APPENDIX ‘A’

GWWD Grade Crossing Assessment

ADDENDUM 1

B. WILLSON, JANUARY 10, 2020

WARNING TIMES SPECIFIED IN "PROFESSIONAL CONSULTING SERVICES FOR REPLACEMENT OF RAILWAY CROSSING PROTECTION CROSSING ASSESSMENT" ARE SUPERSEDED BY THE WARNING TIMES DETAILED IN WSP "ISSUED FOR TENDER DRAWINGS".

CITY OF WINNIPEG

PROFESSIONAL CONSULTING SERVICES FOR REPLACEMENT OF RAILWAY CROSSING PROTECTION

CROSSING ASSESSMENT

AUGUST 22, 2019

CONFIDENTIAL

PROFESSIONAL CONSULTING SERVICES FOR REPLACEMENT OF RAILWAY CROSSING PROTECTION

CROSSING ASSESSMENT

CITY OF WINNIPEG

REPORT
CONFIDENTIAL

PROJECT NO.: 18M-00174-00
DATE: AUGUST 22, 2019

WSP
111-93 LOMBARD AVENUE
WINNIPEG, MB
CANADA R3B 3B1

T: +1 204 943-3178
F: +1 204 943-4948
WSP.COM

August 22, 2019

Confidential

City of Winnipeg
Water and Waste Department
Water Planning and Project Delivery
110 – 1199 Pacific Avenue
Winnipeg MB R3E 1G5

Attention: Matthew Skinner, P.Eng.

Dear Sir:

Subject: Assessment of the At-Grade Railway Crossing of the Greater Winnipeg Water District Railway and Trans-Canada Highway No. 1

WSP Canada Group Limited (WSP) is pleased to submit a grade crossing review report for the crossing of the Greater Winnipeg Water District Railway (GWWD) and the Trans-Canada Highway No. 1. The crossing is located at Mile 67.18 (westbound lanes) and 67.27 (eastbound lanes). The crossing is equipped with a cantilever warning system with flashing lights and bells; however, the warning system has not been in service since a truck collided with the control box and one of the cantilevers. The crossing is currently being manually protected by GWWD when a train passes through the crossing. This inspection was carried out assuming that the crossing warning system is in operation.

This grade crossing assessment has been completed as a portion of the Replacement of Railway Crossing Protection Project. This crossing assessment will be used for the development of the design of the new crossing protection to ensure compliance with the current Transport Canada Grade Crossing Regulations and Grade Crossing Standards. The Manitoba Infrastructure Motor Carrier division requires provincially regulated shortline railways to follow all applicable Transport Canada rules, regulations, standards and guidelines. This report can also be used as a guide for future work, not directly related to the signals system that should be performed on the crossing. The deficiencies identified in the report that will not be mitigated by the new crossing warning system should be addressed when the crossing and approaches are reconstructed.

Should you have any questions or comments about any of the information contained within this report, please contact the undersigned at 204.259.5468, or via email at cam.tytgat@wsp.com.

Yours sincerely,
WSP Canada Group Limited

C.J. Tytgat

Cam Tytgat
Manager
Rail & Transit Canada

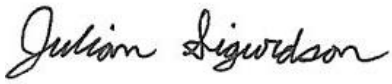
JS/kk

Encl.
WSP ref.: 19M-00938-00

111-93 Lombard Avenue
Winnipeg, MB Canada R3B 3B1
T: +1 204 943-3178
F: +1 204 943-4948

SIGNATURES

PREPARED BY



Julian Sigurdson, E.I.T.
Designer
Rail & Transit Canada

REVIEWED BY

Scott Minty, P.Eng.
Senior Project Manager
Transportation Engineering

PRODUCTION TEAM

CLIENT

Project Engineer	Matthew Skinner, P.Eng.

WSP

Manager	Cam Tytgat
Senior Project Manager	Scott Minty, P.Eng.
Designer	Julian Sigurdson, E.I.T.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 RAIL SAFETY: THE GRADE CROSSINGS REGULATIONS

1.1 GRADE CROSSING SAFETY OVERVIEW

Manitoba Infrastructure's Motor Carrier Division requires all provincial shortline railways in Manitoba to comply with all of Transport Canada's rules, regulations, standards and guidelines that apply to their operations. This requirement includes the Grade Crossing Regulations (GCR) and Grade Crossing Standards (GCS).

Safety at grade crossings is a *shared responsibility* of both railway companies and road authorities. In 2014, after extensive consultations with railway companies, road authorities and private crossing owners, Transport Canada introduced the GCR. The goal of the GCR is to bring a consistent level of safety to all railway grade crossings in Canada by way of the following main three objectives (Transport Canada 2016):

1. Provide comprehensive and enforceable grade crossing safety standards at all new and existing grade crossings in Canada;
2. Clearly defining the roles and responsibilities of both railway companies, road authorities and private authorities; and
3. Promote better communication and greater collaboration between railway companies and road authorities through information-sharing requirements for all public grade crossings.

The following sections provide details of each of the above objectives.

1.1.1 ENFORCEABLE GRADE CROSSING STANDARDS

The first objective of the GCR is to provide clear, comprehensive and enforceable GCS that will work to achieve the ultimate goal of increasing safety at grade crossings in Canada. The GCR achieves this objective by incorporating the GCS into the regulations. The GCS contains clearly defined standards that all grade crossings in Canada must meet, while the GCR provides the timing for when the standards must be in place. For example, all new grade crossings constructed in Canada must comply with the new GCS; changes to an existing grade crossing require that the applicable GCS standard be in place, while existing grade crossings have seven years after the GCR came into force (by November 28, 2021), to be compliant with certain requirements. The seven-year period allows for phased-in implementation of the standards for existing crossings (Transport Canada 2016).

1.1.2 SHARED RESPONSIBILITY

As stated above, grade crossing safety is a *shared responsibility* of the railway companies, road authorities and private authorities. The specific roles and responsibilities have not always been clear in the past, but the GCR seeks to provide clarification by clearly defining the responsibilities of each party.

For public grade crossings, Article 3(1) of the GCR states the following.

A railway company must ensure compliance with the requirements of the GCR respecting:

i. A Railway Crossing Sign, a Number of Tracks Sign and an Emergency Notification Sign;

ii. The maintenance of a Stop Sign that is installed on the same post as a Railway Crossing Sign;

iii. A warning system;

iv. A crossing surface, other than its design; and

v. Sightlines within the railway right-of-way and over land adjoining the railway right-of-way, including the removal of trees and brush that obstruct the sightlines.

A road authority must ensure compliance with the requirements of the GCR respecting:

i. The design, construction and maintenance of a road approach;

ii. Traffic control devices, except for the maintenance of a Stop Sign that is installed on the same post as a Railway Crossing Sign;

iii. The design of a crossing surface; and

iv. 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.

The GCR also provides clarification of the roles and responsibilities for railway companies and private authorities for private crossings, and can be found in Article 3(2) of the GCR.

1.1.3 GREATER COLLABORATION

The third objective of the GCR is to promote better communication and greater collaboration between railway companies and road authorities. It seeks to do this by requiring railway companies and road authorities to share specific critical information about their existing public grade crossings by November 28, 2016, in accordance with GCR Articles 4(1) and 12(1), respectively. Furthermore, both parties must provide written notice when changes are made to a grade crossing, along with details of any changes to the information shared in accordance with the GCR. For railway companies, written notice of changes must be provided to the road authority, in accordance with GCR Articles 5 to 11. For road authorities, written notice of changes must be provided to the railway company, in accordance with GCR Articles 13 to 18 if any of the following take effect:

a) Change in the design vehicle or sightlines;

b) Increase in the road design speed that changes the road approach classification;

c) Location, gradient or crossing angle of a grade crossing has changed;

d) Increase in the absolute gradient of the road approach;

e) Number or width of traffic lanes increase, a shoulder is added or width increased;

f) A traffic signal is installed in which the warning system must be interconnected; and

g) If the road at a public grade crossing is transferred from one road authority to another.

By requiring railway companies and road authorities to share information, better lines of communication will open up and a more collaborative approach to managing grade crossing safety will be the result.

2 REGULATORY REVIEW

2.1 REGULATORY REQUIREMENTS: OVERVIEW

Transport Canada's GCR delineates the regulatory requirements for existing crossings based on timing. The basic requirements, as described by GCR Article 58, are requirements that must be in place immediately; the cumulative requirements, as described by GCR Article 59 and includes the sightline requirements of GCR Article 21, are requirements that must be in place by November 27, 2021. The remaining regulatory requirements refer to standards that become applicable when certain changes are made to an existing crossing, as described by GCR Articles 86 to 91.

This regulatory review will provide a summary of the information exchanged between the railway and the road authority in accordance with GCR Articles 4 and 12; an analysis of the available data, including data collected during the field inspection to determine compliance with the GCR, and provide recommendations for upgrades or mitigations for crossings that are not in compliance, or require upgrades by 2021, to achieve compliance.

2.2 REGULATORY REVIEW: MILEPOST 67.18/67.29

The grade crossing under review is at Mile 67.18/67.29 of the Greater Winnipeg Water District Railway (GWWD). The existing grade crossing has a warning system consisting of cantilevers with flashing lights and bells. However, after a truck struck the eastbound battery box and north side light standard, the warning system has been taken out of service and the crossing has been manually protected. **Table 2.1** below provides information on the grade crossing.

Table 2.1: Grade Crossing Information

RAILWAY SUBDIVISION AND MILEAGE	GREATER WINNIPEG WATER DISTRICT RAILWAY MILE 67.18/67.29
Latitude and Longitude	49°38'59"N, 95°50'19"W
Roadway Name	Trans-Canada Highway No.1
City or Town Name	Rural Municipality of Reynolds
Total Number of Traffic Lanes	4
Annual Average Daily Traffic (AADT) (veh/day)	5380
Grade Crossing Angle (°)	29°
Road Approach Type	Expressway
Path or Sidwalk? (If yes, designated for persons using assistive devices?)	No
Interconnection Time (s)	N/A
Design Vehicle	WB20 Tractor Semi-Trailer – 22.7 m
Number of Tracks	1
Average Annual Daily Railway Movements	1 Train Per Week
Railway Design Speed (Freight and Passenger Trains) (mph)	Freight: 25 mph Passanger: 25 mph
Crossing Warning System Type	Flashing lights and bells (currently warning system is out of service and the crossing is manually protected).

RAILWAY SUBDIVISION AND MILEAGE	GREATER WINNIPEG WATER DISTRICT RAILWAY MILE 67.18/67.29	
Whistling Required?	Yes	
	WESTBOUND APPROACH	EASTBOUND APPROACH
Lane Width (m) (Left)	4.0 m	4.7 m
Lane Width (m) (Right)	3.5 m	4.5 m
Average Approach Gradient (%)	-0.04%	-0.11%
Existing Shoulder Width (m) (Left)	2.3 m	1.9 m
Proposed Shoulder Width (m) (Left)	1.5 m	1.5 m
Existing Shoulder Width (m) (Right)	3.0 m	1.8 m
Proposed Shoulder Width (m) (Right)	3.0 m	3.0 m
Road Crossing Design Speed (km/h)	110 km/h	110 km/h
Departure Time (Design Vehicle) (s)	19.4 s	19.4 s
Departure Time (Pedestrian) (s)	48.4 s	47.5
Stopping Sight Distance (SSD) (m)	366 m	366 m
Waning Time (s)	46 s	46 s

2.2.1 MILE 67.18/67.29 - BASIC REQUIREMENTS – GRADE CROSSINGS STANDARDS PART B

Part B of the GCS outlines the standards that existing crossings must be in compliance with immediately, in accordance with GCR Article 58. For the road authority, the applicable Part B standards relate to the approach width and the crossing surface width in accordance with GCS Article 3.1, which requires that the crossing surface be the same width as the approach, plus a 0.5 m extension on either side. The results of the analysis of the grade crossing at Mile 67.18/67.29 are shown in **Table 2.2**. As shown in the table, the crossing is not currently compliant with GCR 58 and GCS 3.1.

Table 2.2: Mile 67.18/67.29 Review for Compliance with GCR 58 – Basic Requirements

Road Approach Width: Westbound Approach	13.84 m (Average)
Road Approach Width: Eastbound Approach	13.08 m (Average)
Crossing Surface Width: Westbound	25.8 m
Crossing Surface Width: Eastbound	25.9 m
Crossing Surface Extension: Westbound Approach	North Side: <0.5 m South Side: <0.5 m Asphalt crossing surface is only extended to the width of the asphalt. Asphalt crossing surface should be extended a minimum of 0.5 m beyond the edge of the gravel shoulder.
Crossing Surface Extension: Eastbound Approach	North Side: <0.5 m South Side: <0.5 m Asphalt crossing surface should be extended a minimum of 0.5 m beyond the edge of the gravel shoulder.
Railway Crossing Sign	The Railway Crossing Signs that are present satisfy the requirements of GCR 58. The Railway Crossing Sign

	and front lights are missing on the north side of the eastbound lane.
Number of Tracks Sign	Not Applicable.
Reflective Material on Front of Sign	Front of Sign consists of reflective material.

2.2.2 MILE 67.18/67.29 – REQUIREMENTS FOR 2021

Table 2.3 provides a summary of the regulatory review of requirements for 2021, and includes the applicable GCR and GCS reference, a brief description of the parameter being analyzed, the existing conditions, if the existing conditions are in compliance and any recommendations for upgrades or mitigations.

Table 2.3: Summary of Regulatory Review, in Accordance with GCR 59, for the Grade Crossing Located at Mile 67.18/67.29

GCR REFERENCE	GCS REFERENCE	PARAMETER	EXISTING CONDITIONS	COMPLIANCE (YES/NO)	RECOMMENDATIONS
Crossing Surface and Road Approach: General					
Article 60	Article 5.1	Crossing Surface: Smoothness and Continuity.	Poor: Asphalt is chipped on the field side of the rail at both approaches.	No	Replace crossing surface or repair asphalt.
Article 60	Figure 5-1b	Sidewalk, Path or Trail present?	No	N/A	No Recommendation
Article 60	Figure 5-1b	Separation distance between road crossing surface and sidewalk, path or trail crossing surface.	N/A	N/A	No Recommendation
Article 60	Figure 5-1b	If separation distance is less than 1 m, the crossing surface must be continuous.	N/A	N/A	No Recommendation
Crossing Surface and Road Approach: Westbound Approach					
Article 60	Figure 5-1b	Crossing Surface Extension: Road Approach.	North Side: <0.5 m South Side: <0.5 m	No	Crossing surface must be extended at least 0.5 m beyond shoulder width of approaches.
Article 60	Figure 5-1b	Crossing Surface Extension: Sidewalk, Path or Trail.	N/A	N/A	No Recommendation
Article 60	Table 5-1a	Flangeway Width - Minimum: 65 mm Maximum: 120 mm	102 mm	Yes	No Recommendation
Article 60	Table 5-1a	Flangeway Depth - Minimum: 50 mm Maximum: No limit	51 mm	Yes	No Recommendation
Article 60	Table 5-1b	Field Side Gap - Maximum Width: 120 mm Maximum Depth: No Limit	Width: 51 mm Depth: 6 mm	Yes	No Recommendation
Article 60	Table 5-1c	Elevation of top of rail with respect to the crossing surface - Maximum 25 mm above or below.	3 mm Above	Yes	No Recommendation

GCR REFERENCE	GCS REFERENCE	PARAMETER	EXISTING CONDITIONS	COMPLIANCE (YES/NO)	RECOMMENDATIONS
Article 61	Article 6.1	Horizontal and vertical alignment of the road approach and crossing surface must be smooth and continuous.	Good	Yes	No Recommendation
Crossing Surface and Road Approach: Eastbound Approach					
Article 60	Figure 5-1b	Crossing Surface Extension: Road Approach.	North Side: <0.5 m South Side: <0.5 m	No	Crossing surface must be extended at least 0.5 m beyond shoulder width of approaches.
Article 60	Figure 5-1b	Crossing Surface Extension: Sidewalk, Path or Trail.	N/A	N/A	No Recommendation
Article 60	Table 5-1a	Flangeway Width - Minimum: 65 mm Maximum: 120 mm	114 mm	Yes	No Recommendation
Article 60	Table 5-1a	Flangeway Depth - Minimum: 50 mm Maximum: No limit	70 mm	Yes	No Recommendation
Article 60	Table 5-1b	Field Side Gap - Maximum Width: 120 mm Maximum Depth: No Limit	Width: 0 mm Depth: 0 mm	Yes	No Recommendation
Article 60	Table 5-1c	Elevation of top of rail with respect to the crossing surface - Maximum 25 mm above or below.	6 mm Above	Yes	No Recommendation
Article 61	Article 6.1	Horizontal and vertical alignment of the road approach and crossing surface must be smooth and continuous.	Good	Yes	No Recommendation
Signage: Westbound Approach					
Article 63	Article 8.5	Emergency Notification Sign must be parallel to the road or on each side of the grade crossing, facing traffic approaching the grade crossing.	Not Present	No	Install Emergency Notification Sign.
Article 64(1)	-----	Road Crossing Design Speed	110 km/h	Yes	No Recommendation
Article 64(2)	Article 8.4.1	Stop Sign	Not Required	Yes	No Recommendation
Article 65	-----	Stop Sign visibility within SSD	N/A	N/A	No Recommendation
Article 65	Article 8.3.1	Stop Ahead Sign	Not Required	Yes	No Recommendation

GCR REFERENCE	GCS REFERENCE	PARAMETER	EXISTING CONDITIONS	COMPLIANCE (YES/NO)	RECOMMENDATIONS
Article 66(1a)	-----	Railway Crossing Ahead Sign is required if Railway Crossing Sign is not visible within SSD.	Railway Crossing Sign is visible within SSD.	Yes	No Recommendation
Article 66(1b)	------	Vehicle Speed Reduction	Not Required	Yes	No Recommendation
Article 66(2)	Article 8.2	Railway Crossing Ahead Sign and Advisory Speed Tab	Present 140 m from the Stop line.	Yes	No Recommendation
Article 67(1)	-----	Prepare to Stop at Railway Crossing Sign is required if at least one set of front light units is not visible within stopping sight distance or if weather conditions repeatedly obscure visibility of the waring system.	Front light units are visible within SSD.	Yes	No Recommendation
Article 67(2)	Article 18.1	Prepare to Stop at Railway Crossing Sign	N/A	N/A	No Recommendation
Article 67(2)	Article 18.2	Advanced Activation Time	N/A	N/A	No Recommendation
Article 68(1)	Article 13.1	Light units must be installed to ensure a crossing user is within the effective distribution pattern within SSD and is able to see at least one set of front light units clearly.	Light units are clearly visible within SSD.	Yes	No Recommendation
Article 68(1)	Article 13.2	Light units must be installed to ensure a crossing user is within the effective distribution pattern from a stopped position and is able to see at least one set of back light units clearly from each lane.	Back lights are not provided at the crossing.	No	Back lights should be installed such that they are visible from each lane.

GCR REFERENCE	GCS REFERENCE	PARAMETER	EXISTING CONDITIONS	COMPLIANCE (YES/NO)	RECOMMENDATIONS
Article 68(1)	Article 13.3	Cantilever light units are required if DR exceeds 7.7 m, DL exceeds 8.7 m, the road meets the specifications for an expressway, or if the front light units can not be aligned through the center of the approaching traffic lane to the SSD.	Cantilever light units are provided.	Yes	No Recommendation
Article 68(2)	Article 14	Light units must be aligned so that they are visible to road users within SSD.	Light units are visible within SSD.	Yes	No Recommendation
Article 69	Article 16.1	Warning time must be the greatest of 36 s, departure time for design vehicle, the departure time for pedestrians, cyclists, and persons using assistive devices. In this case, warning time must be at least 48.4 s.	46 s at track speed.	No	Warning time must be greater than the departure time for pedestrians, cyclists, and persons using assistive device, which is 48.4 s based on the existing crossing geometry and location of signals.
Signage: Eastbound Approach					
Article 63	Article 8.5	Emergency Notification Sign must be parallel to the road or on each side of the grade crossing, facing traffic approaching the grade crossing.	Not Present	No	Install Emergency Notification Sign.
Article 64(1)	-----	Road Crossing Design Speed	110 km/h	Yes	No Recommendation
Article 64(2)	Article 8.4.1	Stop Sign	Not Required	Yes	No Recommendation
Article 65	-----	Stop Sign visibility within SSD	N/A	N/A	No Recommendation
Article 65	Article 8.3.1	Stop Ahead Sign	Not Required	Yes	No Recommendation
Article 66(1a)	-----	Railway Crossing Ahead Sign is required if Railway Crossing Sign is not visible within SSD.	Railway Crossing Sign south of road is visible within SSD. Railway Crossing Sign north of road is not present.	No	Install Railway Crossing Sign north of road.
Article 66(1b)	------	Vehicle Speed Reduction	Not Required	Yes	No Recommendation
Article 66(2)	Article 8.2	Railway Crossing Ahead Sign and Advisory Speed Tab	Not Required	Yes	No Recommendation

GCR REFERENCE	GCS REFERENCE	PARAMETER	EXISTING CONDITIONS	COMPLIANCE (YES/NO)	RECOMMENDATIONS
Article 67(1)	------	Prepare to Stop at Railway Crossing Sign is required if at least one set of front light units is not visible within stopping sight distance or if weather conditions repeatedly obscure visibility of the waring system.	Front light units are visible within SSD.	Yes	No Recommendation
Article 67(2)	Article 18.1	Prepare to Stop at Railway Crossing Sign	N/A	N/A	No Recommendation
Article 67(2)	Article 18.2	Advanced Activation Time	N/A	N/A	No Recommendation
Article 68(1)	Article 13.1	Light units must be installed to ensure a crossing user is within the effective distribution pattern within SSD and is able to see at least one set of front light units clearly.	Light unit south of road is clearly visible within SSD. Light unit north of road is not present.	No	Install light units north of road.
Article 68(1)	Article 13.2	Light units must be installed to ensure a crossing user is within the effective distribution pattern from as topped position and is able to see at least one set of back light units clearly from each lane.	Back lights are not provided at the crossing.	No	Back lights should be installed such that they are visible from each lane.
Article 68(1)	Article 13.3	Cantilever light units are required if DR exceeds 7.7 m, DL exceeds 8.7 m, the road meets the specifications for an expressway, or if the front light units can not be aligned through the center of the approaching traffic lane to the SSD.	Cantilevers light units are provided on the south side. Cantilever light units are no longer present on the north side.	No	Install cantilever light units on the north side.
Article 68(2)	Article 14	Light units must be aligned so that they are visible to road users within SSD.	Light units are visible within SSD.	Yes	No Recommendation

GCR REFERENCE	GCS REFERENCE	PARAMETER	EXISTING CONDITIONS	COMPLIANCE (YES/NO)	RECOMMENDATIONS
Article 69	Article 16.1	Warning time must be the greatest of 36 s, departure time for design vehicle, the departure time for pedestrians, cyclists, and persons using assistive devices. In this case, warning time must be at least 47.5 s.	46 s at track speed.	No	Warning time must be greater than the departure time for pedestrians, cyclists, and persons using assistive device, which is 47.5 s based on the existing crossing geometry and location of signals.

2.2.3 EXISTING CANTELIVER FOUNDATION LOCATIONS

The GCR identify which sections of the GCS apply to existing grade crossings, new grade crossings, and modifications to grade crossings. Some of the existing locations of the cantilever foundations and road geometry do not satisfy the GCS clearance requirements for new components to a crossing warning system. Remaining in the current condition would not require changes to the locations to satisfy the GCR. However, when the cantilevers are replaced they will be considered new components and according to Article 87(2) of the GCR, new components must satisfy Article 12 of the GCS. Article 12.1 of the GCS specify a minimum clearance of 625 mm from the edge of the shoulder to the clearance line of the signal assembly. On the westbound approach, the north signal currently encroaches 395 mm into the shoulder and the south signal satisfies the current standards. On the eastbound approach, replacing the north signal on the existing foundation would result in the signal assembly encroaching 362 mm into the shoulder and the existing clearance line of the south signal assembly is 165 mm from the edge of the shoulder.

Coordination will be required between the crossing protection replacement design and the road approach design to ensure that in the future condition, the clearance requirements specified in Article 12 of the GCS are met. The signal mast must be at least 1.31 m from the edge of the shoulder to satisfy the clearance requirements.

2.2.4 MILE 67.18/67.29 - SIGHTLINES

The GCR Article 21 outlines the sightline requirements for existing grade crossings. The sightline requirements of GCR Article 21 must be in place by November 27, 2021; however, it is recommended that sightlines be in place as soon as practicable to enhance the safety at the grade crossings. The following section provides a summary of the design parameters involved in determining sightline requirements, lists the required sightlines, and provides an aerial image of the crossing showing the required sightline triangles.

Table 2.4 provides a summary of the design calculations, while **Table 2.5** provides a list of the required $D_{STOPPED}$ values, for each approach at Mile 67.18 (westbound) and 67.29 (eastbound), and recommendations for compliance, as applicable. The $D_{STOPPED}$ value represent the distance along the railway tracks that must be clearly visible from the stopped position (2 m back from the light units).

2.2.5 SIGHTLINES SUMMARY

The review of the existing sightlines found that sightlines are in place for both approaches in either direction. It was noted that trees and shrubs are growing in the northeast quadrant of the westbound approach, and southwest quadrant of the eastbound approach. While these trees and shrubs are currently too low to obstruct sightlines, they

should be monitored and removed as necessary. Refer to **Appendix A** for details on the sightline parameter calculations.

Table 2.4: Summary of Design Parameters and Sightline Requirements for the Grade Crossing at Mile 67.18/67.29

PARAMETER	UNIT	WESTBOUND APPROACH	EASTBOUND APPROACH
Design Vehicle and Length, L	m	WB20 - 22.7	WB20 - 22.7
Clearance Distance, cd	m	59	58
Vehicle Travel Distance, s	m	82	81
Departure Time for the Design Vehicles, T_D	s	19.4	19.4
Departure Time for Pedestrians, Cyclists and Persons, T_P	s	48.4	47.5
Stopping Sight Distance, SSD	m	366	366
Minimum Stopping Sight Distance, T_{SSD}	s	48.4	47.5
Minimum Distance Along a Railway That Must Be Visible from the Stopped Position at Grade Crossing, $D_{STOPPED}$	m	538	528

Table 2.5: Sightline Requirements and Recommendations for Mile 67.18/67.29

SIGHTLINE PARAMETER	REQUIRED	RECOMMENDATION
$D_{STOPPED}$: Westbound Approach Facing North	538 m	Quadrant is clear of obstructions and required sightlines are in place. However, it was observed that there are trees and shrubs that are currently too low to obstruct sightlines, but they should be monitored.
$D_{STOPPED}$: Westbound Approach Facing South	538 m	Quadrant is clear of obstructions and required sightlines are in place.
$D_{STOPPED}$: Eastbound Approach Facing North	528 m	Quadrant is clear of obstructions and required sightlines are in place.
$D_{STOPPED}$: Eastbound Approach Facing South	528 m	Quadrant is clear of obstructions and required sightlines are in place. However, it was observed that there are trees and shrubs that are currently too low to obstruct sightlines, but they should be monitored.

Figure 1: Aerial Imagery of Sightline Triangles

3 CROSSING ASSESSMENT SUMMARY

GCR REFERENCE	GCS REFERENCE	DEFICIENCY	RECOMMENDATIONS
GCR 58 – Immediate Requirements			
Article 58	Article 3.1	The crossing surface is not extended 0.5 m beyond the edge of the shoulder for either of the approaches.	The crossing surface should be extended such that it is at least 0.5 m beyond the edge of the shoulder at both approaches.
Article 58	Article 4.1.2	The north side of the eastbound approach is missing the cantilever, Grade Crossing Sign and front light.	The cantilever with flashing lights and bells (FLB) should be reinstalled prior to the crossing warning system being put back into service.
GCR 60-71 – 2021 Requirements			
Article 60	Article 5.1	The crossing surface is in poor condition on both the eastbound and westbound approaches due to chipping of the asphalt on the field side of the rail.	The asphalt should be repaired or the crossing surface replaced.
Article 63	Article 8.5	An Emergency Notification Sign was not present on either of the approaches.	An Emergency Notification Sign containing information on the location of the grade crossing and the railway company's emergency telephone number must be installed parallel to the road or on each side of the grade crossing, facing the approaching traffic.
Article 68(1)	Article 13.2	Back light units are not provided on either approach.	At least one set of back light units should be installed for each approach such that they are visible from the stopped position.
Article 69	Article 16.1	The warning time was calculated to be 46 s, based on the location of the insulated joints and assuming a track speed of 25 mph.	The warning time must be greater than departure time for pedestrian's, cyclists and persons using assistive devices, which is 47.5 s for the eastbound approach and 48.4 s for the westbound approach.
On-Going Monitoring and Maintenance			
Article 60	Table 5-1a	Flangeway dimensions were observed to be compliant at the time of the inspection.	Flangeways generally fill with dirt, gravel and debris over time, and must be monitored and cleaned as required.
Article 21(2)	Article 7.2	Sightlines were observed to be free of obstructions at the time of the inspection. However, the northeast quadrant of the westbound approach, and the southwest quadrant of the eastbound approach contained significant vegetation that will obstruct sightlines as it grows higher.	Sightlines should be continually monitored and vegetation should be controlled prior to obstructing sightlines.

4 SITE INSPECTION PHOTOS

4.1 WESTBOUND LANE PHOTOS

Date: July 17, 2019	Orientation: West
Description: Westbound crossing taken from east approach. Crossing Sign and light units are visible within SSD.	

Date: July 17, 2019	Orientation: West
Description: Westbound crossing right lane.	

Date: July 17, 2019	Orientation: West
Description: Westbound crossing left lane.	

Date: July 17, 2019	Orientation: Northwest
Description: Westbound sightlines to the north. Sightlines are clear; however, as vegetation grows it will eventually obstruct the sightlines.	

Date: July 17, 2019	Orientation: Southeast
Description: Westbound sightlines to the south. Sightlines are clear.	

Date: July 17, 2019	Orientation: Southeast
Description: Westbound crossing from the south along the rail track. Note: Vegetation in ditch that will eventually obstruct the sightlines.	

Date: July 17, 2019	Orientation: Northwest
Description: Westbound crossing from the north along the rail track.	

Date: July 17, 2019	Orientation: West
Description: Westbound crossing north, crossing the surface extension. Note: Gravel has been built up between rails, but asphalt crossing surface does not extend into shoulder. There is a hole in the gravel at the edge of the asphalt between the rails.	

Date: July 17, 2019	Orientation: West
Description: Westbound crossing south, crossing the surface extension. Note: Gravel has been built up between rails, but asphalt crossing surface does not extend into shoulder.	

Date: July 17, 2019	Orientation: Southeast
Description: Chipped asphalt on field side of rail at the crossing surface. Worst case was 127 mm wide and 102 mm deep.	

4.2 EASTBOUND LANE PHOTOS

Date: July 17, 2019	Orientation: East
Description: Eastbound crossing taken from west approach. Crossing Sign and light units are visible within SSD.	

Date: July 17, 2019	Orientation: East
Description: Eastbound crossing right lane.	

Date: July 17, 2019	Orientation: East
Description: Eastbound crossing left lane. Note: No Crossing Sign or light unit on the left side.	

Date: July 17, 2019	Orientation: Southeast
Description: Eastbound sightlines to the south. Sightlines are clear; however, as vegetation grows, it will eventually obstruct the sightlines.	

Date: July 17, 2019	Orientation: Northwest
Description: Eastbound Sightlines to the north. Sightlines are clear.	

Date: July 17, 2019	Orientation: Northwest
Description: Eastbound crossing from the south along the rail track. Note: Vegetation in ditch that will eventually obstruct the sightlines.	

Date: July 17, 2019	Orientation: Southeast

Description: Eastbound crossing from the north along the rail track.

Date: July 17, 2019	Orientation: East

Description: Eastbound crossing south, crossing the surface extension. Note: The surface does not sufficiently extend beyond the roadway.

Date: July 17, 2019	Orientation: East
Description: Eastbound crossing north, crossing the surface extension. Note: The surface does not sufficiently extend beyond the roadway.	

Date: July 17, 2019	Orientation: East
Description: Chipped asphalt on field side of rail at the crossing surface. Worst case was 51 mm wide and 102 mm deep.	

BIBLIOGRAPHY

- Grade Crossings Regulations (SOR/2014-275). Retrieved from the Justice Laws Website: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2014-275/
- Grade Crossings Standards (January 2019). Retrieved from the Transport Canada Website: https://www.tc.gc.ca/eng/railsafety/grade-crossings-standards.htm
- Determining Minimum Sightlines at Grade Crossings: A Guide for Road Authorities and Railway Companies (2015). Retrieved from the Transport Canada Website: https://www.tc.gc.ca/eng/railsafety/railsafety-978.html
- Grade Crossings Handbook (2016). Retrieved from the Transport Canada Website: https://www.tc.gc.ca/eng/railsafety/grade-crossings-handbook.html

APPENDIX

A DESIGN PARAMETERS AND SIGHTLINE REQUIREMENTS

19M-00938-00 - GWWD Crossing Protection Replacement

Design Parameters and Sightline Requirements for the Grade Crossing at Mile 67.18/67.29

PARAMETER	UNIT	WESTBOUND APPROACH	EASTBOUND APPROACH	REFERENCE/FORMULA
Road Width	m	7.49	9.21	
Angle	degree	29	29	
Sign (Rail)	m	17.3	16.9	
Sign (Road)	m	3.68	2.68	
Road Crossing Design Speed, V	km/h	110	110	
Rail Design Speed, V_t	km/h	40	40	
Road % Stopped	%	-0.12%	0.04%	
Road % SSD	%	-0.04%	-0.11%	
Minimum Sightlines, D_{SSD}	m	162.8	162.4	$D_{SSD} = 0.278\ X\ V_T \times T_{SSD}$
Acceleration Time, t	sec	17.64	17.56	Figure 10-2 - Transport Canada - Grade Crossing Standards
Ratio of acceleration times, G		1.0	1.0	Table 10-1 - Transport Canada - Grade Crossing Standards
Average Travel Speed for Persons, V_p	m/s	1.22	1.22	Article 10.3.3 - Transport Canada - Grade Crossing Standards
Design Vehicle and Length, L	m	22.7	22.7	Table 1 - Transport Canada - Determining Minimum Sightlines at Grade Crossings
Clearance Distance, cd	m	59	58	Figure 10-1 (a) - Transport Canada - Grade Crossing Standards
Vehicle Travel Distance, s	m	82	81	$s = cd + L$
Design Vehicle Departure Time, T_D	s	19.5	19.4	$T_d = 2 + (t \times G)$
Pedestrian Departure Time, T_P	s	48.4	47.5	$T_P = \frac{cd}{V_P}$
Departure Time, $T_{STOPPED}$	s	48.4	47.5	$T_{STOPPED} = the\ greater\ of\ departure\ times\ (T_d\ or\ T_p)$
Stopping Sight Distance, SSD	m	366	366	Table 3 - Transport Canada - Determining Minimum Sightlines at Grade Crossings
Time required for the design vehicle traveling at the design speed to go from the stopping sight distance to completely past the clearance point, T_{SSD}	s	14.6	14.6	$T_{SSD} = \frac{SSD + cd + L}{0.278 \times V}$
Minimum Distance Along a Railway That Must Be Visible From the Stopped Position at Grade Crossing, $D_{STOPPED}$	m	538	528	$D_{STOPPED} = 0.278 \times V_T \times T_{STOPPED}$