1100 RAILWAY CROSSINGS & UTILITIES CHAPTER

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1110 RAILWAY CROSSINGS

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1110
RAILWAY CROSSINGS

1110.01 GENERAL

Any roadworks that revise, reconstruct, or relocate an existing crossing, or create a new crossing, must be approved by the appropriate Federal or Provincial Regulatory bodies. This approval process is co-ordinated through the Rail, Navigable Waters Specialist of Engineering Branch, in Headquarters. The principal contact is:

Rail, Navigable Waters Specialist
HQ Engineering Branch

Mailing address;
PO Box 9850 Stn Prov Govt
Victoria BC V8W 9T5

Physical address;
4B - 940 Blanshard Street
Victoria BC V8W 3E6

Email:
HWYS.Navigable.Water.Railway.Coordination@gov.bc.ca
Ph: 778-974-5344 Fax: 250-387-7735

Drawings:

A special purpose drawing, called an "Application Layout" drawing, must be prepared to accompany an application for new at-grade railway crossings, as well as reconstruction, relocation, or revision of an existing crossing.

Drawing information and crossing requirements shall be in accordance with sample **Figure 1110.A**, at the end of this section. Clear view lines are a function of railway speed and roadway speed. Refer to **Section 1110.11** and **Figure 1110.E** for the roadway and railway approach distances respectively. It is expected that all road design issues will meet the requirements of the *BC Supplement to TAC Geometric Design Guide*.

Time Frames:

For simple crossing revisions, that require no action or work by the Railway, other than approval, and where all costs are being borne by the Ministry, approvals to proceed can take at least 3 months.

For crossings requiring track work the process can take at least 5 months.

For crossings requiring significant railway signal work, the process can take at least 10 months.

For any crossings where grants and/or cost sharing are required (to be determined by the Rail, Navigable Waters Specialist), the process can take 6 months at the very least.

Read the rest of this section to familiarize yourself with the background, process and guidelines.

Prologue:

This standard provides guidance in level railway crossing design and also provides information that will help you decide whether it is possible to construct a public crossing at a specific site. It is not the intention of this section to promote the construction of new crossings but to ensure that necessary crossings are designed to the latest standards. Poorly conceived crossings may create safety concerns not only at the crossing, but also to the road network directly adjacent to the crossing.

Reference Materials:

- *Grade Crossing Standards*, Transport Canada, February 2014
- *Pedestrian Safety at Grade Crossing Guide (Final Draft)*, Transport Canada, September 2007
- *Canadian Road/Railway Grade Crossing Detailed Safety Assessment Field Guide*, Transport Canada, April 2005
- *Engineering Standards for "Walk Light" Grade Crossing Warning Systems,* Transport Canada, TC E-39, February 2010

1110.02 SUMMARY OF RESPONSIBILITY CENTRES FOR RAILWAY CROSSING ISSUES

	RESPONSIBILITY		
	TYPE OF CROSSING		
FUNCTION	**LEVEL**	**OVERHEAD**	**UNDERPASS**
design standards	Eng. Services Branch: Traffic & Hwy Safety, Hwy Design & Survey, and Electrical Sections	Rail, Navigable Waters Specialist	Rail, Navigable Waters Specialist
construction specifications	Construction and Maintenance Branch	Rail, Navigable Waters Specialist	Rail, Navigable Waters Specialist
maintenance contract	Construction and Maintenance Branch	Construction and Maintenance Branch	Construction and Maintenance Branch
maintenance/rehab. issues	District	District	District

Please note that the Rail, Navigable Waters Specialist in Traffic & Highway Safety Section of Engineering Branch provides technical and planning information for the above. See **Section 1110.05 "Summary of Responsibilities of Administration of Level Railway Crossings".**

- For utility and culvert crossings, the Project Manager is responsible to coordinate with the railway.
- For properties, leases, and private railway crossings, it is the responsibility of Regional Properties section to coordinate with the railway.

1110.03 OVERVIEW OF LEVEL RAILWAY CROSSINGS

The history of railways in British Columbia predates most of the Province's roads. Many railways were in operation before vehicles were manufactured. As a result, during the initial railway and roadway construction, engineering was not concerned with the intricacies of crossing design. The advent of vehicles, and larger and faster trains, leaves many of the existing crossings poorly located and designed.

INCOMPATIBLE MODES OF TRANSPORTATION

Physical differences between railway operating equipment and roadway operating equipment lead to conflicts because of the manner in which they operate.

Railway equipment, which tends to be very heavy, large, and therefore not very adaptable to directional and speed changes, require rigidly set operating rules and timetables. A train cannot vary direction and is on a two way path which requires coordinated movements. The rules and timetables tend to dictate when and how the equipment is operated. Therefore, the employees are trained in a strict manner to ensure safe operations. Railway equipment is, for the most part, well maintained to a specific operational standard. Since a breakdown can lead to the closure of the trackage, equipment tests are performed regularly.

Roadway equipment, which is comparatively light, manoeuvrable and can vary speed rapidly, have only operational guidelines which limit speed and provide directional rules. The rules and speed limits tend to only emphasize maximum operational limits. Steerage is controlled by the operator. Vehicular operators are given a test which judges adaptability and can therefore, be subjective or change after a license is granted. Since vehicles are privately owned and must be adaptable for the operator's varied usage, the condition and characteristics can vary tremendously from vehicle to vehicle. Road conditions can also vary the operational characteristics of vehicles.

Right of passage for trains at level crossings has been an operational fact since cars were invented. Therefore, operators on roadways must vary operation when a crossing is occupied, or about to be occupied, by rail equipment. From a practical standpoint, it is preferable for a train to continue unabated. Crossing occupancy time is reduced in this manner.

Determination of crossing safety must be made by the driver each and every time a crossing is approached. In order to allow this decision to be rendered without distraction, the crossing should have clear sightlines to the rail approaches and/or signals. The crossing should have forgiving and smooth horizontal and vertical alignments, laning and number of tracks clearly marked to avoid confusion. Roadside clutter, lane changing, nearby intersections and congestion can also lead to driver distraction. Wherever possible, a crossing and approaches should be designed to provide the driver with only that information required for safe passage.

STRUCTURAL DIFFERENCES

Railway equipment travels on ribbons of steel attached to ties which are on a "roadbed". The wheel flange rides on the inside or gauge side of the rail which maintains alignment and also maintains the railway equipment's ability to travel on the railway. These rails are approximately six to seven inches high. Due to the sizes and weights of railway equipment, the alignments and grades of the railway are not very flexible.

Roadway equipment travels on a paved or prepared gravel surface. This allows vehicles of various sizes and characteristics to travel a common route.

The **crossing** is a discontinuation of the normal road and rail roadbed structures. The requirement for a flangeway on the inside of the rails disrupts the continuous roadway surface. This "gap" increases the roughness of the roadway. Since the ties, supporting the rail, move up and down with the impacts and weights of the rail traffic, it is difficult to maintain a structurally sound surface in smooth condition.

Maintenance difficulties arise out of the operational and physical differences at level crossings. All work must be scheduled and coordinated so it does not conflict with the operation requirements of either facility. The physical differences generally make repairs inaccessible for either party. For example, the railway cannot run a continuous re-ballasting program through a level crossing without close coordination with the road authority. Conversely, the road authority cannot continue a paving program through a crossing without close coordination with the rail authority. As an example, both these programs may require raising the elevation of the crossing. This would be reflected in the approach gradients and may be restricted by other facilities (i.e. bridges, underpasses, intersections and drainage patterns) whose elevations may be fixed. Underground utility maintenance necessary for the safety and operation of either road or rail may also be inconvenient.

Drainage problems are caused on the roadway surface by the flangeway or the grade and crossfall of the railway. The flangeway acts like a flue collecting surface runoff and depositing it on the railway track adjacent to the crossing disturbing the integrity of the rail bed. A break in road profile can cause water and debris to collect on the roadway.

Integrity of the road surface and railway are difficult to maintain. A variety of forces all act to varying degrees at every crossing. Impacts of road traffic on the rail and pavement "creep" can break, overturn and move rails so they no longer function at a safe standard. Train impact loading and rail "creep" can pull and crack the road surface, which can cause an unsafe crossing condition for motorists.

LEGAL CONSIDERATIONS

Level crossings, by their very nature, are considered to be amongst the most expensive section of roadway per square meter to construct and maintain. The **liabilities** can also be amongst the most severe, especially when safety considerations of a proposal or maintenance is not given the highest priority. The strength of a liability claim increases through incompetence and negligence. When inspecting a facility or considering routes, a brief rationalization of the alternatives, considerations and effects must be made. If a fault is found, it must be acted on in a response time that is expedient and reasonable. Inspections must be carried out at intervals, which reflect the usage, history and importance of the crossing.

The right of passage, which permitted the installation of the crossing by either party, usually in the form of an Agreement, Order or Certificate, indicates that a crossing is maintained in accordance with various Railway Acts and the Regulations pursuant thereto. Both railway and roadway authorities have a **legal duty** to ensure crossing safety.

TODAY'S PRACTICES

In order to reflect the developing technology of modern level railway crossings, many of the old crossings should be re-evaluated to determine their future prospects and alternatives (remedial measures) to provide an effective investment.

1110.04 JURISDICTION AND ADMINISTRATIVE LEVELS AND TYPES OF RAILWAY CROSSINGS

Two Charters control various railway crossings by means of Acts, Regulations and/or policies. The following table indicates the appropriate charter.

	FEDERAL CHARTER	PROVINCIAL CHARTER
Railway Companies	Burlington Northern Santa Fe Railway Canadian National Railway Canadian Pacific Railway Kettle Falls International Railway White Pass & Yukon Route	British Columbia Railway (Port Subdivision) Canadian Forest Products Railway Canfor Englewood Logging Division Southern Railway of BC various logging railways industrial/resource spurs
Acts and Regulations	Canada Transportation Act Railway Safety Act Railway Relocation and Crossing Act Grade Crossing Regulations and Standards Supporting standards and regulations	BC Railway Safety Act - Administration Delegation Regulation - Railway Safety Adopted Provisions Regulation Canada Transportation Act (specific sections) Federal Railway Safety Act (specific sections) Federal Standards and Regulations (specific sections)

Administrative Levels of Railway Crossings

Three basic administrative levels of railway crossings exist.

1) **Unrestricted** or **Public** railway crossings are generally recognized as public roads or walkways intersecting a railway.
2) **Restricted** or **Private** railway crossings (temporary or permanent) are generally vehicular or pedestrian crossings with controlled access, serving only one facility or property.*
3) **Farm** railway crossings allow farmers continued access to their lands which were severed by the railway.*

Types of Railway Crossings

Three physical types of railway crossings exist.

1) The most common crossing, because of initial cost and level of engineering involved, is at grade and is most commonly referred to as a **level crossing**.
2) The second most common crossing is the roadway **overhead** structure (road over rail). Since the highway has more flexible horizontal and vertical alignments, this is the most popular grade separated crossing.
3) The roadway **underpass** structure (road under rail) is preferable when the railway is on a fill or near an escarpment, allowing easy passage of the roadway under the trackage with minimal structure size.

*Restricted (or Private) and Farm crossings are not covered in this section and are not administered by the Rail, Navigable Waters Specialist. Engineering considerations for Restricted (or Private) and Farm crossings can be similar to minor public roads.

1110.05 SUMMARY OF RESPONSIBILITIES OF ADMINISTRATION OF LEVEL RAILWAY CROSSINGS

Function	Specific Function	Responsibility Area
1. Identify need	a) increase road capacity or convenience	• Area Manager/District/Region
	b) increase safety	• Area Manager/District • (Fed/Prov) Agencies responsible for administering the Railway Acts • Railway company • Rail, Navigable Waters Specialist
2. Develop plan and proposal		• Area Manager/District/ Region/Design company
3. Communication for facility/clearance provisions with railway/regulatory agencies		• Rail, Navigable Waters Specialist
4. Allocate funds		• Area Manager/District/Region/ Rail, Navigable Waters Specialist
5. Engineering	a) - Level crossings	• Area Manger/District/ Region/Design company
	b) - Railway signals	• Railway company
	c) – Traffic lights, signals	• Regional Traffic Engineer
6. Application and Negotiation		• Rail, Navigable Waters Specialist
7. Agreement by Rail and Road Authorities		• Rail, Navigable Waters Specialist
8. Approval (Order, Decision etc.)		• (Fed/Prov) Agencies responsible for administering the Railway Acts
9. Maintenance work in accordance with approval; work is carried out by:		• Highway Approaches = road authority • Signals = railway company • Crossing Surface = as arranged

1110.06 TYPES OF WORKS, OPERATIONAL CHANGES, AND STATUS CHANGES AT RAILWAY CROSSINGS

TYPES OF WORKS

Eight basic types of railway works are defined although some activities on existing crossings combine more than one type.

1) **Construction** of a new public crossing.
2) **Alteration** of a crossing including works which vary geometry or dimension of the crossing (within 10 metres of trackage or modifying road/rail approaches that may impact stopping, signal or crossing sight distances) such as revising the alignment, adding track switches, multiple tracks or adding a sidewalk.
3) **Reconstruction** of a level crossing usually indicates that an existing crossing is to be totally renewed without substantial alteration.
4) **Relocation** of a level crossing is usually done to upgrade a section of road or replace an unsafe crossing with one at a more suitable site.
5) **Removal** or **closure** of an existing crossing. Road closure or railway abandonment.
6) **Signalization** of a crossing indicates that some form of an active warning or protective device has been installed at a level crossing.
7) **Interconnection/pre-emption** modification to a railway or traffic signal will require a review by a regional Traffic Engineer of the timing sheets and may require modifications to signal operations to maintain a safe crossing environment. Prior to signal/sign reconfiguration, the effect to crossing safety must be evaluated by a regional Traffic Engineer.
8) **Maintenance** work is a repair or partial renewal to an existing crossing or signal to provide safe and unencumbered passage.

OPERATIONAL CHANGES

Operational changes including speed changes (rail or road), lane reconfiguration or changing direction, increasing volumes due to other factors such as development, detours etc. and whistling cessation.

STATUS CHANGES

Status Changes include changes in:

a) road authority
b) jurisdiction
c) maintenance responsibilities.

1110.07 APPROVALS FOR WORKS OR STATUS CHANGES AT RAILWAY CROSSINGS

These are the actions/approvals required before undertaking railway works and status changes.

RAILWAY WORKS/STATUS CHANGES	REGULATORY ACTIONS REQUIRED
Construction	Notice of Railway Works/Agreement/Order
Alteration	Notice of Railway Works /Agreement/Order
Reconstruction	Notify Railway
Relocation	Notice of Railway Works /Agreement/Order
Removal or closure	Notify Railway*****
Signalization	Notice of Railway Works /Agreement/Order
Revised Road Signage	Notify Railway
Interconnection/pre-emption	Notify Railway
Maintenance	Notify Railway
Operational	Notice of Railway Works /Agreement/Safety study
Status	Agreement/Order

NOTE:

A Notice of Railway Works is to be issued at least 60 days before the work commences. See **Section 1110.14** for an example of Notice of Railway Works.

* May require Agreement, Order or Certificate if not in connection with a relocation or not included in an Agreement, Order or Certificate for related work. Federal Grant monies may be available through the Rail, Navigable Waters Specialist.

If an agreement between the Road Authority and a Federally-Regulated Railway is not possible due to a dispute over cost, location or design, a Decision by the Canadian Transportation Agency (CTA) may be required. An Environmental Assessment, in accordance with the Canadian Environment and Assessment Act, may be required to allow the CTA to issue a Decision or Order. The CTA may be able to help the parties resolve the issues through its mediation process before a Decision is rendered. An Environmental Assessment would not be required if the dispute is resolved through mediation. Projects may have other Canadian Environment and Assessment Act triggers.

1110.08 CONSTRUCTION COSTS AND GRANTS RESPONSIBILITIES AT LEVEL RAILWAY CROSSINGS

The following table describes the basic responsibilities in accordance with activity:

ACTIVITY	FEATURE	COST TO	WORK DONE OR DIRECTED BY	WORK PROTECTION REQUIRED
Construction & Maintenance	Level Crossing Surface	Per Agreement or Order	Rail & Road	Rail & Road
	Road Approach	Road*	Road	Road & Rail within 10 m of Rail
	Rail Approach	Rail*	Rail	Road & Rail Shoulder to Shoulder
	Road Culvert/Ditches on road right-of-way	Road*	Road	Road & Rail within 10 m of Rail
	Rail Culvert/Ditches on railway right-of-way	Rail*	Rail	Road & Rail Shoulder to Shoulder
Installation & Maintenance	RR Whistle Post/Flange Sign	Rail	Rail	None
	RR Crossing Sign "Crossbuck" /Number of Tracks Signs/Stop Sign on same post	Rail	Rail	None
	Stop Sign - separate post Stop Ahead Sign	Road*	Road	None
	Railway Crossing Advance Warning Sign	Road	Road	None
	Rail Signals	Per Agreement or Order	Rail	Rail & Road

*** Unless otherwise ordered or agreed.**

Crossing must be public for at least three years and be eligible for Federal Funding, after determination by Transport Canada, for a safety enhancement. Cross-product (trains per day X vehicles per day) should be over 1,000 to have a chance of receiving federal grants for up to 50% of eligible works.

If the road is senior to a railway

a) in a Municipality, City, Town or Village, the rail authority is obligated to pay maintenance costs of the crossing surface up to the width of the original highway right-of-way.

b) In areas outside of a Municipality, City, Town or Village the rail authority is obligated to pay maintenance costs up to a road width of 20.117 m (66`)

Please note: Supply and installation of rail, ties, plates, spikes, etc. are a railway maintenance (work) and cost responsibility [Canadian Transportation Agency Decision No. 642-R-2003, Railway-Highway Crossing at Grade Regulations (SOR/80-748)]. Pavement removal, flagging, public notice, crossing surface materials, grading and repaving are Road Authority responsibility with costs being the responsibility of the junior party or as directed in the Order/Agreement. There can be incremental track costs to accommodate crossings (i.e. longer ties, rail size increases, etc.) for the rehabilitation/reconstruction of a railway crossing that can be invoiced to the Road Authority.

1110.09 LEVEL RAILWAY CROSSING CONSTRUCTION APPLICATION REQUIREMENTS

Level Railway Crossing Construction Approval Procedures

For the **re/construction of railway crossings,** a drawing should be completed, as shown on sample layout **Figure 1110.A**, and forwarded to the Rail, Navigable Waters Specialist. Drawings in PDF format are preferred. Some information, which cannot normally be included on the drawing, is required for the application. Please advise of:

- the proposed date of commencement and the projected time for completion of the works;
- the roadway speed limit; and
- the number of vehicles per day and type of traffic (school buses, logging trucks, bicycles, etc.).

NOTE: Every reasonable attempt must be made to meet the standards. It is required that the design engineer apply for Federal Minister exemption (or delegates) for those crossing elements that do not meet the Federal Standards. Chief Engineer's signoff is required for design elements that do not meet these standard requirements. For reconstruction, safety improvements will be favourably considered even if not all design elements meet standard design requirements.

Road-Railway Crossing Requirements

Note: If tracks are more than 30 metres apart they should be considered as separate crossings. If vehicle queuing between tracks comes within 5 metres of any track, it should be considered a single crossing for traffic and signal design.

Overhead luminaires should be installed when an unsignalised crossing has any of the following conditions:

- train switching movements at the crossing;
- spur crossing in urban areas;
- vehicle headlights do not illuminate the crossing due to approach alignments and grades.

Railway crossing signals shall be required if:

- within three years of opening, the cross-product (trains per day times vehicles per day) is 2000or over;
- sight-lines are inadequate (see **Section 1110.11**);
- the tangential direction of the road alignment at any point within the desirable distance from the crossing (specified in Table A of **Section 1110.11**) is more acute than a 70 degree intersection angle with the railway;
- there is a pedestrian/cyclist crossing of two or more tracks where trains can pass each other;
- the centre line of a pedestrian/cyclist crossing is more than 3.6 metres from a road crossing signal.

A level railway crossing, road intersection, roundabout or property access shall not be constructed where:

- there is less than 30 metres between the level railway crossing and road intersection stop or yield point or a property access;
- there is more than 30 metres and less than 200 metres between the level railway crossing and a road intersection with a stop sign, traffic signal, crosswalk or a roundabout yield point for traffic departing the crossing unless traffic signals are installed and interconnected to railway signals providing a pre-emption clear out phase;
- a study indicates that vehicle queuing will approach within 5 metres of the nearest rail unless the pre-empted traffic signals can provide an effective clear out phase in accordance with latest standards.

A bus stop shall not be located where there is less than 40 m between a level crossing and the back end of a bus at the bus stop.

A community mailbox pullout shall not be located less than 30 m from a level crossing (measured from the start of the taper for the mailbox pullout). This distance should be increased if queuing is expected to approach within 5 m of the nearest rail.

Railway crossing signals with gates shall be required if:

- within three years of opening, the cross-product exceeds 50,000;
- there are two or more passing tracks or railway equipment is stopped within the required sight distance for the departure time (time it takes to clear all tracks) plus at least 5 seconds before the train arrives;
- there is a roadway intersection within 60 metres of the crossing;
- train speeds are 50 mph or more;
- the crossing angle is more acute than 70 degrees;
- pedestrian sight distance 8 metres from the nearest rail is less than the departure time (time it takes to clear all tracks) plus at least 5 seconds before the train arrives.

Pedestrian/Cyclist crossing approaches shall have:

- grades less than 2% within 5 metres of the nearest rail or from a point 2 metres in advance of railway crossing signs, stop signs, signals or gate arms to the nearest rail (less than 1% for crossings with persons using mobility assistive devices). This provides a safe (almost level) stopping area at skewed crossings where the stop location/signals are further from the tracks.
- a minimum width of 1.8 m within 8 metres of the crossing.

Location of Grade Crossings

- Level crossings are prohibited from being constructed within 30 m of the travelled way of an intersection or driveway entrance.

Road grades on each approach lane shall not be more than 2% (positive or negative) within 8 m of the nearest rail and 5% (positive or negative) for 10 m beyond at public grade crossings. Through the crossing surface, each lane of the road shall have a maximum grade differential between road grade and railway superelevation (cross-slope between top of rails) based on road design classification* as follows:

- Rural Local Undivided 2%
- Rural Collector Undivided 1%
- Rural Collector Divided 1%
- Rural Arterial Undivided 0%
- Rural Arterial Divided 0%
- Rural Freeway Divided -
- Urban Local Undivided 3%
- Urban Collector Undivided 2%
- Urban Collector Divided 2%
- Urban Arterial Undivided 0%

* Road Design Classification Source: 2017 TAC *Geometric Design Guide for Canadian Roads*

In addition to meeting the above maximum grades based on road classification, maximum grade differentials based on road speed must also be met as follows:

- 0% for ≥ 60 km/h (road speed)
- 1% for 40 to 59 km/h (road speed)
- 2% for < 40 km/h (road speed)

Zero grade differential is preferred.

Road crossfall on tangent approaches shall be transitioned at a maximum rate of 2% per 30 metres to match the track grade at the crossing. Road superelevation on curved approaches shall be transitioned over the appropriate length of spiral and tangent run out (refer to **Section 330** of the *BC MoT Supplement to TAC Geometric Design Guide*).

A grade separation may be required if the cross-product is 200,000 or over within three years or if on a divided highway or major arterial. ("Cross-product" is trains per day multiplied by vehicles per day. This is a general requirement and there are other significant issues to be taken into account when assessing the need for a grade separated crossing.)

1110.10 TYPES OF CROSSING SIGNALS AND SIGNAGE

Types of Automatic Signalized Protective Devices for Level Railway Crossings

To provide protection from vehicular traffic, the centre of the signal post foundation should be at least 1.5 metres from the face of a curb and when there is no curb/roadside barrier 1.5 metres from the outer edge of road shoulder and a minimum of 2.6 metres from the edge of the travelled way. If signals are subject to damage from vehicle strikes, and relocation is not practical, protection such as concrete barriers is advisable. The post foundation should also be at least 3 to 5 metres from the nearest rail and positioned to stop road traffic at least 5 metres from the nearest rail. No part of a signal or gate may be less than 3 metres from the nearest rail. These are usually installed and maintained by the rail authority. If stop bars are required for traffic control, they should be placed 2.0 metres in front of the signal or gate, whichever precedes the other and be at right angles to the lane.

1) **Floodlights** are installed at railway crossings in areas of railway switching activities and when the highway approach gradients or alignment do not allow the vehicle headlights to illuminate the crossing. Floodlights are also used in areas with weather caused visibility problems.

2) **Automatic Signals** usually consist of flashing lights and bells on a simple post or mast located to the right of the lane they are intended to control. Generally these devices control only one lane of traffic.

3) **Cantilevered Signals** are used;
   - over multiple lanes;
   - when the roadway geometry obscures the signal for approaching traffic;
   - when road speed exceeds 80 km/h;
   - when the signal foundation is more than 7.6 metres from the roadway centreline.

   (Cantilevers should extend from the foundation/mast at right angles to the road lanes and position the lights over the near edge of any lane it is intended to control.)

4) **Gates**, when required, usually are part of the previously mentioned signals. In the lowered horizontal position, the gate should be positioned at right angles to the roadway and extend to within 0.3 metres of the far side of any lane it is intended to control. Gates are used for crossings of multiple tracks, in heavily congested areas, and when the speed and volume of rail and/or road traffic is high. Islands or Median Barriers at the centreline are advisable to ensure driver compliance. Gates will typically begin to descend about 8 to 20 seconds or more after railway signals begin to flash. Some older installations have less than 8 seconds; these should be reviewed with consideration to meet the latest Transport Canada standards. If on a major route, a route with truck traffic, or a route with a grade over +4% this should be at least 12 seconds or more.

5) **Interconnection** of automatic signals and highway intersection traffic lights is required if the facilities are less than 30 metres apart and beyond 30 metres if studies indicate traffic queuing will reach within 5 metres of the trackage. This circuit is used to provide a pre-emptive clearing of all highway traffic from the railway crossing prior to the train's arrival.

6) **Active Advance Warning Signs** (railway) should be employed on approach lanes when a signalized railway crossing is located within a highway speed zone above 60 km/h, or where sight distance to the signal does not allow sufficient stopping distance to a signalised crossing.

7) **Optically Programmable Signs** (Light Emitting Diode most common) **"NO LEFT/RIGHT TURN TRAIN XING"** signs may be used when signalized roadway intersections are within 30 m of a signalized level railway crossing, to ensure that drivers are aware of crossing use by rail equipment before turning toward the crossing. This averts stopped vehicles from blocking lanes or impacting rail equipment. These should not be used in conjunction with or to replace "Protected" turn signals where warranted.

8) **Optically Programmable Signs** (Light Emitting Diode most common) **"STOP - TRAIN APPROACHING"** signs may be used when railway pre-empted signalized roadway intersections are within 250 m of a signalized level railway crossing, to ensure that drivers are aware that a train is approaching during the traffic light green clear out phase before the railway signals start. This allows queue advance to clear vehicles from the track area and keeps drivers from being trapped on the tracks when a train is approaching. This can be used in conjunction with queue cutter phasing. Pre-signals (traffic light heads preceding the crossing) may also be considered in this scenario.

9) **"LEFT TURN ARROW – RAILWAY CLEARANCE ONLY"** sign tabs may be used when the green clear out phase has a dedicated left turn signal head. This is placed on the mast adjacent to the signal head. This informs drivers turning left that they have the right of way to proceed and there are no opposing traffic movements. This reduces the delay for drivers trying to clear the track area when a train is approaching.

10) **Pre-signals** are traffic control signal faces that control roadway traffic approaching a grade crossing in conjunction with the traffic control signal faces that control traffic approaching a roadway-roadway intersection beyond the tracks. Pre-signals are typically used where the clear storage distance is insufficient to store one or more design vehicles.

Note: Should any crossing or interconnected traffic signal system fail, the railway should immediately provide qualified flag persons until the signal is again operational. At no time should the interconnection/pre-emption be disconnected or made inoperative without an approved traffic plan.

Types of Level Railway Crossing Advisory Signage

Three types of advisory signs are used.

1) **Railway Advance Warning Signs** are required at all public level railway crossings (all approaches) and should be placed where most practical, on the right hand side of the road and facing the approaching traffic in accordance with the Ministry's signing manual. On multilane approaches, left side or overhead installations may also be required as necessary. These should also be installed on approaches to intersections where the crossing is within 35 metres of the intersection. These are installed and maintained by the road authority.

2) **Reflectorized Crossing Signboard** is required at all public level railway crossings and should be installed, where practical, at least 3 metres from the nearest trackage, on the right hand side of the road and facing the approaching traffic. When the crossing has automatic signals, this sign is usually attached to the signal post. Small advisory signs are attached to the post below the sign at crossings with multiple tracks to indicate the number of tracks to be traversed.

   These are usually installed and maintained by the rail authority; they are also known as "crossbucks". On federally regulated railways it is common to find the railway mileage noted on the back of the signboard or on the post.

3) **Stop Signs** (R1) - should be at least 3 metres from the nearest track and, where possible, they should not pre-empt good sight-lines or the introduction of automatic signalization, if either is warranted. These are usually installed on the railway crossing sign post (crossbuck) and maintained by the rail authority. If the Stop Sign is not mounted on the crossing sign post it is then maintained by the road authority. Stop signs should not be removed unless an engineering study indicates otherwise. Stop signs may also be required for unsignalised level railway crossings within 60 metres of a major road intersection.

   Stop Bars should be positioned at right angles to the road traffic direction or lane markings and be located no closer than 5 metres from the nearest rail.

Other signs used at railway crossings are "No Stopping On Tracks" or "No Stopping Foul Of Tracks". These are usually used when railway crossings and roadway intersections are less than 60 metres apart or where vehicles frequently stop in the trackage area. At intersections near railways, it may be necessary to install "No Right Turn On Red" signs to ensure motorists do not cross the railway when rail equipment is present.

The railway provides Whistle Posts on the railway approaches to a road crossing. If the Ministry agrees, these posts are removed in areas where an Anti-Whistling By-Law has been approved by the railway and Municipality. Studies must be conducted in accordance with Federal Whistling Cessation Regulations before it can be considered. Anti-Whistling is coordinated by the Rail, Navigable Waters Specialist. “NO TRAIN HORN” signs may be used at crossings where trains are not required to whistle.

Level Cyclist Railway Crossings

Advance warning signs are installed at all railway crossings to warn the cyclist of the crossing. Warning signs may be used to indicate special considerations such as crossing angles of less than 70 degrees or of other challenging conditions requiring extra attention for cyclists. Bike paths and bike lanes may have pavement stencils to warn cyclists of railway crossings.

Pedestrian Crossings

Pedestrian crossing should have clear view of any adjacent road crossing signals or signs. When the centre line of a pedestrian crossing is not within 3.6 metres of a road crossing, separate warning signs are required. Signals dedicated to pedestrian crossing use may be required when the pedestrian crossing centre line is more than 3.6 metres from a public road crossing with signals. Maze barriers may also be warranted to: remind people of train traffic, slow down cyclists, and block other vehicles from entering the crossing.

1110.11 CLEAR VIEW TRIANGLE

Clear view is defined as a sight line without obstruction from 1.1 metres above the road surface to 1.2 metres above track level in a quadrant. Allowance should be made to account for vegetation growth between seasonal trimmings. **Table A** is used for all crossings to calculate the distance along the road approach from the railway crossing the driver must be able to see the train. **Table B** is the distance from the crossing, along the track, that the driver must be able to see the train for crossings that do not have stop signs or signals. Use **Table C** at all crossings with stop signs or signals without gates and at crossings with road design speeds less than 10 km/h. Reference **Figure 1110.E.**

Table A	**Distance Along Road Approach to the Stop Bar or Min. 5 m from Nearest Rail (m)**			
Maximum Road Operating Speed [6] **(km/h)**	Road Grade [1] 0% (or positive grade)	Road Grade -3%	Road Grade -5%	Road Grade -8%
Stop Sign / Signal	10	10	10	10
0-10	35	35	35	35
11-20	50	50	51	51
21-30	60	60	61	62
31-40	70	71	73	74
41-50	110	113	115	118
51-60	130	134	138	144
61-70	180	187	193	203
71-80	210	219	227	241
81-90	265	278	288	307
91-100	330	345	356	378
101-110	360	377	391	416

The above distances exceed Transport Canada's *Determining Minimum Sightlines at Grade Crossings* guidelines (dated August 2017). Table A distances are based on deceleration rates for trucks rather than cars.

See notes on the following page.

Table B **Distance Along The Track From Crossing (No Signals or Stop Signs)** [3]

Track speed (mph)	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
Sight Distance (m)	90	113	135	158	180	203	225	248	270	293	315	338	360	383	405

Table C **Distance Along The Track From Crossing With Stop Sign or Signal (No Gates)** [4]

Track speed (mph)	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
Sight Distance (m)	156	194	233	272	311	350	389	428	467	506	544	583	622	661	700

Correction values for Table B and C to increase sight distance must be applied in accordance with the notes on the following page. Consult Transport Canada's *Determining Minimum Sightlines at Grade Crossings* for information on calculating the appropriate sight distances.

Notes

1. The distances in Table A for 0% road grade are based on deceleration characteristics of trucks without anti-lock brakes taken from 1999 TAC *Geometric Design Guide for Canadian Roads* Table 1.2.5.4.

2. Gates are considered to be a compulsory stop condition used to mitigate the effects of very poor sightlines, nearby intersections and high road and/or rail speeds. Signals without gates are a mandatory stop condition but allow drivers to proceed when they determine it is safe to do so. Therefore, crossings with gates do not normally have a sightline requirement.

3. Correction to the values in Table B should be made for slow moving equipment, very large/long loads and where skewed crossings and multiple tracks may cause road vehicles to occupy the trackage area for longer than 10 seconds.

4. Correction to the values in Table C should be made for slow moving equipment, very large/long loads and where road grades, skewed crossings and multiple tracks may cause road vehicles to occupy the trackage area for longer than 17 seconds. Adjustments due to grade shall only be applied for positive grades. No reduction in Table C sight distances due to negative grades shall be made. Corrections for cyclists over multiple tracks may also be required.

5. Pedestrian sightlines are based on the ability of a pedestrian to see the train a sufficient distance from a point 8 metres from the closest rail or 2 metres in advance of railway crossing signs, stop signs, signals or gate arms to allow the pedestrian to clear all tracks (departure time) plus at least 5 seconds before the train arrives. Pedestrian departure times are based on a travel speed of 1.1 m/s. Where sidewalks/pathways have maze barriers requiring cyclists to dismount, sightlines shall be from the maze barrier. Maze barriers should be no closer than 5 metres and normally no more than 8 metres from the nearest rail.

6. "**maximum road operating speed**" in respect of a grade crossing, means the actual vehicle speed at the safe stopping sight distance, and is:
   (a) the legal maximum speed limit (posted or unposted);
   (b) the posted advisory speed; or
   (c) the reported operating speed where constraints such as traffic control devices at intersections on the road approaches or physical restrictions such as curves restrict speed, or as determined by a traffic engineering study.

1110.12 LEVEL RAILWAY CROSSING SURFACE SELECTION

When constructing a new crossing, or when upgrading, widening and/or relocating a level crossing, determination of the crossing surface type should be made. On upgrading (some widening projects) or relocation projects, where the railway is the junior party, they should be given the opportunity to upgrade the surface to a more suitable type given the traffic and environment. Some cost sharing may be applicable for crossings where rideability and liabilities are paramount.

Roadway speed is a very important consideration in the selection process. Drivers in urban environments, with slow moving traffic, do not consider a rough crossing surface as anything more than a nuisance. On rural routes and highways where speeds exceed 50 km/h, a well designed and maintained crossing will be more likely viewed as a safety issue.

Rail speed increases the requirement for the trackage to be stable and exactly positioned. Most railway mainlines have portions of trackage with speed exceeding 50 mph. Since the track flexes under each wheel, speed can cause the wheel flange to climb the track and cause a derailment if the railway gauge is not exact or due to lateral forces in a curve.

The characteristics of a crossing have a direct bearing on the rideability, safety, and level of maintenance required. Rideability and safety are enhanced if road and railway approaches are level, at a right angle crossing, and in good condition. The crossing life, maintenance costs and rideability suffer a great deal if the crossing is skewed, has super-elevated curves, or poor approach grades, in any combination (common in B.C. due to geography).

Crossing surfaces should incorporate flangeways with dimensions not greater than 120 mm or less than 65 mm.

On crossings in areas with persons depending on mobility (assistive) devices, the flange way should be 65 to 75 mm wide and 50 to 75 mm deep. This minimum flangeway width is preferred for accommodating the above noted users; therefore, skewed crossings should be avoided. In urban areas or on crossings with regular pedestrian/cyclist traffic it is recommended to use this standard. Some railways require a flange way width of 75 mm minimum.

For sidewalks, trails or paths separated from a road crossing, the crossing surface shall be at least 0.5 metres wider (each side) than the approaches but not less than a total width of 2.8 metres measured at right angles to the sidewalk, trail or path.

For roads, the crossing surface shall be 0.5 metres or more beyond each side of the shoulder break points measured at right angles to the road.

The top of the crossing surface must be installed as close as possible to the top of the rail within the wear limits below:

- For public sidewalk, path or trail crossings in areas with persons depending on mobility (assistive) devices, the wear limits should not be greater than 13 mm above or 7 mm below the crossing surface. In urban areas or on crossings with regular pedestrian/cyclist traffic, it is recommended to use this standard.

- At all other public grade crossings, the maximum distance of the top of the rail above or below the crossing surface should not exceed 25 mm.

Field side gaps or outside “mud rails” are permitted in rural areas, except for public sidewalks, paths or trails designated by the road authority for use by persons using assistive devices. The maximum width is 120 mm with no depth limit.

The environment of a crossing can affect safety and maintenance costs/rideability of a crossing. The environment can be defined as the weather patterns of the crossing area and its effect on the surface and subgrade. If there is poor subgrade/subsoil and harsh weather patterns that act on a crossing, more frequent inspection and maintenance is required. Good drainage, as with any weight bearing material, is paramount.

If weather patterns affect surface traction for vehicles, then safety is an increased concern. A crossing with good traction, especially on curves, becomes one of the highest priorities.

1110.13 TYPES OF LEVEL RAILROAD CROSSINGS

See "TYPICAL CROSSING SECTIONS" FIGURE 1110.B

(Also refer to the ministry's *Recognized Product List* under Railway Crossings for accepted products for flangeways and surfaces.)

BITUMINOUS

The **asphalt paved** crossing surface is popular because of the availability of the bituminous material and the construction techniques are universal to all road authorities. They are often paved from the tie level, full depth, to the top of rail or an appropriate lift of gravel is placed to allow paving. In areas of heavy rail or roadway traffic, the pavement often cracks or buckles allowing the creation of potholes in the surface. Cracks and potholes allow the introduction of water into the railway ballast leading to track pumping which, in turn, compounds the problem. Where pavement potholes and cracking are obvious, often the pressure of vehicles is enough to break or overturn a rail which, if not immediately remedied, would certainly cause a train derailment.

CONCRETE PANEL

Concrete panel crossings are normally used at crossings with heavy road traffic or when road speeds are 60 km/h or greater. Generally there are panels between the rails, one on each outer side of the rail. As with all crossings, the railway structure, including ballast, should be renewed. Rubber flangeway "rail seal" products are often attached to the panels but separate (unattached) flangeway materials are satisfactory.

RUBBER

The **rubber** crossing surface is usually made up of full depth panels, pre-formed to abut directly to the rail, forming a seal against water. Some types of rubber crossings are not full depth and require shims to ensure the proper road surface elevation. Full depth rubber crossings provide a flexible member between the pumping of the trackage and rutting of the pavement. Due to the nature of rubber in wet weather, discretion should be used when considering its use near or at curves and intersections/cross-walks.

TIMBER

Timber is the most common type of crossing surface and is especially prevalent on rural roads or crossings with low vehicular speeds and/or volumes. Generally, there are five or six planks between the rails with two on each outer side. The timbers are usually attached to the ties by a spike, although screws are occasionally used. Shims are sometimes placed between the wooden plank and the ties to obtain the proper elevation. The timber planks should not rest on the tie plate and spikes as this may cause a tilting of the plank resulting in a rough crossing surface. Since traction may be poor on wet timber surfaces, use of this type of crossing in curves or near intersections is not recommended.

TREATED TIMBER

Treated hardwood timber planks are usually installed at locations where road traffic is heavy. Generally, six to eight planks are used between the

rails with two on each outer side. Since they are made of hardwood, and are engineered for each placement, high speed highway use is acceptable. Timber sections are screwed into hardwood rail ties. Some manufacturers may provide crossing panels that are made up of several planks fastened with structural rods and post tensioned.

Note: All crossings should be used in conjunction with flangeway designs meeting the requirements noted in the previous section, “Level Railway Crossing Surface Section”.

1110.14 EXAMPLE – NOTICE OF RAILWAY WORKS

Additional guidance regarding distribution of a Notice is provided on the next page.

NOTICE

date:_____

Please be advised that the Ministry of Transportation and Infrastructure is proposing to ___"A"___ __"B"___ road/highway to _____"C"_____ at the railway crossing of _____"D"_____ Railway at Mile ____"E"____ Subdivision.

The location of the proposed work will be from lot_____ to lot_____ in the Land Registry District of _____-or- all within the railway right-of-way.

Attached is a copy of Drawing No. _____ dated _____ which indicates the location and design of the proposed works.

The crossing will be _____ lanes wide and provide _____"F"_____. The road will cross the track at an angle of _____ degrees.

This railway crossing has been designed in accordance with design standards passed in support of the Railway Acts.

This project is scheduled to start _date_____and be completed by_date_____.

For further information contact _____"G"_____.

Please provide written objections based on safety of persons or property to _____"G"_____within 60 days of the Notice date; copies of written objections should be forwarded to:

Regional Director, Surface
Railway Safety Directorate
Transport Canada
625 Agnes Street
New Westminster, British Columbia, V3M 5Y4
Canada

A - construct, relocate, etc.
B - name of road crossing
C - enhance safety, increase capacity etc.
D - name of railway company
E - mileage (including Subdivision name) on railway
F - sidewalks, lighting, improved grades, alignment, sightlines etc.
G - project manager name and address

NOTICE OF RAILWAY WORKS

The following information is excerpted from the Notice of Railway Works Regulations (using that documents numbering format). Only those regulations related to work the ministry might typically undertake have been listed.

Prescribed Kinds of Works

The following are prescribed as railway works of a kind for which notice shall be given:

> 3(c) the construction or alteration of structures located above or below a line of railway by a party other than a railway company, but excluding a mine or an oil or gas well;
>
> 3(d) the construction or alteration of road crossings for public use, including the installation or alteration of road crossing warning systems, but excluding the installation or alteration of road crossing signs

Persons to Whom Notice Is to Be Given

The Notice referred to in 3(c) and 3(d) listed above shall be given

> 5(1)(b) in the case of any party proposing to construct a road crossing, excluding the installation of a road crossing warning system, to the following, namely,
>
> > (i) the railway company whose line is to be crossed,
> >
> > (ii) the municipality in which the crossing works are to be located,
> >
> > (iii) the authority having responsibility for the road in question, and
> >
> > (iv) any owner of land immediately abutting land on which the crossing works are situated; and
>
> 5(1)(c) in the case of any party proposing to alter a road crossing or to install or alter a road crossing warning system, to the following, namely,
>
> > (i) the railway company whose line is crossed,
> >
> > (ii) the municipality in which the crossing works are located, and
> >
> > (iii) the authority having responsibility for the road in question.
>
> 5(2) A copy of a notice referred to in subsection 5(1)(b) and 5(1)(c) listed above shall be sent forthwith to the Director of the regional Railway Safety Directorate office having jurisdiction over the railway at the location of the proposed works.

Refer to the Notice of Railway Works Regulations for more detail.
(http://laws-lois.justice.gc.ca/eng/regulations/SOR-91-103/page-1.html)

Figure 1110.A - Sample Level Crossing Application Layout

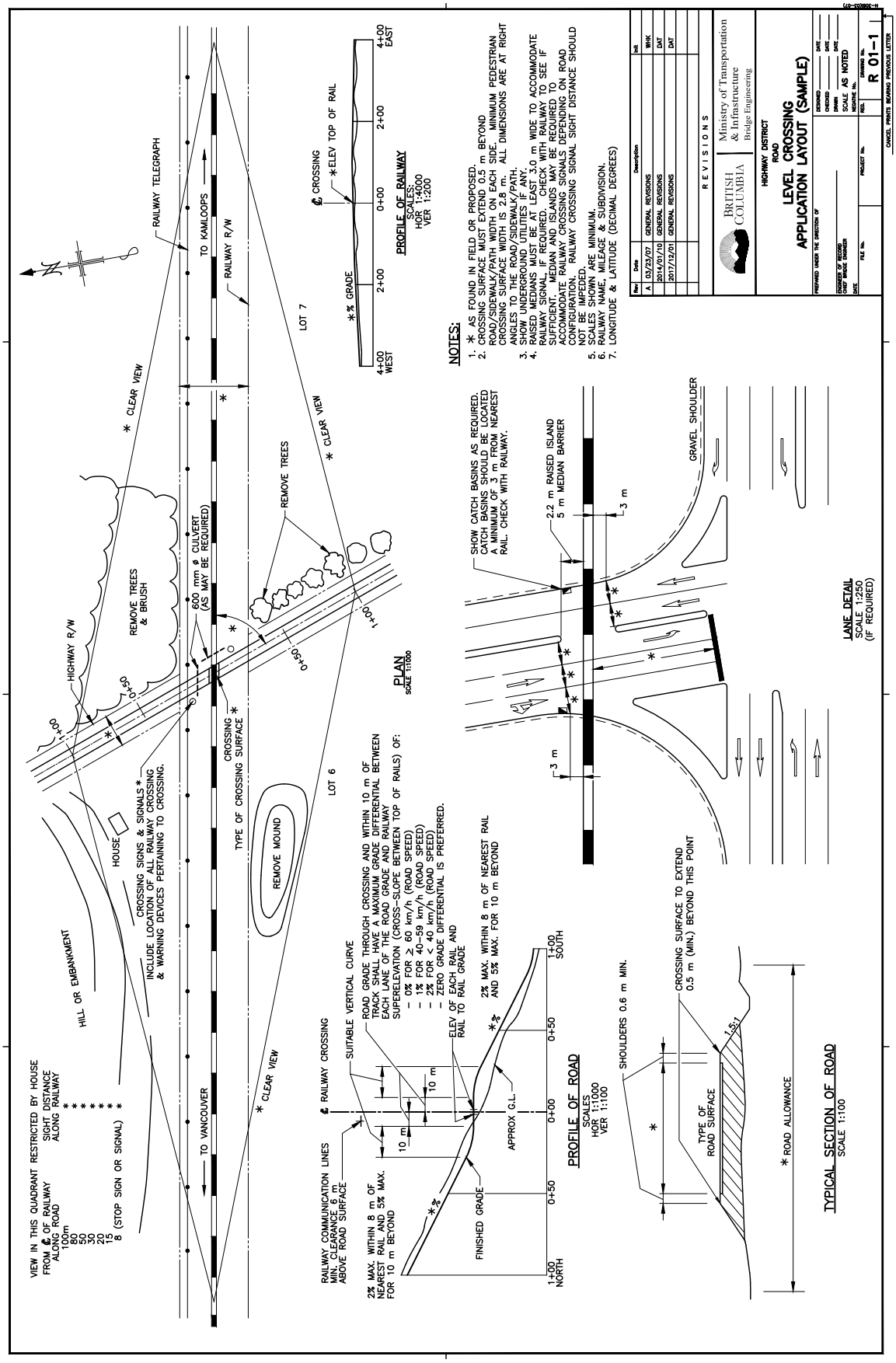
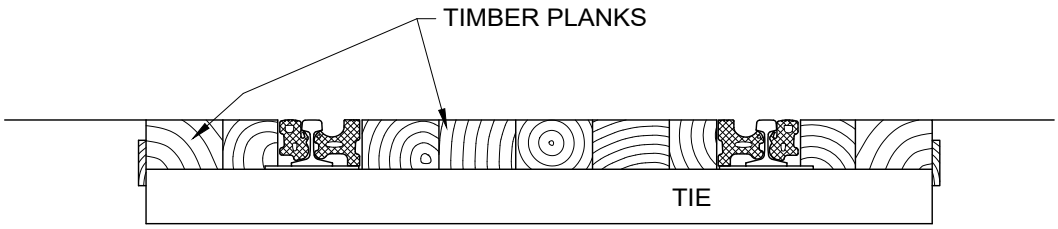
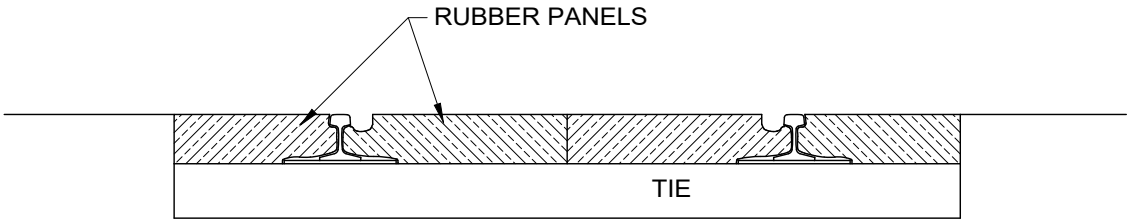


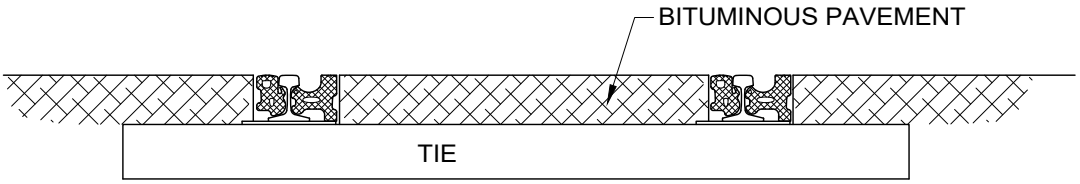
Figure 1110.B - Typical Crossing Sections



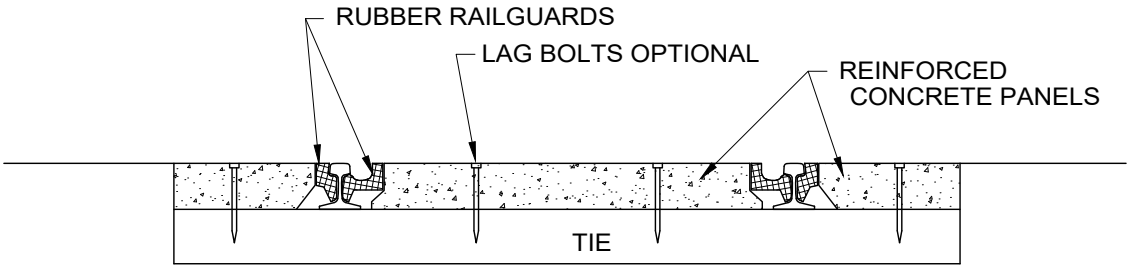
TIMBER CROSSING



RUBBER (ELASTOMERIC) PANEL CROSSING



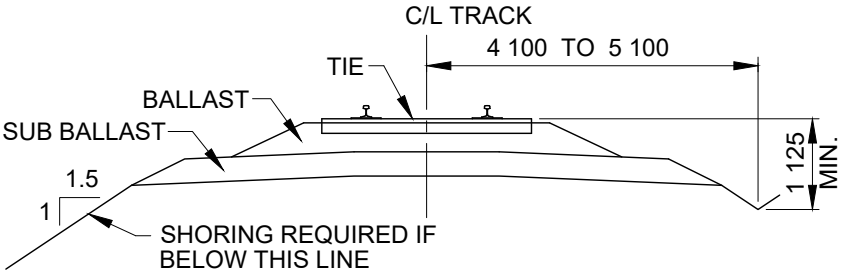
BITUMINOUS CROSSING / RUBBER SEALS



CONCRETE CROSSING / RUBBER SEALS

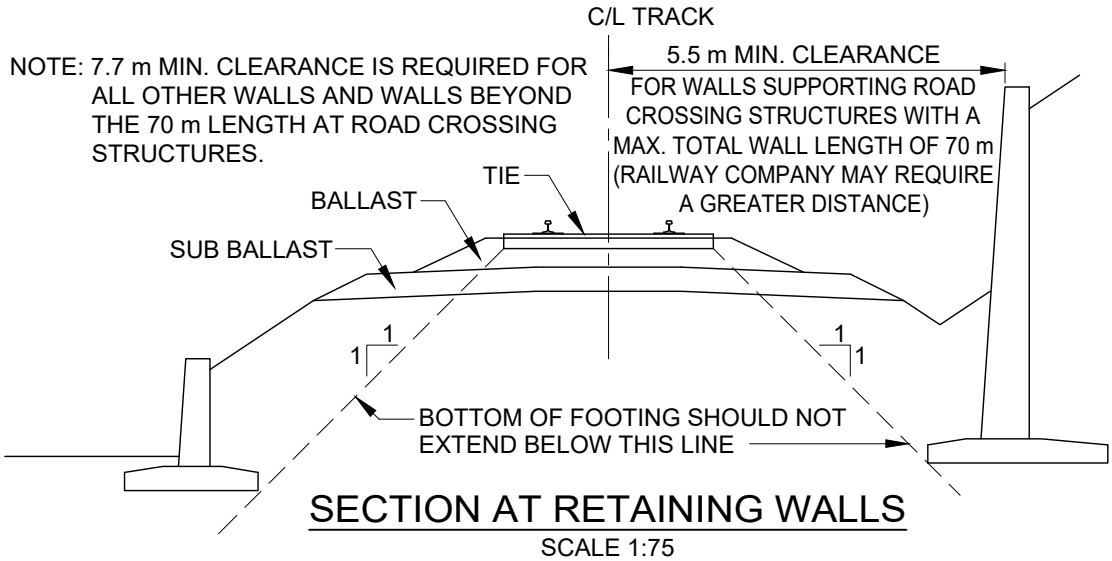
NOTE: - RUBBER FLANGEWAYS TO BE USED.
- RAIL FLANGEWAYS DO NOT CONFORM TO CURRENT STANDARDS.

Figure 1110.C - Typical Cross Sections



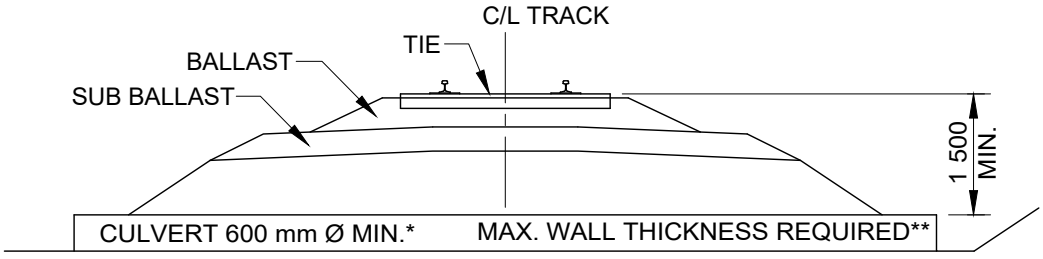
TYPICAL SECTION

SCALE 1:75



SECTION AT RETAINING WALLS

SCALE 1:75



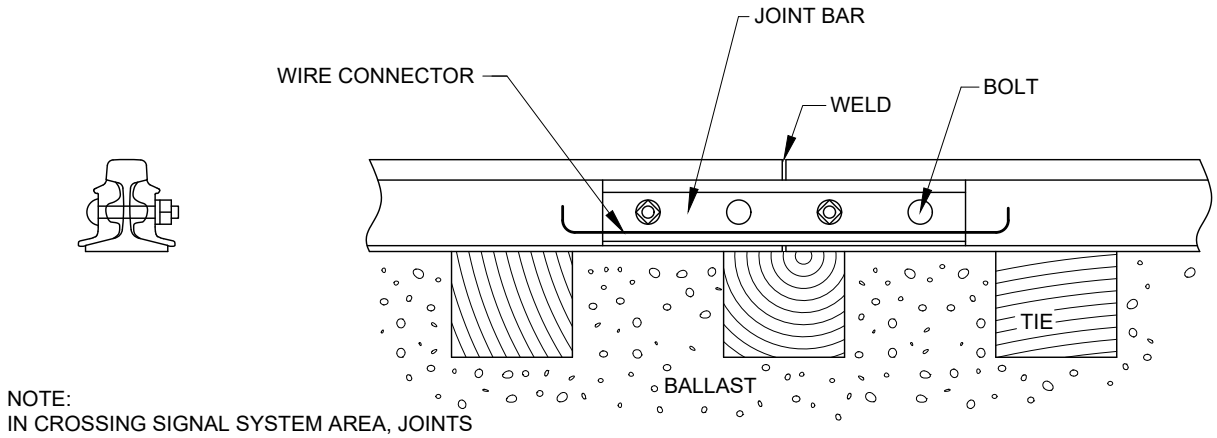
SECTION AT CULVERT

SCALE 1:75

* SOME RAILWAYS MAY HAVE A MINIMUM 900 mm Ø SIZE REQUIREMENT (100 YEAR FLOOD NO GREATER THAN FULL)

** CHECK WITH THE RAILWAY FOR THIS SPECIFICATION

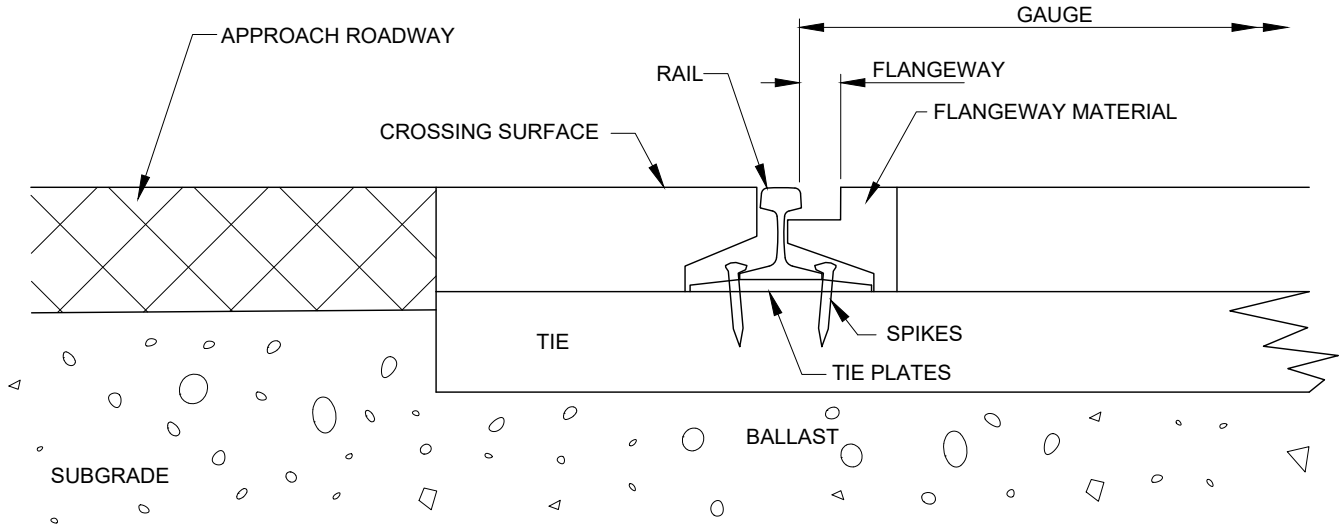
Figure 1110.D - Typical Cross Sections



NOTE:
IN CROSSING SIGNAL SYSTEM AREA, JOINTS
SHOULD BE WELDED IN CROSSING SURFACE

DETAIL AT RAIL JOINTS

SCALE 1:10



NOTE: FLANGEWAY - WIDTH 4.75" TO 2.5" (2.75" PREFERRED IN URBAN AREAS)
- DEPTH <3"

TYPICAL SECTION

SCALE 1:10

Figure 1110.E - Clear View Triangle Requirements

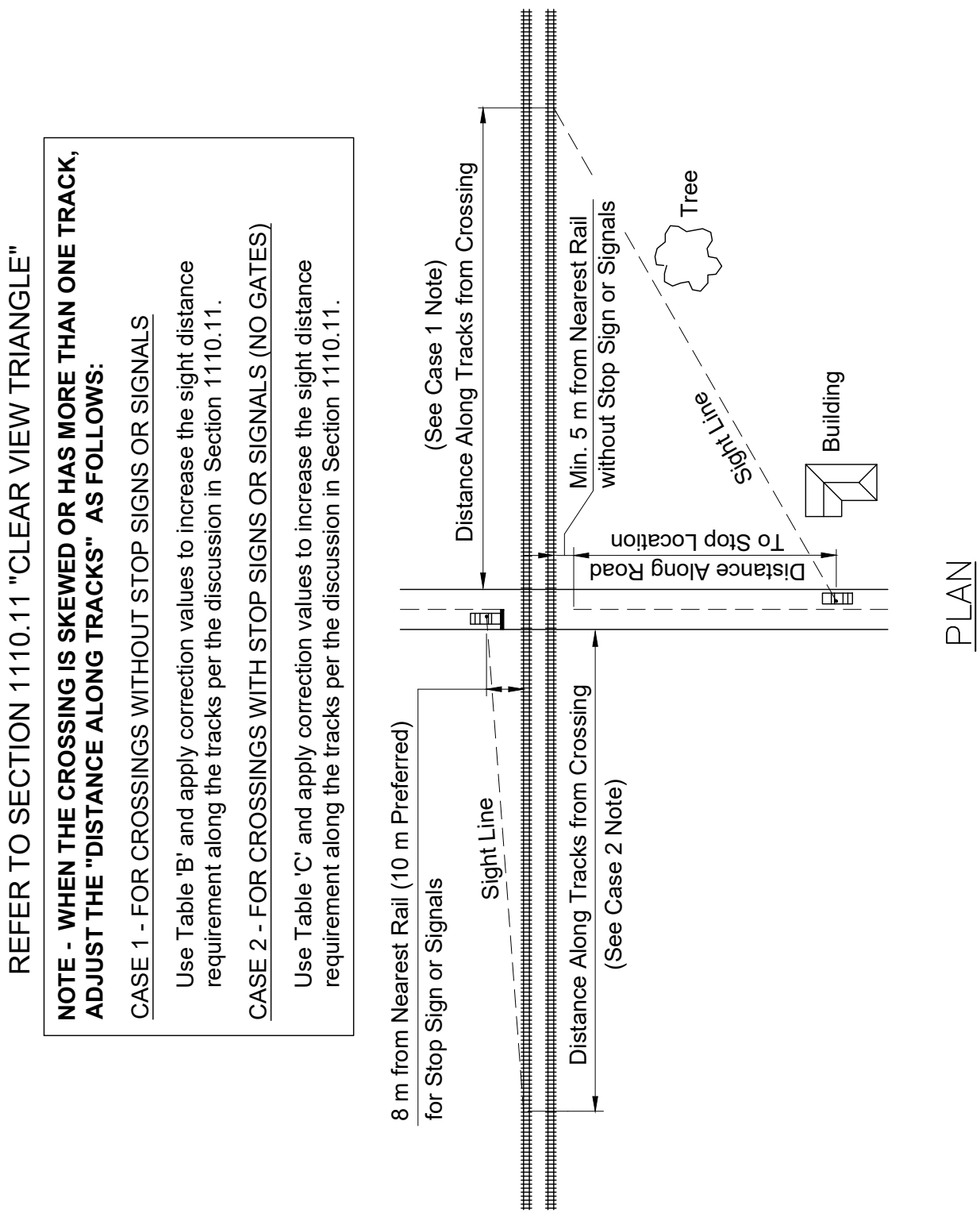


Figure 1110.F - Typical Detail for Crossing Signals

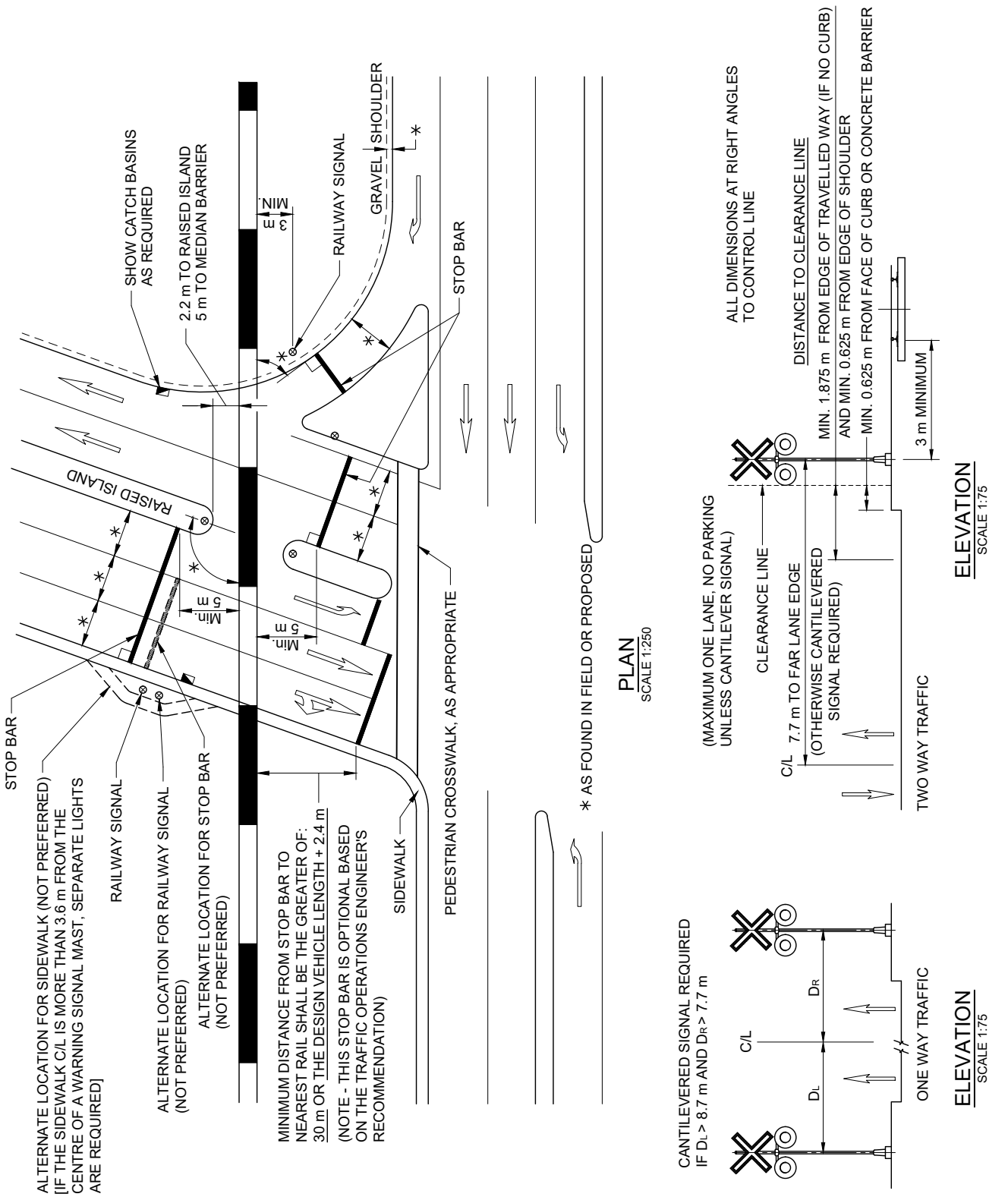
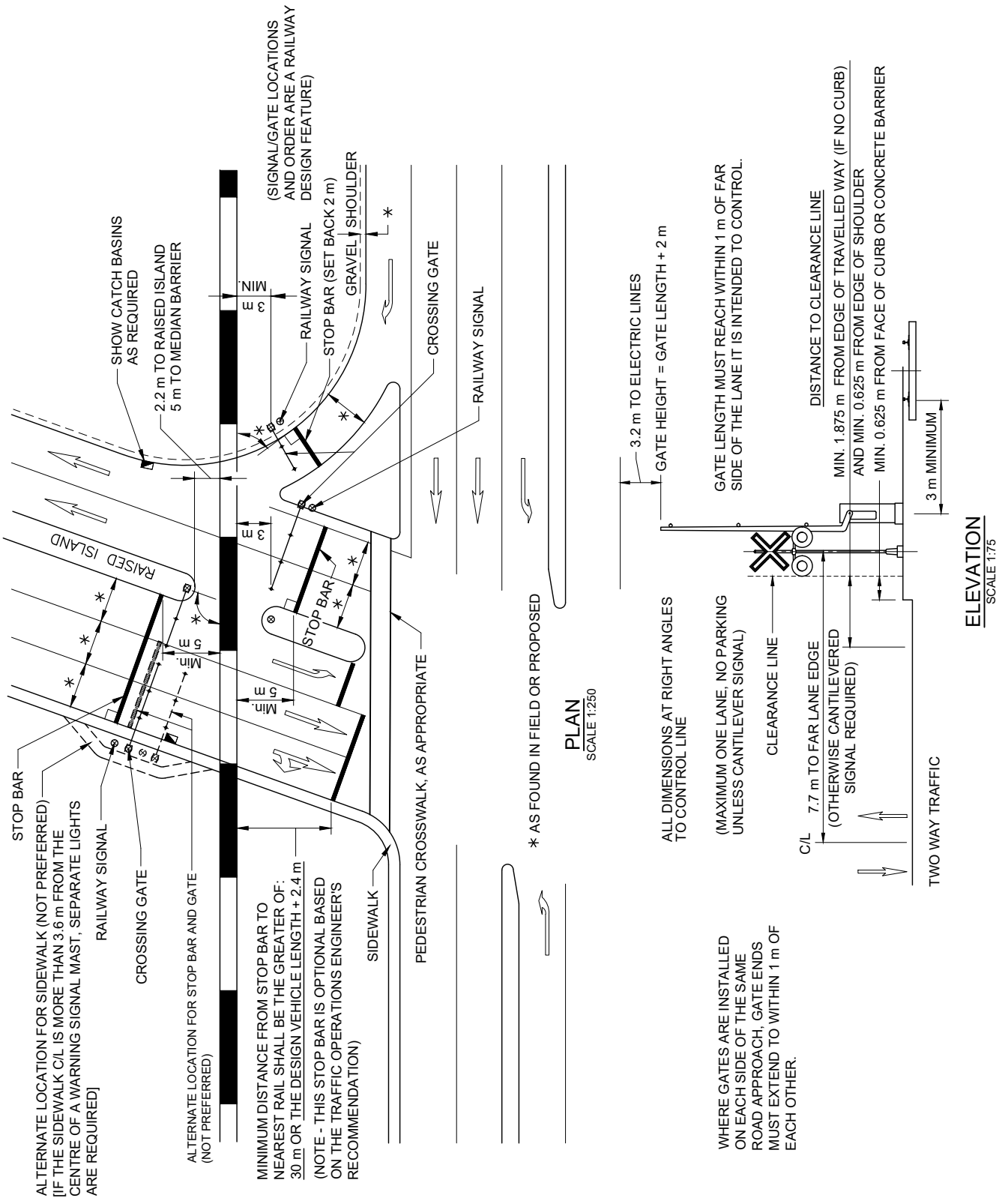


Figure 1110.G - Typical Detail for Crossing with Gates



1120
POLE RELOCATIONS

1120.01 GENERAL

Read this section of the BC Supplement in conjunction with the **Utility Policy Manual**. Where any discrepancy occurs, the Utility Policy Manual shall govern, unless otherwise stipulated.

1120.02 RECOMMENDED GUIDELINES FOR POLE LOCATIONS

Minimum Offset for Utility Poles are as follows:

1. For Curb and Gutter Projects with Posted Speed of 60 km/h or less, at least 0.3 m behind the sidewalk (if there is one) or a minimum of 2.0 m from the outside face of the curb, whichever is greater.
2. For Curb and Gutter Projects with Posted Speed greater than 60 km/h, outside the Clear Zone as per Section 620 or protected by approved guardrail.
3. For Open Shoulder Projects, outside the Clear Zone, as per Section 620, where applicable (preferably within 2.0 m of edge of R/W) or protected by approved guardrail.

Every effort shall be made to avoid poles within traffic islands.

Street lighting is a possibility on all highways through urban areas. Therefore, minimum clearances from Overhead Power Lines shall be established in accordance with the **Utility Policy Manual**.

Minimum vertical clearances above the ground surface or from the pavement crown shall be in accordance with the **Utility Policy Manual**.

1120.03 EXCEPTIONS TO HORIZONTAL OR VERTICAL CLEARANCES

Exceptions to offset requirements are discussed in the **Utility Policy Manual**.

In addition, the *Corridor Ambient Geometric Design Elements Guidelines Policy* (BC Supplement to TAC, Tab 13) may be applied to utility setbacks to ensure uniformity within the specific corridor under review. See the Project Design Criteria.

1120.04 RELOCATION OF UTILITY POLES

For Active Projects:

1. It is desirable to contact each Utility Owner during the design stage, advising that highway improvements are proposed, and to discuss the effects of the design on the utility in question.
2. As soon as plans showing location of proposed streets, limits of cuts and fills, and proposed R/W limits are available, supply a set of prints to each Utility Owner, indicating the poles to be relocated.
3. A legend similar to **Figure 1120.A** shall be affixed to the first sheet (key plan) of each set of prints showing the poles to be relocated.
4. Correspondence to the Utility Owner should:
   a) Give a general project description;
   b) Query the accuracy of the utility locations as shown and ask to be advised of any errors or omissions;
   c) Indicate minimum acceptable distance from face of curb to face of pole on curb and gutter projects;
   d) For telephone pole relocation, request an estimate of the number of spliced sheath metres involved;
   e) State Construction Scheduling, if known.
5. If the project is to be a contract, send a copy of each Utility Owner's accompanying letter, with a copy of the Pole Relocation List (H-96) to the Contract Documents Officer.

1120.05 RELOCATION COSTS OF UTILITY POLES

Where the Ministry requests relocation of pole lines, the Ministry's contribution shall be in accordance with the appropriate Protocol Agreement.

Figure 1120.A Utility Pole Legend Sample

	Blue Circle	Transformer Pole
	Blue Circle	Power Pole
	Blue Circle	Power Guy Pole
	Red Circle & Blue Circle	Combination Power and Telephone Pole
	Red Circle	Telephone Pole
	Red Circle	Telephone Guy Pole
	Black Circle	Telegraph or telecommunication pole
	Black Circle	Telegraph or telecommunication guy pole
	Green Circle	Lamp standard
	Blue Circle	High tension power tower