

A phased approach to prioritize road authority resources to comply with the new
Canadian grade crossings regulations

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Abstract

On December 17th, 2014, the Canada Gazette published the new Grade Crossings Regulations (Statutory Order and Regulations 2014-275) pursuant to the Railway Safety Act. The intended purpose of the new Regulations is to address gaps within the existing voluntary standards and regulations to improve safety performance of grade crossings of all federally regulated railroads and reduce fatalities, injuries, property damage and environmental damage at crossings. While the new Regulations establish enforceable safety standards, they also outline the roles and responsibilities of both the railroads and road authorities in terms of information sharing on operational characteristics, infrastructure at new and existing crossings, and sightlines. Railroads and road authorities will need to work collaboratively to ensure all existing public crossings (approximately 14,000 across Canada) meet or exceed the standards set out in the Regulations within the next seven years to improve safety at grade crossings for all transportation users and avoid potential financial penalties.

This paper provides an overview of the GCR, including how the GCR will be enforced and the roles and responsibilities of road authorities and railway companies, and provides an approach for road authorities to prioritize and allocate resources to comply with the new regulations. Specifically this paper describes an approach to comply with the information sharing requirements and to identify significant grade crossing investments that may necessitate several years to implement.

INTRODUCTION

On December 17th, 2014, the Canada Gazette published the new Grade Crossings Regulations (Statutory Order and Regulations 2014-275) pursuant to the Railway Safety Act. The intended purpose of the new Grade Crossings Regulations (GCR) is to address gaps within the existing voluntary standards and regulations to improve safety performance of grade crossings of all federally regulated railroads and reduce fatalities, injuries, property damage and environmental damage at crossings. Transport Canada requires all applicable grade crossings to comply with the GCR within seven years of coming-into-force (CIF).

Meeting the GCR will require substantial efforts from both road and railway authorities. Generally, road authorities plan capital budgets in short, medium, and long term with short and medium term plans being 5 and 10 years, respectively. The implications of the GCR mean that road authorities will need to be prepared to make financial investments into grade crossing safety that may not have been considered in these budgets. Therefore road authorities must develop a strategy to help ensure GCR compliance within seven years.

To ensure road authorities meet the new Regulations, two key requirements must be met for existing grade crossings. The first requirement GCR is to ensure information has been shared and exchanged with the railway companies. This must be completed within two years of CIF. The second requirement is to have all existing grade crossings comply with the safety standards of the GCR in terms of warning devices, sightlines, traffic signals, and crossing surface. The standards and requirements will apply immediately to any new crossings established from the date the Regulations came into force (December, 2014) and to any major modifications performed to existing crossings.

This paper provides an overview of the GCR, including how the GCR will be enforced and the roles and responsibilities of road authorities and railway companies, and provides an approach for road authorities to prioritize and allocate resources to comply with the new regulations. Specifically this paper describes an approach to comply with the information sharing requirements and to identify significant grade crossing investments that may necessitate several years to implement.

BACKGROUND

In 1995 Transport Canada drafted an initial policy and standards related to railway crossing regulations. In 2003 this draft was updated with the development of RTD 10 Road/Railway Grade Crossings Technical Standards (RTD-10). Since January 2003 interested stakeholders have followed RTD-10 as a recommended practice when constructing or altering grade crossings. In 2005 Transport Canada developed the Canadian Road/Railway Detailed Grade Crossing Safety Assessment Field Guide to help conduct reviews of grade crossings concerning their compliance with RTD-10. Although the guide was a useful reference and is considered a best practice, it was unable to address all the safety shortcomings at grade crossings as these standards were adhered to on a voluntary basis. In 2011, Transport Canada railway safety inspectors measured compliance through a sample of crossings across Canada and found that between 50 and 70 percent of crossings met the standards. Further, the Transportation Safety Board has identified the risk of passenger train collisions at grade crossings on their safety

Watchlist. Figure 1 shows that collisions have generally decreased in the last decade but serious and fatal injuries as a result of accidents at public grade crossings have not declined.

The new Canadian GCR was prepared by Transport Canada as part of the Railway Safety Act (RSA) following a consultation period from a Canadian Gazette issued in the first quarter of 2014. The 90-day consultation period allowed railway companies and roadway authorities to provide written comments which Transport Canada incorporated into the final publication while continuing to balance between costs and the safety of grade crossing users. The GCR incorporates the Grade Crossings Standards (GCS) and will be enforceable at the end of seven years from December 2014, when the Regulations were published.

The GCR aims to achieve its safety objectives by providing comprehensive safety standards, establishing enforceable safety standards, clarifying roles and responsibilities, and ensuring safety information is shared.

Within the new Regulations, there are eight key aspects:

- Enforcing compliance with the Grade Crossing Standards;
- Clarification of roles and responsibilities between road authorities and railway companies;
- Sharing of safety information between road authorities and railway companies;
- Maintaining sightline requirements;
- Inspection and testing of warning systems and interconnected traffic control devices;
- Prohibition of grade crossing obstructions that create a safety concern;
- Temporary protection measures when activity is performed at crossings by road authorities or railway companies; and
- Outline requirements for train whistling cessation.

According to the GCR, a road authority must ensure that the requirements are met concerning: (1) the design, construction, and maintenance of a road approach, (2) traffic control devices, (3) the design of a crossing surface, and (4) 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 brush that obstruct the sightlines. Some improvements required to comply with the GCR, such as resurfacing and removing brush to improve sightlines, can be completed within existing maintenance budgets. However, other improvements, such as installing active warning systems and removing structures to improve sightlines, may require specific capital budgets to complete.

The GCR apply to over 23,000 grade crossings (14,000 of which are public) spread across 42,000 km of federally regulated rail lines (1). Currently, these public grade crossings span over 1500 different governing agencies including municipal, provincial, and territorial authorities. Grade crossings accommodate two distinctly different types of infrastructure and represent points of interaction between trains, vehicles, and vulnerable road users. Because of this, grade crossings offer a unique safety and design challenge for road authorities and railway companies.

The GCR aims to bring safety standards at grade crossings to a consistent level across the country and promotes collaboration between road authorities and railway companies to ensure grade crossings can safely accommodate all users. Railroads and road authorities will need to work collaboratively to ensure all existing public crossings meet or exceed the standards set out in the GCR within the next seven years to improve safety at grade crossings for all transportation

users and avoid potential financial penalties. Failure to comply with the new regulations could result in fines of up to \$1 million per day that the safety standards are not met (1).

Although conducting railway grade crossing safety assessments is not new, the requirement to meet the new regulations is a new process. The Canadian Road/Railway Detailed Grade Crossing Safety Assessment Field Guide is a critical reference for meeting the new Regulations.

Additional key documents that have been historically used by practitioners to perform safety assessments of grade crossings include:

- Canadian Railway-Roadway Grade Crossings Standards;
- Pedestrian Safety at Grade Crossing Guide;
- Manual of Uniform Traffic Control Devices for Canada; and
- RTD 10 Road/Railway Grade Crossings, Technical Standards and Inspection, Testing and Maintenance Requirements.

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ENFORCEABILITY OF THE NEW REGULATIONS

A key change in grade crossing safety, as introduced by the GCR, is the requirement of compliance. Rail safety, and performing safety assessments, is not a new concept and many road authorities have experience in grade crossing assessments. However, under the GCR, grade crossing safety is brought to a consistent level across Canada. Further, the safety standards set out through the Regulations and Standards are enforceable and agencies that do not meet them may be fined.

Typically, existing crossings have not been focused on by jurisdictions and are only brought up to RTD10 standards for specific reasons (such as changes in road geometry or traffic volumes), as these standards were voluntary. Under the Regulations, the grade crossing standards are enforceable. The goal of the GCR through making these standards enforceable is to bring public grade crossing safety up to the standards of the rail industry as a whole. Increasing grade crossing safety will lead to a reduction in collisions, fatalities, injuries, property damage, and environmental impacts.

Enforceable safety standards will encourage road authorities and railway companies to meet the safety requirements set out by the GCR. However, meeting these standards will require a high level of effort by these agencies and compliance will be established in three timeframes:

- *Immediately* for all new grade crossings and any crossing that experiences a major change;
- *Two years* after the Regulation came into effect (December 2014) for sharing of critical safety information between road authorities and railway companies;
- *Seven years* after the Regulation came into effect (December 2014) for all existing crossings to meet safety standards on signage, crossing surface, sightlines, warning systems, etc.

Transport Canada is responsible for enforcing the regulations and may issue the following to violators:

- Letter of Non-Compliance;
- Issuing a Notice, or, in the event of extreme circumstances, an Order that prohibits or restricts the use of the crossing;
- Issuing Ministerial Order to construct, alter or maintain a crossing to the standards of the Regulations; and lastly
- Issuing an Emergency Directive to stop using the crossing or modify maintenance practices.

In the event that the road authority or railway company does not adequately respond to any of the above, the regulated party may be prosecuted through an order of any superior court. If the regulated party is prosecuted and convicted, the penalty for a corporation is a maximum fine of one million dollars for each day of non-compliance. The sequence of enforcement and warnings make a fine unlikely to occur. However, the magnitude of effort and cost to upgrade crossings may challenge some road authorities and, as such, planning and allocating resources to such projects should begin as early as possible.

ROLES AND RESPONSIBILITIES

The new GCR clarifies the roles and responsibilities of road authorities and railway companies with the understanding that through clarification, crossing safety will improve. Transport Canada identified that, under the previous voluntary standards, safety at grade crossings was diminished due to the lack of clear roles and responsibilities. Table 1 provides a list of the roles and responsibilities of road authorities and railway companies that will lead to increased communication and planning between the two.

Road authorities will be responsible for all *public at-grade* crossings within their jurisdiction. The new Regulations do not apply to grade separated crossings and road authorities are not responsible for private crossings.

As shown in Table 1, under the GCR, the road authority is responsible for the geometric design and condition of the road approaches, sightlines and drainage along the road RoW. Traffic control devices including approach signs, stop signs, and interconnected devices. In addition, road authorities are responsible for the lighting conditions at grade crossing to ensure a train and warning devices are adequately illuminated for all road users (vehicles, pedestrians, cyclists,

etc.). Further, road authorities are responsible for the maintenance, such as snow removal, to ensure all road users can safely travel through the grade crossing.

INFORMATION SHARING

Under the GCR, road authorities and railway companies are required to collect, tabulate, and share pertinent grade crossing safety information for every grade crossing under their jurisdiction. This information will assist in identifying the safety needs and any deficiencies at existing grade crossings and guide safety assessment and crossing upgrades.

Road authorities and railway companies are required to share information within two years of the GCR coming into force (December, 2014). Road authorities must provide a railway company, in writing, with the information concerning a public grade crossing as listed in Table 2.

Requirements for road design specifications are set out in the GCS. This information includes road classification such as rural or urban and whether the road approach is a local, collector, arterial, expressway, or freeway road. Further characteristics of roads, both rural and urban, are outlined in Table 10-3 and Table 10-4, respectively, in the GCS.

Road authorities will need to collect information to share with railway companies and in return receive information from railway companies to integrate with their own datasets. In some instances, data may not be readily-available or does not currently reflect field conditions. demonstrates the information that must be gathered and shared between road authorities and railway companies. Within *two years* of the new Regulations coming into force, both road authorities and railway companies must have all the information in Table 3 for grade crossings under their jurisdiction.

MEETING THE GRADE CROSSING STANDARDS

The Grade Crossing Standards are incorporated under the new Regulations. The GCR requires that all new crossings or, in the event of major changes, existing crossings meet the standards effective immediately (as of December 2014). All other existing crossings must comply with the standards within seven years of the Regulations coming into force. This will require that the Grade Crossing Standards are met in their entirety and includes:

- Crossing approach and surface;
- Approach and crossing signs;
- Sightlines; and
- Warning systems.

Compliance for the crossing safety features may fall under the responsibility of road authorities or railway companies. Specifically, roadway authorities are responsible for compliance on the following:

- Design, construction, and maintenance of a road approach;
- All traffic control devices not installed on railway crossing infrastructure;
- Design of crossing surfaces; and
- Sightlines within the road RoW and land in the vicinity of the grade crossing.

Sightlines, a specific objective within the GCR, have varying requirements based on the warning system in place at a grade crossing. Passive crossings, those crossing with only railway crossing signs and stop signs, require a larger clear sightline area. At passive crossings this clear sightline must be maintained from a perpendicular distance of five metres from the nearest rail for a stopped vehicle and a distance calculated based on stopping sight distance for approaching vehicles. Figure 2 shows both these scenarios as illustrated by the *Transport Canada Grade Crossing Standards*. The “clear sightline area” must be kept free of any obstruction with the exception of moving or attended railway equipment. Calculations will need to be performed to identify the required clear sightline area and a maintenance plan put in place by road authorities to ensure these areas are kept clear.

In some cases, a permanent structure may have been constructed within the clear sightline area that obstructs a vehicle from being able to see an approaching train. It is likely unreasonable or impossible to remove a structure such as a building and in such cases an upgrade to the crossing warning system from passive to active may be required. Active crossings are required to maintain the clear sightline area shown in the top image of Figure 2. Road authorities will be required to maintain these areas and appropriate changes to maintenance plans will be required to ensure these sightlines remain clear.

APPROACH TO PRIORITIZE RESOURCES TO COMPLY WITH THE GCR

The new Grade Crossing Regulations will result in improved safety at grade crossings at Canada. These safety improvements will require a high level of effort by road authorities and as such, a structured and pragmatic approach should be taken. Two distinct challenges exist for road authorities to meet the Regulations: (1) limited experience, data and/or personnel to meet the information sharing component, and (2) budgetary constraints and the need to prioritize and plan for grade crossing improvements.

Road authorities have varying levels of information for existing grade crossings under their jurisdiction. In some instances, the road authority does not have an up-to-date inventory of existing grade crossings as segments of track or industry connections may have been removed. Further, road authorities may not have records for existing infrastructure and road and sign conditions at grade crossings. Missing or out-of-date information will need to be obtained by field visits to confirm or collect the data required as part of the information sharing component of the new Regulations.

To assist road authorities in meeting the new Regulations, an approach should be taken that informs the road authority of their expected level of effort as quickly as possible to facilitate budgeting and planning purposes. Specifically, a road authority can use the information sharing component of the Regulations (which must be completed within two years of CIF) as a means to prioritize their safety assessment program and begin planning likely required grade crossing improvements.

A first step in developing a strategic plan for complying with the GCR is to conduct an initial study. The following approach, which some jurisdictions have found useful, is presented as guidance for conducting an initial study and which can be adopted or adapted by individual road authorities as desired.

Step 1 – Organize Information Sessions with Transport Canada

Transport Canada is hosting open houses and will meet with road authorities to discuss the requirements of the new Regulations to assist staff in planning and meeting the Regulations. Road authority managers should schedule an information session with their local Transport Canada representative and ensure all appropriate staff attend. It may also be beneficial to invite local consultants to these sessions.

Step 2 – Assess Current Knowledge

As previously mentioned, road authorities do not always have an up-to-date inventory of existing grade crossings or the current field conditions at their crossings. Road authorities should develop an inventory of the grade crossings under their jurisdiction and identify what information, and in what format, they have available to them. This information may include digital databases or hardcopy data of the information requirements outlined in Table 2.

Step 3 – Consolidate Information

In this step, the information identified in Step 2 is consolidated into a single source. Road authorities should develop a digital geospatial database that contains a list of all grade crossings and fields for the required information to be shared with railway companies. During this step, road authorities may discover discrepancies or identify missing information for all or some grade crossings.

Step 4 – Collect Field Data

Field staff should visit each grade crossing during this step to confirm or collection information as per Step 3. Specifically, field staff should collect information on:

- Number of traffic lanes;
- Width of each lane;
- Average approach gradient;
- Presence of a sidewalk and/or multi-use path; and
- Grade crossing surface type and condition.

Conducting field visits to verify and gather information ensures quality control of the information shared with railway companies. Further, this step provides road authorities with the opportunity to gather additional information that can assist in prioritizing full safety assessment efforts and resources. Without requiring a full safety assessment, field staff can assess potential sightline issues for passive crossings where fixed structures obstruct the sightline of an approaching vehicle (see bottom image of Figure 2).

Step 5 – Gather Information from Railway Companies

The new Regulations require railway companies to share rail-related information for each crossing with the respective road authority. The information a road authority should gather for each public grade crossing from railway companies is identified in Table 4. This information must be provided to a road authority under Section 3 of the *Notice of Railway Works Regulations* which requires a railway company to share information within 60 days for prescribed kinds of works such as construction or alteration of road crossings. Further, the new Grade Crossings Regulations require that this information also be shared by the end of two years from the Regulation coming-into-force. Obtaining this information may be a challenge as, traditionally,

this information has been obtained through notices of change. Meeting the two year timeframe on information sharing will require collaboration between road authorities and railway companies. Railway companies will typically have a better understanding of the current status of grade crossings so the information in Table 4 should be requested as soon as possible to help direct road authorities in their efforts.

Information from railway companies that will benefit road authorities include the precise location of the crossing, average annual daily railway movements, and railway design speed. This information helps road authorities locate grade crossings that are still being used or identify defunct crossings, calculate cross products of traffic (which affects the type of warning systems required), and determine clear sightline areas.

Step 6 – Centralize Rail and Road Information

Upon gathering the necessary road authority and railway company information, a central database should be created to store, manage, and disseminate the information as required. In addition to complying with the information sharing component of the GCR, this database can be used to inform planning, engineering, and management decisions concerning transportation systems, city planning, and road safety. Road authorities should identify which users require access to such information and provide the data through an interactive data dissemination tool. Data dissemination tools can be created in a variety of mediums but for municipal-wide, spatial information such as roads, railroads, and grade crossings, geographic information systems (GIS) provide a good opportunity to organize and visualize data.

Figure 3 shows one example of an easy-to-use data dissemination tool developed using GIS software. This example highlights five grade crossings along a two kilometre segment of track using Google Earth®. Each grade crossing icon (shown as a brown square with white rail lines on it) contains the precise location of each crossing along with the centralized road and rail information. The benefits of using Google Earth is that geography, road, and rail information is built into the software and the user can easily search for, and locate, points of interest and street intersections.

As mentioned, each of the grade crossing icons in the mapping environment contain all the road and rail information gathered in the previous steps. Clicking an icon on the map brings up an information balloon with a table that provides data on crossing location along with the required road and rail information. Figure 4 provides an example of what this system could look like using the Google Earth environment. Currently, this system contains only data from the information sharing requirement of the new Regulations in order to meet the two year time frame. One of the benefits of using a system like this is that all data and information gathered from the full safety assessments can be integrated and visualized using a similar approach.

Step 7 – Prioritize Crossings for Full Safety Assessment

Completing steps 1 through 6 can help road authorities comply with the information sharing requirements of the GCR. These steps can also help road authorities identify crossings that may require costly upgrades such as removing structures to meet sightline requirements or installing active warning systems. For example, Step 4 provides preliminary information to identify candidate locations that violate sightline requirements due to the presence of permanent structures. Steps 2 and 5 obtain data for calculating the cross-product of road and rail traffic

volumes which is used as an input for warranting active warning systems. Step 6 centralizes information in a GIS which can help cluster crossings within a geographic proximity. This can benefit a road authority that is planning to outsource safety assessments by efficiently assigning and distributing crossing assessments to multiple consultants. For instance, one cluster could contain only crossings with CP and another only with CN. Categorizing locations according to the level of effort required to comply with the GCR can help road authorities prioritize funding and develop a seven year plan for completing these improvements. Efficiently assigning groups of crossings based on their characteristics to consultants can help ensure road safety assessments are completed in a timely manner.

CONCLUSIONS

Under the new regulations that came into force in December 2014, road authorities and railway companies are required to work collaboratively towards consistent safety standards for all public grade crossings. The GCR makes reference to the GCS, an existing document that promotes best practices in safety standards for grade crossings and gives Transport Canada the ability to enforce these standards. There are three main components and deadlines of the GCR: (1) effective immediately, all new crossings must comply with the GCR; (2) road authorities and railway companies must share safety-related information for grade crossings within two years; and (3) all existing grade crossings must meet the standards set out in the GCR within seven years.

Meeting the timelines provided for compliance with the GCR will require significant effort from road authorities. Many road authorities have established operating and capital budgets in the short and medium term and have limited additional resources available. The GCR may create strains on the resources of road authorities but strategic planning can help road authorities maximize these resources. Conducting an initial study as described in this paper is one approach that can help road authorities develop a strategic plan and start allocating resources and planning for grade crossing upgrades as early as possible.

REFERENCES

1. Grade Crossings Regulations, Canada Gazette, Part II Vol. 148, No. 26 (Ottawa, ON: Government of Canada, December 17, 2014).
2. Grade Crossing Standards (Ottawa, ON: Transport Canada, February 2014)

TABLES

Table 1: Roles and Responsibilities of Road Authorities and Railway Companies

Road authority responsibilities	Railway company responsibilities
<ul style="list-style-type: none"> • Sharing road-related information on grade crossing • Design of crossing surface • Design and maintenance of road approaches up to the railway ties • Sightlines within and adjacent to the road RoW • Drainage along the row RoW • Traffic control devices on road approaches and stop signs at grade crossings (unless the stop sign is attached to a railway crossing sign) • Devices interconnected with crossing warning systems • Lighting devices to ensure trains and other rail equipment are visible to all road users • Snow removal to ensure travel safety for all road users over grade crossings 	<ul style="list-style-type: none"> • Sharing rail-related information on grade crossing • Construction and maintenance of the road surface between the rails and extended to the end of the railway ties • Sightlines with and adjacent to the railway RoW • Drainage along the railway RoW • Grade crossing signs such as railway crossing, number of tracks, emergency notification, stop signs installed on railway crossing signs • Grade crossing warning systems

Table 2: Information Sharing Requirements for Road Authorities as per New Grade Crossing Regulations

<ul style="list-style-type: none"> • Precise location of crossing • Number of traffic lanes at the crossing • Average annual daily traffic • Road design speed • Road classification • Traffic lane width on road approach • Design vehicle used for designing the crossing 	<ul style="list-style-type: none"> • Stopping sight distance • Average gradient of the road approach • Crossing angle • Departure time • Advance activation time • Pre-emption time • Presence of sidewalks, paths, trails and if they are designated for persons with assistive devices
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Table 3: Data Requirements for Safety Assessments

Data	Road Authority	Railway Authority
Precise location of grade crossing	✓	✓
Number of tracks that cross the grade crossing		✓
Average annual daily railway movements		✓
Railway design speed		✓
Crossing angle		✓
Warning system at the grade crossing		✓
Installation of a Stop sign on the Railway Crossing sign		✓
Whistling requirements		✓
Number of traffic lanes that cross the grade crossing	✓	
Annual average daily traffic	✓	
Road design speed	✓	
Road classification	✓	
Width of each traffic lane approaching the crossing	✓	
Design vehicle	✓	
Stopping sight distance	✓	
Average gradient of the road approach	✓	
Departure time	✓	
Advance activation time	✓	
Pre-emption time	✓	
Presence of a sidewalk and design for VRUs with assistive devices	✓	
Grade crossing surface	✓	✓
Posted and travel speed	✓	

Table 4: Information Sharing Requirements for Railway Companies as per New Grade Crossing Regulations

<ul style="list-style-type: none"> • Precise location of crossing • Number of tracks that cross the grade crossing • Average annual daily railway movements • Railway design speed 	<ul style="list-style-type: none"> • Crossing angle • Warning system • Installation of a Stop sign on the Railway Crossing sign • Whistling requirements
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FIGURES

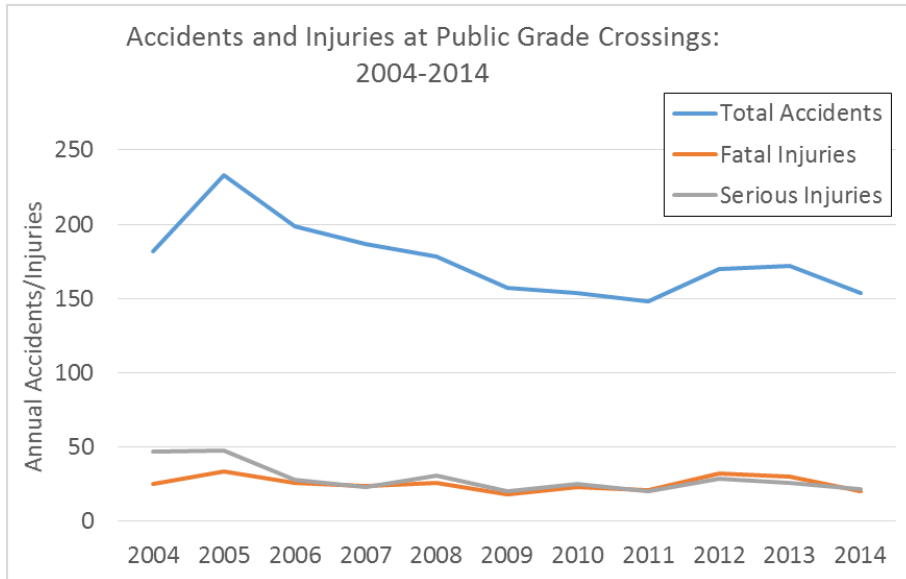


Figure 1: Accidents and Injuries at Public Grade Crossings in Canada (Source: Transportation Safety Board – Rail Data Statistics)

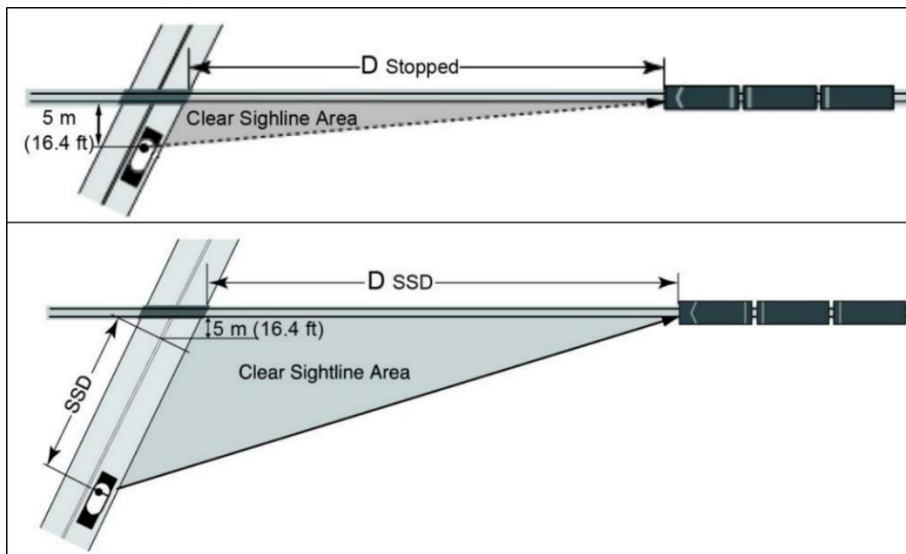


Figure 2: Sightline Clearance Requirements for stopped vehicles (top image) and approaching vehicles (bottom image) (Source: Transport Canada Grade Crossing Standards)

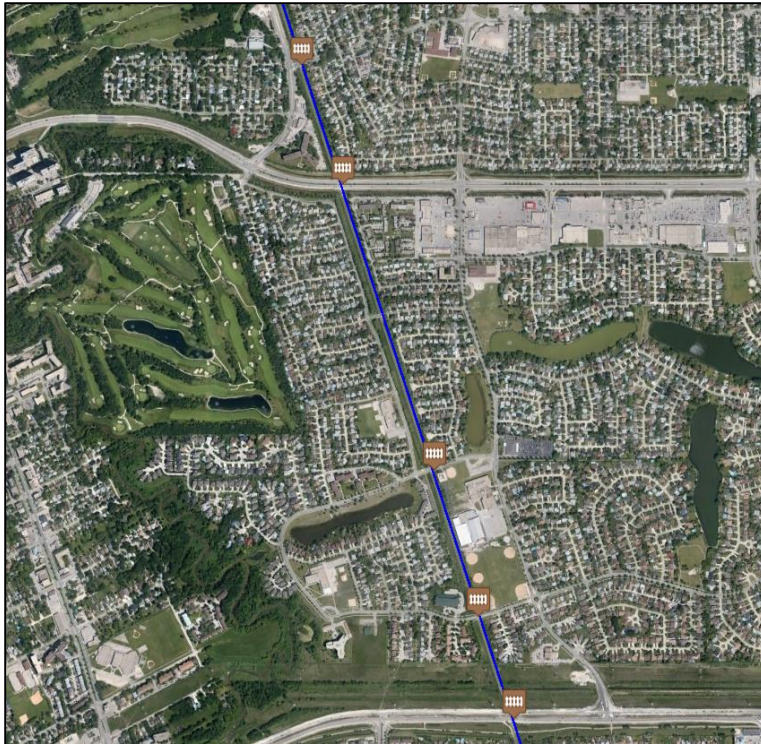


Figure 3: Interactive Data Dissemination Tool for Grade Crossing Information

Grade Crossing Location	
Street	Fermor Avenue
Intersection	Near Archibald and Fermor
Rail Mileage	3.44
Rail Subdivision	Emerson
Longitude	-97.083995
Latitude	49.856366

Road Authority Information	
Road Authority	Winnipeg
Traffic Lanes	4
AADT	25000
Design Speed	70kph
Classification	Arterial
Lane Width	8.15
Design Vehicle	WB 60

Directions: [To here](#) - [From here](#)

Figure 4: Sample Information Balloon for Complete Grade Crossing Information