be Cooper's E80 track loading, with diesel impact as specified in C.S.A. Standard Z662-99. The use of optional limits states design processes under C.S.A. Standard Z662-99 will not apply to the design of oil and gas pipelines crossing under railways.

5. REQUIREMENTS FOR OIL AND GAS PIPELINES UNDER RAILWAYS

5.1 Amend C.S.A. Standard Z662-99 Clause 4.7 Cover and Clearance Requirements as follows:

Table 4.8 "Minimum Cover and Clearance Requirements": In the case of oil and gas, and hazardous* gas pipelines crossing under railways, Table 4.8 shall be amended as follows:

Table 4.8 Minimum Cover and Clearance Requirements

(1) Minimum cover for buried pipelines, cm (measured to top of carrier or casing pipe, as applicable

Minimum Cover and Clearance Requirements

Location	Type of Pipeline	Class Location	Normal Excavation	Rock Excavation requiring blasting or removal by comparable
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				means
Crossings of railway rights-of-way: below base of rail**				
All tracks:				
Cased	Flammable or hazardous* gas or liquid	All	168 (5.5ft)	168 (5.5ft)
Uncased	Flammable or hazardous* gas or liquid	All	305 (10.0ft)	305 (10.0ft)
Crossings of railway rights-of-way: below bottom of ditches or ground surface ***				
Cased	Flammable or hazardous* gas or liquid	All	91 (3.0ft)	91 (3.0ft)
Uncased	Flammable or hazardous* gas or liquid	All	183 (6.0ft)	183 (6.0ft)
Railway rights-of-way for cased or uncased buried longitudinal pipelines***				
Between 762cm and 1524 cm from centreline of nearest track	Flammable or hazardous* gas or liquid	All	183 (6.0ft)	183 (6.0ft)
Greater than 1524cm from the centre-line of nearest track	Flammable or hazardous* gas or liquid	All	152 (5.0ft)	152 (5.0ft)

* Non-flammable gas or liquid products which, from their nature or pressure, might cause damage or endanger the lives, well-being and health of people, or the environment, if escaping on or in the vicinity of railway property.

** Within 7 metres of centre of outside rail, measured at right angles to the centre line of the track.

*** On portions of the right-of-way where carrier or casing pipe is not directly beneath any track.

5.2 Amend C.S.A. Standard Z662-99 Clause 4.7.1 as follows;

Add to end of Clause 4.7.1: For oil and gas pipelines crossing under railways, minimum cover requirements shall be in accordance with Table 4.8 of the referenced standard C.S.A. Z662-99, as amended herein. For any proposed pipeline crossing physically unable to meet the minimum cover requirements specified in Table 4.8 as amended herein, the applicant will propose alternative methods and shall obtain approval of the Engineer to use such methods.

5.3 Amend C.S.A. Standard Z662-99 as follows;

Add as a new Clause 4.8.5 called "Pipe installation near railway bridges and buildings" the

following: Pipelines carrying flammable or hazardous gas or liquids under railways shall not be placed within a culvert, under railway bridges nor closer than 13.7m to any portion of any railway bridge, building or other important structure on a railway right-of-way, except in special cases and then by special design as approved by the Engineer.

Add to Clause 10.2.2: Emergency response procedures shall be developed by the applicant to handle a situation in which a pipeline leak or railroad derailment or incident may jeopardize the integrity of the pipeline. Local conditions shall be considered when developing these procedures.

Add to Clause 10.2.8.4: Oil and gas pipeline crossings shall be prominently identified where pipelines enter and exit railway right-of-way, approximately on the limits thereof, by signs in a language or languages appropriate to the region in which the sign is located. Such signs shall meet the requirements of C.S.A. Standard Z662-99, as amended herein. Additional signage will be required by the Engineer where the above signs are not readily visible from the track.

Add as a new Clause 4.4.11 called "Emergency Shutoff Valves" the following: For oil and gas pipelines, accessible emergency shutoff valves shall be located each side of the railway within effective distances as mutually agreed to by the Engineer and the pipeline company. These valves shall be marked with signs for identification. Where pipelines are provided with automatic control stations and/or valves that are remotely operated, no emergency shutoff valves are required at the crossing.

Add as a new Clause 4.7.4 called "Longitudinal installations" the following: Longitudinal oil and gas pipelines on the railway right-of-way shall be located as far as possible from any track. They shall not be within 7.62m of the centre-line of any track, and shall be marked by a sign approved by the Engineer every 152.4m and at every road crossing, streambed, other utility crossing, and at locations of major change in direction of the line. In exceptional situations, where it is not physically possible to locate the pipeline beyond 7.62m of the centre-line of a track, the carrier pipe shall be encased or of special design and must be approved by the Engineer.

5.4 Amend C.S.A. Standard Z662-99 Table 4.9 "Least Nominal Wall Thickness for Steel Casing Pipe in Cased Crossings and Carrier Pipe in Uncased Crossings" as follows;

All least nominal wall thicknesses for steel casing pipe in cased crossings and steel carrier pipe in uncased crossings shall be as shown in Table 4.9, except that the least nominal wall thickness shall not be less than 4.8 mm in any case.

Add new Notes under Table 4.9, as follows:

Notes:

1) When steel casing pipe or carrier pipe is installed under a railway without benefit of a protective coating or is not cathodically protected, the least nominal wall thickness shown in Table 4.9 shall be increased by a minimum of 1.6mm.

2) Steel casing or carrier pipe installed under a railway shall have a specified minimum yield strength of 241 Mpa or greater.

5.5 Amend C.S.A. Standard Z662-99 Clause 4.8.3 "Crossings of Roads and Railways" as

follows;

Add new item to Clause 4.8.3.3 Cased Crossings:

(h) Casing pipe and joints under railways shall be of leakproof construction capable of withstanding railway loadings specified herein, and shall be of steel unless otherwise indicated herein, or as approved by the Engineer.

5.6 Replace C.S.A Standard Z662-99 Clause 12.4.6 with the following:

Polyethylene carrier pipe may be used in pipeline systems for the transportation of gaseous hydrocarbons under railways if

- i. The design pressure does not exceed 700 kPa.
- ii. The carrier pipe is made from polyethylene materials permitted by C.S.A. Standard CAN/CSA-B 137.4-92 (R 1998), and subsequent revisions.
- iii. The outside diameter of the carrier pipe is not greater than 168.3mm.
- iv. The polyethylene carrier pipe within the entire limits of the railway right-of-way, is encased in a steel casing pipe meeting the requirements of C.S.A Standard 2662-99, as amended herein.

5.7 Replace C.S.A. Standard Z662-99 Clause 15.4.5 with the following:

Aluminum pipe is not acceptable for use in pipeline crossings under railways.

6. REQUIREMENTS FOR STEAM, WATER, SEWER AND OTHER NON FLAMMABLE SUBSTANCE PIPELINES UNDER RAILWAYS

6.1 Carrier and Casing Pipe Requirements

Pipelines carrying steam, water (other than oilfield steam and water), sewer, and other non-flammable or non-hazardous substances under railways shall be encased in a larger pipe or conduit called the casing pipe. Casing pipe may be omitted under the following conditions:

- (a) under secondary or industrial tracks as approved by the Engineer, provided maximum operating pressure in the carrier pipe does not exceed 700 kPa.;
- (b) for non-pressure sewer crossings where the strength of the pipe and its joints are capable of withstanding railway loading, as approved by the Engineer.

Carrier pipe, casing pipe, and joints shall conform to the applicable requirements of AREMA Ch. 1 Section 5.3 with respective materials in conformance with C.S.A. Standards, and be:

- (a) of acceptable material and construction as approved by the Engineer, and
- (b) of sufficient strength to withstand the internal pressure and external loading, and
- (c) properly connected at the joints and leakproof.

Joints for carrier line pipe shall be leakproof mechanical or welded type.

For steel carrier or casing pipe the least nominal wall thickness shall be in accordance with C.S.A. Standard Z662-99 as amended in Section 5 of this Pipeline Crossing Standard.

For pressures under 700 kPa in the carrier pipe, the casing pipe, if required, may be reinforced concrete pipe conforming to specifications in AREMA Manual for Railway Engineering Chapter 8 "Concrete Structures and Foundations", Part 10 "Reinforced Concrete Culvert Pipe", or coated corrugated metal pipe conforming to AREMA Manual Chapter 1, Part 4, all as approved by the Engineer. Respective materials shall conform to applicable C.S.A. standards.

6.2 Minimum Cover and Clearance Requirements

(a) Minimum cover for buried pipelines, cm (measured to top of carrier or casing pipe, as applicable)

Minimum cover and clearance requirements for burried pipelines

Location	Type of Pipeline	Class Location	Normal Excavation	Rock Excavation requiring blasting or removal by comparable means
Crossings of railway rights-of-way: below base of rail**				
Main tracks:				
Cased	Water, sewer, steam or non-flammable or non-hazardous* substance	All	168 (5.5 ft) or below frost line	168 (5.5 ft) or below frost line
Crossings of railway rights-of-way: below base of rail ** Second or Industrial Tracks:				
Cased	Water, sewer, steam or non-flammable or non-hazardous* substance	All	137 (4.5 ft) or below frost line	137 (4.5 ft) or below frost line
Uncased	Water, sewer, steam or non-flammable or non-hazardous* substance	All	137 (4.5 ft) or below frost line	137 (4.5 ft) or below frost line
Crossings of railway rights-of-way below bottom of ditches or ground surface ***				
Cased	Water, sewer, steam or non-flammable or non-hazardous* substance	All	91 (3.0 ft) or below frost line	91 (3.0 ft) or below frost line
Uncased	Water, sewer, steam or non-flammable or non-hazardous* substance	All	91 (3.0 ft) or below frost line	91 (3.0 ft) or below frost line
Railway rights-of-way for cased or uncased buried longitudinal pipelines ***				
Up to 1524 cm from centre-line of nearest track	Water, sewer, steam or non-flammable or non-hazardous* substance	All	122 (4.0 ft) or below frost line	122 (4.0 ft) or below frost line
Greater than 1524	Water, sewer, steam or		91 (3.0 ft) or	

cm from centre-line of nearest track	non-flammable or non-hazardous* substance	All	below frost line	91 (3.0 ft) or below frost line
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* Non-flammable gas or liquid products which, from their nature or pressure, might cause damage or endanger the lives, well-being and health of people, or the environment, if escaping on or in the vicinity of railway property.

** Within 7 metres of centre of outside rail, measured at right angles to the centre line of the track.

*** On portions of the right-of-way where carrier or casing pipe is not directly beneath any track.

6.3 General Installation Requirements

For water and sewer crossings under railways, the highest point of carrier pipe shall be below the frost line. In regions of permafrost or where other obstacles make it impossible to place the pipe below the frost line, the applicant will propose alternate methods to protect the pipe in sub-freezing temperatures and shall obtain approval of the Engineer to use such methods.

Pipelines carrying steam, water (including oilfield steam and water), sewer and other nonflammable or non-hazardous substances under railways, shall not be placed within culverts nor under railway bridges where there is likelihood of restricting the area required for the purposes for which the culverts or bridges were built, or of endangering the foundations. Any such pipelines laid longitudinally on railway rights-of-way shall be located as far as practicable from any tracks or other important structures. If located within 7.62 metres of the centre-line of any track, or where there is significant risk of damage from leakage to any bridge, building or other important structure, the carrier pipe shall be encased or of special design as approved by the Engineer.

Every open drain crossing tracks in a railway yard shall be safely covered for at least 3.0m from the centre-line of track, except in times of flood when uncovered open drains may be provided as may be necessary. In this case warning signs shall be erected.

C.S.A. Standards current at time of constructing the pipeline, shall govern the inspection and testing of the facility within the railway rights-of-way. The proof testing of the strength of carrier pipe shall be in accordance with C.S.A requirements.

APPENDIX

Plans and Design Requirements for Pipelines Crossing under Railways

For all pipeline crossings under railways (including oil and gas, steam, water, sewer, storm drain, etc.), plans for proposed installation shall be submitted to and meet the approval of the Engineer before construction is begun.

Plans shall be drawn to scale showing the relation of the proposed pipeline to railway tracks,

angle of crossing, location of nearest shut-off valves, railway mileage, right-of-way lines and general layout of tracks and railway structures and facilities. Plans should also show a cross-section (or sections) from field survey, showing pipe in relation to actual profile of ground and tracks, with location of any joints in the carrier or casing pipe within the railway right-of-way, and necessary geo-technical boreholes (soil type) and ground water levels. Pipelines shall be installed under tracks by boring and/or jacking, if practicable. If open-cutting or tunneling is approved, the proposed limits of excavation, details of sheeting and method of supporting tracks or driving tunnel shall be shown, with supporting engineering calculations.

In addition to the above, plans should contain the following data:

- Railway Mileage & Subdivision
- Municipal Descriptions of Adjoining Properties
- Name of Pipeline Owner

It should also contain data for the **Carrier Pipe and Casing Pipe** for the following fields:

- Contents to be handled, Outside Diameter, Pipe Material, Specification and grade, Wall thickness, Maximum Operating Pressure, Maximum Surge & Test Pressure, Maximum Operating Temperature, Minimum Operating Temperature, Type of joint, Coating, Method of installation

Additional data to be entered:

- Vents: Number, Size, Height above ground, Seals, Both ends, Type

More fields to be entered:

- Bury: Base of rail to top of casing (metres)
- Bury: (Not beneath tracks) (metres)
- Bury: (Roadway ditches) (metres)
- Extent of casing measured perpendicular to centre-line of track (metres)
- Type, size and spacing of insulators or supports (metres)
- Distance C.L. track to face of jacking/receiving pits (metres)
- Bury: Base of rail to bottom jacking/receiving pits (metres)
- Cathodic Protection: (yes/no)
- Geotechnical Boreholes: (yes/no)
- Soil Type
- Base of Rail to ground water (metres)

Plans shall be sealed and signed by a professional engineer, competent in this field, registered in the province or territory in which the pipeline crossing is located.

The execution of work on railway rights-of-way, including the supporting of tracks, shall be subject to the inspection and direction of the Engineer.

Where laws or orders of public authority prescribe a higher degree of protection than specified herein, then the higher degree of protection so prescribed shall be deemed a part of this Standard.

Table 4.9
Least Nominal Wall Thickness for Steel Casing Pipe in Cased Crossings and Carrier Pipe in Uncased Crossings
 (See Clauses 4.8.3.1, 4.8.3.2, 4.8.3.3, and 15.4.5.)

Pipe outside diameter, mm	Least nominal wall thickness, mm	
	Roads	Railways
88.9	3.2	3.2 4.8
101.6	3.2	3.2 4.8
114.3	3.2	3.2 4.8
141.3	4.0	4.0 4.8
168.3	4.8	4.8
219.1 (8")	4.8	4.8
273.1	4.8	4.8
323.9	4.8	4.8
355.6	4.8	5.6
406.4	4.8	5.6
457	4.8	6.4
508 (20")	4.8	7.1
559	5.6	7.9
610	6.4	8.7
660	6.4	9.5
711	6.4	10.3
762 (30")	6.4	10.3
813	6.4	11.1
864	6.4	11.9
914	6.4	11.9
965	7.9	12.7
1016	7.9	12.7
1067	7.9	12.7
1118	7.9	14.3
1168	7.9	15.9
1219	8.3	15.9
1270	8.7	15.9
1321	9.5	19.1
1372	9.5	19.1
1422	9.5	19.1
1524	10.3	20.6

Note: For intermediate pipe outside diameters, the minimum wall thickness may be interpolated.

min. yield strength - 241 Mpa

** Add 1.6 mm if no protective coat or not cathodically protected*

4.8.3.2 Uncased Railway Crossings

It shall be permissible to install uncased steel pipelines under railways, provided that

- (a) the pipe has been designed to sustain the loads at the crossing in accordance with the requirements of Clause 4.3;
- (b) for steel pipe with a joint factor of 1.00, the hoop stress in the carrier pipe does not exceed 50% of its specified minimum yield strength;
- (c) for steel pipe with a joint factor of less than 1.00, the hoop stress in the carrier pipe does not exceed
 - (i) 50% of its specified minimum yield strength, if such pipe crosses secondary or industry tracks; and
 - (ii) 30% of its specified minimum yield strength, if such pipe crosses tracks that are other than secondary or industry tracks;

- (d) the pipe nominal wall thickness is not less than the applicable least nominal wall thickness specified in Table 4.9, or the applicable least nominal wall thickness for steel carrier pipe required by Clause 4.3.3.7.2, whichever is the greater;
- (e) the D/t ratio is not greater than the applicable maximum D/t ratio specified in Table 4.10;
- (f) the design requirements are applied to the pipeline for a minimum distance of 7 m beyond the centreline of the outside track, measured at right angles to the centreline of the track; and
- (g) all circumferential joints within the railway rights-of-way are nondestructively inspected in accordance with the applicable requirements of Clause 7.

Table 4.10
Maximum Pipe Diameter to Wall Thickness (D/t)
Ratio for Uncased Railway Crossings
 (See Clause 4.8.3.2.)

Maximum operating pressure, kPa	Maximum D/t ratio									
	Steel pipe grade									
	172	207	241	290	317	359	386	414	448	483
14 000	—	10	15	20	22	25	27	29	32	34
13 300	—	10	16	21	23	26	29	31	33	36
12 600	—	11	17	22	25	28	30	32	35	38
11 900	—	11	18	24	26	30	32	34	37	40
11 200	—	12	18	25	28	32	34	36	40	43
10 500	—	13	19	27	30	34	36	39	42	45
9 800	—	13	21	29	32	36	39	42	45	49
9 100	—	14	22	31	34	39	42	45	49	53
8 400	—	15	23	34	37	42	45	49	53	57
7 700	—	16	25	37	41	46	50	53	58	62
7 000	—	17	26	40	45	51	55	59	64	68
6 300	—	19	28	43	50	56	61	65	71	76
5 600	—	20	31	46	56	64	68	73	80	85
4 900	10	22	33	50	63	73	78	85	85	85
4 200	12	24	36	55	70	85	85	85	85	85
3 500	13	27	39	61	79	85	85	85	85	85
2 800	15	29	43	67	85	85	85	85	85	85
2 100	17	33	48	80	85	85	85	85	85	85
1 400	20	37	55	85	85	85	85	85	85	85
≤ 700	24	43	71	85	85	85	85	85	85	85

Notes:

- (1) For intermediate operating pressures, the D/t ratio may be interpolated.
- (2) D/t ratio means the OD divided by the nominal wall thickness.
- (3) Design conditions are the following:
- (a) 2.0 m minimum depth of cover;
- (b) 55°C temperature differential;
- (c) maximum hoop stress of 50% SMYS;
- (d) maximum combined circumferential stress of 72% SMYS;
- (e) maximum combined equivalent tensile stress of 90% SMYS;
- (f) E-80 rail loading criteria with an impact factor of 1.4 at the surface, reducing linearly to 1.0 at 3.0 m;
- (g) fluctuating stress limitation of 69 MPa based upon 2 000 000 cycles; and
- (h) maximum D/t ratio of 85.

4.8.3.3 Cased Crossings

Where cased crossings are installed, the design shall be in accordance with the following requirements:

- (a) Carrier pipe shall be designed in accordance with the applicable requirements of Clause 4.3.
- (b) For carrier pipe smaller than 168.3 mm OD, the outside diameter of the casing pipe shall be at least 50 mm greater than the outside diameter of the carrier pipe. For carrier pipe 168.3 mm OD or larger, the outside diameter of the casing pipe shall be at least 75 mm greater than the outside diameter of the carrier pipe.
- (c) Carrier pipe shall be held clear of the casing pipe by properly designed supports, insulators, or centring devices, so installed as to minimize external loads transmitted to the carrier pipe.
- (d) The ends of the casings shall be suitably sealed to the outside of the carrier pipe. Venting of sealed casings is not mandatory; however, where vents are installed, they shall be protected from the weather to prevent water from entering the casing. Where casing seals of a type that will retain more than 35 kPa pressure between the casing and the carrier pipe are installed, and vents are not used, provision shall be made to relieve the internal pressure before carrying out maintenance work.
- (e) Casing pipe under roads shall be of sufficient length to absorb all of the external loading from the road bed at the point of crossing.
- (f) Casing pipe under railways shall extend to the greatest of the following distances, measured at right angles to the centreline of the track:
- (i) 7 m each side from the centreline of the outside track;
 - (ii) 0.6 m beyond the toe of slope; and
 - (iii) 1 m beyond the ditch line or area that may be affected by normal ditch cleaning operations.
- (g) The nominal wall thickness for steel casing pipe shall be not less than the applicable least nominal wall thickness specified in Table 4.9.

4.8.4 Crossings of Water

Note: Where the designer considers that the design and construction requirements of Clause 11 are more appropriate, such requirements should be used for water crossings.

4.8.4.1

The wall thickness of pipe shall be determined in accordance with the applicable requirements of Clauses 4.2, 4.3, and 4.6. Special attention shall be given to the physical characteristics of crossings, such as composition and stability of the bed and banks, waves, currents, scouring, flooding, type and density of water-borne traffic, and other features that may cause adverse effects. Weight coatings, river weights, anchors, or other means shall be used to maintain the position of pipelines under anticipated conditions of buoyancy and water motion.

4.8.4.2

Aerial crossings may be used where determined by the designer to be preferable to submarine crossings. Overhead structures used to suspend pipelines shall be designed in accordance with sound engineering practices.

4.9 Requirements for Pipelines in Proximity to Electrical Transmission Lines and Associated Facilities

4.9.1 General

Pipelines in proximity to electrical transmission lines and associated facilities shall comply with the applicable requirements of CSA Standard C22.3 No. 6.

Notes:

(1) Fault currents resulting from lightning and upset conditions of electrical facilities could result in danger to personnel and damage to coating and pipe. These adverse effects may occur where a pipeline is close to the grounding facilities of electrical transmission line structures, substations, generating stations, and other facilities that have high fault current-carrying grounding networks.

(2) Where buried pipelines are close to high fault current-carrying grounding networks, remedial measures may be

Appendix "C1" - Water/Sewer Pipe Line Crossings

Applicants must submit 7 copies of an acceptable plan. Plans must meet TC E-10 and CN Standards.

Cost for reviewing the first plan received shall be included in the basic application fee. The applicant will be charged an additional fee for each review after the initial application due to inadequate or missing information.

The following information is required on application drawings:

- application drawings must be to scale or have all dimensions shown.
- site plan showing location tied into legal description, width of CN right-of-way, number of tracks and angle of crossing.
- direction of flow, location of shut-off valve.
- profile showing depth of burial from base of rail and ditch bottoms to top of pipe.
- cross-section showing or note stating carrier pipe will be held clear of casing pipe by supports (if cased).
- type, wall thickness and pressures (operating and maximum test) of carrier and casing pipes.
 - concrete pipe must be minimum of class V.
- casing is not required for gravity feed sewer lines or on industrial and secondary tracks with mop of less than 700 kpa
- steel casing is required for a water line.
- intention to install warning markers at each edge of CN right-of-way.
- type of cathodic protection and/or protective coating (if used).
- when casing is used, it must extend the full width of CN's core right-of-way or a minimum of 50' on each side of outermost track.
- caption stating "Installation and maintenance to be in accordance with TC E-10".
- note stating method of installation (i.e. boring/augering).
- must be shown or noted that the **ends of the casing will not be sealed.**
- professional engineer's stamp and signature.
- contact name, address and phone number of pipeline owner on plan or cover letter.
- copy of soils investigation (when required to support method of installation or as requested by CN at time of application).
- The nearest point at which digging can take place for bore holes etc. is as follows: Starting 10 feet from the nearest rail calculate a slope to the bottom of the proposed pipe at 1.5:1. If a 1.5:1 slope cannot be maintained or more restrictive conditions occur, approved shoring will be required.

WATERLINE SPECIFICATIONS

CARRIER PIPE

O.D. - 450 mm
 W.T. - 10.4 mm
 MAX. OPR. PRESS. - 700 K. Pa.
 TEST PRESS. - 1100 K. Pa.
 PROTECTION - CATHODIC

CASING PIPE

O.D. - 660 mm
 W.T. - 8.25 mm
 LENGTH - 31 m

STORM SEWER SPECIFICATIONS

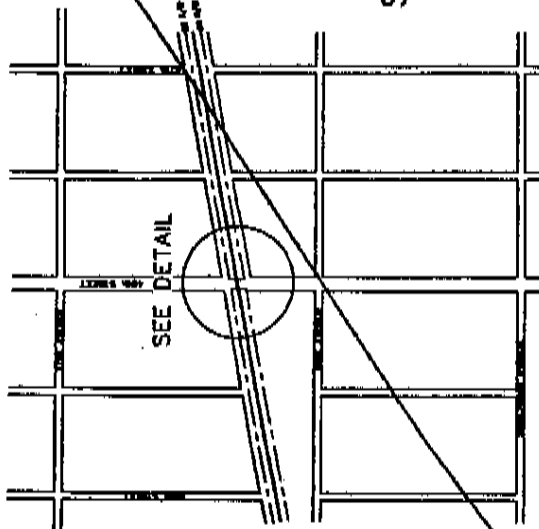
O.D. (NOMINAL) - 1050 mm ϕ
 MATERIAL - REINF. CONC.
 GRADE - C76-V

METHOD OF INSTALLATION: BORED

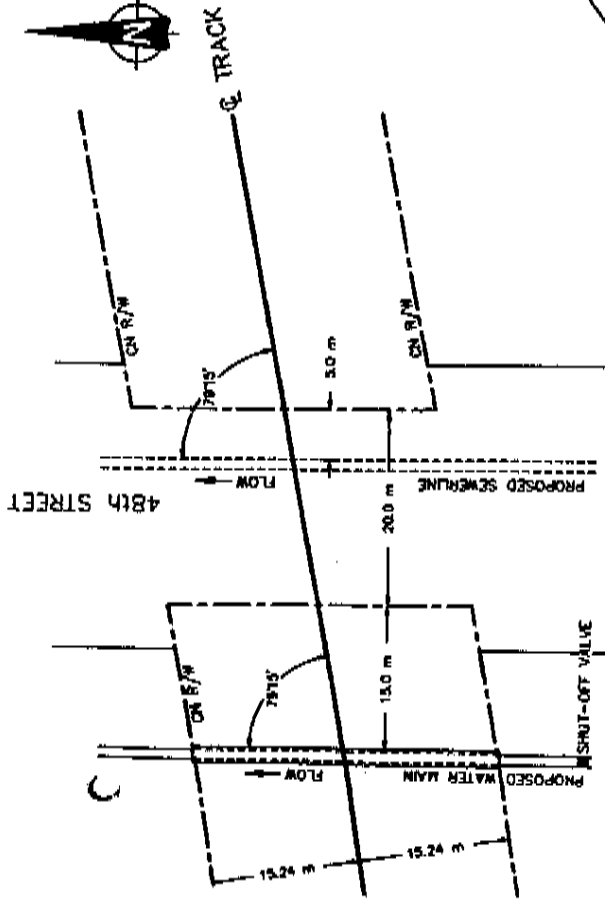
PROFESSIONAL ENGINEER STAMP

NOTE: INSTALLATION AND MAINTENANCE TO BE IN ACCORDANCE WITH GENERAL ORDER E-10.

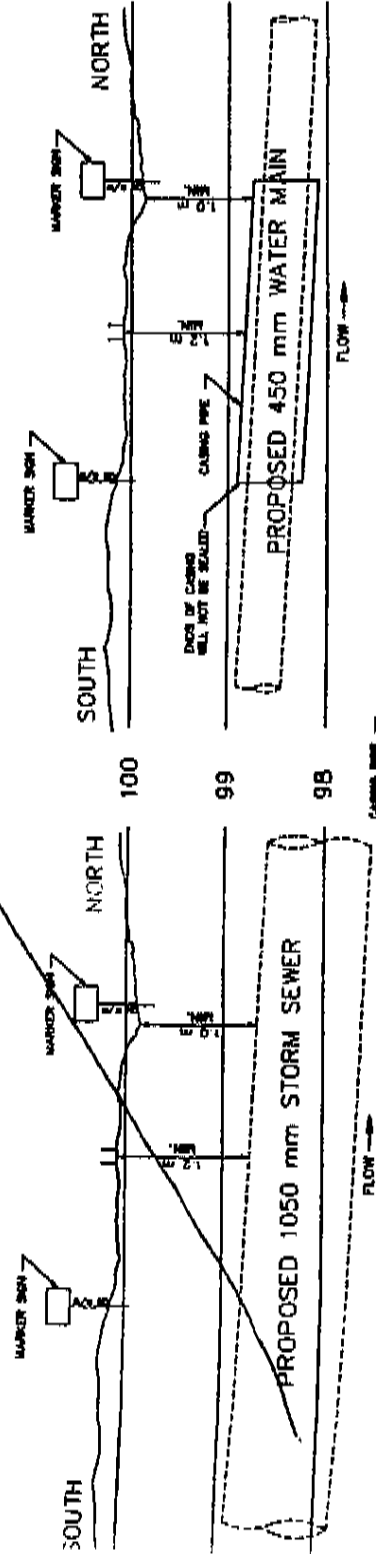
TYPICAL CROSSINGS
 WATER AND SEWERLINE



PIPE CROSSING AT 48th ST.
LOCATION PLAN
 SCALE 1:10,000



DETAIL PLAN
 SCALE 1:500



STORM SEWER PROFILE
 SCALE - HOR. 1:500
 VER. 1:50

WATER MAIN PROFILE
 SCALE - HOR. 1:500
 VER. 1:50

