

## **Meeting Canada's New Grade Crossing Regulations**

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## Abstract

In order to evaluate the effects of the proposed changes to the *Railway Safety Act*, the City of Vancouver (City) asked MMM Group to use the Rupert Street grade crossing to evaluate the effects and challenges of meeting these new *Grade Crossing Regulations* (Regulations) at all City grade crossings.

The proposed *Grade Crossing Regulations* require that Railway Companies and Road Authorities share information about public grade crossings within five years of the coming into force of the Regulations. In addition, Railway Companies and Road Authorities would be responsible for ensuring that all grade crossings meet the Basic Requirements prescribed in the Regulations within five years of the coming into force of the Regulations. Given that there are more than 14,000 public grade crossings across Canada, this represents a significant investment in time, expertise, and money.

Rupert Street is a four-lane secondary arterial that carries more than 28,500 vehicles per day. Two tracks of CN Rail's New Westminster Subdivision cross Rupert Street at an active crossing equipped with flashing lights, bells, and gates (FLBG). About six trains use this crossing on a typical day. The high level of vehicle activity at this crossing is exacerbated by the pedestrians, cyclists and transit passengers using the adjacent Rupert SkyTrain Station and BC Parkway multi-use trail.

Based on the Rupert Street findings, MMM advised the City as to what information is needed, and how best to collect it, for Vancouver's more than 100 grade crossings. MMM also provided cost estimates for gathering the various pieces of information for a typical Vancouver grade crossing to assist with budget planning.

This paper will:

- Identify the types of information (i.e. information on the 40 data fields) that need to be collected, as well as the methods and/or sources for capturing the required location and technical data;
- Summarize the road-rail parameters and information that needs to be collected and shared between Responsible Authorities, in this instance the City of Vancouver and CN Rail; and
- Present order of magnitude cost estimates for completing the data collection and processing that will assist the Road Authorities with budget planning.

As a result of the information that MMM provided about Grade Crossing Information, how best to collect it, and the associated costs; Road Authorities are in a position to proactively address changes to Canada's *Grade Crossing Regulations*.

# Meeting Canada's New Grade Crossing Regulations

## Introduction

In order to evaluate the effects of the proposed changes to the *Railway Safety Act*, the City of Vancouver (City) asked MMM Group to use the Rupert Street grade crossing to evaluate the effects and challenges of meeting these new *Grade Crossing Regulations* (Regulations) at all City grade crossings.

The proposed *Grade Crossing Regulations* (1) require that Railway Companies and Road Authorities share information about public grade crossings within five years of the coming into force of the regulations. In addition, Railway Companies and Road Authorities would be responsible for ensuring that all grade crossings meet the Basic Requirements prescribed in the regulations within five years of the coming into force of the regulations. Given that there are more than 14,000 public grade crossings across Canada, this represents a significant investment in time, expertise, and money.

As the new regulations will apply at over 100 railway-roadway grade crossings within Vancouver, the City has chosen the Rupert Street grade crossing as the basis of a Case Study that evaluates the effects of the proposed changes. Rupert Street is a four-lane Secondary Arterial that carries more than 28,500 vehicles per day. Two tracks of CN Rail's New Westminster Subdivision cross Rupert Street at an active crossing equipped with flashing lights, bells, and gates (FLBG). About six trains use this crossing on a typical day. The high level of vehicle activity at this crossing is exacerbated by the pedestrians, cyclists and transit passengers using the adjacent Rupert SkyTrain Station, BC Parkway multi-use trail and pedestrian signal.

Based on the Rupert Street findings, MMM advised the City as to what information is needed, and how best to collect it, for Vancouver's more than 100 grade crossings. MMM also provided cost estimates for gathering the various pieces of information for a typical Vancouver grade crossing to assist with budget planning.

## Objectives of this Paper

This paper will:

- Identify the data that need to be collected for the Grade Crossing Information, as well as the methods and/or sources for capturing the required location and technical data;
- Present an order of magnitude cost estimate for completing the data collection and processing that will assist Road Authorities with budget planning.

## Background

Railway Companies and Road Authorities share ownership of grade crossings. The current federal acts and regulations governing these grade crossings are the:

- *Railway Safety Act* (RSA);
- *Railway-Highway Crossing at Grade Regulations*;
- *Highway Crossings Protective Devices Regulations*; and
- *Railway Safety Management System Regulations*.

Other federal guidelines and voluntary standards to uphold safety at federally regulated grade crossings include:

- *Minimum Railway/Road Crossing Sightline Requirements for All Grade Crossings Without Automatic Warning Devices (G4-A)*;
- *Procedures and Conditions for Eliminating Whistling at Public Crossings (Guideline No. 1)*; and
- *Road/Railway Grade Crossings — Technical Standards and Inspection, Testing and Maintenance Requirements (Draft RTD 10)*.

The Federal Government has concluded that the RSA, voluntary standards and existing regulations do not adequately address grade crossing safety management issues. Furthermore, it has determined that inadequate implementation of voluntary standards and a lack of information sharing between Road Authorities and Railway Companies have put the safety of Canadians at risk. Consequently, Transport Canada has developed new *Grade Crossing Regulations* that would establish new safety standards for federally regulated grade crossings. Under the authority of the *Railway Safety Act*, the proposed regulations will improve safety by helping to reduce the frequency and severity of accidents, therefore saving lives and preventing injuries and derailments at federally regulated grade crossings. In particular, the proposed regulations would improve safety by:

- Providing comprehensive and enforceable safety standards for grade crossings;
- Clarifying the roles and responsibilities of Railway Companies and Road Authorities; and
- Mandating the sharing of key safety information between Railway Companies and Road Authorities.

The Regulations were published in the *Canada Gazette, Part I* on February 8, 2014. Stakeholders and the public have 90 days to comment on the proposed regulations. Comments will be considered before the regulations are finalized and published in *Canada Gazette, Part II*.

### Implications

**IMPLICATION No. 1:** The proposed regulations will require that Railway Companies and Road Authorities share critical information with each other for public grade crossings within five years of the coming into force of the regulations to ensure safety at grade crossings. Critical information that must be shared between both parties includes layouts of the tracks and roadway, traffic volume, speed of trains, volume of trains, existing warning systems, and available sightlines. The Railway Companies would be required to keep the most recent information shared. For the purposes of this paper, the information shared between Railway Companies and Road Authorities will be referred to as Grade Crossing Information (GC Information).

**IMPLICATION No. 2:** The proposed regulations will require that a Road Authority ensure that the basic requirements of the proposed regulations are met at existing grade crossings under its jurisdiction within five years after the day on which the regulations come into force. As the Road Authority, the City would be responsible for:

- The design, construction and maintenance of a road approach;
- Traffic control devices, except for a STOP sign that is installed on the same post as a RAILWAY CROSSING sign;
- The design of a crossing surface; and
- Sightlines within the land on which the road is situated and over land in the vicinity of the grade crossing, including the removal of trees and bushes that obstruct the sightlines.

**IMPLICATION No. 3:** On the other hand, the Railway Company must ensure that the requirements of the Regulations are met with respect to:

- A RAILWAY CROSSING sign, a NUMBER OF TRACKS sign, an EMERGENCY NOTIFICATION sign, and a STOP sign that is installed on the same post as a RAILWAY CROSSING sign;
- A warning system;
- The construction and maintenance of a crossing surface; and
- Sightlines within the railway right-of-way and over land adjoining the railway right-of-way, including the removal of trees and bushes that obstruct the sightlines.

### Objectives of the Case Study

As the new regulations will apply at over 100 railway-roadway grade crossings within Vancouver, the City chose the Rupert Street grade crossing as the basis of a Case Study evaluating the effects of the proposed changes. The objectives of this Case Study included:

1. Confirming that the Rupert Street grade crossing complied with the proposed regulations by:
  - a. Compiling the Grade Crossing Information; and
  - b. Completing a Detailed Safety Assessment.
2. Providing order of magnitude cost estimates to gathering and completing GC Information at a typical grade crossing in Vancouver for budget planning purposes.

## **Findings**

### Grade Crossing Information

Section 4 of the proposed *Grade Crossing Regulations* specifies that a Railway Company must provide a Road Authority with the following information with respect to a public grade crossing:

- The precise location of the grade crossing;
- The number of tracks that cross the grade crossing;
- The average annual daily railway movements;
- The railway design speed;
- The crossing angle;
- The warning system in place at the grade crossing;
- Whether a STOP sign is installed on the same post as the RAILWAY CROSSING sign at the grade crossing; and
- Whether or not whistling is required when railway equipment is approaching the grade crossing.

Section 11 specifies that a Road Authority must provide a Railway Company with the following information with respect to a public grade crossing:

- The precise location of the grade crossing;
- The number of traffic lanes that cross the crossing surface;
- The average annual daily traffic;
- The road design speed;
- The road classification to which the road approach corresponds;
- The width of each traffic lane on the road approach;
- The design vehicle that is selected for use in the design of the grade crossing;
- The stopping sight distance;

- The average gradient of the road approach;
- The departure time;
- The advance activation time;
- The pre-emption time, if applicable; and
- An indication of whether the grade crossing has a sidewalk, path or trail, and if so, whether the sidewalk, path or trail has been designated for persons using assistive devices.

**Tables 1 and 2** summarize the road-rail parameters and information that must be collected and shared between the Railway Companies and Road Authorities, in this instance CN Rail and the City of Vancouver. These parameters have been divided into two types: A) Location Data; and B) Technical Data. Furthermore, guidance is provided as to how specific data sets could be collected, namely:

- Request data from either the Railway Company, Roadway Authority or other agency;
- Record data from a desktop study;
- Measure during a site visit;
- Observe during a site visit; and
- Calculate using the equations / tables contained in the proposed Regulations or Standards.

The following expands on a number of the data fields.

- Warning System means an automated system, other than a traffic signal, that indicates the approach or presence of railway equipment at a grade crossing, and that is composed of light units, bells, gates, operating mechanisms and control circuits. Grade crossings can be controlled through either 'passive' or 'active' systems. Passive control systems provide warnings through signs and line markings. They do not react to the presence of an approaching train. Active traffic control systems react to an approaching train to warn road users of the train. This warning consists of flashing lights and sounds (combined with static controls such as signs and pavement markings) which are triggered by a train. Another level of active control is achieved by placing a barrier between vehicles or pedestrians and trains. This is done with electro-mechanical devices such as gates used in combination with other active and passive controls. For the purposes of Grade Crossing Information, warning systems could be classified as:
  - Passive – RAILWAY CROSSING sign (RCS)
  - Passive – STOP sign and RAILWAY CROSSING sign (SRCS)
  - Active - Flashing Lights and Bells (FLB)
  - Active - Flashing Lights, Bells and Gates (FLBG)
- Departure Time is the time required for the Design Vehicle to pass completely through the clearance distance after stopping. It includes the time required for the driver to look in both directions along the rail line and to accelerate and move the vehicle completely through the clearance distance. Note that clearance distance is the distance between the clearance point in advance of the grade crossing, to the clearance point beyond the farthest rail.
- Pre-Emption Time allows for the pre-emption of traffic signal operation at adjacent intersections by the warning system so that:
  - Sufficient time is provided to clear the grade crossing of road traffic before the arrival of railway equipment at the grade crossing; and
  - Road traffic is prevented from moving from the adjacent intersection towards the grade crossing.

## Cost Estimates for Completing Grade Crossing Information

High level estimates were developed to inform the City – for budgeting purposes – the approximate costs for a qualified consultant to collect, tabulate and format the GC Information (see **Table 3**). Note that actual costs depend on crossing location (travel distance), crossing complexity (site visit duration), and the number of grade crossings assessed at the same time (economy of scale).

## **Recommendations**

In light of the findings, the following recommendations are forwarded for consideration:

1. In collaboration with Railway Companies, Road Authorities should develop plans to collect, tabulate, format and share the 40 pieces of data identified in Tables 1 and 2 that form the Grade Crossing Information which the proposed Regulations require be shared between the two Responsible Authorities.
2. Road Authorities should set aside sufficient funds to effect the collection, tabulation, formatting and sharing of the Grade Crossing Information, which is estimated at \$900 per crossing. Note that actual costs depend on crossing location (travel distance), crossing complexity (site visit duration), and the number of grade crossings assessed at the same time (economy of scale).

## **Conclusions**

The proposed *Grade Crossing Regulations* require that Railway Companies and Road Authorities share information about public grade crossings within five years of the coming into force of the Regulations. In addition, Railway Companies and Road Authorities would be responsible for ensuring that all grade crossings meet the Basic Requirements prescribed in the Regulations within five years of the coming into force of the Regulations. Given that there are more than 14,000 public grade crossings across Canada, this represents a significant investment in time, expertise, and money.

As the new Regulations will apply at over 100 railway-roadway grade crossings within Vancouver, the City chose the Rupert Street grade crossing as the basis of a Case Study that evaluates the effects of the proposed changes. Based on the Rupert Street findings, MMM advised the City that:

- The Grade Crossing Information is comprised of 40 pieces of data that needs to be collected, tabulated, formatted and shared between the Railway Company and Road Authority for each crossing; and
- The order of magnitude cost estimate for the 6 hours that are necessary to complete the data collection and processing is approximately \$900 per crossing. Note that actual costs depend on crossing location (travel distance), crossing complexity (site visit duration), and the number of grade crossings assessed at the same time (economy of scale).

As a result of the information that MMM has provided about Grade Crossing Information, how best to collect it, and the associated costs; Road Authorities are in a position to proactively address changes to Canada's *Grade Crossing Regulations* thereby enriching the quality of people's lives.

## References

1. Grade Crossing Regulations, *Canada Gazette, Part I Vol. 148, No. 6* (Ottawa, ON: Government of Canada, February 8, 2014) <http://www.gazette.gc.ca/rp-pr/p1/2014/2014-02-08/html/reg2-eng.php>
2. *Grade Crossing Standards* (Ottawa, ON: Transport Canada, February 2014)
3. *Geometric Design Guide for Canadian Roads* (Ottawa, ON: Transportation Association of Canada, September 1999)



## Tables

**Table 1 – Grade Crossing Information Requirements (Location Data)**

No.	Location Parameter	Method for Collecting Data	Party Responsible for Data Collection
A1.	Date (YY/MM/DD)	Record	Road Authority & Railway Company
A2.	Longitude	Measure	
A3.	Latitude	Measure	
A4.	Municipality	Record	
A5.	Province	Record	
A6.	Road Authority (include contact information)	Record	Road Authority
A7.	Crossing Type (public / private)	Record	
A8.	Location Type (Municipality / District / Reserve / Other)	Record	
A9.	Road Name	Record	
A10.	Road Number	Record	
A11.	Railway Company (include contact information)	Record	Railway Company
A12.	Subdivision Name	Record	
A13.	Crossing Mile	Record	
A14.	Track Identification Number	Record	
A15.	Spur Headblock Mile	Record	
A16.	Spur Name	Record	

**Table 2 – Grade Crossing Information Requirements (Technical Data)**

No.	Technical Parameter	Method for Collecting Data	Party Responsible for Data Collection			
B1.	No. of tracks	Measure	Railway Company			
B2.	Average annual daily railway movements (railway movements per day)	Request		Railway Company		
	Passenger Train AADR					
	Freight Train AADR					
B3.	Maximum Rail Operating Speed (mph)	Request			Railway Company	
	Passenger Train					
	Freight Train					
B4.	Crossing angle (degrees)	Measure				Railway Company
B5.	Warning system (RCS, SRCS, FLB, FLBG)	Observe				
B6.	STOP sign installed on the same post as the RAILWAY CROSSING sign (Yes / No)	Observe				
B7.	No. of traffic lanes over crossing surface	Measure	Road Authority			
B8.	Average annual daily traffic (vehicles per day)	Measure				
B9.	Road design speed (km/h)	Observe				
B10.	Road classification (Expressway / Freeway / Arterial / Collector / Local)	Record				
B11.	Width of each traffic lane on the road approach (m)	Measure				
B12.	Design vehicle (include special vehicles)	Record				
B13.	Stopping sight distance (m)	Calculate				
B14.	Average gradient of the road approach	Measure				
B15.	Departure time (s)	Calculate				
B16.	Advance activation time (s)	Calculate				
B17.	Warning system is interconnected with highway traffic control signals (Yes / No)	Observe	Road Authority			
	Traffic control signals are pre-empted in advance of the warning system flashing light (Yes / No)	Observe				
	Pre-emption time of traffic control signals (s)	Calculate				
B18.	Sidewalk, path or trail (Yes / No)	Observe		Road Authority		
	Crossing regularly used persons using assistive devices (Yes / No)					

**Table 3 – Cost Estimates for GC Information**

<b>Task</b>	<b>Level of Effort (Hours)</b>	<b>Cost</b>
<b>Grade Crossing Information (per location)</b>		
Obtain crossing information from Road Authority / Railway Company	2	\$300
Site visit	2	\$300
Data tabulation / formatting	<u>2</u>	<u>\$300</u>
<b>Total</b>	<b>6</b>	<b>\$900</b>

## Figures

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