



Standards Respecting Pipeline Crossings Under Railways

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STANDARDS RESPECTING PIPELINE CROSSINGS UNDER RAILWAYS

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)

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 ** All Tracks:				
Cased	Flammable or hazardous* gas or liquid	All	168 (5.5 ft)	168 (5.5 ft)
Uncased	Flammable or hazardous* gas or liquid	All	305 (10.0 ft)	305 (10.0 ft)
Crossings of railway rights-of-way: below bottom of ditches or ground surface ***				
Cased	Flammable or hazardous* gas or liquid	All	91 (3.0 ft)	91 (3.0 ft)
Uncased	Flammable or hazardous* gas or liquid	All	183 (6.0 ft)	183 (6.0 ft)
Railway rights-of-way for cased or uncased buried longitudinal pipelines ***				
Between 762 cm and 1524 cm from centre-line of nearest track	Flammable or hazardous* gas or liquid	All	183 (6.0 ft)	183 (6.0 ft)
Greater than 1524 cm from centre-line of nearest track	Flammable or hazardous* gas or liquid	All	152 (5.0 ft)	152 (5.0 ft)

* 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 jeopardise 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-B137.4-92 (R1998), 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 Z662-99, 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)

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 ** Secondary 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 cm from centre-line of nearest track	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

* 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 non-flammable 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 'A'
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

	Carrier Pipe	Casing Pipe
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

Vents: Number	Size.....	Height above ground
Seals:	Both ends.....	Type.....

Bury: Base of rail to top of casing	m
Bury: (Not beneath tracks)	m
Bury: (Roadway ditches)	m

Extent of casing measured perpendicular to centre-line of track m
Type, size and spacing of insulators or supports
Distance C.L. track to face of jacking/receiving pits m
Bury: Base of rail to bottom jacking/receiving pits m

Cathodic Protection : yes..... no.....
Geotechnical Boreholes: yes..... no.....

Soil Type
Base of Rail to ground waterm

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.