Peel Goods Movement

Improvements to At-Grade Rail Crossings:
Prioritizing Crossings for Grade-Separation

A Recommendation Report

Infrastructure Improvement

Part of the Peel Goods Movement Strategic Plan

Action Item #4
Spring 2014
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EXECUTIVE SUMMARY

Purpose

Improving the efficiency of goods movement in and through the Regional Municipality of Peel (Peel or Region) is Peel Term of Council Priority 15. The Peel Goods Movement Task Force (PGMTF) was established in 2009 to realize this goal by advocating for transportation policy and infrastructure that:

- Supports the movement of goods by delivering services quickly and efficiently,
- Maximizes economic opportunities, and
- Reduces associated environmental and community impacts.

The PGMTF's Technical Working Group identified 23 action items to be addressed over five years (2012-16) in response. Action item 4 called for prioritizing at-grade rail crossings on Regional roads for separation.

The purpose of this study is to identify all at-grade rail crossings that occur on Regional roads in Peel and determine which crossings should be prioritized for separation. This would not only satisfy action item 4, but also compliments the Regional Official Plan and Long Range Transportation Plan.

Background

Goods movement makes up a large part of Peel’s economy. There are over 2000 trucking companies in the Region and truck activity in Peel represents 25% of all truck activity in Ontario. When combined with manufacturing, goods movement accounts for 27% of the Region’s employment.

Peel’s roads are congested which affects the reliability and predictability of the movement of goods and people, in turn threatening the Region’s economic competitiveness. As such, infrastructure investments that reduce congestion, such as grade-separation of rail and road intersections, are a priority for the Region.

Findings

After reviewing various grade separation criteria used across North America and beyond and applying them in Peel, two at-grade crossings have been recommended for separation, pending further study, through a feasibility assessment.

Recommendations

As a result of applying a basic exposure index and criteria identified as appropriate for Peel’s context, the following is being recommended:
1. The two at-grade rail crossings located in Bolton, on Coleraine Drive and King Street, should be further studied through a feasibility assessment to evaluate the impact of separation.

   It is important to note that it is not necessary to grade separate these crossings immediately as their exposure indices are currently below Transport Canada’s threshold, but barring any significant unexpected issues grade separation should be considered within the next 10 years.

2. The other 10 crossings that were not identified for further grade separation assessment at this time should continue to be regularly maintained by the Region in accordance with the most current version of Transport Canada’s Road/Railway Grade Crossings Technical Standards and Inspection, Testing and Maintenance Requirements until conditions warrant a reexamination of grade separation needs.
1.0 INTRODUCTION

Improving the efficiency of goods movement within and through the Regional Municipality of Peel (Peel or Region) is Peel Term of Council Priority 15. To meet this priority Peel Regional Council directed staff to facilitate the formation of the Peel Goods Movement Task Force. The mission of the Task Force is to support businesses by advocating for transportation policy and infrastructure that:

- Moves goods and delivers services quickly and efficiently,
- Maximizes economic opportunities, and
- Reduces associated environmental and community impacts.

The Task Force, through its Technical Working Group, identified 23 action items to be addressed over five years (2012-2016). Action item 4 is to prioritize at-grade rail crossings for separation in partnership with Transport Canada, the Canadian National Railway, the Canadian Pacific Railway, the Orangeville-Brampton Railway (OBRY), and Peel’s area municipalities.

In addition to being a Term of Council Priority, both the Regional Official Plan (ROP) and Peel’s Long Range Transportation Plan (LRTP) acknowledge the importance of goods movement. They both seek to efficiently use existing and new Regional transportation infrastructure to enhance economic vitality, sustain long-term growth and minimize adverse environmental and human health impacts caused by transportation.

The purpose of this study is to identify all at-grade rail crossings that occur on Regional roads in Peel and determine which crossings should be prioritized for separation. This would not only satisfy action item 4, but also compliments the Regional Official Plan and Long Range Transportation Plan.

1.1 STUDY CONTEXT

Peel Region is strategically located in the west-central portion of the Greater Toronto and Hamilton Area (GTHA). It is composed of the Cities of Brampton and Mississauga and the Town of Caledon which are referred to as the “area municipalities”. The Region covers approximately 1,254 square kilometers and consists of a diverse range of urban, suburban, rural, agricultural, industrial, commercial and undeveloped land.

Peel is one of Ontario’s fastest growing regions. By 2031, the population is expected to expand by 42%, reaching 1.64 million residents. Employment growth is expected to expand by 64%, from 530,000 to 870,000 workers by 2031. Rapid population and employment growth has, and will continue to, put pressure on Regional roads and infrastructure (1).

Goods Movement

Peel is one of Canada’s most important goods movement hubs. Within the Region there are major arterials and highways that connect the Region to Canadian and US markets, the Toronto Pearson International Airport and both the Canadian National (CN) and the Canadian Pacific (CP) Railway
lines. There is also a major intermodal hub in Mississauga (CN) and two other intermodal hubs located just outside of the Region’s borders, to the east and west.

There are over 2000 trucking companies in Peel, and truck activity in Peel represents 25% of all truck activity in Ontario. Goods movement, when combined with manufacturing, accounts for 27% of Peel’s employment (2).

Peel’s roads are congested which impacts the goods movement industry. Congestion affects the reliability and predictability of the movement of goods and people, thereby threatening the Region’s economic competitiveness.

**Road and Rail Crossings**

Within Peel there are 35 intersections of railway lines (moving people or goods) and Regional Roads. Twenty-three of these intersections are grade separated (above or below ground) and 12 crossings occur at-grade (in the same location and elevation). At-grade rail crossings create conflicts between the movement of goods and people and have an impact on the quality of life in the surrounding communities. At these crossings, two distinct transportation modes meet differing in physical characteristics, speed and purpose. As a result, traffic flows are affected for one or the other transportation mode.

**Key Stakeholders**

Many stakeholders are impacted by this study and its outcomes. They either play a regulatory role or operate or maintain infrastructure in Peel. The stakeholders that were consulted by Peel staff in preparation of the study include:

- Transport Canada
- The Ministry of Transportation
- Metrolinx
- The City of Brampton
- The City of Mississauga
- The Town of Caledon
- Canadian National Railway
- Canadian Pacific Railway
- Orangeville Brampton Railway

**1.2 STUDY APPROACH**

The study began with consultation with CN, CP and OBRY, to identify all at-grade rail crossings on the Region’s roads (map in Appendix A). Next, a literature review was conducted to learn about criteria commonly used to determine whether crossings are candidates for separation. The process then considered the Regional context, the purpose of this study, and various data constraints to determine which criteria are appropriate for local use. Finally, four at-grade crossings in Peel that are candidates for further assessment were identified and two have been recommended for further study to understand the costs and benefits associated with their separation.
2.0 LITERATURE REVIEW

Literature from North America and Australia was reviewed to understand how different criteria have been applied to at-grade rail crossings for determining if they are candidates for grade-separation. The review guided the development of screening criteria for the 12 at-grade rail crossings in Peel to determine which ones should be further assessed and prioritized for separation.

2.1 REVIEW OF LITERATURE AND GUIDELINES

Reports and studies from cities, regions or states that have explicit methods for prioritizing crossings for separation and are applicable to Peel were examined. The reports came from:

- Melbourne, Australia
- Claremore, Oklahoma
- Riverside County, California
- Kern County, California
- Livingston, Montana
- Burlington, Ontario

The following documents and guidelines were also reviewed:

- Pedestrian Safety at Grade Crossing Guide, Transport Canada
- Railroad-Highway Grade Crossing Handbook, US Department of Transportation

Based on the literature review, criteria for prioritizing at-grade rail crossings for separation are shown in Table 1.

Table 1: Criteria for Separation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected vehicular, truck and train volume growth</td>
<td>Melbourne, Australia</td>
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<tr>
<td></td>
<td>Melbourne, Australia</td>
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<tr>
<td></td>
<td>Claremore, Oklahoma</td>
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<td></td>
<td>Riverside County, California</td>
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<td></td>
<td>Kern County, California</td>
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<td></td>
<td>Livingston, Montana</td>
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<tr>
<td>Congestion relief/ travel time savings</td>
<td>Melbourne, Australia</td>
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<td></td>
<td>Melbourne, Australia</td>
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<tr>
<td></td>
<td>Riverside County, California</td>
</tr>
<tr>
<td></td>
<td>Kern County, California</td>
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<td></td>
<td>Kern County, California</td>
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<tr>
<td>Accident reduction</td>
<td>Melbourne, Australia</td>
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<td></td>
<td>Melbourne, Australia</td>
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<tr>
<td></td>
<td>Claremore, Oklahoma</td>
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<td></td>
<td>Riverside County, California</td>
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<tr>
<td></td>
<td>Kern County, California</td>
</tr>
<tr>
<td></td>
<td>Transport Canada’s Pedestrian Safety at Grade Crossing Guide</td>
</tr>
<tr>
<td>Development impacts/future planning projects</td>
<td>Melbourne, Australia</td>
</tr>
<tr>
<td></td>
<td>Melbourne, Australia</td>
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<td></td>
<td>Riverside County, California</td>
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<td>Kern County, California</td>
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<td>Kern County, California</td>
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<tr>
<td>Emissions reduction</td>
<td>Melbourne, Australia</td>
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<td>Riverside County, California</td>
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<td>Kern County, California</td>
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<td>Livingston, Montana</td>
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<td></td>
<td>Burlington, Ontario</td>
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<tr>
<td></td>
<td>Claremore, Oklahoma</td>
</tr>
<tr>
<td></td>
<td>Grade Crossing Handbook</td>
</tr>
</tbody>
</table>
2.2 EXPOSURE INDICES

Many of the jurisdictions reviewed employ an exposure index as a primary screening tool. An exposure index looks at the average number of trains that cross a specific location along a road each day multiplied by the average daily traffic that cross the road at the same location. The resulting rate is objective and allows for crossings to be screened based on volumes of both trains and road vehicles. This approach quickly identifies whether a crossing would benefit from grade separation, based on minimizing traffic related delays and associated economic losses (4) (5) that result from delay.

While the primary inputs of the exposure index are train and vehicular volumes, other measures can also be added depending on the objectives of the study such as train speed, vehicle speed, sight distance, protection factors (gates, lights, signs) and crossing width. Qualitative factors can also be used as input such as the types of vehicles using the crossing (passenger trains, those carrying hazardous goods, etc.) or requests from the public (4). The exposure index can be misleading as the length of the train and the time of day are not considered. Both of these factors can have a significant impact on the overall exposure of the at-grade crossing.

For the purpose of this study, a basic exposure index was used, multiplying the number of vehicles using a crossing by the volume of trains at each crossing. This method has been used by the Town of Milton and York Region (which has 42 at-grade railway crossings on Regional roads) when assessing their at-grade crossings for separation. Transport Canada encourages the use of an exposure index threshold of 200,000 (includes all vehicles not just goods movement vehicles) as one of the factors in determining if a crossing should be funded for separation. None of the 12 crossings considered in this report currently meet this Transport Canada threshold, but some will exceed it in the next ten years.

In its basic form the exposure index is only one level of evaluation. It should be considered with other criteria described previously to determine whether or not to grade separate a crossing.
3.0 CRITERIA APPLIED IN PEEL

Although nine criteria emerged from the literature review, some criteria had more applicability to Peel than others. Table 2 describes the criteria derived from the literature review that were applied to all 12 at-grade crossings and used to determine which crossings required further analysis. Table 3 shows the reasons why other criteria were not considered.
Table 2: Criteria Applied for Prioritizing Locations for Grade Separation

<table>
<thead>
<tr>
<th>Criteria Applied</th>
<th>Applicability to Peel</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing and projected vehicular, truck and train volume (2031)</td>
<td>When considering train volumes at each of the 12 intersections the Region looked at both freight and passenger trains. It is important to note that the CP line in Caledon does not currently handle passenger movements and the OBRY line has a very limited number of passenger/excursion movements. The CN line does handle a large quantity of passenger movements for VIA Rail and GO Transit (for the Kitchener line- formerly the Georgetown line). The scope of this project is inherently focused on goods movement. As such, understanding current vehicular and truck volumes at an at-grade crossing is important to understanding how goods flow through the Region. Projecting those volumes into the future will also be important, as truck and vehicular volumes are expected to grow with new development and demographic changes. Understanding projected growth would allow the Region to predict which at-grade crossings will continue to impact goods movement flows. All railway organizations have indicated to Peel staff that their train volumes will increase in the future. However, no numbers were given at the time this study was complete. When those numbers become available Regional staff will take that into consideration.</td>
<td>Existing and projected train volumes used as input were provided by the respective railway owners. The existing truck and vehicular volumes were based on Average Annual Daily Traffic (AADT) numbers, as well as Automatic Traffic Recorder (ATR) data. Projected volumes were calculated using population and employment forecasts and applied to the traffic volumes in order to project to 2031. Calculations and a description of the process can be found in Appendix B.</td>
</tr>
<tr>
<td>Development Impacts &amp; future planning projects</td>
<td>There are several important land use planning projects to consider in Peel.</td>
<td>Information pertaining development impacts and future planning projects was gathered by Regional staff. Some of the listed projects will be expanded upon later in this report when profiling the crossings selected for</td>
</tr>
</tbody>
</table>
funding and time constraints and low expected ridership. The preferred location for the station is at
the intersection of Humber Station Road and King Street. This will lead to increased traffic flow in
that area in the future.

- **Pits and Quarries (Caledon):** It is estimated that Caledon has a 100 year supply of aggregates
  (bedrock, sand, gravel), indicating that trucks will continue to be needed for extraction and
  transportation. At-grade rail crossings could interfere with the predictable and efficient flow of
  goods into and out of the area.

- **Kitchener GO Transit Line (Brampton):** Formerly the Georgetown Line, the Kitchener line
  extends from Union Station in Toronto to Kitchener and runs through Brampton at peak hours.
  While most of the crossings on Regional roads are separated on this line, the crossings at
  Mississauga Rd. and Winston Churchill Blvd. are not. Further, based on Schedule G of the
  Region’s LRTP, this line will become a full-day service line by 2031 and because of demand,
  Metrolinx plans to expand the Kitchener Line to an all-day, two-way service in the future.

- **Heritage Heights Planning Area (Brampton):** Made up of Secondary Plan area 52 and 53,
  Heritage Heights is being planned to accommodate compact urban residential and commercial
  uses. This is in direct conflict with the presence of at-grade rail crossings.

- **BramWest Parkway (Brampton):** An Environmental Assessment is currently being done for the
  north-south arterial road that will be an extension of Financial Drive from Heritage Road to Winston
  Churchill Boulevard. The BramWest Parkway is intended to address capacity issues in the north-
  western portion of Brampton and potentially around the nearby crossings.

- **The Strategic Goods Movement Network (Peel Region):** The systematic, hierarchical truck
  routes identified within the network will be protected, maintained and designed to accommodate
  heavy truck flows through the Region. Where a truck route intersects with an at-grade rail crossing,
  the flow of goods could be impacted.

- **Meadowvale Conservation Area (Mississauga):** Located south of Highway 407 and north of Old
  Derry Road, this area contains several natural, cultural and recreational resources that may be in
  conflict with at-grade rail crossings.

- **Road Improvements (Peel Region):** To cope with expected congestion and future travel
  demands Peel has initiated a Roads Improvement Program (RIP) to construct and maintain roads
  and structures. To ensure financial efficiencies, it will be important to ensure that any grade-
  separations do not conflict with the improvement programs. For more detail, refer to Section 3 in
  Peel’s Long Range Transportation Plan.

<table>
<thead>
<tr>
<th>Criteria Applied</th>
<th>Applicability to Peel</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>funding and time constraints and low expected ridership. The preferred location for the station is at the intersection of Humber Station Road and King Street. This will lead to increased traffic flow in that area in the future.</td>
<td>further review.</td>
<td></td>
</tr>
</tbody>
</table>
In addition to the above listed criteria, there are other factors that played a role in prioritizing at-grade crossings for separation in Peel:

- **The Orangeville Brampton Railway (OBRY):** Running north-south through the western portion of Peel, the OBRY was formally owned by CP but was closed because there was not enough industry around the line for cost efficiency. Orangeville bought it for their local industry. Currently the line sees an average of 1 train per day and is primarily used for hauling of freight and tourism.

- **Uploading of Roads:** The Region, through the Arterial Road Rationalization Review, is working to upload the ownership of certain roads from the area municipalities. Currently, Coleraine Drive is being reviewed and is expected to be uploaded from Caledon in 2014. With the uploading of roads, the Region will take responsibility of all the municipal infrastructures in the right-of-way, including maintenance of rail crossings.
### Table 3: Criteria Not Applied

<table>
<thead>
<tr>
<th>Criteria not Applied</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion relief/ travel time savings</td>
<td>In order to estimate congestion relief, the length and speeds of the trains are required, along with time of day information. Train length and speed, along with projected train traffic, was requested from the railway corporations. Average speeds and number of cars were provided. While all the railway corporations said that volumes were to increase in the future, only OBRY provided this data. As such, Regional staff could not calculate the impacts based on this information. Rather than looking at congestion relief, vehicular, truck and train volumes were used instead. Maximum delay was estimated using the maximum lengths and number of cars, in order to provide information regarding the worst case delay possible.</td>
</tr>
<tr>
<td>Accident reduction</td>
<td>Accident data shows that there have been very few collisions at crossing locations over the last 5 years, with only one (non-fatal) collision occurring. This indicates that there is no collision trend. Modelled data may be necessary for areas that are identified for development, or if accident rates are otherwise anticipated to increase in the future.</td>
</tr>
<tr>
<td>Emissions reduction</td>
<td>In order to measure emission reductions associated with a grade-separation, the Region would need to understand idling times. Idling times require both train length and speed as critical inputs. In addition, the emissions standards are always changing. Given the assumptions and needed data, this calculation will not yield dependable results for the Region. The need for this calculation can be re-evaluated at a later time, especially since it is a Term of Council Priority to lower greenhouse gas emissions.</td>
</tr>
<tr>
<td>Constructability and the cost of treatment</td>
<td>Depending on the number of crossings shortlisted, the constructability and cost of treatment will be valuable for the Region to understand. This factor should be explored in more detail through a feasibility analysis once the crossings prioritized for separation have been identified. This will allow for the calculation of net present values and benefit-cost ratios, which will help strengthen the ‘go’ or ‘no go’ decision on grade separation.</td>
</tr>
</tbody>
</table>
### Criteria not Applied

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crossing Condition</strong></td>
<td>Maintenance of at-grade crossings may be important to consider for those crossings not being separated. Bumps and irregular surfaces can lead to vehicles slowing down and collisions, especially during inclement weather.</td>
</tr>
<tr>
<td></td>
<td>This factor will be important once the crossings prioritized for separation have been identified. Working with railways and the area municipalities to improve the crossings through design standards will be a cost effective way to allow for improved goods movement flow.</td>
</tr>
<tr>
<td><strong>Emergency vehicle access</strong></td>
<td>The extent to which an at-grade crossing impacts the ability for emergency vehicles to travel to locations of emergencies in a timely manner can be considered. This is a relevant criterion in the event that an emergency occurs on the opposite side of the crossing that a hospital, fire station, etc. is located. This is particularly relevant in future build out areas in and around Bolton. Until those plans are finalized, the Region cannot use this criterion.</td>
</tr>
<tr>
<td><strong>Proximity of nearby crossings</strong></td>
<td>The extent to which nearby at-grade crossings influence traffic operations can be considered. In particular, the grade separation of one crossing could lead to the ability to close a nearby at-grade crossing, thereby eliminating the corresponding maintenance and operations costs. Because of the geographic distribution of Regional Roads, this criterion may not be relevant at this time.</td>
</tr>
<tr>
<td><strong>Current and anticipated transit coverage</strong></td>
<td>The extent to which an at-grade crossing affects transit routes and rail and/or bus schedules can be considered since grade separation may facilitate the ability to improve transit operations and schedules. For example, with two-way-all-day service set to start on the line to Kitchener-Waterloo, the frequency of trains passing through the Winston Churchill crossing (highlighted in Section 4.1) will greatly increase. Given the evolving role of transit investments, this criterion may be better suited for a transit focused discussion rather than a goods movement conversation.</td>
</tr>
</tbody>
</table>
4.0 ANALYSIS

All 12 at-grade crossings in Peel were considered for preliminary screening. A list of those crossings along with their estimated vehicular and truck volumes and train volumes are shown in Table 4. The exposure index based on truck and vehicular volumes are also provided.

As a result of the preliminary screening four crossings were identified for grade separation consideration and described in section 4.1 (detailed profiles can be found in Appendix B) using the criteria established from the literature review.

1. King Street between Humber Station Road and Harvest Moon Drive in Caledon
2. Coleraine Drive between Ellwood Drive West and Manchester Court in Caledon
3. Winston Churchill Boulevard between Wanless Drive and Adamson Street North in Brampton
4. Bovaird Drive between Van Kirk Drive and Gillingham Drive in Brampton

Note that in Table 4 the exposure index for the crossing on Mississauga Road between Bovaird Drive and Wanless Drive is 226,300, which exceeds the Transport Canada threshold. However, this crossing is already slated for grade separation in 2017. Therefore it was not considered as part of this study.

Also note that crossings on the OBRY line were only considered if significant truck traffic volumes were present, as was the case for the crossing at Bovaird Drive (between Van Kirk Drive and Gillingham Drive), which sees the highest truck volumes of the 12 crossings studied. The OBRY line has extremely low train volumes at at-grade crossings so grade-separation is generally not warranted.

Results

After the preliminary screening, crossing profiles shown in section 4.1 were developed for the four crossings identified for further study (more detailed profiles for the locations can be found in Appendix B). While none of these crossings currently exceed the Transport Canada exposure index threshold of 200,000 they were selected for further study due to:

- Planned development growth in close proximity to the crossings in Caledon
- A combination of high volumes of either truck or train traffic combined with automobile traffic in Brampton

The 2031 forecasted truck and total vehicle volumes are summarized in Table 5 and the exposure index was applied to the forecasted volumes. It is important to note that because the Region was unable to obtain data on forecasted train volumes to 2031, the EI estimate is on the conservative side, assuming no train volume increase from now until 2031. This process identified the two crossings recommended for further study:

1. King Street between Humber Station Road and Harvest Moon Drive in Caledon
2. Coleraine Drive between Ellwood Drive West and Manchester Court in Caledon
### Table 4: Detailed Results of At-Grade Crossings Analysis

Note: ORBY = Orangeville-Brampton Railway; CP = Canadian Pacific Railway; CN = Canadian National Railway

<table>
<thead>
<tr>
<th>Owner</th>
<th>Town/City</th>
<th>Regional Road at Railway Line</th>
<th>Limits</th>
<th>Truck Traffic Volumes (Daily, both directions)</th>
<th>Truck Volume (%)</th>
<th>Total Traffic Volumes (Total daily)</th>
<th>Train Volumes (Both directions, total daily, approx.)</th>
<th>Exposure Index (Trucks)</th>
<th>Exposure Index (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBRY</td>
<td>Caledon</td>
<td>Porterfield Rd</td>
<td>Queen Street and Highpoint Side Road</td>
<td>150</td>
<td>5.7%</td>
<td>2,600</td>
<td>1</td>
<td>150</td>
<td>2,600</td>
</tr>
<tr>
<td>OBRY</td>
<td>Caledon</td>
<td>Queen St. E</td>
<td>Main Street and Catherine Street</td>
<td>150</td>
<td>5.7%</td>
<td>2,600</td>
<td>1</td>
<td>150</td>
<td>2,600</td>
</tr>
<tr>
<td>OBRY</td>
<td>Caledon</td>
<td>Olde Baseline Rd</td>
<td>McLaughlin Rd and Chinguacousy Road</td>
<td>60</td>
<td>3.9%</td>
<td>1,600</td>
<td>1</td>
<td>60</td>
<td>1,600</td>
</tr>
<tr>
<td>CP</td>
<td>Caledon</td>
<td>King St</td>
<td>Humber Station Road and Harvest Moon Drive</td>
<td>770</td>
<td>9.3%</td>
<td>8,300</td>
<td>16</td>
<td>12,320</td>
<td>132,800*</td>
</tr>
<tr>
<td>CP</td>
<td>Caledon</td>
<td>Coleraine Dr</td>
<td>Ellwood Dr W and Manchester Court</td>
<td>810</td>
<td>7.3%</td>
<td>11,100</td>
<td>16</td>
<td>12,960</td>
<td>177,600*</td>
</tr>
<tr>
<td>OBRY</td>
<td>Caledon</td>
<td>King St</td>
<td>McLaughlin Rd and Chinguacousy Road</td>
<td>540</td>
<td>8.3%</td>
<td>6,500</td>
<td>1</td>
<td>540</td>
<td>6,500</td>
</tr>
<tr>
<td>OBRY</td>
<td>Caledon/ Brampton</td>
<td>Mayfield Rd</td>
<td>McLaughlin Rd and Robertson Davies Drive/Cresthaven Road</td>
<td>1,020</td>
<td>6.9%</td>
<td>14,800</td>
<td>1</td>
<td>1,020</td>
<td>14,800</td>
</tr>
<tr>
<td>OBRY</td>
<td>Brampton</td>
<td>Bovaird Dr W</td>
<td>Van Kirk Drive and Gillingham Drive</td>
<td>4,800</td>
<td>10.4%</td>
<td>46,700</td>
<td>1</td>
<td>4,800</td>
<td>46,700*</td>
</tr>
<tr>
<td>OBRY</td>
<td>Brampton</td>
<td>Steeles Ave W</td>
<td>Churchville Road and Polonia Avenue</td>
<td>3,610</td>
<td>16.2%</td>
<td>22,300</td>
<td>1</td>
<td>3,610</td>
<td>22,300</td>
</tr>
<tr>
<td>CN</td>
<td>Brampton</td>
<td>Winston Churchill Blvd</td>
<td>Wanless Drive and Adamson Street North</td>
<td>110</td>
<td>4.5%</td>
<td>2,400</td>
<td>31</td>
<td>3,410</td>
<td>74,400*</td>
</tr>
<tr>
<td>CN</td>
<td>Brampton</td>
<td>Mississauga Rd</td>
<td>Bovaird Dr W and Wanless Drive</td>
<td>400</td>
<td>5.5%</td>
<td>7,300</td>
<td>31</td>
<td>12,400</td>
<td>226,300</td>
</tr>
<tr>
<td>OBRY</td>
<td>Miss.</td>
<td>Derry Rd</td>
<td>Envoy Drive and Godwick Drive</td>
<td>2,680</td>
<td>8.8%</td>
<td>30,600</td>
<td>1</td>
<td>2,680</td>
<td>30,600</td>
</tr>
</tbody>
</table>

*Crossings chosen for further analysis, Note: for more details on the calculation, see Appendix B
## 4.1 Crossing Profiles

The following Crossing Profiles provide details about the four crossings identified in the preliminary screening. Additional information can be found in Appendix B.

<table>
<thead>
<tr>
<th>Location &amp; Map</th>
<th>Crossing Characteristics</th>
<th>Land Use</th>
<th>Goods Movement</th>
<th>Other</th>
<th>Growth Forecast</th>
</tr>
</thead>
</table>
| King Street between Humber Station Road & Harvest Moon Drive, Caledon | - CP Railway line  
  - Avg. of 16 freight trains daily  
  - Avg. speed of 40 km/hr  
  - Maximum train length of about 3,700m translates into a maximum delay of up to 100 minutes per day  
  - Highest collision rate, with 7 collisions occurring between 2007 and 2011  
  - All collisions in daylight hours and none with a train; 6 out of 7 were rear-end collisions  
  - Automatic gates and flashing lights are sufficient in protecting pedestrian safety | - Industrial/commercial land use at present and into the future  
  - Nearby land proposed for the Bolton Employment Expansion Area, which could impact vehicular traffic  
  - Close proximity to the Bolton Residential Expansion Study Area  
  - Canadian Tire warehouse and distribution centre proposed for just south of the crossing, which could increase truck volumes  
  - Limited vehicular impact expected  
  - Concerns about the movement of paramedic vehicles from the paramedic station east of the track to residential areas west of the track | - King St. intended to be a primary truck route under the Strategic Goods Movement Network (SGMN)  
  - The Bolton Arterial Road (BAR) is planned to be complete in 2015 and will act as a goods movement route; it will be located just east of the crossing  
  - Significant truck flow expected | - Rail service between Bolton and Union Station is feasible based on estimated population and employment growth, with ridership projected to reach 4,400 daily by 2031  
  - Preferred station location close in proximity to the crossing  
  - Significant truck flow expected | - Annual population / employment growth rates for the area:  
  2011 to 2021: 4.5%  
  2021 to 2031: 3%  
  - Average Annual Daily Traffic (AADT) volumes, all vehicles:  
  2013: 8,300  
  2021: 13,000  
  2031: 17,000  
  - Average Annual Daily Traffic (AADT) volumes, trucks only:  
  2013: 800  
  2021: 1,200  
  2031: 1,600  
  - Exposure index threshold of 200,000 will be reached in less than 10 years assuming the train frequency remains at 16 per day  
  - Canadian Pacific Railway line is expected to grow | |
| Coleraine Drive between Ellwood Drive W & Manchester Court, Caledon | - CP Railway line  
  - Currently not on a Regional road but the Region will assume responsibility for Coleraine Dr. in 2014  
  - Avg. of 16 freight trains daily  
  - Avg. speed of 40 km/hr  
  - Maximum train length of about 3,700m translates into a maximum delay of up to 100 minutes per day  
  - 2 collisions occurred between 2007 and 2011, none involving a passing train  
  - There was a collision with a train in 2012 as a result of the driver driving around the protective gates when they were down in an attempt to pass the train | - Between residential and employment lands  
  - Nearby land proposed for the Bolton Employment Expansion Area, which could impact vehicular traffic  
  - Close proximity to the Bolton Residential Expansion Study Area  
  - Canadian Tire warehouse and distribution centre proposed for just south of the crossing, which could increase truck volumes  
  - Expected further commercial and industrial development | - This portion of Coleraine Dr. is classified as a primary truck route under the Strategic Goods Movement Network (SGMN)  
  - Connections to Highway 50, the Bolton Arterial Road (BAR), and the planned GTA West corridor  
  - Significant truck flow expected | - Preferred station location close in proximity to the crossing  
  - Significant truck flow expected | - Annual population / employment growth rates for the area:  
  2011 to 2021: 4.5%  
  2021 to 2031: 3%  
  - Average Annual Daily Traffic (AADT) volumes, all vehicles:  
  2013: 11,100  
  2021: 17,000  
  2031: 22,000  
  - Average Annual Daily Traffic (AADT) volumes, trucks only:  
  2013: 800  
  2021: 1,200  
  2031: 1,600  
  - Exposure index threshold of 200,000 will be reached in less than 10 years assuming the train frequency remains at 16 per day |
<table>
<thead>
<tr>
<th>Location &amp; Map</th>
<th>Crossing Characteristics</th>
<th>Land Use</th>
<th>Goods Movement</th>
<th>Other</th>
<th>Growth Forecast</th>
</tr>
</thead>
</table>
| **Winston Churchill Boulevard between Wanless Drive & Adamson Street N, Brampton** | - CN Railway line  
- Used for both freight and passenger trains (VIA Rail and GO Transit)  
- 14 passenger trains, 17 freight trains  
- Approx. 31 daily trains  
- VIA Rail: 113 km/hr  
- GO Transit: 93 km/hr  
- Freight Trains: 88 km/hr  
- Passenger trains take barely a minute to cross if travelling at maximum speed  
- Freight trains do not cause significant delays either  
- Maximum delay is approx. 65 minutes per day  
- No collisions associated with this crossing | - Residential neighbourhood with greenbelt lands to the west  
- On border of Heritage Heights planning area  
- Winston Churchill Blvd. is slated to be a character road  
- Intention to include cycling paths, walking trails, trees, and bushes on either side of Winston Churchill Blvd.  
- More pedestrian oriented than goods movement oriented  
- Located in NW Brampton Urban Development Area, which is intended for high density development – could impact traffic volumes | - Not included in the Strategic Goods Movement Network (SGMN) and major truck flows are not anticipated  
- Anticipated that trucks will opt for GTA West and BramWest Parkway instead, after they are completed  
- Possible grade separation would be more for pedestrian safety and commuter convenience than goods movement | - Road improvement on this portion of Winston Churchill Blvd. expected by 2021  
- At that time, additional safety measures for pedestrians at the crossing should be considered  
- Two-way-all-day commuter service expected from Toronto to Kitchener-Waterloo. This will result in an increase in the number of trains that pass through the crossing | - Annual population / employment growth rates for the area:  
- 2011 to 2021: 5%  
- 2021 to 2031: 3%  
- Average Annual Daily Traffic (AADT) volumes, all vehicles:  
- 2013: 2,400  
- 2021: 4,000  
- 2031: 5,000  
- Average Annual Daily Traffic (AADT) volumes, trucks only:  
- 2013: 110  
- 2021: 200  
- 2031: 250  
- Well below exposure index threshold of grade separation  
- Future two-way, all-day GO service on this line will increase delay |
| **Bovaird Drive between Van Kirk Drive & Gillingham Drive, Brampton** | - OBBY line  
- Only one train crosses daily  
- Primarily a tourist function with some freight movement  
- Avg. speed of 40 km/hr  
- Maximum delay is approx. 1.5 minutes per day  
- 4 collisions occurred between 2007 and 2011, none involving a passing train | - Industrial/commercial land use at present and in the future  
- Additional industrial uses expected along Bovaird Dr.  
- Bovaird Dr. is classified as a primary truck route under the Strategic Goods Movement Network (SGMN)  
- Highest vehicular volumes of any crossing in Peel Region | - Members of the Ontario Trucking Association indicated that this crossing was problematic  
- Issues are related more to the crossing surface than the delay associated with passing trains; important to consider the role of the crossing surface on the safety and efficiency of passing vehicles  
- Road improvement on this portion of Bovaird Dr. expected by 2023 | - Annual population / employment growth rates for the area:  
- 2011 to 2021: 4%  
- 2021 to 2031: 2.5%  
- Average Annual Daily Traffic (AADT) volumes, all vehicles:  
- 2013: 46,700  
- 2021: 69,000  
- 2031: 89,000  
- Average Annual Daily Traffic (AADT) volumes, trucks only:  
- 2013: 4,800  
- 2021: 7,000  
- 2031: 9,000  
- Future AADT volumes will not be accommodated on Bovaird Dr. under the current capital improvement plan  
- Well below exposure index threshold of grade separation |
Table 5: 2031 Forecasted Truck, Vehicle and Train Volumes and Resulting 2031 Exposure Index for Four Identified At-Grade Crossings

<table>
<thead>
<tr>
<th>Owner</th>
<th>Town/City</th>
<th>Regional Road at Railway Line</th>
<th>Location</th>
<th>2031 Truck AADT (Both directions)</th>
<th>2031 Vehicular AADT (Both directions)</th>
<th>2031 Exposure Index</th>
<th>2031 Total Daily Train Volumes (Minimum)</th>
<th>Total Maximum Delay due to Trains (Minutes)</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>Caledon</td>
<td>King Street</td>
<td>Bolton</td>
<td>1,600</td>
<td>17,000</td>
<td>272,000</td>
<td>16</td>
<td>100</td>
<td>High</td>
</tr>
<tr>
<td>CP</td>
<td>Caledon</td>
<td>Coleraine Drive</td>
<td>Bolton</td>
<td>1,600</td>
<td>22,000</td>
<td>352,000</td>
<td>16</td>
<td>100</td>
<td>High</td>
</tr>
<tr>
<td>CN</td>
<td>Brampton</td>
<td>Winston Churchill Boulevard</td>
<td>North of the Community of Norval, Halton</td>
<td>250</td>
<td>5,000</td>
<td>155,000</td>
<td>31</td>
<td>65</td>
<td>Low</td>
</tr>
<tr>
<td>OBRY</td>
<td>Brampton</td>
<td>Bovaird Drive West</td>
<td>West of Hurontario Street</td>
<td>9,000</td>
<td>89,000</td>
<td>89,000</td>
<td>1</td>
<td>1.5</td>
<td>Low</td>
</tr>
</tbody>
</table>
4.2 RECOMMENDATIONS

As a result of applying the basic exposure index to 2031 forecasted volumes of vehicle, truck, and train volumes and considering the criteria identified as appropriate for Peel’s context, the following is recommended:

1. The two at-grade rail crossings located in Bolton, the Coleraine Drive crossing followed by the King Street crossing, should be further studied for grade separation.

   It is important to note that it is not necessary to grade separate these crossings immediately as their exposure indices are currently below Transport Canada’s threshold, but barring any significant unexpected issues, grade separation should be considered within the next 10 years.

2. The other 10 crossings that were not identified for further grade separation study at this time should continue to be regularly maintained by the Region in accordance with the most current version of Transport Canada’s Road/Railway Grade Crossings Technical Standards and Inspection, Testing and Maintenance Requirements until conditions warrant a reexamination for grade separation.

5.0 NEXT STEPS

Moving forward, the Region should conduct a feasibility assessments to better understand the costs and benefits associated with separating the Coleraine Drive and King Street at-grade rail crossings in Bolton. The feasibility assessment will explore, but not be limited to, the following:

- Land availability and requirements
- Preliminary design concepts (above or below grade separation)
- Impact on utilities
- Environmental, social and cultural impacts
- Cost estimates and potential funding sources

Cost implications, cost sharing, and alternative strategies should also be considered moving forward. Through a preliminary review it has been noted that the average cost of a grade-separation in Peel is estimated at $10-20 million (including the cost of physical separation, detours, staging, road closures), depending on several factors.

The Region could benefit from the Government of Canada’s $53 billion New Building Canada Plan (NBCP), specifically, the New Building Canada Fund (NBCF), in reduced costs. The NBCF is a ten year program with $14 billion in funding reserved for infrastructure projects that contribute to economic growth and prosperity. Out of this $14 billion, $2.72 billion has been reserved for Ontario projects. Up to one-third of the total grade separation cost could be covered by contributions from the NBCF and each project should be evaluated on a case-by-case basis. The Region should being considering different funding strategies (Appendix D).
Appendix A

Map of Rail Crossings on Regional Roads
Prioritizing Crossings for Grade-Separation Recommendation Report

PEEL REGION GOODS MOVEMENT STRATEGIC PLAN – ACTION ITEM 4
Appendix B
Crossing Profile Details
Crossing Profiles

The following profiles have been created for the four crossings to give context to the at-grade rail crossings that Regional staff feels warrant closer consideration for prioritization. Documentation of the forecasting method and other analyses can be found in Appendix c.

**KING STREET BETWEEN HUMBER STATION ROAD AND HARVEST MOON DRIVE IN CALEDON**

**Figure B-1: King Street between Humber Station Road and Harvest Moon Drive, Caledon**
(Source: Google maps)

Crossing Characteristics

Intersecting King Street between Humber Station Road and Harvest Moon Drive in Caledon, this Canadian Pacific Railway line sees an average of 16 freight trains daily, moving at an average speed of 40km/hr. Of all the at-grade rail crossings occurring on Regional roads, this crossing has seen the highest collision rate, with 7 collisions occurring between 2007 and 2011. None of the collisions were with a train, all occurred in the daylight hours and the majority (6 out of 7) were rear-end collisions. This indicates that the automatic gates and flashing lights used at this crossing to warn drivers of oncoming trains are sufficient in protecting pedestrian safety.
Land Use
The land surrounding this crossing is currently designated as industrial/commercial and will remain industrial/commercial into the future. The Western side of Coleraine Drive has been proposed for the Bolton Employment Expansion Area by the Town of Caledon, which will have industrial and commercial uses. In June 2013 the Provincial government approved the location of a Canadian Tire warehouse and distribution centre at the corner of Coleraine Drive and Healey Road (just south of the crossing), which could increase truck volumes on Highway 50 and surrounding areas.

While this crossing falls within the Bolton Residential Expansion Study Area, based on the preliminary report, it is not anticipated that the expansion area will be located in close proximity to the crossing since Option 1 and 3 have been chosen for further study (see figure below). As a result, limited vehicular impact is expected. It is important to note that there are concerns about the movement of paramedic vehicles from the paramedic station east of the track to residential areas west of the track.

Figure B-2: The Bolton Residential Expansion Study Area
(Source: Town of Caledon)

Goods Movement
In terms of goods movement, King Street is intended to be a primary truck route under the Strategic Goods Movement Network (SGMN), with connectors to Highway 50 and the future planned Bolton Arterial Road (BAR). The BAR is planned to be complete in 2015 and will act as a goods movement route, by-passing the Bolton community. With the presence of the BAR just east of the crossing and the designation of King Street as a primary goods movement road, it is anticipated that there will be significant truck traffic flow in this area.

Other
The Bolton Commuter Rail Service feasibility study has been completed and was released by GO Transit in 2011. Findings indicate that rail service between Bolton and Union Station is technically feasible based on estimated population and employment growth, with ridership projected to reach 4,400 daily by 2031. The feasibility study identified the preferred station location to be at the intersection of King Street and Humber Station Road, which is in close proximity to both the King...
Street and Coleraine Drive crossings. While originally included in MoveOntario 2020 (which subsequently became the Big Move), Metrolinx has not included the Bolton commuter rail within the first or second wave of projects. While no work is expected to occur prior to 2031 on the Bolton commuter line, it is important to consider the increased vehicular traffic as well as train volumes that would be associated with it.

**Growth Forecast**

In order to forecast growth in the Bolton area, which includes both the at-grade crossings at King Street and Coleraine Drive, population, employment, historical traffic trends and impacts of new developments and land use changes were considered. Population from the surrounding traffic super zones was analyzed in order to calculate a population growth rate for the area. Likewise, super zones for the airport and those on the east border of Peel, between Bolton and the airport, were selected in addition to the surrounding areas to calculate the employment growth rate.

Due to its location close to the Peel border, interregional traffic was also a consideration. Since Vaughan and Planning District 9 in Toronto also have industrial lands that will experience growth in the future, they were included in the analysis due to their proximity and connections with the Bolton area. The Canadian Pacific Intermodal Terminal in Vaughan is located just a few kilometers from Peel's border as well, which is a major generator of truck traffic.

A summary of the growth percentages calculated is shown in Table B-1 below. In addition to the increase in traffic from population and employment growth as planned by the Residential Expansion Study and the industrial expansion in the Bolton Area, the construction of the BAR will also change the way King Street is utilized since the BAR acts as a bypass for the Rural Service Centre of Bolton, making it much more convenient for trucks to travel via this area in the future.

<table>
<thead>
<tr>
<th>Period of Growth</th>
<th>2011 to 2021</th>
<th>2021 to 2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Growth Rate</td>
<td>4.5%</td>
<td>3%</td>
</tr>
</tbody>
</table>

The traffic volume projections for King Street yielded a volume of approximately 17,000 daily vehicles, in total for both directions in 2031. This is more than double the volume experienced on King Street today. Approximately 1,600 trucks can be expected on a daily basis in this area for 2031 based on the existing truck volume percentages, as shown in Table B-2. If road capacity remains the same, with no separation, congestion may be diverted to nearby roads.

<table>
<thead>
<tr>
<th>Type of Traffic</th>
<th>Current E/W AADT</th>
<th>Projected 2021E/W AADT</th>
<th>Projected 2031E/W AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>8,300</td>
<td>13,000</td>
<td>17,000</td>
</tr>
<tr>
<td>Truck</td>
<td>800</td>
<td>1,200</td>
<td>1,600</td>
</tr>
</tbody>
</table>

According to the exposure index established by Transport Canada, for the purposes of prioritizing grade separation of at-grade rail crossings, the threshold at which grade-separation is recommended, 200,000 points, will be reached in less than 10 years if the frequency of trains remains at 16 per day. Given the lack of available data train volumes for 2031 were not predicted, implying that this threshold may be reached earlier.

Another factor affecting the truck traffic in this area is the nature of the railway line. Since this railway corridor is a primary Canadian Pacific Railway line, it experiences significantly higher train
volumes, especially when compared to the Orangeville-Brampton Railway (OBRY) line, and is expected to grow and continue to be an important link in the Canadian railway network.

The speed at which the trains travel is dependent on the tracks and track classification (17). The operating speed for all trains throughout this section is 25mph (40km/hr) since it is only used by freight trains, which have a slower operating speed than passenger trains. At a maximum train length of about 3,700m, the delay caused by each train could be up to 6 minutes, totaling 100 minutes a day due to 16 daily trains at each at-grade rail crossing in this area.

**COLERAINE DRIVE BETWEEN ELLWOOD DRIVE W AND MANCHESTER COURT IN CALEDON (REFER TO FIGURE B-1)**

**Crossing Characteristics**
Located on Coleraine Drive between Ellwood Drive West and Manchester Court on the CP line this crossing is currently not on a Regional road (refer to Figure 1). However, through the ARRASC process, Coleraine Drive will be uploaded to the Region from the Town of Caledon by 2014 and the Region will assume responsibility for it. This crossing sees an average of 16 freight trains daily, moving at an average speed of 40km/hr. Between 2007 and 2011 there were two collisions at the railway crossing, none involving a passing train. It is important to note that in 2012 there was a collision with a train however it was due to the fact that the driver drove around the protective gates when they were down in an attempt to pass the train.

**Land Use**
The crossing falls between residential and employment lands. Like the crossing located on King Street, just to the north-west, the most significant land use impact in the area is the new Canadian Tire distribution centre and other planned commercial industrial uses. This crossing also falls within the Bolton Residential Expansion Study Area but will not be in close proximity to the selected expansion area (1 and 3) (Refer to Figure 2 for more detail). Finally, it is important to note that Coleraine Drive is proposed for the Bolton Employment Expansion Area which could impact the number of vehicles passing through the crossing.

**Goods Movement**
This portion of Coleraine Drive is classified as a primary truck route in the SGMN with connections to Highway 50, the BAR and the planned GTA West corridor. The GTA West corridor, which is to run east-west through the northern portion of Peel, is still in its planning stage but will be complete in 2035. With the primary route designation and the presence of planned goods movement corridors, it is anticipated that there will be significant truck flows in this area.

**Other**
Similar to the crossing at King Street, it will be important to consider the impact of the increased vehicular traffic as well as train volumes that would be associated with the Bolton commuter line on the flow of goods around this crossing.

**Growth Forecast**
The rate of growth in traffic for the Coleraine at-grade rail crossing is the same as that on King Street due to the close proximity of their locations in the Bolton area. In order to forecast the increase in traffic at this at-grade rail crossing, the population of the surrounding areas was considered, in addition to the economic growth rate. This was calculated based on the corridors of goods movement that connect to Bolton, including Planning District 9 in Toronto, and the City of Vaughan due to the Canadian Pacific Railway Intermodal Terminal. Other relevant industrial hubs such as the airport in Peel were also used in the analysis.

In Bolton, the employment and residential expansion plans play a major role in the future traffic patterns for this area. Table B-1 (shown above) shows the growth rate calculated for this area and
Table B-3 below summarizes the traffic projections for truck and vehicular traffic. There are 1,600 trucks expected to use Coleraine Drive daily by in 2031, out of a total daily traffic volume of 22,000 for both directions combined. These volumes are twice the volumes experienced on Coleraine Drive today, and are representative of the impact of the BAR.

Table B-3: Summary of Current and Projected Average Annual Daily Traffic (AADT) Volumes for the Coleraine Drive At-Grade Crossing.

<table>
<thead>
<tr>
<th>Type of Traffic</th>
<th>Current E/W AADT</th>
<th>Projected 2021E/W AADT</th>
<th>Projected 2031E/W AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>11,100</td>
<td>17,000</td>
<td>22,000</td>
</tr>
<tr>
<td>Truck</td>
<td>800</td>
<td>1,200</td>
<td>1,600</td>
</tr>
</tbody>
</table>

It should be noted that the King Street and Coleraine Drive rail crossings are both going to reach the threshold for grade separation set by Transport Canada in less than 10 years, at which point separation is strongly recommended. As mentioned for the at-grade crossing at King Street, the train volumes, lengths and speed at this crossing on Coleraine Drive can cause a maximum total delay of up to 100 minutes daily.
WINSTON CHURCHILL BOULEVARD BETWEEN WANLESS DRIVE AND ADAMSON STREET N IN BRAMPTON

Figure B-3: Winston Churchill Boulevard between Wanless Drive and Adamson Street N, Brampton
(Source: Google Maps)

Crossing Characteristics
The at-grade rail crossing located on Winston Churchill Boulevard between Wanless Drive and Adamson Street N in Brampton is owned by the Canadian National Railway. This line, which is used for both freight and passenger (VIA Rail and GO Transit) trains, sees approximately 31 trains daily. The VIA passenger trains travel at an average speed of 113km/hr while the GO Trains travel at a slower speed (93km/hr). The freight trains move at about 88km/hr. There were no collisions reported at this crossing.

Land Use
This crossing falls within a residential neighborhood with greenbelt lands to the west, in Halton. It is also on the boarder of the Heritage Heights planning area, which is made up of Secondary Plan 52 and 53. Through the Preliminary Concept report for Heritage Heights, Winston Churchill Boulevard is slated to be a character road in order to respect the greenbelt lands in Halton Hills. The intention is to have the north-west portion of Winston Churchill Boulevard blend in with high density design by having cycling paths, walking trails, trees and bushes on either side of the road. This indicates that this road will not see significant goods movement but should anticipate higher pedestrian volumes. It is also important to note that, as indicated in Schedule A of Brampton’s Official Plan, this crossing is located in the North West Brampton Urban Development Area, which
is intended for high density development to accommodate growth. As a result, GO train service on the tracks, which is currently run during rush hour times, will increase and could impact traffic flow in the future.

**Goods Movement**
The stretch of Winston Churchill in Brampton is not included in the SGMN, and as such major truck flows are not anticipated. Further, it is anticipated that in the future, with the completion of the GTA West and BramWest Parkway, trucks will opt for those roads rather than Winston Churchill Boulevard. This crossing may not require separation to meet the future needs of goods movement, but rather for pedestrian safety.

**Other**
The Region has developed the Road Improvement Program with the goal of maintaining safe and efficient roads. Within it, Winston Churchill Boulevard between Mayfield Road and just north of Bovaird Drive is scheduled for a road improvement by 2021. As part of that improvement, additional safety measures for pedestrians at the crossing should be considered.

**Growth Forecast**
The growth in traffic at Winston Churchill Boulevard was calculated in a similar way to the crossings mentioned previously. The growth rate was calculated by selecting the bordering Traffic Super Zones and analyzing the increase in population and employment over time, until 2031. The Halton area was not considered in this analysis since it is not expected to contribute to traffic significantly due to lower intensification targets.

The Bramalea and airport super zones were included in addition to the surrounding areas for the employment growth rate calculation. The Bramalea super zone is connected to the area around this crossing well, via Bovaird Drive West, and the growth in employment in the airport super zone may have an impact in this area. Further, historical traffic trends were analyzed using ATR data and were also considered in the growth rate, summarized in Table B-4 below.

Due to the Heritage Heights preliminary concept report and the planned BramWest Parkway, Winston Churchill Boulevard may be given the status of a character road in the future. This creates the possibility that BramWest Parkway, which will have a connection to the GTA West highway in the future, will primarily carry the industrial traffic for this area. It should be noted that the forecasts below in Table B-5 are therefore for the roads in that general area, and not necessarily Winston Churchill Boulevard alone.

<table>
<thead>
<tr>
<th>Period of Growth</th>
<th>2011 to 2021</th>
<th>2021 to 2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Growth Rate</td>
<td>5%</td>
<td>3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Traffic</th>
<th>Current E/W AADT</th>
<th>Projected 2021E/W AADT</th>
<th>Projected 2031E/W AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>2,400</td>
<td>4,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Truck</td>
<td>110</td>
<td>200</td>
<td>250</td>
</tr>
</tbody>
</table>
At 31 trains per day and growing, the projected daily traffic volume of 5,000 vehicles in 2031 is well below the threshold at which grade separation is recommended. The railway line that crosses Winston Churchill Boulevard here is a main line for Canadian National Railway, however, unlike the crossing at King Street and Coleraine Drive, it carries passenger trains in addition to freight.

The speeds at which passenger trains and freight trains move is significantly different, as are the lengths of the trains. Fourteen out of 31 trains are passenger trains on this line, and passenger trains are shorter (at 10 cars) and also move much faster, taking barely a minute to cross if travelling at the maximum speed. Similar to the Canadian Pacific line near Bolton, 17 freight trains use this line per day, however due to the class of the tracks, they travel at more than double the speed, causing shorter delays on the road. The total maximum delay per day for this crossing is 59 minutes, slightly more than half of the crossings in the Bolton area.

BOVAIRD DRIVE BETWEEN VAN KIRK DRIVE AND GILLINGHAM DRIVE IN BRAMPTON

Crossing Characteristics
The crossing located at Bovaird Drive between Van Kirk Drive and Gillingham Drive in Brampton is owned by the OBRY. As mentioned earlier, on average only one train crosses this track daily and serves primarily a tourist function with some freight movement. The average speed of the trains using these tracks is approximately 40km/h. Between 2007 and 2011, four collisions occurred at this crossing and none were with a train.

Land Use
This crossing falls within industrial/commercial lands and will remain industrial/commercial into the future with additional industrial uses expected along Bovaird Drive.

Goods Movement
Bovaird Drive is classified in the SGMN as a primary truck route. It currently has the highest vehicular volumes of any crossing in Peel Region.

Other
It is important to note that when members of the Ontario Trucking Association were surveyed, they indicated that this crossing was problematic. Due to the fact that there is low train frequency, it can be deduced that the issues related more to the crossing surface than the delay associated with passing trains.

This portion of road is also scheduled for road improvements by 2023, as indicated in the Region’s Long Range Transportation Plan. It will be important to consider the role of the crossing surface in the efficiency and safety of trucks and vehicles passing it at that time.

Figure B-4: Bovaird Drive between Van Kirk Drive and Gillingham Drive, Brampton
Source: (Google maps)
Growth Forecast
For both the population and employment growth rate calculations, the Traffic Super Zones bordering the area of this at-grade rail crossing on Bovaird Drive West were included in the analysis. For the employment growth rate, the airport super zone was included in addition to the surrounding areas, as with all other crossings.

A summary of the growth rates calculated is in Table B-6 below. ATR data was used to study historical traffic growth, and a consistent increase in volumes was anticipated. The growth rates calculated for this area closely match this historical increase in traffic. Table 11 below summarizes the projected traffic volumes. Since Bovaird Drive West is already a 6-lane road, further widening of this corridor is unlikely based on current Regional practices, therefore traffic patterns will change once congestion levels increase on this road. Mayfield Road may be a potential alternative for many future origins and destinations in this area. As such, the volumes listed in Table B-7 will not be achieved on Bovaird Drive West alone, but will be dispersed as other communities and roads develop in the vicinity of this crossing.
Table B-6: Annual Growth Rates for the Bovaird Drive West At-Grade Crossing Area

<table>
<thead>
<tr>
<th>Period of Growth</th>
<th>2011 to 2021</th>
<th>2021 to 2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Growth Rate</td>
<td>4%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Table B-7: Summary of Current and Projected Average Annual Daily Traffic (AADT) Volumes for the Bovaird Drive West At-Grade Rail Crossing.

Note that these volumes will not be accommodated on Bovaird Drive West under the current capital improvement plan, and represent the growth for that general area instead.

<table>
<thead>
<tr>
<th>Type of Traffic</th>
<th>Current E/W AADT</th>
<th>Projected 2021 E/W AADT</th>
<th>Projected 2031 E/W AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>46,700</td>
<td>69,000</td>
<td>89,000</td>
</tr>
<tr>
<td>Truck</td>
<td>4,800</td>
<td>7,000</td>
<td>9,000</td>
</tr>
</tbody>
</table>

At approximately just over one train per day in the future, the projected daily traffic volume of 89,000 vehicles in 2031 is well below the threshold at which grade separation is recommended. Given that the use of this railway line is limited to recreational passenger trains and some freight, the lengths of these trains is quite short and crossing time is anticipated to be about 1.3 minutes per train, just once a day. Delays to goods movement due to the rail crossing are therefore not significant in this area.
Appendix C

Detailed Calculations
1.0 TRAFFIC VOLUME MEASUREMENT

The two primary forms of data used in calculations to evaluate the at-grade rail crossings were Average Annual Daily Traffic (AADT), conveying vehicular traffic volumes per day, and Automatic Traffic Recorder (ATR) data, to gather information on the ratio of trucks and cars using the road of interest. These two types of data are described and discussed further below.

1.1 Automatic Traffic Recorder (ATR) Data

Automatic Traffic Recorders collect data on how many vehicles use a particular roadway over a 24-hour period. ATR counts also provide information on the type and speed of vehicles (22). ATR also provides hourly traffic data, which is useful in order to gauge level of congestion during the peak hours of travel.

Data is collected by using rubber tubing that is stretched across a roadway and connects to a counting device. There are approximately 232 ATR stations in Peel Region (22). For the purpose of this study, 2011 ATR data was used for Peel Regional roads, and 2012 data was used for Coleraine Drive. Adjustments in calculations were made as appropriate in order to account for the difference for the one year difference.

1.2 Average Annual Daily Traffic (AADT) Data

Annual Average Daily Traffic is a calculation of the total number of vehicles that pass a certain place in an average weekday of the year. AADT measurements are based on the data collected using Automatic Traffic Recorders (22).

1.3 Preliminary Analysis

AADT and ATR data was used at the initial stage of the study in order to gain information on the busiest Regional roads used for passenger travel and goods movement. For the purpose of this study, the total volume crossing each road-rail intersection was noted, i.e. the combined volumes for east and west, or north and south, travel.

ATR vehicle classification data was used for deriving the truck volume passing each at-grade rail intersection at the closest location possible. These AADT and ATR stations are noted on each intersection profile in chapter 4. Trucks are those vehicles classified from Class 5 to Class 13 in the Federal Highway Administration (FHWA) Vehicle Classification Scheme F Report (23). This is the Regional standard of measurement for truck volumes in the various Transportation groups at Peel.

The percentage of truck volume out of the total volume of traffic, as well as the corresponding truck volumes were used in the preliminary analysis using ATR data, in addition to the AADT. The relationship between these three pieces of data can be described as follows:

\[ V_{trucks} = \%_{truck\ \text{volume}} \times V_{all\ \text{traffic}} \]
Prioritizing Crossings for Grade-Separation Recommendation Report

Where:

\[ V_{\text{trucks}} = \text{volume of truck traffic in trucks/day throughout the day} \]
\[ \%_{\text{truck volume}} = \text{percentage of truck volume out of total traffic volume in the day} \]
\[ V_{\text{all traffic}} = \text{total traffic volume, including trucks, in vehicles/day} \]

Due to the nature of the data, there may be fluctuations in the volumes. This can be attributed due to many factors – weather, road condition, sampling error, equipment condition, or even human error. For this reason, the traffic volumes have been rounded to 3 significant figures, and less where there are lower volumes present.

The Exposure Index (EI), which is sometimes referred to as the cross product, was then calculated using these numbers, providing an approximate ranking for all at-grade rail crossings in Peel. Based on the literature review mentioned previously in section 2.2 of the document, the method for calculation the exposure index is described below.

\[ EI = (V_{\text{all road traffic}})(V_{\text{train}}) \]

Where:

\[ V_{\text{all road traffic}} = \text{volume of all traffic, including automobiles and trucks in vehicles/day} \]
\[ V_{\text{train}} = \text{volume of trains in trains/day} \]

This exposure index was applied to forecasted traffic volumes as well, in order to estimate when the threshold for grade-separation, as set by Transport Canada at 200,000 points, would be reached. It should be noted that no forecasts were done for train volumes, but the respective railway owners have indicated that growth in daily train volumes can be expected.

2.0 TRAFFIC VOLUME FORECASTS

In order to account for future growth in traffic, and land use changes that can trigger changes in travel patterns, traffic volumes and associated increases in truck volumes were forecasted using growth projections.

Existing population and employment data was used to project an annual growth percentage for a particular geographical area, which was then applied to the AADT and truck volumes in order to estimate the volumes in the future. Current and future land designation also played an important role in this process.

Hourly data for the AM peak period was used from the ATR data in order to project congestion levels in the future, by comparing future volume with the future capacity resulting from planned road widening and capital investments. ATR data from previous years was also analyzed, however, with the new developments and evolving land uses in Peel, it may not be a reliable indicator for the future since the construction of new roads, among other changes, cannot be accounted for through this method of forecasting. The data was only used to contribute to the growth rate where applicable, based on professional judgment.
2.1 Exponential Growth

The standard at the Region of Peel is to assume that an exponential growth rate best describes the population growth patterns in Peel, therefore all growth calculations have been made accordingly with the same assumption. The derived formula is explained further below.

Standard Exponential Growth Equation: \( X_t = X_0 (1 + r)^t \)

where:
- \( t \) = time in years, > 0
- \( X_t \) = population at time \( t \)
- \( X_0 \) = initial population at \( t = 0 \)
- \( r \) = growth rate

Therefore, the equation to find the annual growth rate, \( (1 + r) \), is:
\[
(1 + r) = \left( \frac{X_t}{X_0} \right)^{\frac{1}{t}}
\]

2.2 Data by Traffic Super Zones

The estimation for the population and employment growth rates was done by utilizing data organized by geography. The Region is divided into Traffic Analysis Zones, which are then aggregated to form Traffic Super Zones (Figure C-1). The boundary for these zones is based on the land use, which is evident by the larger areas in rural Caledon, and smaller areas in urban Mississauga. The description of each super zone can be found in Table C-1.

The most up-to-date forecasted population and employment numbers were calculated in 2009, for years 2011, 2021 and 2031.
<table>
<thead>
<tr>
<th></th>
<th>Labels of Traffic Super Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bolton</td>
</tr>
<tr>
<td>2</td>
<td>Mayfield West</td>
</tr>
<tr>
<td>3</td>
<td>Caledon S.</td>
</tr>
<tr>
<td>4</td>
<td>Caledon E.</td>
</tr>
<tr>
<td>5</td>
<td>Caledon N.</td>
</tr>
<tr>
<td>6</td>
<td>Caledon Village</td>
</tr>
<tr>
<td>7</td>
<td>Brampton E.</td>
</tr>
<tr>
<td>8</td>
<td>Bramalea</td>
</tr>
<tr>
<td>9</td>
<td>Downtown Brampton</td>
</tr>
<tr>
<td>10</td>
<td>Brampton W.</td>
</tr>
<tr>
<td>11</td>
<td>Wildfield</td>
</tr>
<tr>
<td>12</td>
<td>Snelgrove</td>
</tr>
<tr>
<td>13</td>
<td>Castlemore</td>
</tr>
<tr>
<td>14</td>
<td>NW Brampton</td>
</tr>
<tr>
<td>15</td>
<td>Port Credit</td>
</tr>
<tr>
<td>16</td>
<td>Clarkson</td>
</tr>
<tr>
<td>17</td>
<td>Applewood</td>
</tr>
<tr>
<td>18</td>
<td>Downtown Mississauga</td>
</tr>
<tr>
<td>19</td>
<td>Goodville</td>
</tr>
<tr>
<td>20</td>
<td>Erin Mills</td>
</tr>
<tr>
<td>21</td>
<td>Airport</td>
</tr>
<tr>
<td>22</td>
<td>Commercial</td>
</tr>
<tr>
<td>23</td>
<td>Streetsville</td>
</tr>
<tr>
<td>24</td>
<td>Meadowvale</td>
</tr>
</tbody>
</table>
Figure C-1: Map of Traffic Super Zones for the Region of Peel.
2.3 Population and Employment Growth Rate Estimation

Estimation for the population and employment growth rate is done by selecting the zone of interest where the at-grade rail crossing occurs, as well as catchment areas of potential origins and destinations of trips that may pass through the intersection. Different zones have been selected for the population growth rate calculation and the employment growth rate.

For the employment growth rate, the super zones included in the calculation contain the airport and relevant industrial areas that may be generators of traffic for the industries in the zone of interest. For the crossings in Caldedon, due their proximity to the border with Toronto and Vaughan, relevant areas outside of Peel have been added to the employment totals in order to calculate growth more comprehensively.

2.4 Historical ATR Trend

The ATR data from year 2003 onwards was analyzed to detect relevant trends that would inform traffic growth projections. In some cases, significant growth was noticed, in others, a decline in traffic volumes occurred. That data was not used to predict growth in traffic volumes. Additionally, for certain roads in years 2006 to 2008, data was unavailable due to construction during the data collection period.

Data from many ATR stations surrounding the at-grade rail crossings were analyzed in order to gauge the traffic patterns in the area and indications for increased traffic in the future. From this historical information, the annual exponential growth rate was calculated based on linearly extrapolated traffic volumes for 2021 and 2031 from various stations. Professional judgment was then used to calculate the average growth seen in ATR volumes by choosing the stations that seemed more appropriate based on the growth in volumes and surrounding land uses.

2.5 Traffic Growth Rate Estimation

In order to estimate the growth rate that best describes the increase in traffic by the year 2031, two data sources were primarily considered and weighted to produce one growth rate – population and employment data, and historical ATR data. Since forecasts are based on many assumptions, historical trends can be useful to predict traffic where few land use changes are expected. In most of these areas, however, new development will occur, and aspects such as the planned capital investments and associated road capacities will also need to be taken into account. Similarly, new planned roads will change traffic volumes, such as near the rail crossing at Winston Churchill Boulevard, where it is likely that the future BramWest Parkway will carry most of the industrial vehicles and trucks, leaving Winston Churchill Boulevard to become a character road and support largely passenger traffic based on the Preliminary Plan for Heritage Heights (21).

Road capacities are a limiting factor for traffic growth and need to be acknowledged since growth projections may not be able to reflect these constraints on their own. For example, since Bovaird Drive West is already a 6-lane road, further widening of the road is unlikely, therefore the traffic volumes are constrained by capacity and future traffic will distribute itself onto other roads in the network, in order to reach existing and new destinations in the area.
Together, all these aspects have been considered and the information has been weighted appropriately to reflect potential traffic volumes in 2021 and 2031. These calculations resulted in an AADT equivalent for the year 2031, in order to estimate future volumes in the area. Given the available data, it was assumed that the ratio of trucks and passenger cars on the road would stay consistent.

The ensuing volumes provide a sense of where the investment in grade-separation of an at-grade rail crossing may be most useful. If traffic patterns were to change due to new developments, which would be indicated in the population and employment numbers, these calculations verify that the need for grade separation will not change in the future.

2.6 AM Peak Hour Volumes

Congestion is a major concern for goods movement and would increase substantially if delays due to passing trains were to occur. For this reason, the AM peak hour traffic counts, for all traffic, were studied. A ballpark figure was used as the base to forecast future AM peak volumes, so as to account for intersections where the PM peak volume was greater.

These forecasted AM peak hour volumes were then compared to future lane capacities based on the planned capital improvements scheduled in Peel’s Long Range Transportation Plan (LRTP). This allows a basic ratio of volume to capacity to be calculated in order to provide a sense of how much congestion can be expected, as well as verify if the growth projection is in the correct ballpark range.

The AM peak hour volumes were also compared to the AM Peak forecasts for the Region of Peel, in order to ensure consistency with prior analyses and verify the projected growth rates. These values were similar to those previously estimated for some locations. In the future, detailed work on AM Peak forecasts can be carried out for these locations, such as in the feasibility study, in order to evaluate the impact of the at-grade crossings on congestion.

Impacting as many Peel businesses and residents as possible is an important component of creating the most cost-effective solution for addressing the need for grade-separation. Since the total daily traffic volumes provide the information necessary to analyze and rank these at-grade crossings, the AM Peak estimation was only performed for the sake of comparison with other sources of information, and not to inform the recommendation of this study. Goods movement travel patterns can also vary during the day for different corridors, and off peak travel may be more common. Time savings due to grade separation can be better calculated if this information is derived from detailed local analyses in the future based on the busiest time for trucks, therefore this analysis is more appropriate for the level of detail of the feasibility study.

With more accurate information regarding the arrival rate of vehicles during peak hours, the average delay, rather than the worst-case scenario, and the associated road user costs can be appropriately calculated, and this would provide a better economical perspective regarding the advantages of grade separation at the recommended locations.
2.7 Estimation of Delays

For the purposes of this study, total maximum delay caused by the crossing of trains was estimated based on present day conditions. This implies that the time taken to decelerate, accelerate and wait for the queue of cars to clear was not included, as that would rely on information specific to a particular time of day. This total maximum delay is the time a crossing is closed to vehicular traffic, assuming the train is travelling at its maximum allowable speed, with the maximum number of cars and average daily frequency, as provided by the railway companies and online sources. This, when qualitatively assessed, would be the most likely scenario for a typical train on a typical day, given that the average operating speeds of the trains are very close to the maximum allowable limit, and most trains run by CN and CP have a length between 3 km and 4 km (16).

In general, the railway companies provided the speed of the trains and the train volumes associated with each rail crossing. The length of each car, locomotive, and the train lengths were deduced from correspondence as well as research. This information is summarized below.

<table>
<thead>
<tr>
<th>Regional Road</th>
<th>Daily Freight Train Volume</th>
<th>Freight Train Speed (kmph)</th>
<th>Freight - Max. Cars</th>
<th>Freight - Number of Locomotives</th>
<th>Freight - Max. Length of Car (km)</th>
<th>Max. Delay per Freight Train (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleraine Drive</td>
<td>16</td>
<td>40</td>
<td>140</td>
<td>4</td>
<td>0.026</td>
<td>6.2</td>
</tr>
<tr>
<td>King Street</td>
<td>16</td>
<td>40</td>
<td>140</td>
<td>4</td>
<td>0.026</td>
<td>6.2</td>
</tr>
<tr>
<td>Winston Churchill Boulevard</td>
<td>17</td>
<td>89</td>
<td>140</td>
<td>4</td>
<td>0.026</td>
<td>3.1</td>
</tr>
<tr>
<td>Bovaird Drive West</td>
<td>1</td>
<td>40</td>
<td>20</td>
<td>2</td>
<td>0.026</td>
<td>1.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regional Road</th>
<th>Daily Passenger Train Volume</th>
<th>Passenger Train Speed (kmph)</th>
<th>Passenger - Max. Cars</th>
<th>Passenger - Number of Locomotives</th>
<th>Passenger - Max. Length of Car (km)</th>
<th>Max. Delay per Passenger Train (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleraine Drive</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>King Street</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Winston Churchill Boulevard</td>
<td>14</td>
<td>113 (VIA Train)</td>
<td>10</td>
<td>2</td>
<td>0.026</td>
<td>0.782 (VIA Train)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>93 (GO Train)</td>
<td></td>
<td></td>
<td></td>
<td>0.818 (GO Train)</td>
</tr>
<tr>
<td>Bovaird Drive West</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regional Road</th>
<th>Total Max. Train Crossing Delay per day (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleraine Drive</td>
<td>100</td>
</tr>
<tr>
<td>King Street</td>
<td>100</td>
</tr>
<tr>
<td>Winston Churchill</td>
<td>65</td>
</tr>
</tbody>
</table>
\[ D_{\text{max train}} = \left[ (N_{\text{cars}} + N_{\text{loco}}) \times (L_{\text{avg car}}) \times 60 \text{ mins/h} \right]/S_{\text{train}} + D_{\text{additional}} \]

\[ D_{\text{max total daily train}} = (D_{\text{max freight train}} \times V_{\text{freight}}) + (D_{\text{max passenger train}} \times V_{\text{passenger}}) \]

Where:
- \( D_{\text{max train}} \) = maximum delay caused by a train when travelling at the anticipated speed
- \( N_{\text{cars}} \) = number of train cars
- \( N_{\text{loco}} \) = number of locomotives
- \( L_{\text{avg car}} \) = average length of train car
- \( S_{\text{train}} \) = speed of train

\( D_{\text{additional}} \) = additional delay = 37 seconds, which includes:
- 3 seconds in between the start of the flashing lights and the lowering of the gate;
- 15 seconds for the gate to lower;
- 5 seconds in between the lowering of the gate and the arrival of the train;
- 12 seconds for the gate to raise;
- and 2 seconds for driver perception delay after the lights stop flashing (28)

\( D_{\text{max total daily train}} \) = total delay caused by all trains at the crossing in one day, when travelling at the anticipated speed (maximum), based on average train volumes

\( D_{\text{max freight train}} \) = delay caused by one freight train at the intersection
\( V_{\text{freight}} \) = average number of freight trains passing in a day

\( D_{\text{max passenger train}} \) = delay caused by one passenger train at the intersection
\( V_{\text{passenger}} \) = average number of passenger trains passing in a day

In the future, train volumes and lengths may increase, however the growth in these individual attributes is not as drastic as the growth in vehicular traffic at the intersection. Therefore the train attributes have not been forecasted for 2031. It should be noted that regulations for level or at-grade rail crossings are currently under review by Transport Canada and should be considered to reassess the future volumes and delays for the feasibility study once the review process is complete.
Appendix D

Cost of Separation and Alternatives
COST OF SEPARATION

The average cost of a grade-separation in Peel is estimated at $10-20 million, depending on local conditions such as the angle of intersection and terrain. This estimate includes the cost of the physical separation, along with the cost of detours, staging and road closures. Generally the cost is split between the railway agency and the party requesting separation. Currently Transport Canada does not provide funding for grade separations. However, they are working on finalizing regulations for at-grade crossings.

Under the Canadian Transportation Act, cost issues related to grade separations are mediated by the Canadian Transportation Agency, specifically when the parties involved are unable to reach an agreement. Consideration is given for the benefits of the separation project for each party.

Generally, the costs are apportioned as follows:

1. When separation is required primarily due to road development 85% is paid by the road authority and 15% by the railway company.
2. When road and railway conditions have contributed to the need for the project, the road and railway authorities pay 50% of the costs each.
3. When separation is required primarily due to railway development, 85% is paid by the railway company and 15% by the road authority.

For overhead bridge separations, the road authority pays for maintaining the substructure, superstructure and retaining walls and the railway company covers the cost of all other maintenance issues, such as track structure, drainage and communication devices. For below grade separations, the railway company pays for the maintenance of the substructure and superstructure and the road authority pays the remaining maintenance costs such as retaining walls, road surface, sidewalks and lighting (6).

To reduce its own costs, the Region could benefit from the Government of Canada’s New Building Canada Fund (NBCF). The NBCF is a ten year program with $14 billion in funding reserved for infrastructure projects that contribute to economic growth and prosperity. Out of this $14 billion, $2.72 billion has been reserved for Ontario projects. Generally speaking, up to one-third of the total grade separation cost could be covered by contributions from the NBCF. Each project will be evaluated on a case-by-case basis.

To be considered for the NBCF, the applicant will need to prepare a project proposal and detailed business case with assistance from the Ministry of Infrastructure.

Note that the projects results of the net present value and benefit-cost ratio calculations will play a significant role in Peel’s ability to deliver a winning proposal and business case to the Province. This is significant because if the Region receives funding from the NBCF, cost to the Region will be greatly reduced, resulting in a more favourable net present value and benefit-cost ratio and a stronger case for a ‘go’ decision (24).

Other Cost Considerations

In order to increase federal funding contribution, the Region must work with its area municipalities, Members of Parliament and other partners to establish the case that the grade separation projects are “projects of national priority.” Given the significance of Goods Movement to the Regional, Provincial and national economies, the importance of the case for increased federal contribution must be elevated so that all parties that benefit from the project also contribute to the costs.
ALTERNATIVES

In addition to grade separation, there are several alternatives that allow for improved traffic flow at railway crossings at lower costs. Below is a list of those alternatives, an explanation of their costs and benefits, and their applicability in Peel.

**Elimination**

According to the US Federal Highway Administration Grade Separation Handbook, elimination of a “redundant or unneeded” crossing should always be considered as the first alternative for treating an at-grade rail crossing. This can be done through closing the crossing to traffic or through the abandonment or relocation of the railway line. Not only does this allow for the highest level of safety by removing the point of intersection, but can also have the potential to improve traffic flow and reduce maintenance costs (of both the surface and traffic control devices associated with the crossing) (4).

Despite the obvious safety benefits, there are some operational and construction costs to this alternative. Whenever a crossing is closed, it is important to consider the impact of the traffic diversion on nearby roads. If a closure is coupled with upgraded traffic control devices, effects can be mitigated.

It is unlikely that in Peel the CN or CP rail lines will be removed as the volumes of freight and passenger trains are expected to increase. The OBRY, although not used heavily for freight is likely to remain as a tourism and leisure line, getting between 8 and 12 trains weekly by 2031 (currently 4-8 trains per week).

**Road Relocation**

Relocating a road can lessen the impact of a crossing on communities surrounding it in terms of vehicular delays and related emissions, noise and safety. Further, the process of relocating a crossing can be beneficial to community improvement. The cost can be prohibitive for relocation as it would require completely rebuilding railway facilities (including tracks), the acquisition of land rights, construction of drainage structures and putting up new signals. Prior to relocating a crossing, it is important to weigh the costs against the benefits (4).

In Peel, there are very few at-grade crossings on Regional roads that run through residential neighborhoods. Rather than relocating roads, it is recommended that future zoning be such that new railway corridors should be isolated from residential and commercial activity.

**Passive Traffic Control Devices**

Passive traffic control devices provide static warning messages and in some cases actions for vehicular drivers to react to as they approach the crossing. They are aimed at providing drivers with a warning that they are approaching a crossing and that precaution should be taken. Some passive traffic control devices include regulatory signs, warning signs, guide signs and pavement markings (4).

Passive traffic control devices improve safety conditions around a crossing and can also increase vehicle flow by reducing the chances of a collision at a crossing. Passive traffic control devices should be placed at a distance that allows the driver enough time to comprehend and react to signage. It is important however, that drivers understand the message conveyed on the sign in order to comply with it.

Currently in Peel all at-grade crossings on Regional roads have a passive traffic control device associated with them.
Active Traffic Control Devices

Active traffic control devices are designed to give drivers advanced notice of approaching trains and are activated when a train passes over a detection circuit in the track. In some situations, there is a manual control that is used. They are often accompanied by signs or pavement markings (passive control devices). Active traffic control devices differ from passive control devices by alerting passing and approaching motorists when a train is coming. They can include flashing lights, cantilevered flashing lights, and automatic gates (4) (7).

All at-grade crossings on Peel Regional roads have an active traffic control device. All crossings have flashing lights while only four have automatic gates. These types of warning systems help with relieving traffic delays associated with crossings, as well as safety and environmental concerns. It is recommended that the Region consider putting up automatic gates at the crossings that do not already have them.

Maintaining the Crossing

By maintaining a smooth intersection of railroad track and roadway, vehicular traffic can flow much more efficiently through at-grade rail crossings. If the profile of a track is too rough cars and trucks tend to slow down to avoid causing damage to the vehicle or losing control. These slowdowns can lead to delays and back-ups regardless of whether a train is crossing the track. Further, if a vehicle has to slow down suddenly when crossing over the tracks, collisions with other vehicles could result (15).

Transport Canada has established a set of standards for at-grade crossings, including standards for the crossing surface. One such standard dictates that the “profile and elevation of the grade crossing surface and the rest of the road shall match and safely accommodate the maximum road operating speed …” Further, it indicates that the surface of the road approaching the at-grade crossing “shall be maintained in good condition for the maximum road operating speeds, including clearance of snow and ice or adequate treatment with abrasives” in order to allow vehicles to stop safely within the sight distance of the crossing and to start from a stopped position to move safely over the tracks (8).

The Region of Peel currently maintains their at-grade rail crossings based on the above mentioned guidelines through visually monitoring the crossings for potholes and erosion. When the “ride-ability” of the road is compromised, the Region will work with the owner of the tracks to repair the infrastructure. The Region is always working to try new solutions to make the track/road intersection safer, such as using rubber paneling.
Appendix E

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