Final Report

Beamsville Truck By-Pass Implementation Study

Prepared for Town of Lincoln
by IBI Group

October 28, 2021

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1 Introduction

The Town of Lincoln, together with Niagara Region, is conducting a study to evaluate a truck by-pass route that would divert truck traffic away from downtown Beamsville and to provide recommendations for the by-pass route's implementation. The route would divert truck traffic away from Ontario Street and King Street in downtown Beamsville to Bartlett Road to the east, South Service Road to the north and Durham Road to the west. IBI Group is assisting the Town and Region with the by-pass implementation study.

One of the most important ways to have truck drivers follow the proposed truck by-pass route once implemented will be to implement a clear and intuitive signage strategy, potentially supported by other strategies.

This report includes the following sections:

- **Background**: review of background documents with policies, plans or background information relating to the corridors of interest;
- **Existing Conditions**: summary of existing traffic, description of existing truck travel patterns in the area, and safety review;
- **Policies and Strategies**: truck route signage, the issue of truck inspection scale avoidance and potential strategies to address, and recommended strategies for the by-pass route;
- **Operational Assessment**: summary of field review, truck diversion, intersection operational assessment, improvements to railway grade crossings, street lighting improvements, active transportation plan, and traffic noise study; and
- Conclusions and Recommendations: summary of study findings and proposed implementation plan.

2 Background

As part of this task, five reports were reviewed in order to extract policies, plans, or background information relating to the road corridors that are part of the proposed truck by-pass.

2.1 Town of Lincoln Transportation Master Plan (WSP 2019)

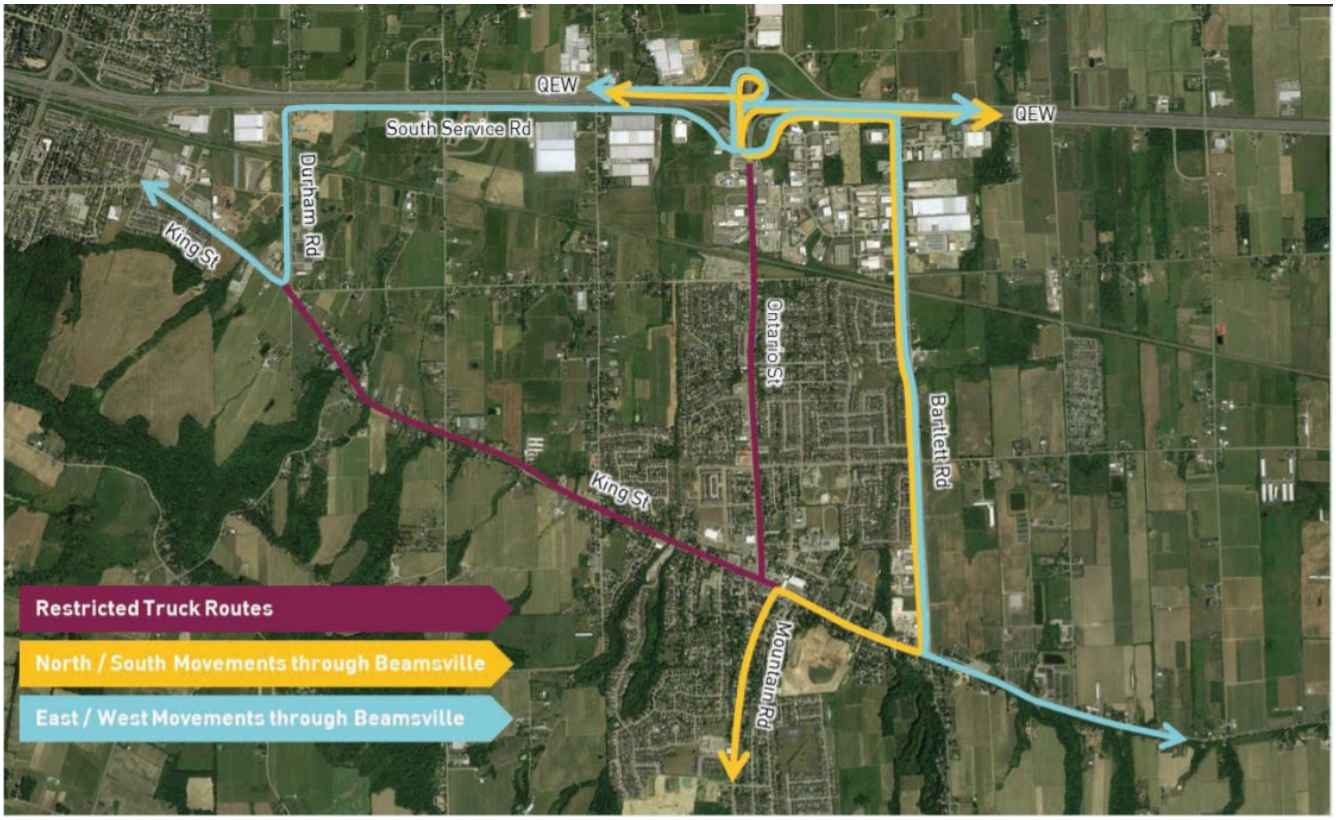
The objective of the Town of Lincoln's Transportation Master Plan (TMP) was to develop an understanding of travel patterns and behavior to, from and within Lincoln, and to ensure that adequate transportation networks are provided to meet the travel demand.

The following are key findings and recommendations of this study that are applicable to the proposed truck by-pass:

- Goods Movement:
  - Truck traffic along Ontario Street, King Street and Mountain Street within Beamsville are creating operational and safety concerns for road users and residents, especially in the downtown area.
  - A truck route network for Lincoln should be created that bypasses downtown Beamsville, as shown in **Exhibit 2.1**;
    - The proposed bypass would detour trucks around Beamsville to and from King Street via Durham Road, South Service Road, and Bartlett Road.
  - Support any remaining studies, implementation, and construction of the Park Road to Bartlett Road connection to the QEW;
  - Work with the Region to develop and implement traffic safety improvement measures;
  - Work with the Ministry of Transportation of Ontario (MTO), Niagara Regional Police and the Region to initiate frequent truck safety inspection / enforcement blitzes;
  - Develop enforcement strategies with MTO and the Region for truck traffic bypassing of the QEW inspection station; and
  - After the Park Road / Bartlett Road, Grimsby connection is open, transfer Mountain Street / Mountain Road (RR 18), between Fly Road (RR 73) and King Street (RR 81), from the Region's control to the Town and prohibit trucks on this section of Mountain Street / Mountain Road (RR 18).

- Road Network:
  - Bartlett Road modifications from King Street (RR 81) to South Service Road;
  - Durham Road modifications from King Street to South Service Road; and
  - King Street (RR 81) and Mountain Road intersection improvements.

Exhibit 2.1: Proposed Truck Routing within Beamsville



Source: Figure 18, *Town of Lincoln Transportation Master Plan* (WSP/Town of Lincoln 2019)

2.2 Town of Lincoln Active Transportation Strategy (WSP 2019)

As part of the Town of Lincoln TMP, the intent of the Active Transportation Strategy study (ATS) was to provide the Town with the processes and tools to address the demand for infrastructure, programs and initiatives that support alternative forms of transportation.

The following are key findings of this study, applicable to the proposed truck by-pass:

- A paved shoulder is proposed along Bartlett Road, from South Service Road to King Street (RR 81);
- A buffered bike lane is proposed along King Street (RR 81), from Bartlett Road to Mountain Street (RR 18); and
- Mountain Street / Mountain Road (RR 18), from King Street (RR 81) to Spring Creek Road, is proposed to be a signed bike route.

2.3 Niagara Escarpment Crossings Traffic Operations and Safety Study (Wood 2019)

This study was undertaken to evaluate the traffic operations and controls across the Niagara Escarpment along with the development of strategies to improve the roadway design for the north-south crossings.

The following are key findings and recommendations of this study that are applicable to the proposed truck by-pass:

- At the Mountain Street (RR 18) / King Street (RR 81) intersection:
  - Strategic property acquisition should be considered at the south-west quadrant of the intersection to facilitate safer and wider turning of heavy vehicles; and
  - Install bollards at the south-west corner of the intersection to provide safety to pedestrian waiting to cross and to also restrict larger vehicles from mounting the curb and sidewalk platform;
- Based on the Origin-Destination Surveys, local trips are a significant contributor to heavy vehicle traffic in the area;
- Speeding is a concerning problem at the majority of the data collection points;
- There is inconsistency in the road geometry along the length of Mountain Street / Mountain Road (RR 18); and
- Road signage and markings within the study area were observed to be under-maintained and inconsistent.

2.4 Niagara Region Transportation Master Plan (IBI Group 2017)

This study was conducted to identify and adopt a strategic transportation vision that incorporates these priorities and addresses the key trends expected to impact the Region.

While the study does not speak directly to the proposed truck by-pass, the following is noted related to commercial vehicle movement in Niagara Region:

There is an opportunity for Niagara Region to lay the groundwork for allowing autonomous and connected trucks to effectively operate in the region through strategic initiatives and policy. This includes fostering the testing of these vehicles and maintaining the Region's infrastructure, such as pavement markings and signage, at a level that ensures the effective operation of these vehicles.

Niagara Region is planning to provide additional capacity to the Niagara Escarpment Crossing. This includes extending Bartlett Avenue to Mud Street, which could potentially carry traffic from Mountain Road.

2.5 Town of Lincoln Truck Safety Motion (2019)

The motion identified a number of concerns related to truck traffic and identified a number of action items to address. It was passed on April 15, 2019 by the Town of Lincoln Council.

The following are the progress to date for the motion action items that are related to improving truck safety:

- Niagara Region intend to transfer Mountain Street to the Town of Lincoln once the new Escarpment Crossing (as mentioned in **Section 2.4**) is implemented;
- Niagara Region has advised that Mountain Street is on their list to be considered as a community safety zone;
- A truck safety inspection blitz was conducted successfully on June 23, 2020 across west Niagara by MTO, Niagara Regional Police (NRP), Halton Police, and the Ontario Provisional Police (OPP). The Town will continue to collaborate with NRP and MTO for more frequent truck safety inspection blitzes in the community (as mentioned in **Section 2.1**) to ensure adherence to speed and weights within the Town;
- Town staff have established frequent working meetings with their quarry stakeholders to discuss ways to work together on patrolling initiatives to enforce scale avoidance short cutting;
- The Town of Lincoln provide support and advocate to the Niagara Region for the implementation of specific enforcement measures (i.e. traffic / safety cameras or increased police enforcement) at Mountain and Regional Road 81 (King Street):
  - The Region also implemented a 1-year Pilot Monitoring Program using innovative technology at Mountain Street / King Street and King Street / Ontario Street to collect data as it relates to all conflicts at these two intersections across all modes of travel. The Region will share reports and data findings when the pilot is complete.

Late in 2019, the Region implemented traffic calming measures on Mountain Street including a permanent flashing 50km/hr. speed sign and strategic line painting to remind trucks to reduce speed prior to approaching the urban area of Beamsville.

3 Existing Conditions

This section provides a summary of the existing traffic data, a description of existing truck travel patterns in the area, and a summary of the collision history data review.

3.1 Traffic Volumes and Speeds

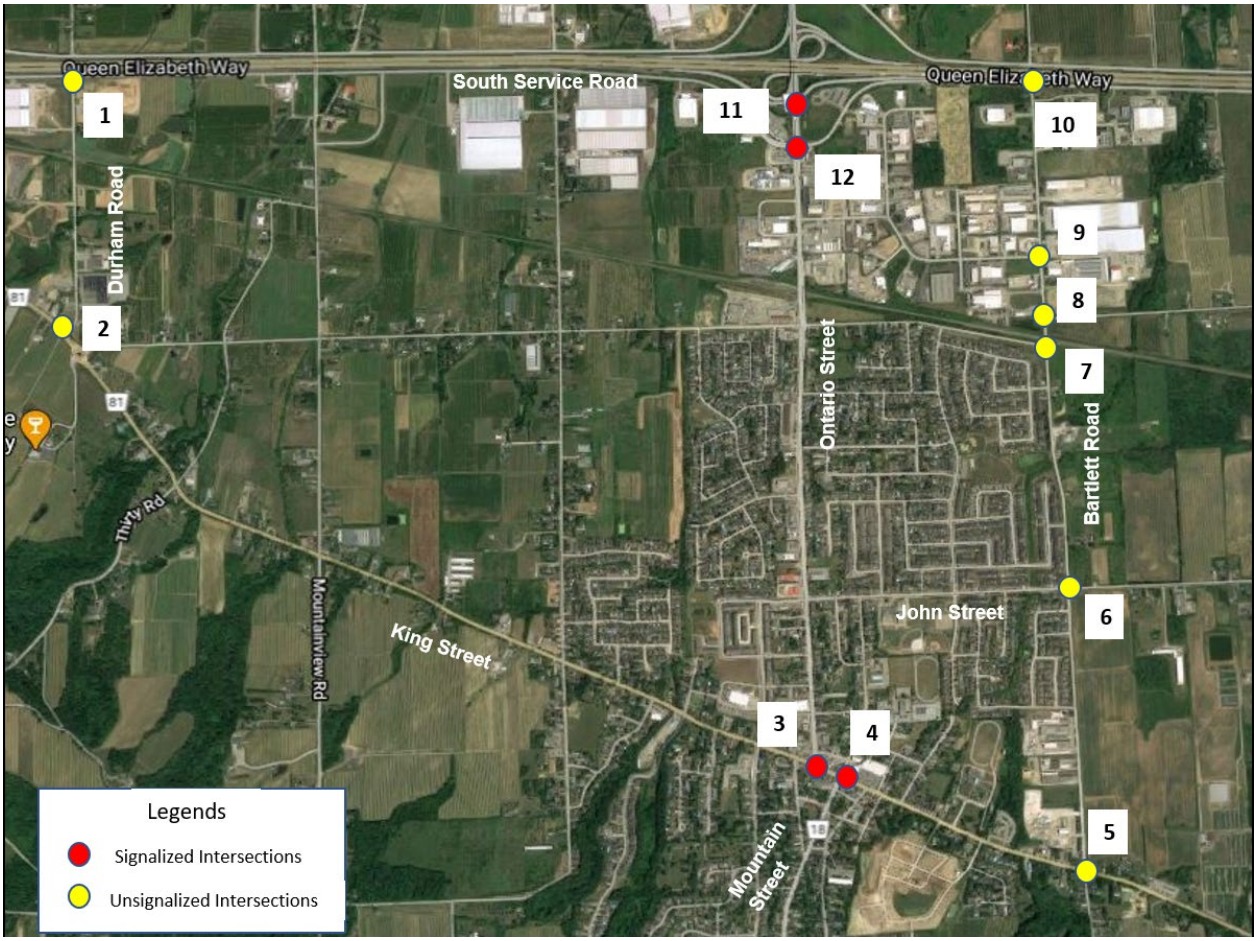
Historic turning movement count (TMC) data and current automatic traffic recorder (ATR) data and were provided by the Town of Lincoln and Niagara Region, found in **Appendix A**.

Exhibit 3.1 and **Exhibit 3.2** summarize the locations and count dates for the TMC data, collected during weekday peak traffic periods. This data is used in the operational assessment described in **Section 6**.

Exhibit 3.3 and **Exhibit 3.4** summarize the locations of the ATR count data. These were collected in 2021 for various count periods ranging from 1 day to 22 days per site. **Exhibit 3.4** also summarizes daily and peak hour traffic volumes at each site.

In addition to traffic volume data, the ATR data included average speeds and 85^{th} percentile speeds are compared to the posted speed limit. The 85^{th} percentile speed is often regarded as the speed that a typical driver feels comfortable driving at given roadway conditions. The information on the speed data collected are summarized in **Exhibit 3.5**.

Exhibit 3.1: Turning Movement Count Locations



Source: Google Earth, Adapted by IBI Group

Exhibit 3.2: Turning Movement Count Locations and Count Years

Map ID	Intersection[1]	Count Year
1	South Service Road and Durham Road – Unsignalized	2021
2	Durham Road and King Street (RR 81) – Unsignalized	2021
3	Ontario St (RR 18) and King Street (RR 81) - Signalized	2016
4	Mountain Street (RR 18) and King Street (RR 81) – Signalized	2019
5	Bartlett Road and King Street (RR 81) – Unsignalized	2021
6	Bartlett Road and John Street – Unsignalized	2021
7	Bartlett Road and Greenlane (west leg) - Unsignalized	2021
8	Bartlett Road and Greenlane (east leg) - Unsignalized	2021
9	Bartlett Road and Union Road – Unsignalized	2021
10	South Service Road and Bartlett Road - Unsignalized	2021
11	Queen Elizabeth Way off ramp & Ontario Street (RR 18) – Signalized	2007
12	South Service Road and Ontario Street (RR 18) – Signalized	2018

[1] Map ID 9 and 11 were not included in the traffic operation assessments in Section 6. Rather, they were used to validate the adjacent study area data.

Exhibit 3.3: Automatic Traffic Recorder Count Locations (2021)

Source: Google Earth, Adapted by IBI Group

Exhibit 3.4: Automatic Traffic Recorder Data Locations and Summary Volumes

Map ID	Location	Total Daily Traffic Volume	Daily Truck Traffic Volume	Peak Hour	Peak Hour Total Volume
A	**Durham Road**, North of King Street	1,600	125	3 to 4 PM	150
B	**King Street**, West of Durham Road	7,600	275	3 to 4 PM	775
C	**Mountain Street** Between Fly Road and King Street	6,300	525	4 to 5 PM	525
D	**King Street** Between Mountain Street and Merritt Road	5,900	550	3 to 4 PM	575
E	**South Service Road** Between Ontario Street and Merritt Road	1,600	175	3 to 4 PM	150
F	**South Service Road** Between Ontario Street and Victoria Avenue	3,400	125	3 to 4 PM	300
G	**King Street** Between Bartlett Avenue and Thirty Road	9,200	325	12 to 1 PM	875
H	**Bartlett Road** Between King Street and Arejay Avenue	6,200	200	4 to 5 PM	225

Note: All ATR data was collected in 2021; volumes are rounded.

Exhibit 3.5: Summary of Speed Data for ATR Sites

Map ID	Location	Posted Speed Limit (km/h)	Average Speed (km/h)	85th Percentile Speed (km/h)
A	**Durham Road**, North of King Street	50	47	55 to 59
B	**King Street**, West of Durham Road	50	63	70 to 74
C	**Mountain Street** Between Fly Road and King Street	50	51	60 to 63
D	**King Street** Between Mountain Street and Merritt Road	70	62	81 to 84
E	**South Service Road** Between Ontario Street and Merritt Road	80	89	100 to 103
F	**South Service Road** Between Ontario Street and Victoria Avenue	80	82	90 to 93
G	**King Street** Between Bartlett Avenue and Thirty Road	50	57	64 to 68
H	**Bartlett Road** Between King Street and Arejay Avenue	50	58	67

Exhibit 3.6: Automatic Traffic Recorder Count Locations (2021)

Source: Google Earth, Adapted by IBI Group

Exhibit 3.7: Automatic Traffic Recorder Data Locations and Summary Volumes

Map ID	Location	Total Daily Traffic Volume	Daily Truck Traffic Volume	Peak Hour	Peak Hour Total Volume
A	**Durham Road**, North of King Street	1,600	125	3 to 4 PM	150
B	**King Street**, West of Durham Road	7,600	275	3 to 4 PM	775
C	**Mountain Street** Between Fly Road and King Street	6,300	525	4 to 5 PM	525
D	**King Street** Between Mountain Street and Merritt Road	5,900	550	3 to 4 PM	575
E	**South Service Road** Between Ontario Street and Merritt Road	1,600	175	3 to 4 PM	150
F	**South Service Road** Between Ontario Street and Victoria Avenue	3,400	125	3 to 4 PM	300
G	**King Street** Between Bartlett Avenue and Thirty Road	9,200	325	12 to 1 PM	875
H	**Bartlett Road** Between King Street and Arejay Avenue	6,200	200	4 to 5 PM	225

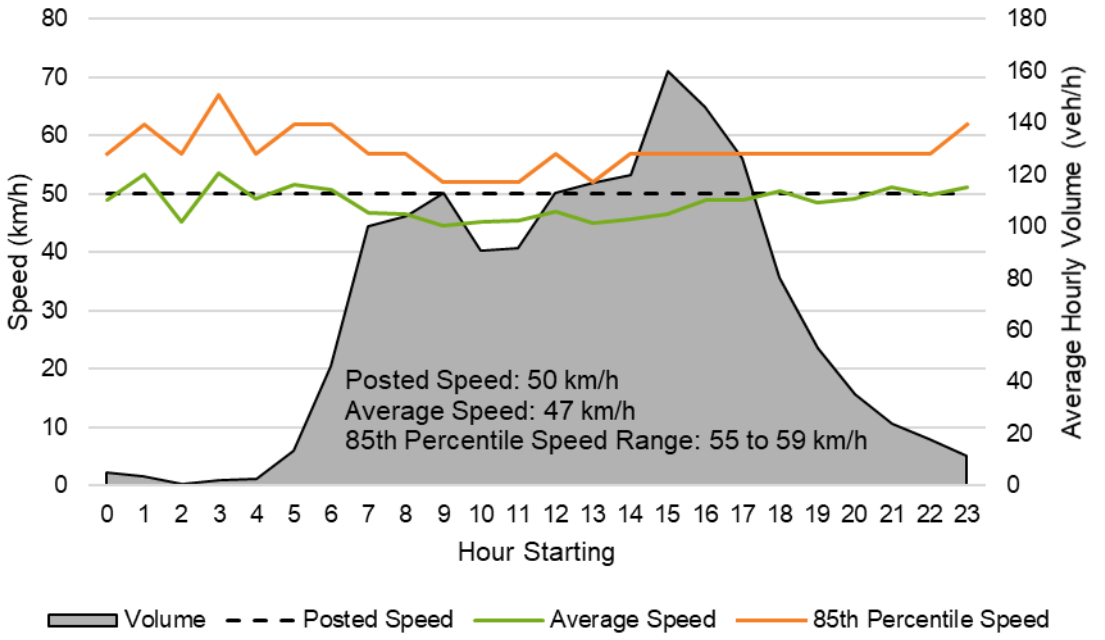
Note: All ATR data was collected in 2021; volumes are rounded.

Speed and volume characteristics for each site based on the 2021 ATR data are discussed below. Speed and volume plots for are presented for each direction separately in **Appendix B**.

3.1.1 Durham Road, North of King Street

The speed plot for traffic on Durham Road, North of King Street is shown in **Exhibit 3.8**. The speed data were collected from March 9, 2021 to March 15, 2021, which are 7 days in total. The hourly traffic volumes shown are an average for each hour over the seven-day collection period. The posted speed limit for this roadway segment is 50 km/h.

Exhibit 3.8: Speed and Volume Plot of Durham Road, North of King Street (Both Directions)



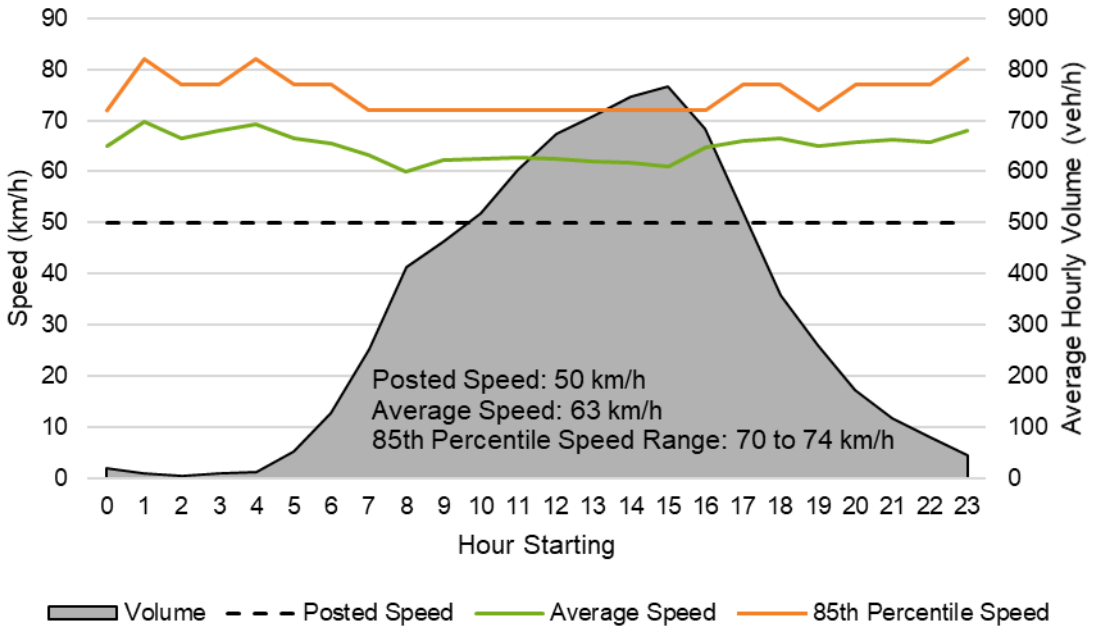
Based on **Exhibit 3.8** and a review of vehicle speed data, the following observations can be made:

- The peak hour of traffic demand occurred between 3 to 4 PM, and traffic volumes were higher in the southbound direction;
- The operating speeds are approximately equal in both directions;
- The 85th percentile speeds were relatively constant throughout the day, which suggests that traffic generally operates free-flow at this location since there is limited congestion causing drivers to slow down;
- The 85th percentile speeds were 5 to 9 km/h above the posted speed limit, which suggests that high operating speeds do not appear to be an issue along this segment of Durham Road.

3.1.2 King Street, West of Durham Street

The speed plot for traffic on King Street, west of Durham Road, is illustrated in **Exhibit 3.9**. The speed data were collected from March 9, 2021 to March 15, 7 days in total. The hourly traffic volumes shown are an average for each hour over the seven-day collection period. The posted speed limit for this roadway segment is 50 km/h.

Exhibit 3.9: Speed and Volume Plot of King Street, West of Durham Road (Both Directions)



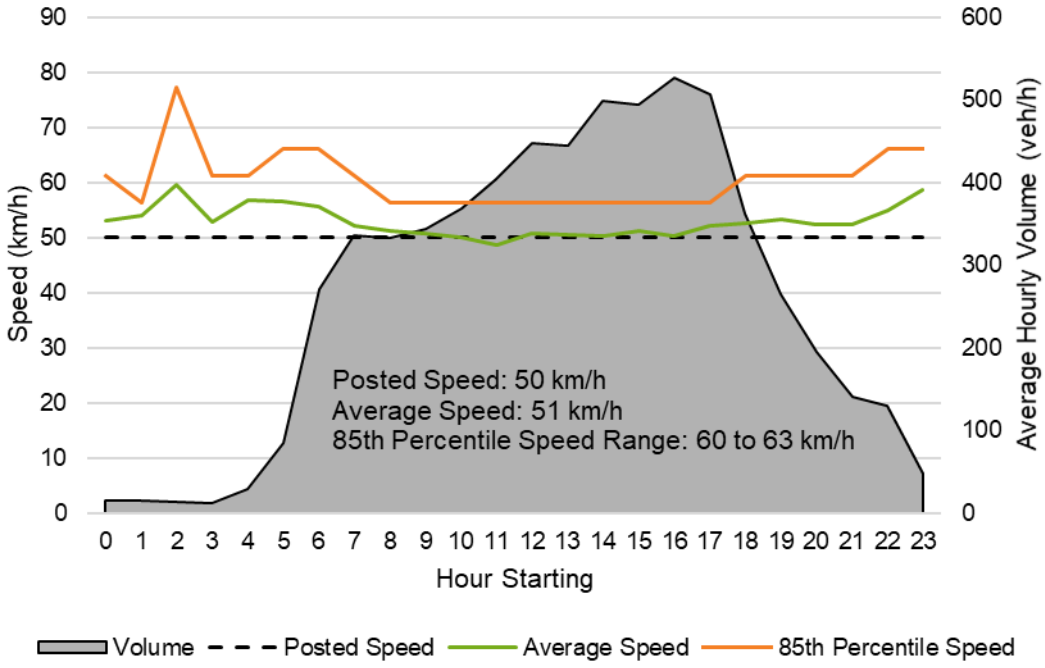
Based on **Exhibit 3.9** and review of vehicle speed data, the following observations can be made:

- The peak hour of traffic demand occurred between 3-4 PM, and traffic volumes were relatively equal in both directions;
- The speeds are generally faster in the eastbound direction, which may be due to lower vehicle speeds for westbound drivers departing the roundabout east of Durham Road;
- The 85th percentile speeds were relatively constant throughout the day, which suggests that traffic generally operates free-flow at this location since there is limited congestion causing drivers to slow down;
- The 85th percentile speeds were approximately in excess of 20 km/h above the posted speed limit, which suggests that there are high operating speeds along this roadway segment.

3.1.3 Mountain Street Between Fly Road and King Street

The speed plot for traffic on Mountain Road between Fly Road and King Street is illustrated in **Exhibit 3.10**. The speed data were collected on June 24, 2021.The posted speed limit for this roadway segment is 50 km/h.

Exhibit 3.10: Speed and Volume Plot of Mountain Street Between Fly Road and King Street (Both Directions)



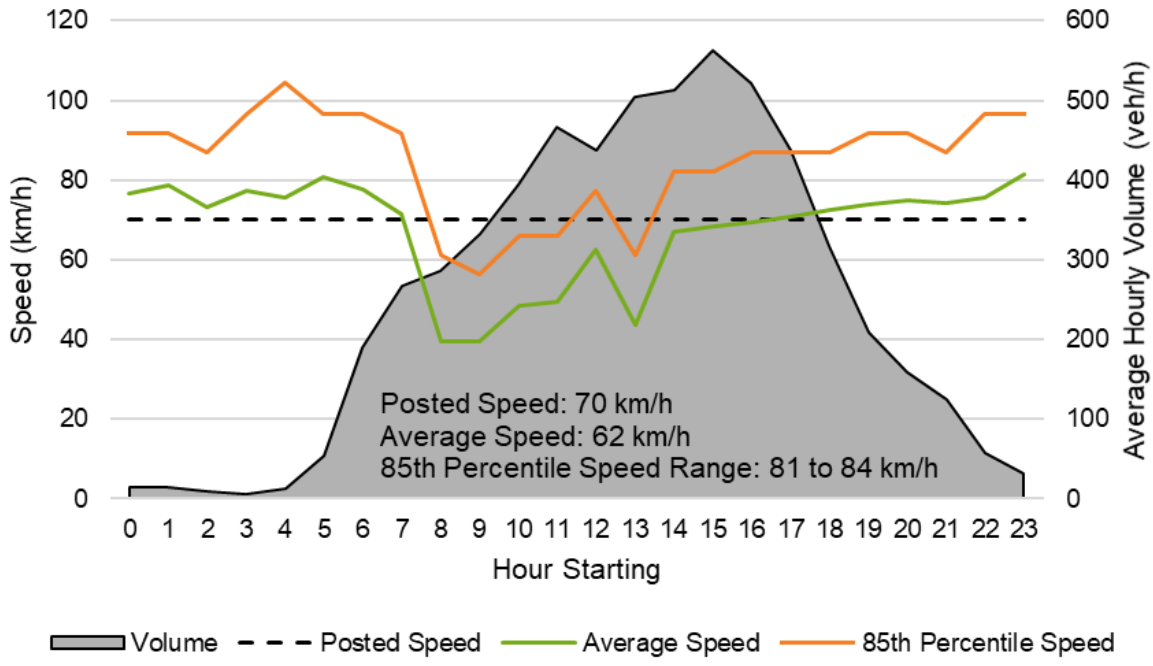
Based on **Exhibit 3.10** and review of vehicle speed data, the following conclusions can be drawn:

- The peak hour traffic demand occurred between 4 to 5 PM, and traffic volumes were higher in the southbound direction;
- The speeds are generally faster in the northbound direction, likely due to the downhill grade for northbound drivers;
- The 85th percentile speeds were relatively constant throughout the day, which suggests that traffic generally operates free-flow at this location since there is limited congestion causing drivers to slow down;
- The 85th percentile speeds were 10 to 13 km/h above the posted speed limit, which suggests that there are high operating speeds along this roadway segment;
- Average vehicle speeds in both directions generally decrease with increasing vehicle length, which suggests that the relatively high 85th percentile speeds may be attributable to passenger vehicles as opposed to trucks.

3.1.4 King Street Between Mountain Street and Merritt Road

The speed plot for traffic on King Street between Mountain Street and Merritt Road is illustrated in **Exhibit 3.11**. The speed data were collected on June 24, 2021. The posted speed limit for this roadway segment is 70 km/h.

Exhibit 3.11: Speed and Volume Plot of King Street Between Mountain Street and Merritt Road (Both Directions)



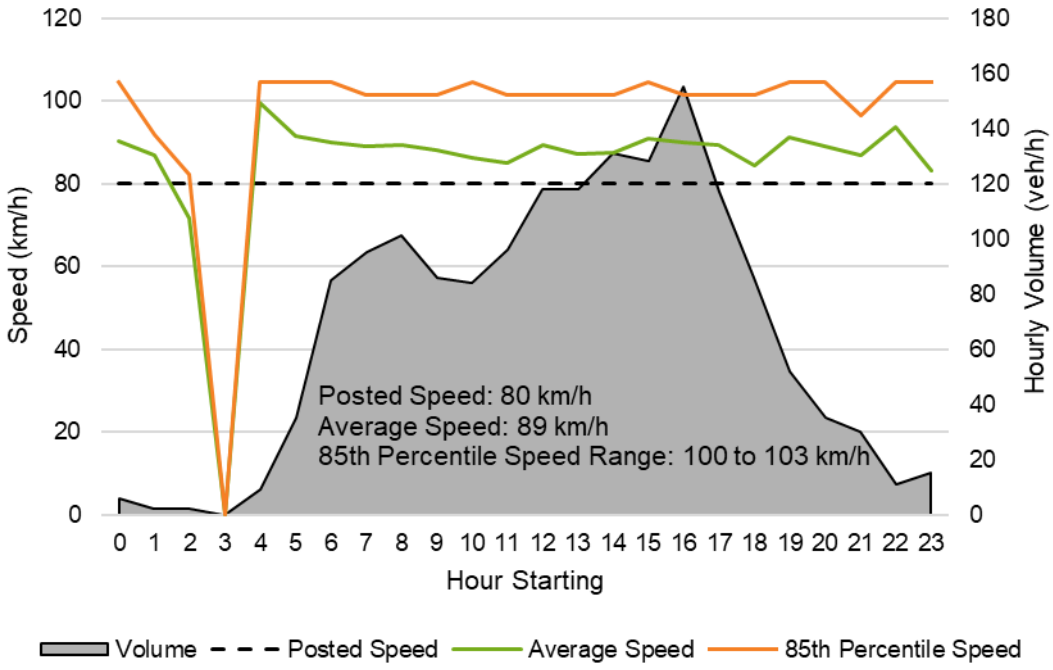
Based on **Exhibit 3.11** and review of vehicle speed data, the following conclusions can be drawn:

- The peak hour of traffic demand occurred between 3 to 4 PM, and traffic volumes were higher in the eastbound direction;
- The speeds are generally higher in the westbound direction, which may be due to drivers approaching from a less developed area. The speed limit west of Bartlett Road is 50 km/h, which may contribute to lower eastbound speeds;
- The average and 85th percentile speeds are generally lower during periods with higher traffic volume, which suggests that congestion could contribute to the lower operating speeds;
- The 85th percentile speeds for westbound drivers were 11 to 14 km/h above the posted speed limit, which suggests that there are high operating speeds along this roadway segment.

3.1.5 South Service Road Between Ontario Street and Merritt Road

The speed plot for traffic on South Service Road between Ontario Street and Merritt Road, is illustrated in **Exhibit 3.12**. The speed data were collected on June 24, 2021. The posted speed limit for this roadway segment is 80 km/h.

Exhibit 3.12: Speed and Volume Plot of South Service Road Between Ontario Street and Merritt Road (Both Directions)



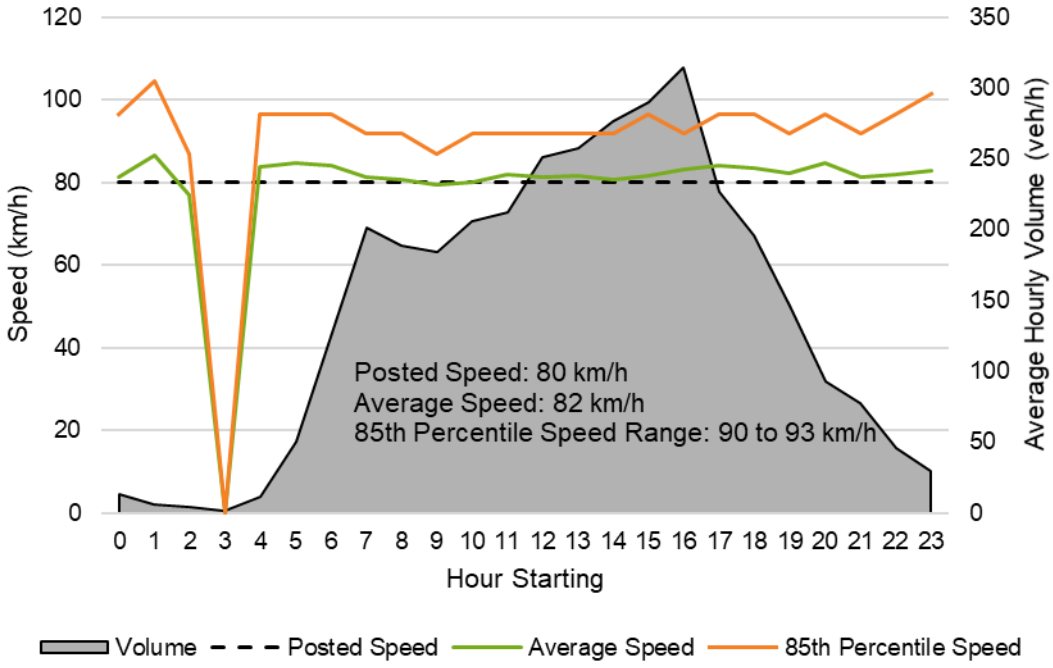
Based on **Exhibit 3.12** and review of vehicle speed data, the following observations can be made:

- The peak hour of traffic demand occurred between 3 to 4 PM, and traffic volumes were higher in the eastbound direction;
- The speeds are faster in the eastbound direction, where the 85th percentile speed was observed to exceed 105 km/h. 85th percentile speeds were measured between 100 to 103 km/h;
- The 85th percentile speeds were relatively constant throughout the day, which suggests that traffic generally operates free-flow at this location since there is limited congestion causing drivers to slow down;
- The 85th percentile speeds were more than 20 km/h above the posted speed limit, which suggests that there are high operating speeds along this roadway segment.

3.1.6 South Service Road Between Ontario Street and Victoria Avenue

The speed plot for traffic on South Service Road between Ontario Street and Victoria Avenue, is illustrated in **Exhibit 3.13**. The speed data were collected from June 24, 2021. The posted speed limit for this roadway segment is 80 km/h.

Exhibit 3.13: Speed and Volume Plot of South Service Road Between Ontario Street and Victoria Avenue (Both Directions)



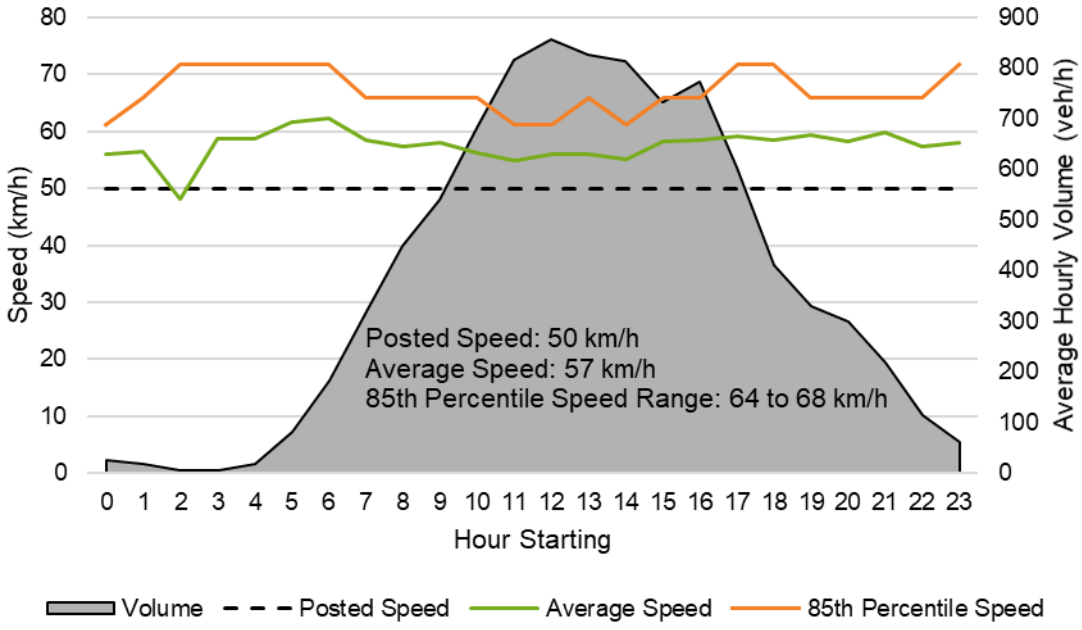
Based on **Exhibit 3.13** and review of vehicle speed data, the following observations can be made:

- The peak hour of traffic demand occurred between 3 to 4 PM, and traffic volumes were relatively equal in both directions;
- The speeds are generally faster in the eastbound direction;
- The 85th percentile speeds were relatively constant throughout the day, which suggests that traffic generally operates free-flow at this location since there is limited congestion causing drivers to slow down;
- The 85th percentile speeds were 10 to 13 km/h above the posted speed limit, which suggests that high operating speeds are not prevalent along this roadway segment.

3.1.7 King Street Between Bartlett Avenue and Thirty Road

The speed plot for traffic on King Street between Bartlett Avenue and Thirty Road is illustrated in **Exhibit 3.14**. The speed data were collected from June 24, 2021. The posted speed limit for this roadway segment is 50 km/h.

Exhibit 3.14: Speed and Volume Plot of King Street Between Bartlett Avenue and Thirty Road (Both Directions)



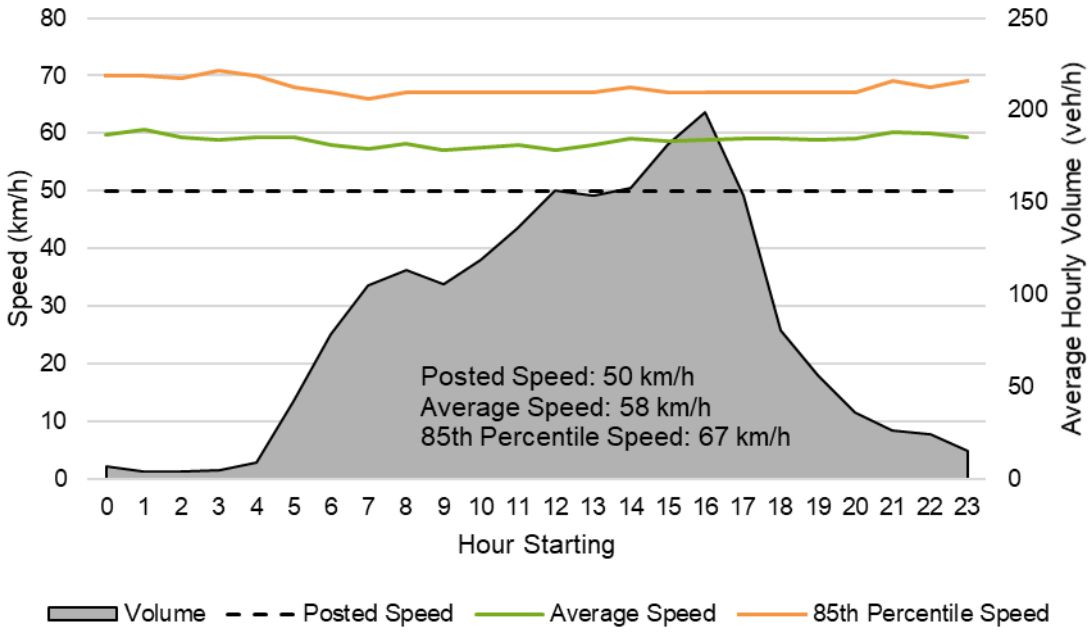
Based on **Exhibit 3.14** and review of vehicle speed data, the following observations can be made:

- The peak hour of traffic demand occurred between 12 to 1 PM, and traffic volumes were relatively equal in both directions;
- The speeds are approximately the same in both directions;
- The 85th percentile speeds were relatively constant throughout the day, which suggests that traffic generally operates free-flow at this location since there is limited congestion causing drivers to slow down;
- The 85th percentile speeds were 14 to 18 km/h above the posted speed limit.

3.1.8 Bartlett Road Between King Street and Arejay Avenue

The speed plot for traffic on Bartlett Road between King Street and Arejay Avenue is illustrated in **Exhibit 3.15**. The speed data were collected from January 13, 2021 to February 3, 2021, which are 22 days in total. The hourly traffic volumes shown are an average for each hour over the 22-day collection period. The posted speed limit for this roadway segment is 50 km/h.

Exhibit 3.15: Speed and Volume Plot of Bartlett Road Between King Street and Arejay Avenue (Both Directions)



From **Exhibit 3.15** and review of vehicle speed data, the following conclusions can be drawn:

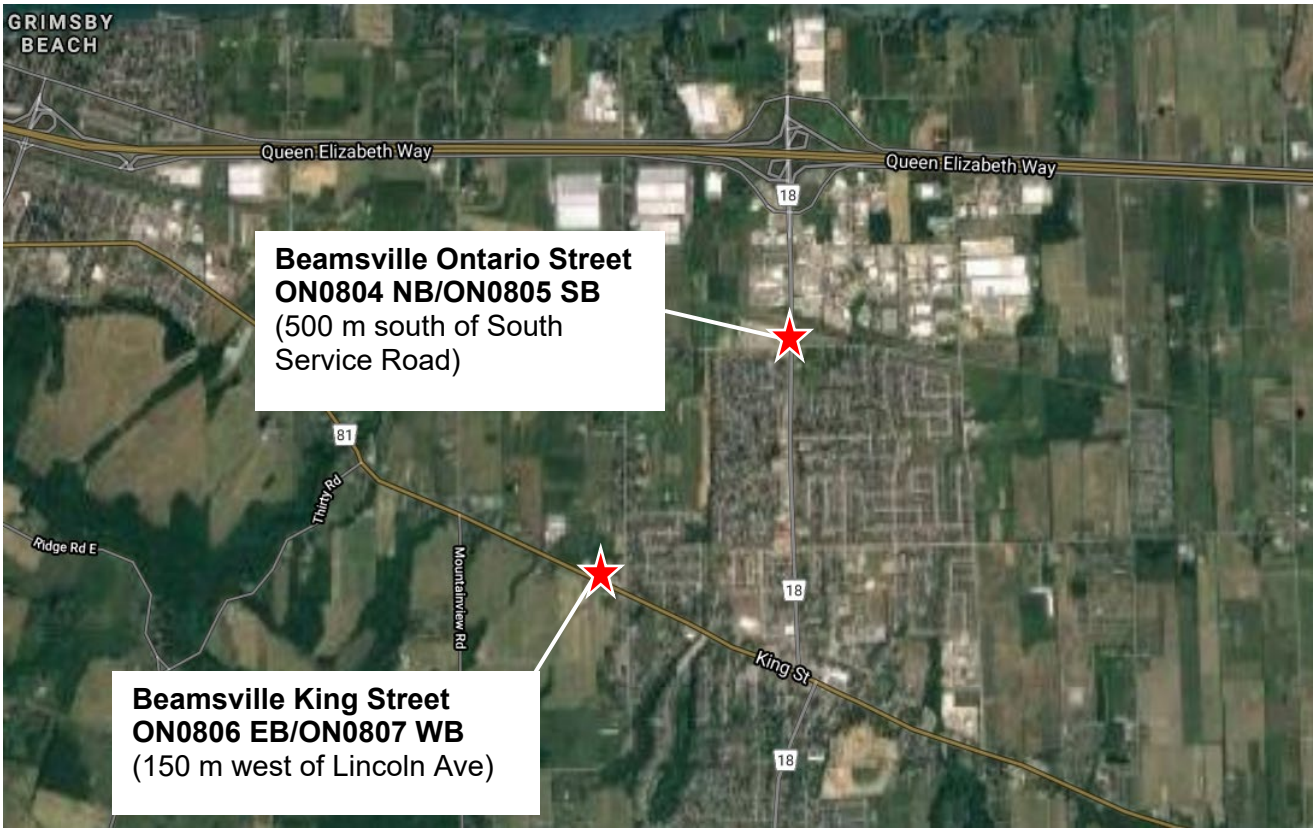
- The peak hour of traffic demand occurred between 4 to 5 PM, and traffic volumes were higher in the northbound direction;
- Southbound traffic speeds were slightly higher compared to northbound speeds. This might be because vehicles are closer to King Street, and might not have the same amount of time to increase speeds after turning onto Bartlett Road;
- The average and 85th percentile speeds were constant throughout the day, which suggests that congestion does not contribute to the lower operating speeds;
- The 85th percentile speeds were higher than the posted speed by up to 18 km/h, which suggests that high operating speeds may be prevalent along this roadway segment.

3.2 Truck Travel Patterns

The Ontario Commercial Vehicle Survey (CVS) is conducted by the Ministry of Transportation of Ontario. The CVS is a rich dataset of commercial vehicle trip information obtained through interviews with commercial vehicle drivers at truck inspection stations, laybys, border crossings and other roadside locations about their current trip, along with vehicle measurements and observations.

The survey is updated every few years, as survey conduct require multiple years of data collection to obtain sufficient data sample at numerous survey sites for a reliable data update. The most recent release of the Ontario CVS is the "2012" CVS, which represents data collected from 2010 to 2014. (An updated release is currently being prepared by MTO.) The 2012 dataset included a partnership with Niagara Region to include additional survey locations of interest to the Region; these include two bi-directional survey locations in Beamsville of particular interest to the Beamsville Truck By-Pass study, as shown in **Exhibit 3.16**: Ontario Street south of South Service Road, and King Street west of Lincoln Avenue.

Exhibit 3.16: Selected 2012 Commercial Vehicle Survey Data Collection Sites



Source: Google Earth, Adapted by IBI Group

For each CVS data collection site, two weeks of traffic classification counts were conducted and validated through comparison with a sample of manual vehicle classification counts toward creating one-week traffic profiles for each site, which are used to ensure accurate survey data expansion. **Appendix C** shows CVS weekly traffic profiles for the Ontario Street and King Street sites.

Of note is a directional imbalance of truck traffic at the Ontario Street survey site, which had 93% more northbound trucks than southbound (2,274 total weekly truck trips northbound vs. 1,180 trucks southbound) – the difference being even greater for multi-unit trucks (over 3 times more northbound multi-unit trucks). This imbalance can be attributed in part to the counts being slightly offset north and south of the survey site, but also to a portion of the truck traffic bypassing the westbound-only Vineland Truck Inspection Station (situated along the westbound QEW 9 km east of the QEW/Beamsville Ontario Street interchange). Northbound counts on Ontario Street may fluctuate depending on whether the Vineland station is conducting inspections at the time. However, local and regional origins and destinations are the larger component of northbound Ontario Street traffic.

Meanwhile, there was only a slight directional imbalance of traffic on King Street (with 363 weekly eastbound truck trips and 413 westbound).

The CVS trip records that pass these two survey sites were assigned to the Province's modelled TransCAD road network. (This includes survey records from interviews at these sites as well as trips that pass the sites from survey interviews at other survey sites in the province.) The resulting flows are shown in **Exhibit 3.17** and **Exhibit 3.18**. The plots indicate the following:

- Commercial vehicle trips passing Ontario Street and King Street in Beamsville have a wide range of origins and destinations: locally, regionally, throughout southern Ontario and also in the United States via the Niagara River international crossings.
- For the Ontario Street survey site:
  - Approximately 90% of northbound commercial vehicle trips travel on the QEW to a range of destinations: most (1566 trips per week or 69%) continue to the west on the QEW while a smaller portion (478 trips or 21%) continue to the east.
  - To the south, for northbound trips, 33% arrive at Ontario from King Street from the east (the broader-scale plot indicates that approximately half of these having more local trip origins and the remainder arrive from further east along the QEW corridor), 12% arrive from King Street from the west (primarily from industries situated close to Ontario Street), and 27% from Mountain Street. The remaining 28% of trips are to/from Ontario Street locations.
- Commercial vehicle trips along King Street also have both local and longer-distance origins and destinations. More than half of King Street trips continue to/from Grimsby westerly along the QEW.

Exhibit 3.17: Commercial Vehicle Survey Traffic Model Assignment: Ontario Street

A. Local View

B. Broader View

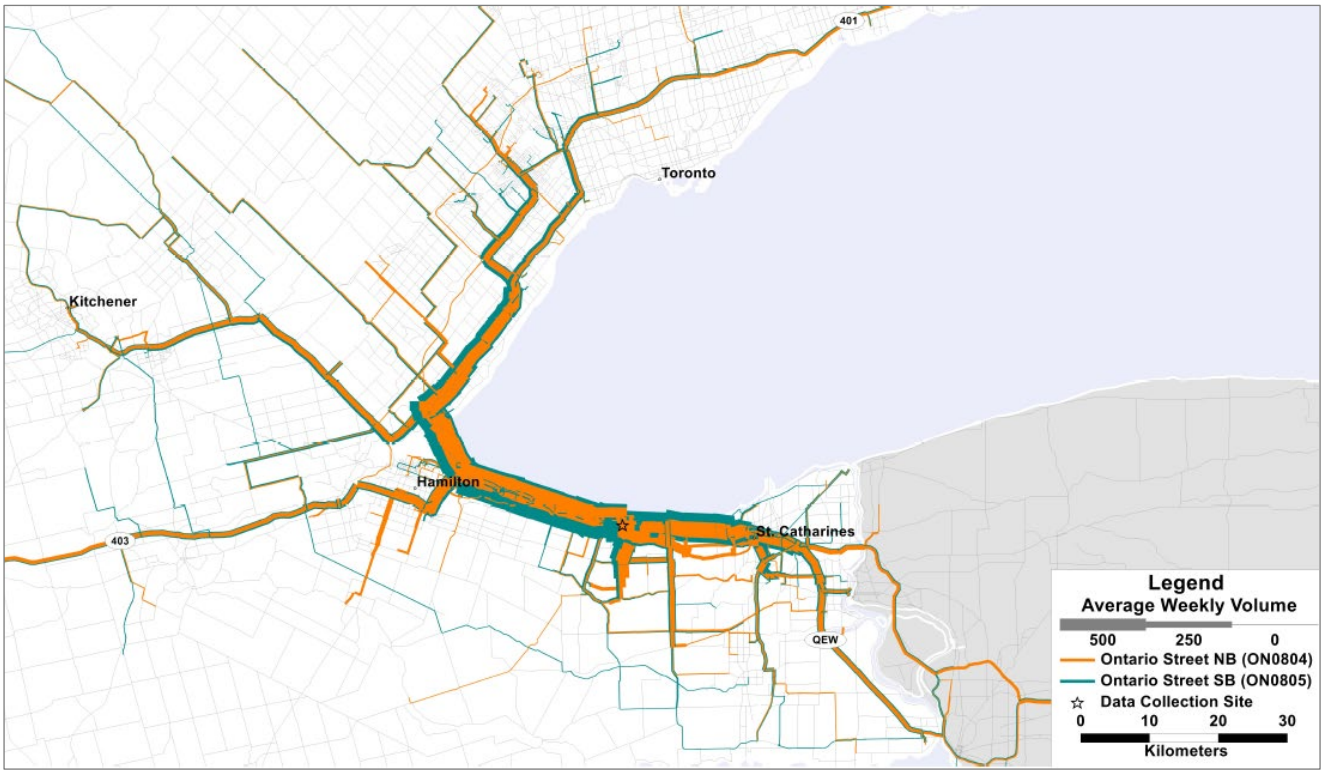
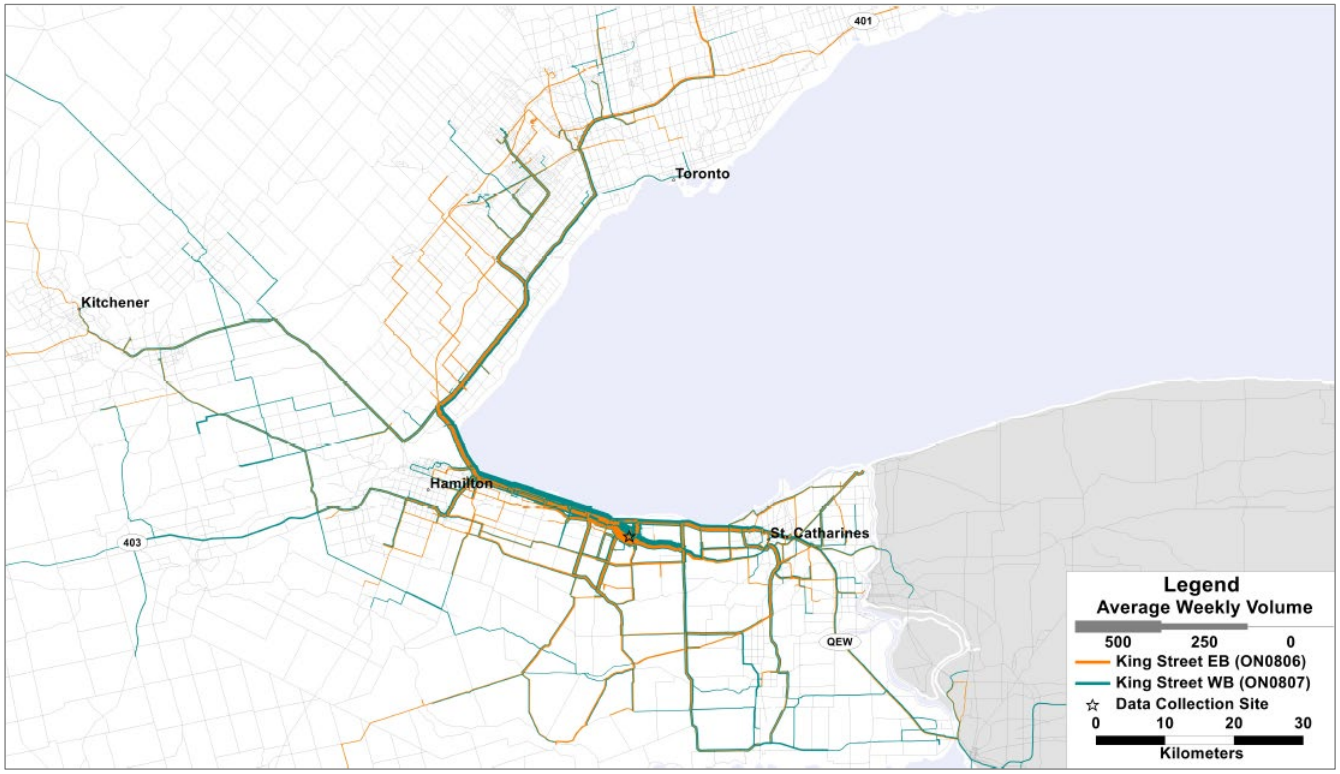


Exhibit 3.18: Commercial Vehicle Survey Traffic Model Assignment: King Street

A. Local View

B. Broader View

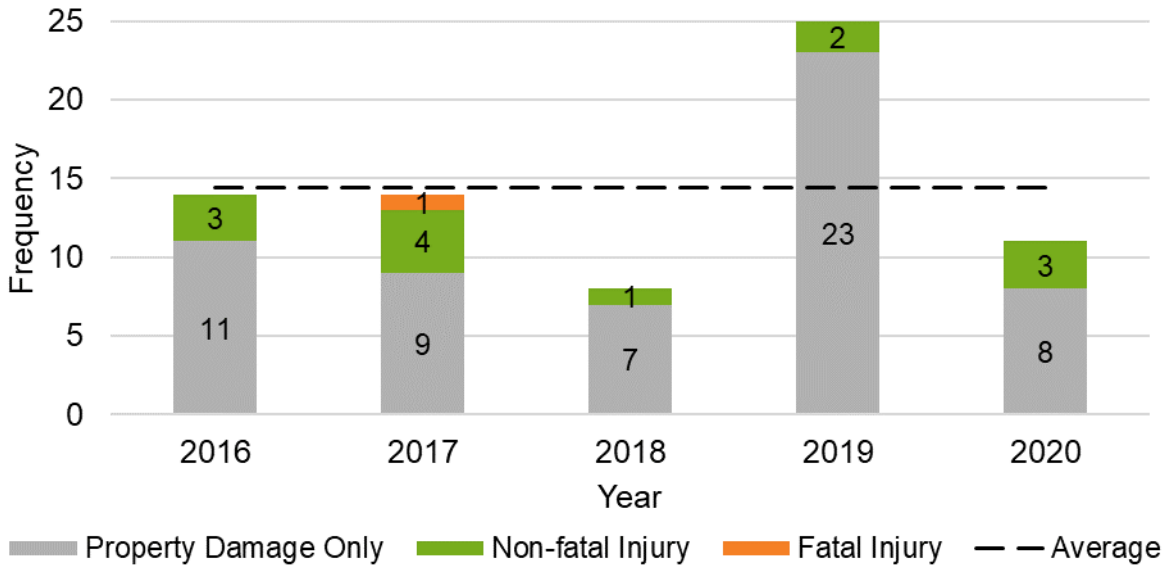


3.3 Safety Review

Historical collision data was provided by Town of Lincoln staff, on February 12, 2021, for the 5-year period of January 2016 to December 2020. Supplementary information regarding the travel direction and manoeuvres of the vehicles involved in these collisions, as well as details of an additional collision that occurred in December 2020, was provided on March 2, 2021 and used to refine the analysis. Overall, a total of 72 collisions were recorded; including 1 fatal collision, 13 injury collisions, 55 property-damage only (PDO) collisions, and 3 non-reportable collisions.

The number of collisions by severity per year, month, weekday, and time period are summarized in **Exhibit 3.19**.

Exhibit 3.19: Collisions by Severity per Year



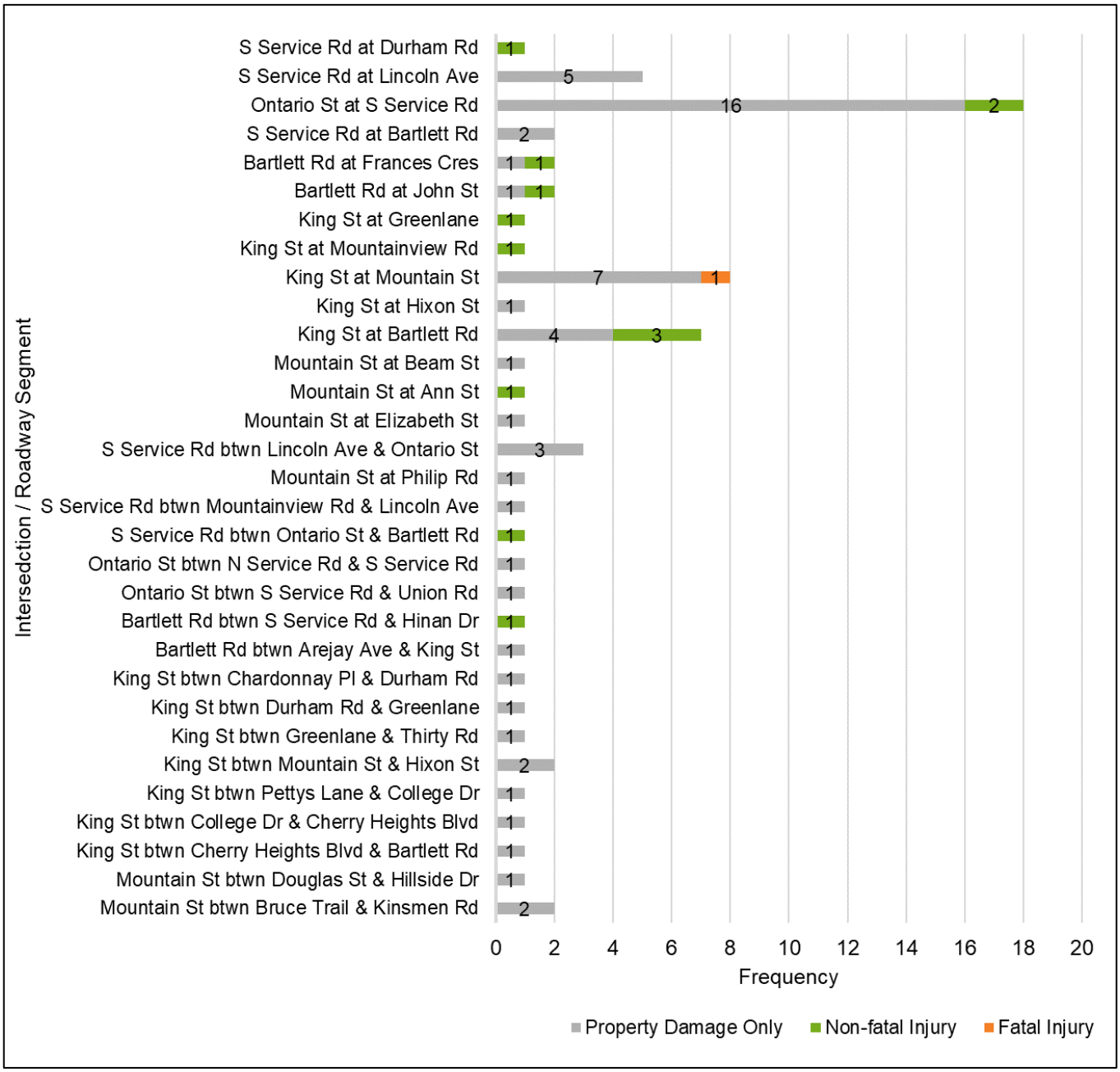
As illustrated in **Exhibit 3.19**, there is, on average, approximately 14 collisions per year, although the actual number of collisions varies year-by-year. A large increase in the number of collisions occurred in 2019, however, there is no discernable cause for this increase, and it is therefore likely attributable to natural variation. The following is a summary of the safety review:

- The collisions are evenly distributed, month-by-month, with an increase during the winter months (i.e. January to February). This can likely be attributed to winter driving conditions (e.g. snow, freezing rain, etc.) which may increase the risk of collisions occurring (see **Appendix D, Exhibit D.1**).
- No discernable pattern was identified for the distribution of historic collisions by weekday. All weekdays, except for Tuesday and

Saturday, ranged between 11 to 12 collisions (**Appendix D, Exhibit D.2**).

- The majority of collisions occurred during the midday off-peak period, followed by the AM and PM peak periods. This is abnormal, given that there is typically more traffic during the AM and PM peaks compared to the midday off-peak period (**see Appendix D, Exhibit D.3**). Based on a review of the collision data, roughly half of the collisions that occurred during the midday off-peak period occurred at the following three intersections:
  - Ontario Street & South Service Road;
  - King Street & Mountain Street; and
  - King Street & Bartlett Road.
- The most frequent impact type was turning movement collisions, followed by single motor vehicle (SMV) other, rear end and angle collisions (**see Appendix D, Exhibit D.4).** Three bicycle collisions were recorded within the study area at the following locations:
  - King Street & Bartlett Road;
  - Bartlett Road & Frances Crescent; and
  - Ontario Street & South Service Road.
- Most collisions occurred under daylight or artificial light conditions, which align with the time of day trends (see **Appendix D, Exhibit D.5**).
- Adverse roadway conditions (i.e. wet, snow, ice, etc.) were present during a third of the collisions (see **Appendix D, Exhibit D.6**) and adverse environmental conditions (i.e. raining, snowing, etc.) were present during 25% of all collisions (see **Appendix D, Exhibit D.7**).
- The number of collisions per intersection / roadway segment are illustrated in **Exhibit 3.20**.

Exhibit 3.20: Number of Collisions per Intersection / Roadway Segment



4 Stakeholder Engagement

There was key stakeholder engagement as part of the implementation study.

4.1 Stakeholder Meeting 1

The first Stakeholder meeting was held on March 26, 2021. The stakeholders included the following:

- Town of Lincoln Active Transportation Advisory Committee;
- Town of Lincoln Economic Development;
- Town of Lincoln Chamber of Commerce;
- Town of Lincoln BIA;
- Niagara Region;
- Niagara Regional Police Service;
- Ministry of Transportation Ontario;
- CN Rail;
- GO Transit Implementation Office;
- Town of Lincoln Chamber of Commerce; and
- Aggregate companies.

The main items raised by the stakeholders included:

- Truck Route enforcement – There was discussion about trucks by-passing the MTO Vineland scale station on the QEW westbound, using regional and local roads;
- Active Transportation – A separate multi-use path on Bartlett Road would be desirable;
- King/Mountain Intersection – Concerns about pedestrian safety, and traffic congestion; and
- Niagara Region truck route plans – How this study and plan would relate to other plans for Niagara Region.

4.2 Follow-Up Stakeholder Engagement

The stakeholder input lead to follow-up stakeholder engagement, as follows:

4.2.1 Enforcement

A meeting was held with enforcement officials on April 20, 2021. There were representatives from MTO Enforcement and Niagara Regional Police. The discussions included:

- MTO enforcement assistance in municipal truck safety blitzes;
- Real-time identification of Vineland Scale-avoiding trucks, through cameras and license plate readers;
- Provision of lay-bys on municipal roads to support enforcement activities; and
- Geometric Design Features to discourage trucks from using certain routes.

The Niagara Regional Police Service subsequently reported that their Commercial Motor Vehicle Inspection Officer met with the MTO Truck Enforcement Officers and scheduled Thursday June 17, 2021 as the date of the first Truck Enforcement Blitz date, named “Project Avoidance”. The blitz was operated out of the MTO scales in Vineland. A benefit to using the scales for the blitz was that traditionally MTO activates the scale inspection lights on the QEW, a large number of trucks attempt to avoid the scales and begin utilizing local roads. Knowing this, as part of this blitz, Niagara Regional Police, OPP, Halton Police and MTO Officers patrolled local roads in and around the Town of Lincoln stopping these trucks and conducting inspections. The objective of this approach was that A) it is safer and easier for the Officers to conduct inspections at the scales and B) that word will get out (at least for the short term) that when the scale lights come on in the future the police are out on the local roads so there is no benefit to the truckers to attempt to utilize them to avoid the scales, therefore hopefully reducing the number of larger trucks travelling on Town roads. The results indicated that approximately 25% of trucks take a bypass route when the QEW Vineland Station is open.

4.2.2 Active Transportation

A presentation was made to the Active Transportation Citizen Advisory Committee on April 22, 2021. The scope of the study was described, and input was sought on active transportation issues for the roads included in the truck by-pass routes.

The input from the Stakeholder meeting, and the follow-up meetings was considered and addressed in the Operational Assessment. The plan is to convene a second meeting with the Stakeholder group following the presentation of the final report to Council.

5 Policies and Strategies

One of the most important ways to have truck drivers follow the proposed truck by-pass route once implemented will be to implement a clear and intuitive signage strategy, potentially supported by other strategies. This section discusses truck route signage, the issue of truck inspection scale avoidance and potential strategies to address this issue, and puts forward recommended strategies for the Beamsville truck by-pass route.

5.1 Truck Route Signage

Clear and effective signage marking the Beamsville truck by-pass route will be an important means of informing truck drivers of the route, especially as there is no map book for truckers, and GPS systems for truck routes are limited and not always up to date and reliable.

This section describes provincial regulations and guidance on truck route signage and summarizes the signage strategies used in selected Ontario municipalities.

5.1.1 Provincial Regulations and Guidance on Truck Route Signage

5.1.1.1 Ontario Highway Traffic Act

Section 182 (1) of the Ontario Highway Traffic Act (R.R.O. 1990, Reg. 615) states that the province may make regulations prescribing the types of signs and markings used along highways and roadways, and that:

> Every driver or operator of a vehicle or streetcar shall obey the instructions or directions indicated on any sign so erected. R.S.O. 1990, c. H.8, s. 182 (2).

Section 33 of the act describes a “No Heavy Trucks” sign, stipulating a minimum 60 cm x 60 cm size, as well as its markings and dimensions.

A driver charged with Failure to Obey a Sign, including heavy truck drivers that disregard a “No Heavy Trucks” sign, can be fined and lose two Demerit Points.

5.1.1.2 Ontario Traffic Manual Book 5 – Regulatory Signs

Ontario Traffic Manual Book 5 – Regulatory Signs (March 2000) (“OTM Book 5”) provides information and guidance for the selection and application of various regulatory road signs. Among these is General Truck Control Signs (Section 11.1). This section notes:

> Truck routes are typically identified by permissive signing (based on the permissive green annular band symbol), supplemented by prohibitive signing (based on the interdictory red annular band

> symbol). The permissive signs indicate a continuous route preferred for heavy truck use.
>
> If supported by municipal by-law, the permissive signs can be given a mandatory function, that is, the signs can prohibit heavy trucks from travelling anywhere but on a truck route identified by permissive signing. Whether or not a permissive signing system is enforceable by municipal by-law, supplementary prohibitive signs may be used where problems have been encountered with heavy trucks using roads from which they are prohibited. (page 105)

In other words, a municipality can use permissive truck-route signs to achieve the same effect of directing truck traffic as prohibitive signs, by making it mandatory in its by-laws that truck drivers stay on routes marked with the permissive truck-route signs.

The standard permissive and prohibitive truck route signs are shown in **Exhibit 5.1**. The exhibit also shows Movements Permitted tabs to use only with the permissive signs to clarify permitted truck movements at intersections:

> The Rb-61 sign with the Rb-61t tab sign attached must be used at intersections to indicate permitted left-turn, right-turn and/or straight-through movements to access designated truck routes. By implication, movements not indicated on the tab sign may be prohibited. (p. 106)

OTM Book 5 also includes prohibitive signs with time restrictions, specific to individual lanes, and with height restrictions. It also discusses signs for tonnage restrictions for trucks.

OTM Book 5 summarize the legal status of permissive signs as follows:

> No Highway Traffic Act reference.
>
> Enforceable in municipalities by municipal by-law which:
>
> - Specifies that heavy trucks are prohibited from all roads other than truck routes indicated by the permissive truck route signing system;
> - Specifies a schedule of roads on which trucks are permitted, corresponding to the roads included in the permissive truck route signing system; or
> - Specifies a schedule of roads on which trucks are prohibited, corresponding to the roads excluded from the permissive truck route signing system. (p. 107)

OTM Book 5 summarize the legal status of permissive signs as follows:

> Highway Traffic Act, Regulation 615, Section 33 (R.R.O. 1990).
>
> Sign must be supported by municipal by-law to be enforceable in municipalities. (p. 108).

Exhibit 5.1: OTM Book 5 General Truck Control Signage

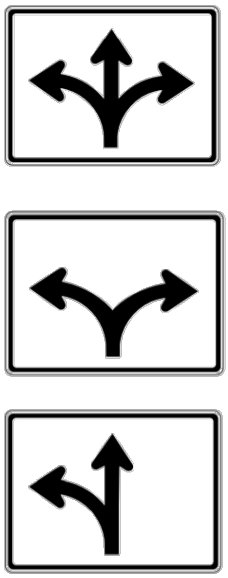
TRUCK ROUTE Sign (Permissive)

Rb-61	60 cm x 60 cm
Font	N/A
Colour	Permissive Symbol – Green Reflective Legend & Border – Black Background – White Reflective

NO HEAVY TRUCKS Sign (Prohibitive)

Rb-62	60 cm x 60 cm
Font	N/A
Colour	Interdictory Symbol – Red Reflective Legend & Border – Black Background – White Reflective

MOVEMENTS PERMITTED Tab Sign



Rb-61t	45 cm x 60 cm
Font	N/A
Colour	Legend & Border – Black Background – White Reflective

Image Source: OTM Book 5 (March 2000, Section 11.1)

5.1.1.3 Ontario Traffic Manual Book 1B – Introduction to the Ontario Traffic Manual

Ontario Traffic Manual Book 1B – Introduction to the Ontario Traffic Manual (July 2001) ("OTM Book 1B") also discusses prohibitive (interdictory) vs. permissive signs in Appendix B – Sign Design Principles, using truck route signage as an example:

> For some applications, such as turn control signs, it is recommended that the interdictory symbol be used rather than the permissive symbol. The interdictory symbol is preferred for both comprehension and enforceability, since it more directly indicates the action prohibited. With the permissive symbol, the driver must go through an additional step to interpret that actions contrary to the permitted one(s) are prohibited. For example, it does not necessarily follow to all drivers that a permissive turn control sign indicating that right turns and straight through movements are permitted means that left turns are not allowed. Also, permissive regulatory signs for moving traffic may be more difficult to enforce than interdictory regulatory signs.
>
> Permissive signs, however, do have a practical role in the OTM. In some cases, it is very awkward to express a message using an interdictory sign where a permissive sign is very straightforward. […] There are still other applications, such as signing for heavy truck routes, in which the permissive and prohibitive systems can work together. In this case, the permissive signs are typically used to indicate a continuous route preferred for heavy truck use, as supplemented by prohibitive signs installed where there is a demonstrated problem with trucks using a non-designated route. (Section 6.2, page 17)

A District Enforcement Manager with the Ministry of Transportation of Ontario's Transportation Safety Division[2] also confirmed the value of using both types of signage to make it clear which routes are prohibited for heavy trucks while also making it clear to drivers of heavy trucks which routes they should take. His experience was that prohibitive signs, being red in colour, are more noticeable to drivers than the green permissive signs, and both types of signs together send the clearest message to drivers.

[2] Discussion with Nick Korakas, District Enforcement Manager, Commercial Inspection and Enforcement Branch, Transportation Safety Division, Ministry of Transportation, Hamilton/Niagara District. March 24, 2021.

5.1.2 Truck Traffic Control Signage By-Laws in Town of Lincoln

Local municipalities in Niagara Region reference the Region's Traffic By-law (89-2000) and related Schedule S regarding heavy truck restrictions. The local municipalities can make amendments to their own roadways as needed.

The Town of Lincoln does not include mention of the control of truck movements in its "By-Law Regulating Traffic and parking on Municipal Roads Under the Control and Jurisdiction of the Town of Lincoln" (By-Law 88-146).

The by-law does list among definitions that "commercial motor vehicle has the same meaning as The Highway Traffic Act, R.S.O. 1980, c. 198", and includes regulations controlling trailer and commercial motor vehicle parking (205.04), prescribing 30-minute loading zone limits (305.02), and relating to load restrictions (Part VI).

Niagara Region cannot commit to prohibiting trucks on regional roadways. A Truck Route Master Plan is scheduled for 2023, pending budget approval. The Region will support signage for "Preferred Truck Routes" as it has in the past.

5.1.3 Jurisdictional Review of Truck Control Signage By-Laws

The truck route control by-laws of selected jurisdictions in Ontario are summarized in **Exhibit 5.2**.

As can be seen in the exhibit, prohibitive truck route systems are most common.

The City of Hamilton and City of Welland both use a hybrid truck route signage System utilizing both permissive and prohibitive truck route signing. These involve using permissive truck route trailblazing signs and augmenting the permissive signs with restrictive truck route signs at critical locations to reinforce the truck route system.

5.1.3.1 Heavy Truck Definitions

Note that by-law wording describing truck traffic control signage should include a clear definition of what are included commercial motor vehicles. These definitions are based on those in the Ontario Highway Traffic Act, with a 4,500-kilogram threshold definition for trucks/heavy vehicles/commercial motor vehicles. For example, Niagara Region's by-law describes *"heavy vehicles" as:*

> a commercial motor vehicle having a registered gross weight greater than 4,500 kilograms, but does not include a passenger vehicle, an emergency vehicle, any vehicles owned and operated by the Transit Commission, a privately-owned commercial motor vehicle making a delivery to or a collection from a bona fide destination which cannot be reached via a highway or highways upon which heavy vehicles are not prohibited by this bylaw and taking the most direct route to such a destination or part of a highway upon which heavy vehicles are not prohibited by this by-law.

Exhibit 5.2: Truck Control Signage By-Laws in Selected Ontario Municipalities

Local	By-Law	Truck Control Type		
		Permissive	Prohibitive	Hybrid
Niagara Region	Traffic By-law (89-2000). Heavy vehicle restrictions are listed in Schedule S (not viewed). *The Region's local municipalities refer to this by-law, sometimes amended.*		✓	
City of St. Catharines (Niagara Region)	Traffic By-law (89-2000)		✓	
Niagara Falls (Niagara Region)	Traffic By-law (89-2000)		✓	
Welland (Niagara Region)	Traffic By-law 89-2000 schedule XXXI. GIS map of permitted truck routes: https://www.welland.ca/Traffic/Traffic.asp.			✓
City of Hamilton	Traffic By-Law (No. 01-215) Section 56 Designated truck routes in Schedule 27. Maps of the truck route network are available on the City's website.			✓
Haldimand County	By-law 139-01 Schedule A, amended by By-laws 710-06 and 972-08. Maps are not provided.		✓	
Cambridge (Region of Waterloo)	By-law (187-06), exceptions are listed in Schedule 21 (not viewed).		✓	
Kitchener (Region of Waterloo)	Traffic By-law (2007-138), exceptions are listed in Schedule 23 (not viewed).		✓	
Waterloo (Region of Waterloo)	Traffic By-law (2008-077), exceptions are listed in Schedule 20 (not viewed).		✓	
City of Guelph	By-law (2002-17017). Permitted routes are listed in Schedule XIII, but must contact Traffic Services for access to the schedule.	✓		
Burlington (Halton Region)	By-law 86-2007 pt. V, and detailed in Schedules 14-16 of the by-law.		✓	
Oakville (Halton Region)	Map of prohibitions and restrictions is linked to on the Safety & Traffic page of the Town's website).		✓	
Mississauga (Region of Peel)	Traffic By-law (555-00); heavy vehicle restrictions are listed in Schedule 13.		✓	
Brampton (Region of Peel)	Traffic By-law - heavy truck prohibitions (Schedule XI) and load restrictions (XII). Maps of restrictions and prohibitions are also provided.		✓	
City of Toronto	The by-law Schedule (§ 950-1329) lists the heavy truck restrictions (483 pages) on City roads, no map is provided.		✓	

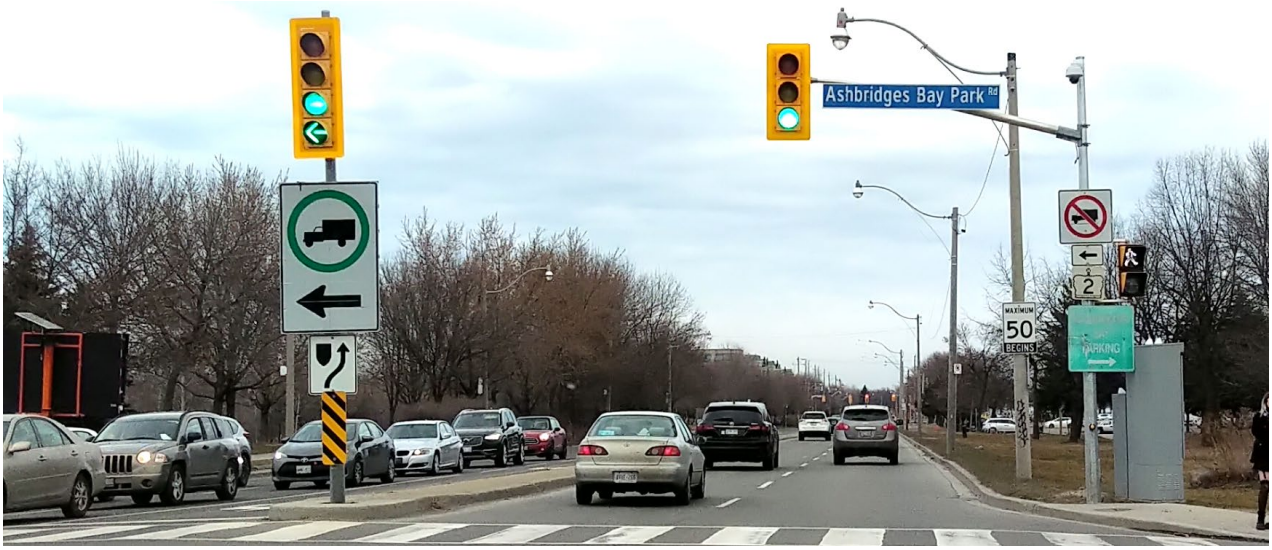
5.1.4 Other Truck Route Signage Implementation Considerations

Regardless of whether a municipality's by-law states that it has a permissive, prohibitive, or hybrid truck route signage system, using both permissive and prohibitive signs together, especially at key junctions of the truck route, can result in the greatest clarity for truck drivers. For example, **Exhibit 5.3** is an example of both types of signs used together in Toronto, where a prohibitive truck route system is in place. In this case, advance truck route information was also provided upstream.

Important aspects of signage implementation include the following:

- **Size:** The Ontario Highway Traffic Act stipulates a 60 cm x 60 cm size for "No Heavy Trucks" signs. However, at key decision points it can be helpful have regulatory signs larger than this size.
- **Nearby Signage and Visual Clutter:** Other signage in close proximity to the truck route signage can distract from the truck route signs, and in some cases can confuse the signage message. For example, in **Exhibit 5.3**, the "No Heavy Truck" sign is intended for the route straight ahead, but placing the Highway 2 wayfinding signage directly below it, confuses the message. In this case, the permissive and prohibitive signs both seem to apply to the route to the left.
- **Advance Signage:** In cases where a road's sight lines do not allow the truck route signage at the intersection until close to the intersection, (such as at South Service Road eastbound approaching Ontario Street) advance signage can increase the likelihood of drivers using the truck route safely, especially for multi-lane roads where a lane change may be required to use the heavy truck route.

Exhibit 5.3: Use of Both Permissive and Prohibitive Truck Route Signage Together in Toronto



5.1.5 Truck Route Wayfinding Considerations Beyond Signage

Currently, GPS navigation systems are designed for general traffic, as opposed to trucks. Truck drivers relying on GPS navigation systems will often find themselves on truck-prohibited routes. There are some GPS navigation systems designed for and marketed to truck drivers, but they often do not have complete or up-to-date information.

In the past, truck drivers used a North American road atlas for truckers and could plan out their route in advance. This atlas is no longer produced.

Beyond clear truck route signage, actions the Town of Lincoln could take to help ensure that truck drivers have the information they need to plan their route in the Town of Lincoln include the following:

- Having a truck route map easy to locate on the Town of Lincoln website;
- Working with Niagara Region and other local municipalities to have a Region-wide truck route map easy to locate on the Niagara Region website; and
- Encouraging and working with the Ministry of Ontario to make a province-wide truck route map readily available, and to include truck routes on online tools such as Ontario 511.

5.2 Other Enforcement Strategies

In addition to determining the appropriate truck route signage, the Town of Lincoln has other concerns related to the movement of heavy trucks through the town, prompting a Truck Safety Motion to be put forward and passed by Town of Lincoln Council in April 2019 (https://lincoln.ca/trucksafety). The motion actions relate to designation of a truck by-pass route and restricting trucks on Mountain Street, as well as the following:

- That the Town of Lincoln continue to work closely with NRPS, MTO and other agencies on multi-stakeholder and multi-agency strategies to ensure adherence to speed and weights within the Town of Lincoln, including a request for more speed enforcement.
- That scale avoidance enforcement blitzes begin as soon as possible with a focus on Jordan Road, south from QEW, Victoria Avenue and all other roads deemed vulnerable to scale avoidance.
- That the Town of Lincoln request regular safety checks including weighing and inspections through MTO.
- That the Town of Lincoln provide support and advocate to the Niagara Region for the implementation of specific enforcement measures (i.e. traffic/safety cameras or increased police enforcement) at Mountain and Regional Road 81 (King St.).

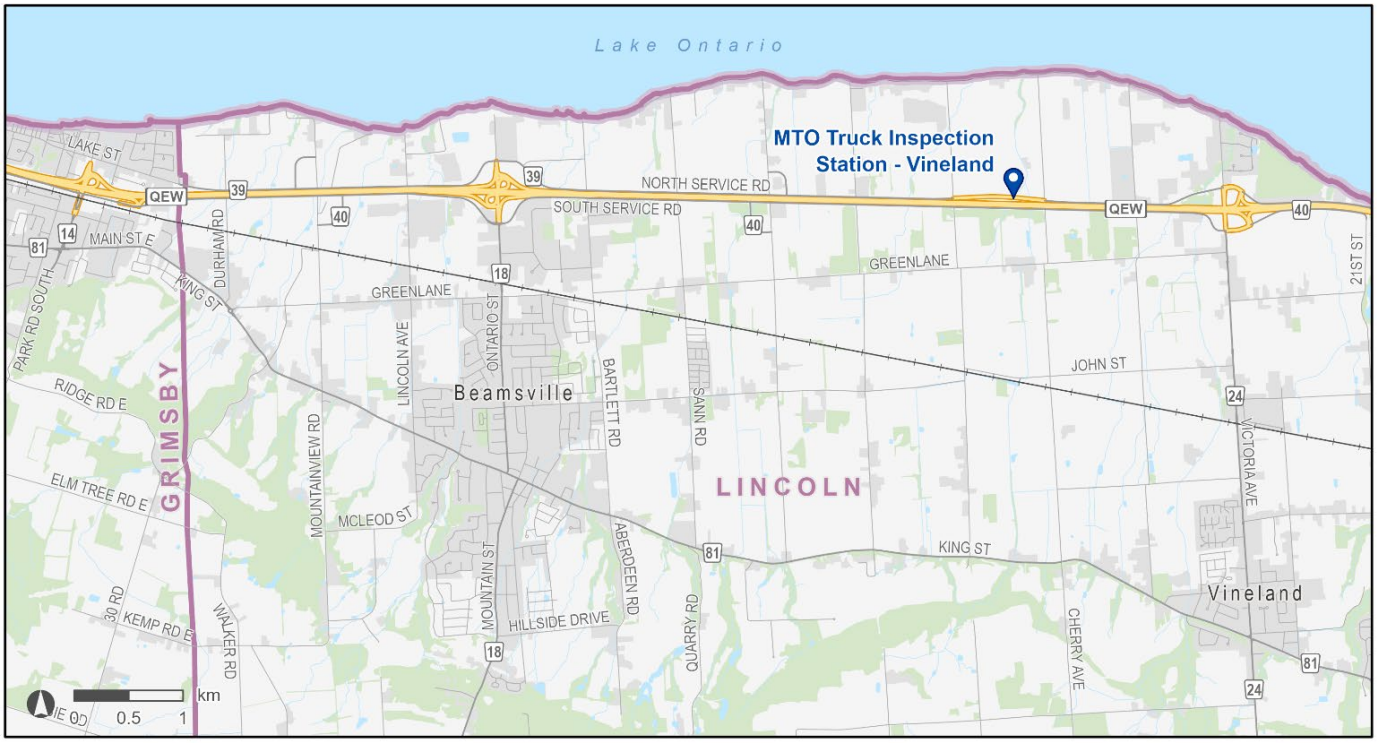
- That the Town of Lincoln monitor these changes if/when they are implemented and furthermore, as part of the monitoring work, note any impacts in the outer limits and/or rural roads with the Town.

These action items confirm that MTO Vineland scale avoidance, exceeding vehicle/axle weight limits, and speeding are also issues that are important to the Town of Lincoln to be addressed by enforcement measures. These are discussed below.

5.2.1 MTO Vineland Scale Avoidance

The MTO Vineland Truck Inspection Station (or "Scale") is located along the QEW just west of the next QEW interchange to the east of Beamsville at Victoria Avenue, as shown in **Exhibit 5.4**[3]. It operates only in the westbound direction to focus on trucks that are coming inbound from the United States. MTO also conducts inspections in the eastbound direction at a QEW layby near Winona, though much less frequently than at Vineland.

Exhibit 5.4: MTO Vineland Truck Inspection Station Location Relative to Beamsville



When inspection lights are turned on either at Vineland or Winona sites, trucks are obligated to turn in and undergo a vehicle inspection if required, or face

[3] Understanding of the scale avoidance issue and actions to address this was informed/confirmed through a discussion with Nick Korakas, District Enforcement Manager for the Hamilton/Niagara District of the Ministry of Transportation of Ontario's Commercial Inspection and Enforcement Branch, Transportation Safety Division (March 24, 2021).

fines or other charges. However, a portion of truck drivers avoid passing the inspection station when the inspection lights are on by turning away from the highway in advance, e.g. turning southbound onto Victoria Avenue toward Vineland, then continuing west on the North or South Service Roads alongside the QEW, or on Greenlane, or King Street/Niagara Road 81, before rejoining the QEW at a downstream QEW interchange, often Ontario Street in Beamsville. (Drivers may avoid the Service roads because they understand that MTO officers are more likely to patrol the Service roads than other potential Scale-avoidance routes.) Truck drivers use a variety of routes to bypass the scale – some cross-border trips even stay farther south by taking Regional Road 20 or Highway 3, especially when there may be more serious safety or licensing issues involved. Among all these diversion options, the Victoria Avenue/King Street/Ontario Street route is understood to be a common Scale-avoidance route.

Truck drivers are more likely to avoid the scale in the westbound direction, though some may avoid the area in both directions.

Truck drivers communicate quite readily with each other by radio, driver app, or other means, so they can know well in advance that inspections are being conducted, and can be prepared to turn away from the highway at Victoria Avenue or earlier.

Many of the by-passing trucks are understood to be making trips to or from the United States via the Niagara international border crossings, and often are registered to companies in the United States, with United States licence plates.

Truck drivers may avoid the scale for various reasons. Some may just find it an inconvenience to be stopped, while others may have known issues that they are attempting not to have the officer discover, such as licencing issues, excessive weights or other vehicle safety issues.

Drivers who are taking a detour from the QEW can have legitimate reasons for doing so, such as making a pick-up or delivery in Vineland, Beamsville, etc. At other times they may claim to the officers to be stopping for coffee, viewing a vehicle for sale, etc. to legitimize their route choice.

Drivers who are bypassing the scale for any reason would likely attempt to stay on designated truck routes, as being pulled over for truck route non-compliance may allow the enforcement officer to discover other issues.

The Town of Lincoln, in partnership with MTO, is planning an intersection camera truck monitoring pilot in 2022.

5.2.1.1 Potential Actions

Potential actions that can be taken to further understand, or to enforce against, Scale avoidance by trucks include the following:

Origin-destination analysis of mobile tracking data

This study makes use of Geotab mobile tracking data of truck trips in the vicinity of the proposed Beamsville truck route bypass to understand the potential volume of trucks that could use the proposed bypass.

A separate origin-destination analysis for trucks passing selected points in the vicinity of the proposed route is anticipated to provide greater insight into the proportion of Scale-avoiding trips. However, as noted by an MTO enforcement supervisor, the trucks avoiding the Scale may be less likely to subscribe to services that are trackable by Geotab, which may underrepresent the degree of Scale avoidance in this analysis.

Roadside truck travel survey

Another option to better understand the Scale avoidance issue is to conduct roadside surveys of truck drivers, temporarily diverted from their trip on municipal roads to ask about their current trip. The survey could be conducted in partnership with the province as part of the province-wide Ontario Commercial Vehicle Survey, which collects detailed information about commercial vehicle trips, and or it could be a more simplified survey that focuses on truck trip origins, destinations and routing.

Considerations to consider in the design of a roadside truck travel survey include the following:

- Only Niagara Police or MTO enforcement officers would have the authority to direct drivers from the roadway, and their assistance would be crucial to the success of such a survey;
- Safe locations would need to be identified where officers could direct the trucks to for the survey interview;
- Whether the Vineland Truck Inspection Station is conducting inspections at the time of the survey will affect Scale-avoidance rates;
- Brief safety inspections may need to part of the survey process;
- Survey locations will need to be moved periodically, as word will quickly spread among truck drivers of delays due to survey operations;
- COVID-19 restrictions and safety guidelines at the time of the survey will affect the survey conduct.

Licence-plate trace survey along bypassing routes

A much less obtrusive means of identifying the routing of vehicles in the study area compared to the roadside surveys option above is a licence-plate trace survey. This methodology involves safely locating survey staff with high-resolution cameras at strategic roadside locations to record licence plate images of trucks as they pass by, with vehicle and time information, and matching licence plates between sites to identify the approximate routing.

Considerations in the design of a licence-plate trace survey include the following:

- The survey locations would need to be identified carefully to ensure that key routes are captured. Each additional survey station requires additional staff resources, equipment and processing time, but adds to a more complete vehicle routing picture. The main route to include, in one or more directions, includes:
  - Victoria Avenue south of South Service Road, Vineland;
  - Ontario Street south of South Service Road, Beamsville; and
  - King Street east of Bartlett Road, Beamsville.

  Additional locations can be added to capture other potential bypassing routes.
- A very high licence plate image capture rate and high accuracy is needed for each location. Because vehicles pass by too quickly to read plates accurately manually, image capture is required – this also allows for later review and verification of each licence plate.
- In general, one team should be used for each direction of travel, to ensure that vehicles in one direction are not blocked by view by another direction.
- Sufficient staff should be available to rotate among survey crews to provide for breaks to allow for continuous licence plate image capture.
- While automatic licence plate readers may be used, these can be very expensive to procure, and require manual review of each image to ensure accuracy regardless. IBI Group has had very good success in past licence plate surveys with a contractor using high-resolution cameras from a roadside vehicle taking the photos of the rear of passing vehicles and processing the time-stamped images afterward.
- Surveys would be weather dependent, as rain could make it harder to read the licence plates in the images.

MTO enforcement assistance in municipal truck safety blitzes

MTO's enforcement officers focus on the provincial highway system, but are sometimes invited by municipalities to conduct commercial vehicle safety blitzes of traffic on municipal roads in Niagara Region, with the municipalities providing safe locations for officers to conduct these blitzes. At these blitzes, officers inspect vehicles for vehicle safety and also determine whether the route they are following is appropriate for their trip or is an attempt to by-pass the scales. Successful blitzes were recently conducted on June 23, 2020 across west Niagara and on October 14, 2020 at the Hinan Drive Public Works yard (just south of South Service Road, east of Ontario Street in Beamsville).

More recently another blitz, “Project Avoidance”, was conducted on June 17, 2021. This involved stopping a total of 103 commercial vehicles on municipal roads while the Vineland scale was in operation and most likely to be bypassed. A total of 45 of these vehicles underwent inspections. It was found that 25% of the vehicles were bypassing the scale to avoid inspections, as they did not have a valid reason not to be continuing along the QEW instead of along municipal roads. Most of the bypassing vehicles were identified near Victoria Ave and King Street in Vineland (which would continue westbound along King St to Beamsville); very few were identified on North or South Service Roads. Of the vehicles inspected, two drivers were placed out of service and fifteen vehicles were placed out of service, and others had tickets issued. Some of the charges included not having daily logs, no annual safety inspection, brake issues, no trailer brakes, insecure load, and over-width vehicle or load, among others.

Real-time identification of Scale-avoiding trucks

One potential means of efficiently identifying scale by-passing trucks would be to install automatic licence-plate readers on Ontario Street in Beamsville, Victoria Avenue in Vineland or other routes used by Scale-avoiding trucks. The licence plate reader would automatically take an image of the licence plate, read the plate number, and send message from the scale if it matches a vehicle that should not be using local roads. However, this can be cost-prohibitive.

Another option is to have an officer note which trucks (i.e. vehicle type, company name and/or licence plate) are turning southbound onto Victoria Avenue when the Vineland inspection lights are on, and have another officer pull them over when they appear again at Ontario Street northbound. This has been found to be effective, but it takes significant enforcement resources.

Provision of lay-bys on municipal roads to support enforcement activities

A challenge to officers in engaging with truck drivers on municipal or regional roads is finding a safe location at or near the roadside to which they can direct the truck as well as their own enforcement cruiser. The number of places where they can safely do this can be very limited.

Having the Town of Lincoln provide strategic roadside lay-by locations along municipal roadways, long enough for a transport truck combination and a police/enforcement cruiser and wide enough for the vehicles and officers to be safe from nearby traffic would greatly support enforcement activities. Other advantages of providing such lay-bys include the following:

- The lay-by could discourage use of the route for Scale avoidance, as the driver would be aware of the lay-by as a possible location for enforcement activities;
- Trucks and other vehicles could use the lay-by to deal with vehicle safety issues, make phone calls, or other activities more safely;
- The lay-bys could serve as a safe location to conduct Ride-Checks or other police/enforcement activities.

The Town of Lincoln could also encourage Niagara Region to provide one or more lay-bys on Regional Road 81 east of Bartlett Road for the same reasons.

Geometric Design Features to discourage trucks from using certain routes

The Beamsville By-Pass Implementation Study includes the development of functional designs for the by-pass routes. The by-pass routes will intersect with some east-west roads that may be used by trucks to avoid the Scale. The inclusion of geometric design features at intersections such as Bartlett Road and Greenlane may serve to discourage certain movements.

5.2.2 Exceeding Vehicle Weight Limits

Exceeding the allowable weight limits for commercial vehicles or their individual axles is a major concern as it compromises the maneuverability and safety of the vehicle, as well as creating excessive wear on the roadway surface and increasing the amount of maintenance required.

Officers in MTO's Commercial Inspection and Enforcement Branch are fully trained in determining whether vehicles are within their allowable weight limits, either at the permanent scales truck inspection station or by use of portable scales they use while on patrol. However, municipal police forces are generally not trained in enforcing vehicle weights. Currently Niagara Regional Police Services has one officer trained in the enforcement of commercial vehicle weights and other mechanical/technical vehicle safety issues. MTO enforcement officers are therefore frequently invited to conduct commercial vehicle safety blitzes on municipal roads to help ensure that vehicle weight limits are followed.

Having more municipal police officers trained in commercial vehicle safety would be an important step in having more consistent enforcement of commercial vehicle weight limits.

5.2.3 Speeding

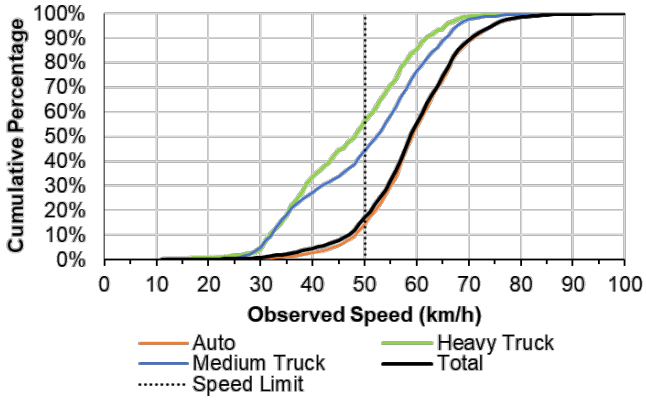
The Town of Lincoln's Truck Safety Motion, action 5, indicates that speeding is one concern of the municipality.

The first step to taking action to enforce speeding is to verify that speeding is prevalent enough to take action.

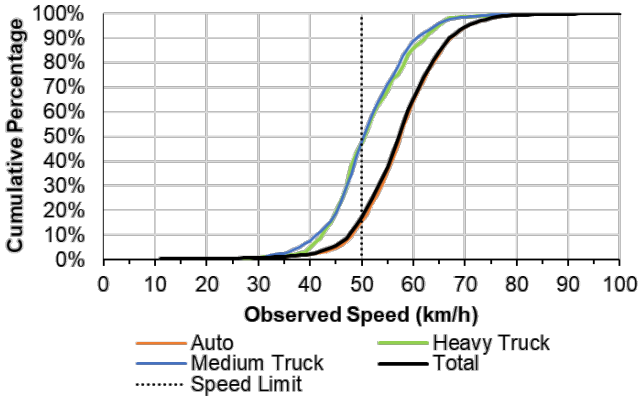
In addition to the vehicular speed data discussed in **Section 3.1.8**, measurements of individual vehicle lengths and speeds for Bartlett Road (between King Street and Arejay Avenue) were collected by the Town of Lincoln. This road section has a 50 km/h speed limit. **Exhibit 5.5** shows the cumulative distribution of vehicle speeds at this location.

Exhibit 5.5: Speed Profile for Bartlett Road, Beamsville

A. Southbound



B. Northbound



Source: IBI Group analysis of Black Cat data collected by the Town of Lincoln January 13 to February 3, 2021

From **Exhibit 5.5**, the following conclusions may be drawn with respect to vehicles travelling southbound:

- The overall median (50%) speeds across autos, medium trucks, and heavy trucks are approximately 58 km/h, 53 km/h, and 48 km/h, respectively; and
- The 85th percentile speeds across autos, medium tricks, and heavy trucks are approximately 67 km/h, 64 km/h, and 59 km/h, respectively; and
- Approximately 26% of all vehicles were travelling southbound at speeds of 65 km/h or greater, with the majority being passenger vehicles.

Furthermore, with respect to vehicles travelling northbound:

- The overall median (50%) speeds across autos, medium trucks, and heavy trucks are approximately 55 km/h, 50 km/h, and 50 km/h, respectively; and
- The 85th percentile speeds across autos, medium tricks, and heavy trucks are approximately 65 km/h, 58 km/h, and 59 km/h, respectively;
- Approximately 15% of all vehicles were travelling northbound at speeds of 65 km/h or greater, with the majority being passenger vehicles.

Overall, these results largely coincide with the speeds reported in **Section 3.1.8** (i.e., 85th percentile speeds of approximately 67 km/h). As the vast majority of vehicles on this roadway are autos, these speeds are largely reflective of auto speeds, and medium and heavy trucks tend to travel at slower speeds, though approximately 1 in 10 southbound trucks and 1 in 20 northbound trucks drive at

speeds higher than 65 km. The roadway is straight with few driveways along the way, reflective of a higher design speed. As this roadway is also proposed to have a paved shoulder or other measures for active transportation, measures to keep vehicles closer to the speed limit should be considered, beginning with roadway design features.

Analysis of speeds of other locations along the current or proposed truck route will confirm where action is needed to reduce speed by roadway design or through enforcement measures. In some cases, additional measures may be warranted, such as was implemented in late 2019 on Mountain Street, including a permanent flashing 50 km/h speed limit sign and strategic line painting. Target police enforcement can also discourage speeding.

6 Operational Assessment

IBI Group completed a corridor operational review, which consisted of conducting field observations, a safety review, and intersection operational assessments of existing (2021) and future (2024) conditions to understand the operational constraints along the by-pass route and identify any mitigation measures required to improve traffic operations.

6.1 Summary of Field Review

IBI Group conducted a field review of the study area on March 15, 2021. Observations were made along the entire corridor to document any existing deficiencies that may lead to issues with implementing the Beamsville truck by-pass route. Additionally, the project team confirmed detailed in the field, such as posted speed limits, intersection lane configurations, dedicated turning lane lengths, walking and cycling infrastructure, intersection sight distances, and other important items that will serve to inform the corridor operational review and intersection operational assessments. **Exhibit 6.1** summarizes the locations along the proposed by-pass route where operational issues were observed.

6.2 Existing Volumes

As noted in **Section 3.1**, IBI Group received historic turning movement count (TMC) data from Town of Lincoln and Niagara Region staff. Full turning movement count data is presented in **Appendix A**. A summary of the TMC details, including Weekday AM and Weekday PM Peak hours, is presented in **Appendix E**.

Given the relative age of the TMCs at several study area intersections, historic traffic volumes were subjected to various annual growth rates, depending on vehicle type (i.e., passenger vehicle and truck volumes were grown differently). Additionally, adjustment factors were developed to apply to data collected during the COVID-19 pandemic. This is discussed further in **Appendix E**.

Exhibit 6.1: Field Review – Operational Issues Observed

Location	Operational Issues Observed
South Service Road, west of Ontario Street	• Eastbound left-turning vehicles have limited visibility of opposing westbound vehicles due to the curve in the roadway. • Visibility of the auxiliary signal head for the eastbound approach may be blocked by the vegetation on the north side of the street.
Bartlett Road and South Service Road	• Intersection geometry was observed to present challenges for turning trucks.
Bartlett Road	• A lack of sidewalks along Bartlett Road forces pedestrians to walk on the shoulder. • Passing vehicles were observed giving way for pedestrians. • Right-turning trucks travelling along Bartlett Road were observed to be encroaching on oncoming traffic lanes.
Bartlett Road and Greenlane	• Curb radii was observed to be large enough for truck drivers to potentially use to travel to and from Ontario Street. • Potential sight visibility constraints due to the rail crossing between the two legs of Greenlane at Bartlett Road.
King Street and Mountain Street	• Tight intersection geometry presents challenges for southbound left-turning trucks entering the intersection. • Vehicles in the eastbound through lane were observed to stop ahead of the stop bar to provide enough room for turning trucks to maneuver through the intersection. • It was noted by local residents during field observations, that King Street at Mountain Street is frequently blocked by vehicles and trucks. • Eastbound right-turning trucks observed to turn from the centre lane. • Eastbound and westbound turning trucks were observed waiting for a yellow or red light before making their turning movements.
King Street and Ontario Street	• A lack of lane delineation for the westbound approach results in vehicles turning right from the centre lane. This issue is compounded by the large corner radius on the NE corner, which results in eastbound right-turning vehicles turning at high speeds. • Vehicle queues were observed blocking the intersection of King Street and Ontario Street. • During field observations, local residents noted that King Street at Ontario Street is frequently blocked by vehicles and trucks.
Durham Road	• Poor pavement surface condition along the entire length of Durham Road. • Narrow pavement widths result in turning trucks blocking the roadway. • There is no roadway lighting along Durham Road.

6.3 Truck Diversion

IBI Group conducted the truck by-pass assessment under 2024 future conditions when the proposed by-pass route is expected to be implemented, as per the Town of Lincoln Transportation Master Plan.

Tasks included:

- Conducting an origin-destination analysis in order to understand the existing truck travel patterns in Beamsville in order to inform the anticipated truck diversion; and
- Using the results of the origin-destination analysis to divert the truck volumes onto the by-pass route.

6.3.1 Origin-Destination Analysis

This section describes an analysis of origin-destination flow patterns for commercial vehicles for two key locations on the proposed Beamsville truck route bypass:

- King Street and Bartlett Road; and
- King Street and Mountain Street / Central Avenue.

A key question driving this analysis is to better understand the degree to which commercial vehicles bypass MTO's Vineland Truck Inspection Station, which is located approximately four kilometres east of the Ontario Street (Beamsville) interchange with the Queen Elizabeth Way, and operates in the westbound direction only.

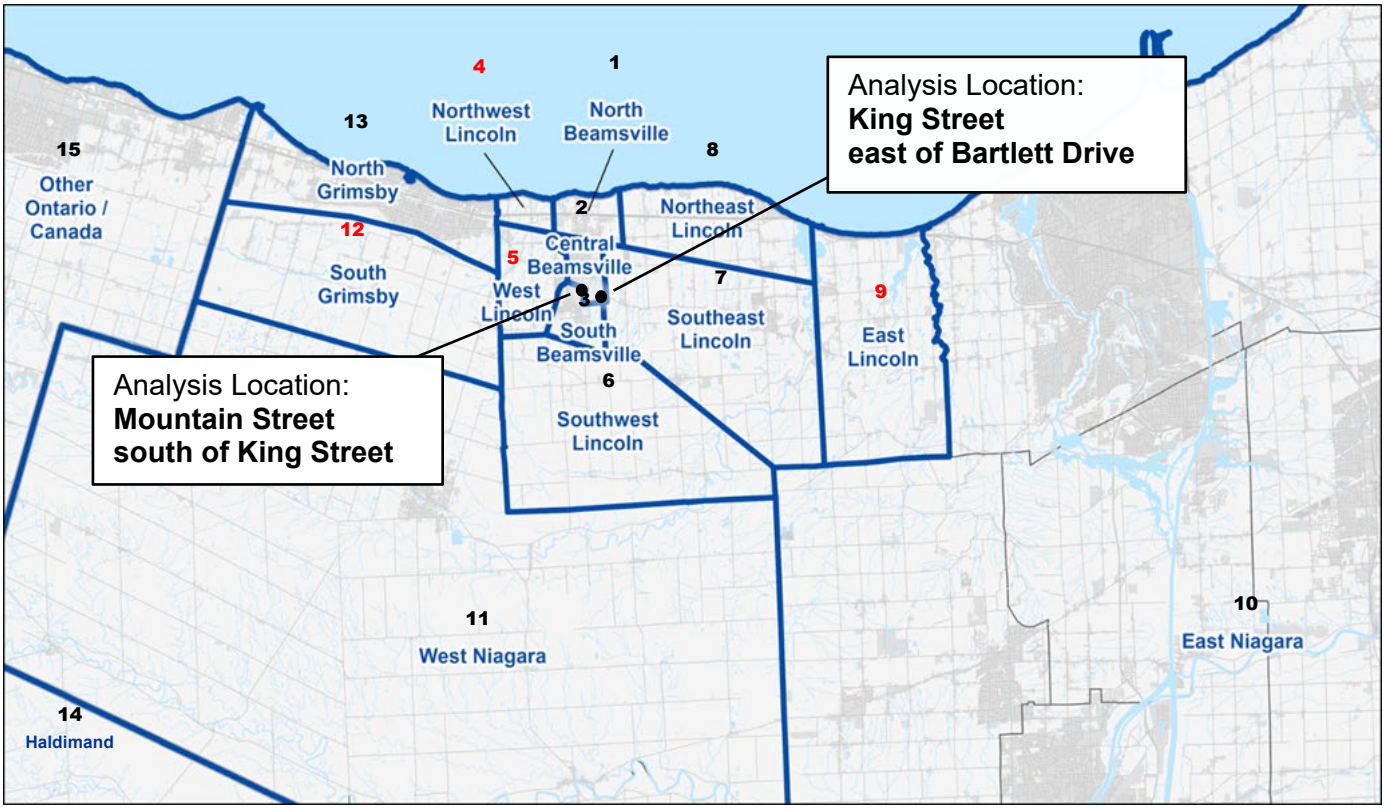
Data for this analysis was provided by Geotab commercial vehicle fleet tracking data. Geotab has had the functionality to conduct origin-destination analyses since November 2020; November 2020 was selected for this analysis, rather than a more recent time period, to more closely represent conditions that are relatively close to typical, as additional COVID-19 restrictions were put in place by the Province of Ontario in December 2020.

The analysis was conducted based on a 15-zone system, shown in **Exhibit 6.2**. Four of the zones shown, as well as the United States as a sixteenth zone, were not found to have any trip origins or destinations associated with them in the Geotab data. This may be a limitation of Geotab's market base, as MTO's enforcement officers understand that US-based trucks are potentially a significant component of trips bypassing the QEW truck inspection station at Vineland. Therefore, the findings below may underestimate the proportion of trucks making long-distance trips through the study area to bypass the Vineland scale.

The findings presented in this section represent a weekday daytime period (5:00 a.m. to 6:00 p.m.). **Exhibit 6.3** is a table showing weekday daytime origin-destination flows for both analysis locations (i.e., at each location). The flows

are illustrated to scale conceptually for the two locations in **Exhibit 6.4** and in **Exhibit 6.5**, respectively.

Exhibit 6.2: Zone System and Analysis Locations for Origin-Destination Analysis



Note: Zones with **red** zone numbers were not associated with trip origins or destinations in the analysis.

Exhibit 6.3: Origin-Destination Flows for Weekday Daytime (November 2020)

Origin Zone	Destination Zone 1	2	3	6	7	8	10	11	13	15	Total
King Street East of Bartlett Road											
1 North Beamsville											**0**
2 Central Beamsville					19.3		32.1				**51**
3 South Beamsville											**0**
6 Southwest Lincoln											**0**
7 Southeast Lincoln										25.7	**26**
8 Northeast Lincoln											**0**
10 East Niagara		96.2							38.5	121.8	**256**
11 West Niagara											**0**
13 North Grimsby							25.7				**26**
14 Haldimand											**0**
15 Other Ontario/Canada					38.5		102.6				**141**
Total	**0**	**96**	**0**	**0**	**58**	**0**	**160**	**0**	**38**	**147**	**500**
Mountain Street South of King Street											
1 North Beamsville						6.0				7.9	**14**
2 Central Beamsville		6.0	11.9		6.0		13.9				**38**
3 South Beamsville			15.9				19.9			61.6	**97**
4 Northwest Lincoln											**0**
5 West Lincoln											**0**
6 Southwest Lincoln											**0**
7 Southeast Lincoln										10.0	**10**
8 Northeast Lincoln											**0**
9 East Lincoln											**0**
10 East Niagara		10.0	19.9					7.9	13.9	43.7	**95**
11 West Niagara		7.9					15.9				**24**
13 North Grimsby			7.9				11.9	7.9		7.9	**36**
14 Haldimand		17.9									**18**
15 Other Ontario/Canada		19.9	83.5	7.9			29.8	19.9			**161**
Total	**0**	**56**	**111**	**8**	**0**	**0**	**58**	**36**	**14**	**62**	**344**

Exhibit 6.4: Origin-Destination Flows at King Street East of Bartlett Road

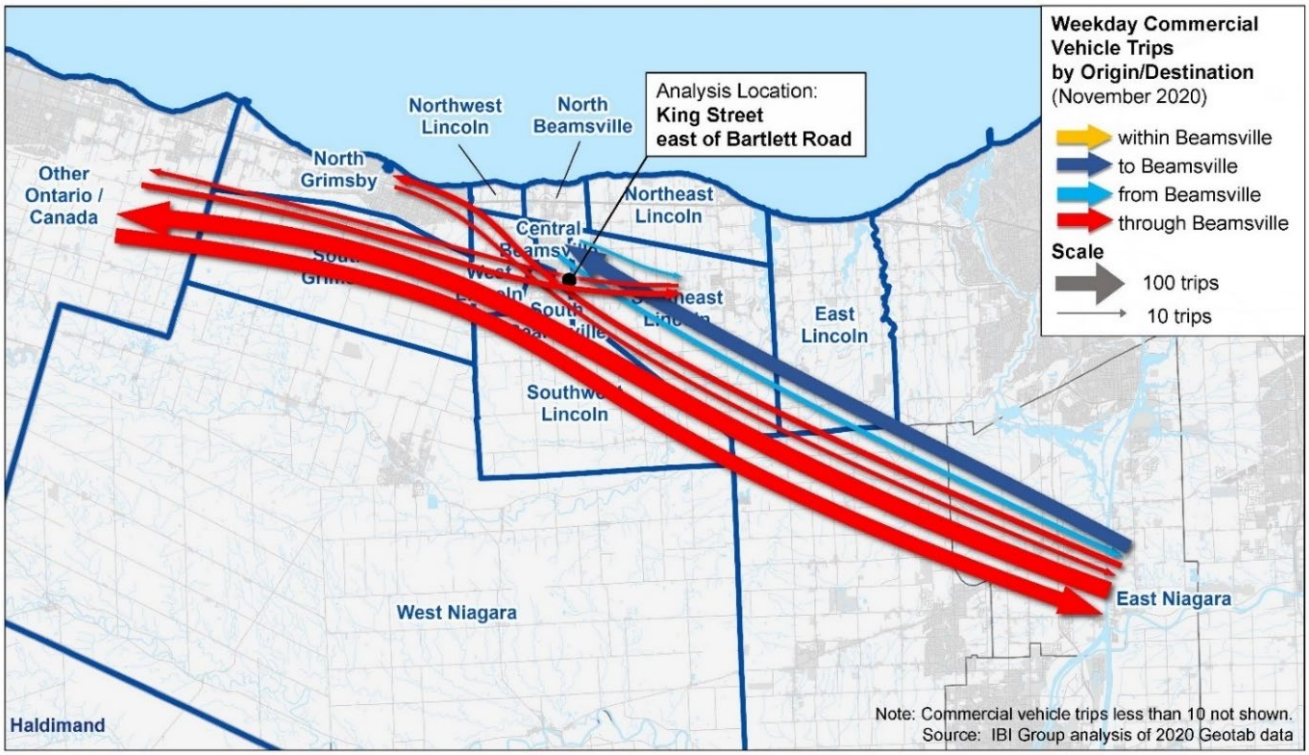
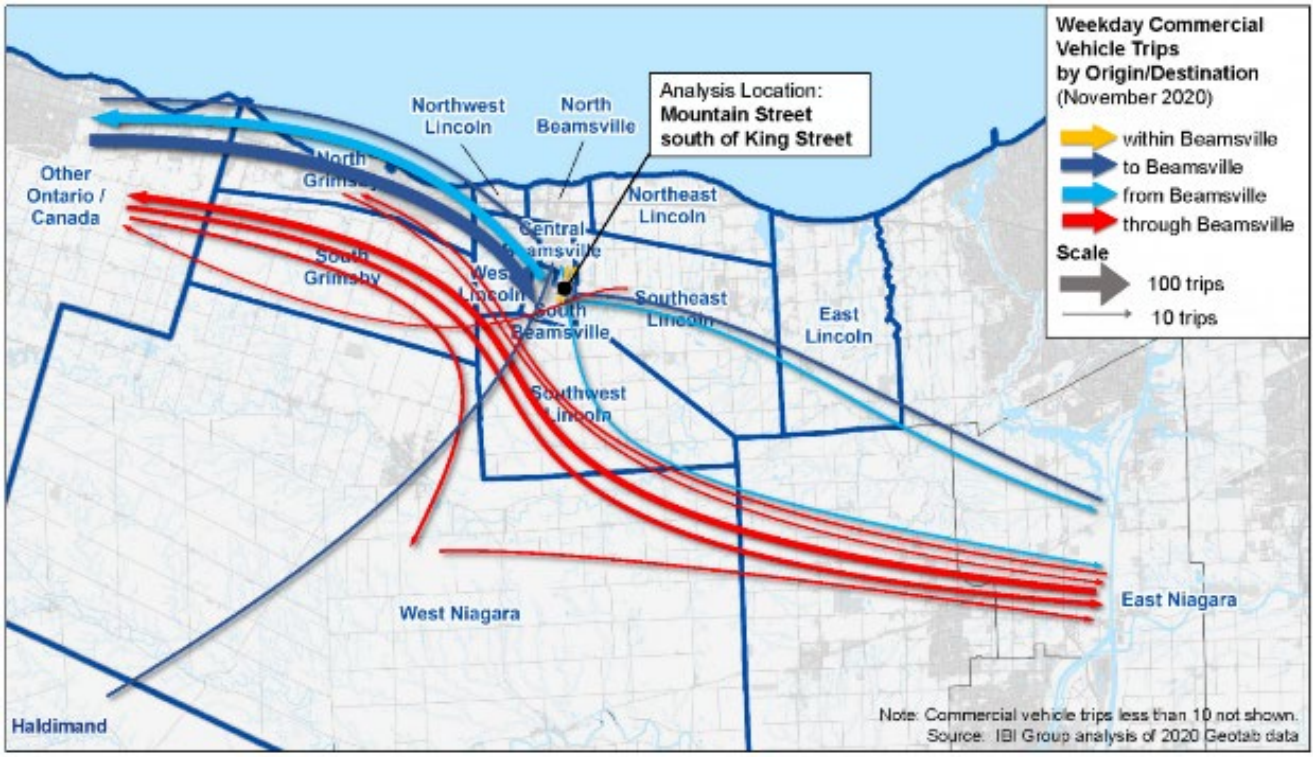


Exhibit 6.5: Origin-Destination Flows at Mountain Road South of King Street



6.3.1.1 King Street East of Bartlett Road

Based on the Geotab data analysis reflecting an estimated 500 weekday daytime commercial vehicle trips at the King Street location:

- 42% of trips (212 trips) are locally based: to, from or within Lincoln – King Street is likely the shortest path to/from their local origins/destinations; however, as many of these are likely travelling to/from industries the northern part of central Beamsville, they could use the proposed Bartlett Road truck route bypass instead;
- The remaining 58% of trips are to/from East Niagara (beyond the Town of Lincoln):
  - 13% of trips (64 trips) are between East Niagara and the Town of Grimsby in Hamilton; and
  - 45% of trips (224 trips) are between East Niagara and locations beyond Niagara Region and Grimsby.

  Many of the longer-distance trips to/from East Niagara likely use Ontario Street in Beamsville to connect with the QEW (or parallel service routes). Except for the small number of trips that may have a stop in downtown Beamsville, these long-distance trips could divert to the proposed Bartlett Road bypass routing.

The greatest directional imbalance in the origin-destination findings is seen among trips to or from Central Beamsville. Approximately twice as many daily truck trips were destined westbound to Central Beamsville (96 trips) then there were travelling eastbound from Central Beamsville (51 trips). This seems to reflect a local knowledge about avoiding the westbound-only QEW truck inspection station by travelling westbound on King Street, with a greater likelihood of using the QEW instead of King Street when travelling eastbound.

6.3.1.2 Mountain Street South of King Street

Based on the Geotab data analysis reflecting an estimated 493 weekday daytime commercial vehicle trips at the Mountain Street location:

- 68% of trips (334 trips) are locally-based: to, from or within the Town of Lincoln.
  - Of these locally-based trips, two thirds (221 trips or 45% of total trips), are to and/or from South Beamsville (i.e., south of King Street), for which travelling north-south along Mountain Street would be the most direct route.
    - Approximately three quarters of the trips to or from South Beamsville are to/from places west of the Town (via Ontario Street or King Street west). The proposed Bartlett Road routing would represent a slightly longer trip compared to the current routing.

- The remaining 32% of trips (136 trips) are not locally based (neither origin nor destination in the Town of Lincoln); these flows include:
  - 15% (74 trips) between East Niagara and other Ontario/Canada locations – **these are the most likely to reflect potential vehicles bypassing the truck inspection station**;
  - 8% (42 trips) between Grimsby and locations outside of Town of Lincoln;
  - 4% (20 trips) between West Niagara and other Ontario/Canada locations; and
  - 5% (24 trips) between East Niagara and West Niagara.

The above analysis indicates a high potential for diversion of trucks to the proposed truck route bypass along Bartlett Road – especially among truck trips at King Street east of Bartlett Road. This is especially true of the non-local trips.

Between the two analysis locations, a total of 114 trips were to/from Grimsby, representing the likely upper limit of daily additional trips using the Durham Road bypass, though many of these would likely find other routing besides Durham Street to be more convenient to access their Grimsby trip ends.

6.3.2 Sensitivity Analysis

It should be noted that for the purpose of this assessment, we have assumed two scenarios for truck diversion / rerouting, as described in **Exhibit 6.6**:

Exhibit 6.6: Truck Rerouting Scenarios

Scenario	Scenario Description
75% Rerouting Scenario	• 75% of trucks not currently using the proposed by-pass route are diverted to the proposed by-pass route. • The remaining 25% will continue to use Ontario Street (between South Service Road and King Street) and along King Street (between Ontario Street and Durham Road).
100% Rerouting Scenario	• 100% of trucks along Ontario Street (between South Service Road and King Street) and along King Street (between Ontario Street and Durham Road) intending to pass through Beamsville have been rerouted as per the proposed truck by-pass route.

The following principles were applied for determining traffic volumes under the two truck rerouting scenarios:

- Based on the origin-destination analysis, truck routes eligible for rerouting (i.e., those that are not associated with local deliveries along Ontario Street, between South Service Road and King Street, and along King Street, between Ontario Street and Durham Road) were identified and were rerouted, as per the proposed truck routing;

- During this rerouting process, truck volumes under the 100% rerouting scenario were inspected and adjusted based on first principles in order to preserve volume balancing; and
- Passenger vehicle volumes are unaffected in the 75% and 100% rerouting scenarios.

Rerouted truck volumes expected to travel around the study area under the 75% and 100% rerouting scenarios are illustrated in **Exhibit 6.7** and **Exhibit 6.8**, respectively. A summary of the anticipated diverted truck volumes onto Durham Road and Bartlett Road under the 75% and 100% rerouting scenarios is presented in **Exhibit 6.9**.

Exhibit 6.7: Truck Volume Diversion, 75% Rerouting Scenario

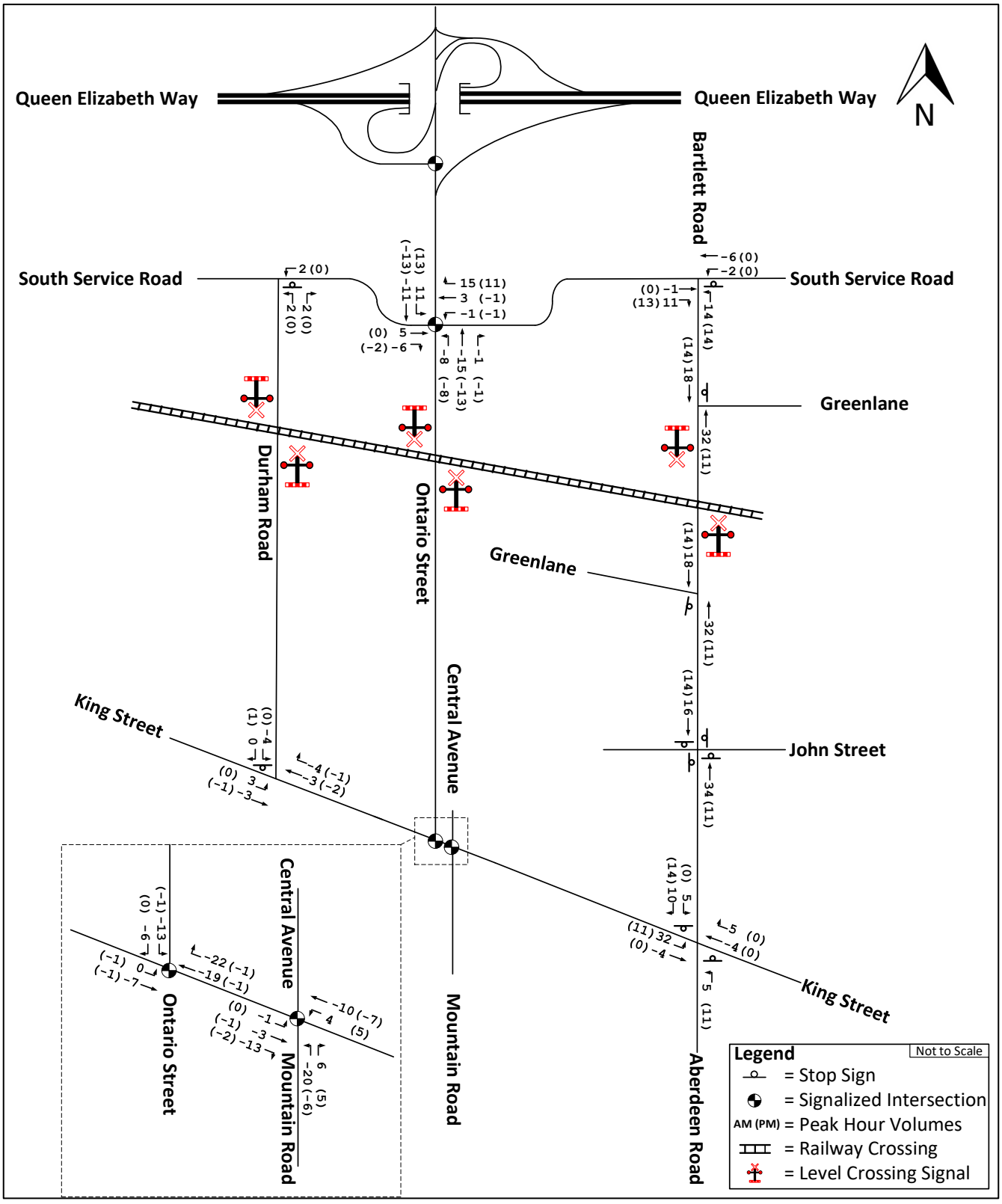


Exhibit 6.8: Truck Volume Diversion, 100% Rerouting Scenario

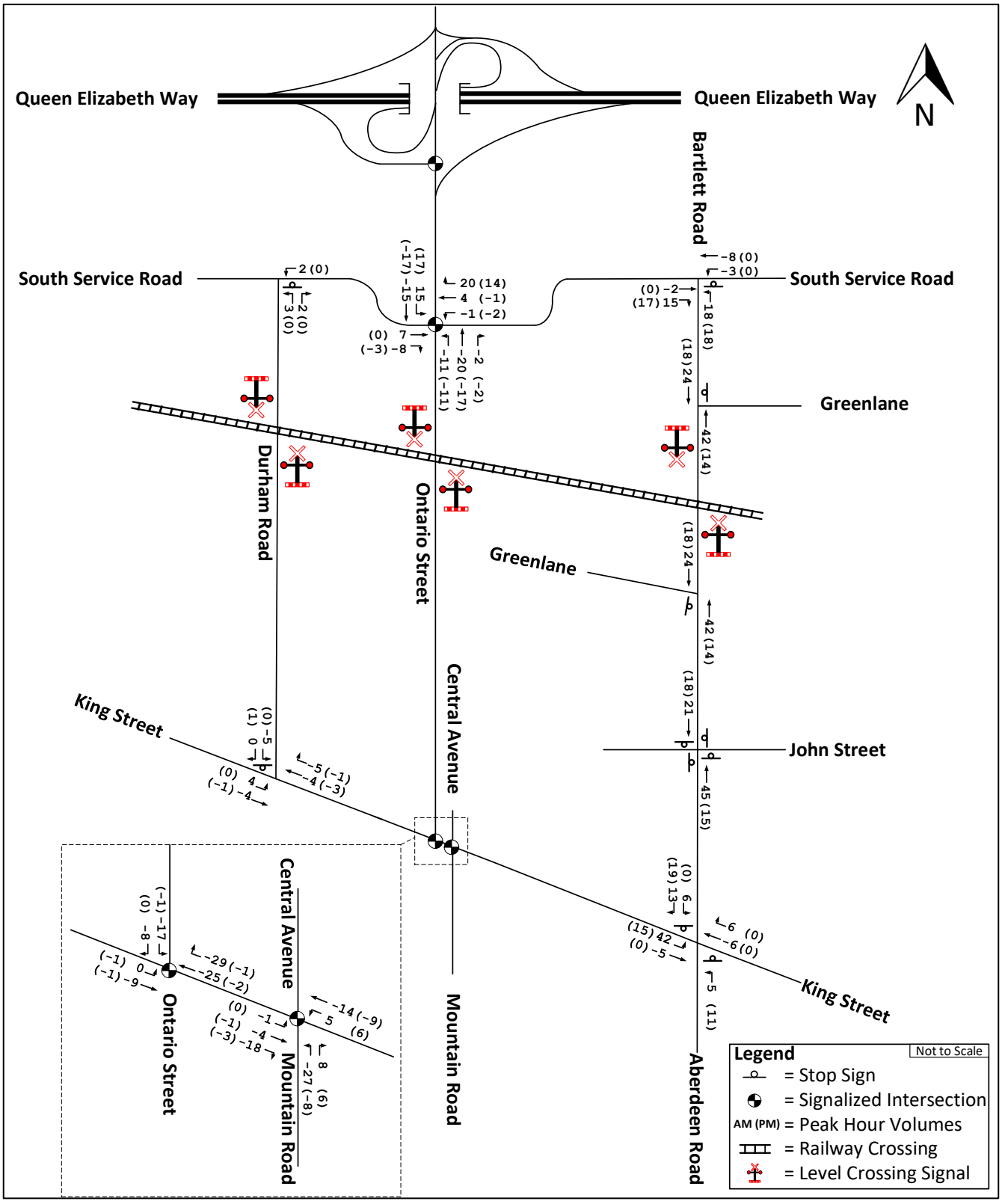


Exhibit 6.9: Anticipated Diverted Truck Volumes by Peak Hour

Rerouting Scenario	Anticipated Diverted Truck Volumes			
	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Durham Road	Bartlett Road	Durham Road	Bartlett Road
75% Rerouting Scenario	3 – 4	29 – 46	0 – 1	24 – 28
100% Rerouting Scenario	4 – 5	37 – 60	0 – 1	32 – 37

With respect to diverted two-way truck volumes over a 24-hour period, **Exhibit 6.10** summarizes estimated ranges of daily truck volumes expected to reroute away from Ontario Street and onto the proposed truck by-pass route (i.e., via Durham Road and Bartlett Road).

Based on a comparison of the pass-through truck volumes (i.e., truck volumes not intended for local deliveries along Ontario Street and King Street) under existing routing and under the 75% rerouting scenario, approximately 130 two-way trucks per day are estimated to divert away from Ontario Street, with approximately 10 two-way trucks per day rerouting onto Durham Road and approximately 120 two-way trucks per day rerouting onto Bartlett Road.

Exhibit 6.10: Anticipated Diverted Daily Truck Volumes, 2024 Horizon Year

Rerouting Scenario	24-Hour Two-Way Truck Volume Estimates		
	Ontario Street	Durham Road	Bartlett Road
Existing Routing; Total Trucks	240 - 360	170 - 190	250 - 300
Existing Routing, Pass-through Trucks	170 - 290	110 - 120	200 - 230
75% Rerouting, Pass-through Trucks	40 - 70	120 - 130	320 - 440
75% Rerouting, Total Trucks	110 - 140	180 - 200	370 - 480
Estimated Diverted Trucks	**-130**	**+10**	**+120**

This distribution of trucks will be able to be managed by the network for the next ten years.

6.4 Intersection Operational Assessment

IBI Group completed intersection operational assessments, using Synchro software, for the key intersections along the proposed by-pass route. A detailed assessment is found in **Appendix E**.

The signalized and unsignalized study area intersections are observed to operate below critical capacity thresholds under 2021 Existing Conditions.

With the addition of background traffic growth to the horizon year of 2024, the signalized study area intersections are expected to continue operating below critical capacity thresholds. However, traffic operations for the southbound left-

turn movements at the King Street and Durham Road, as well as the King Street and Bartlett Road / Aberdeen Road unsignalized intersections are expected to exceed critical operational thresholds during the Weekday AM and Weekday PM Peak hours. These constraints are likely attributable to the anticipated increase in eastbound and westbound through traffic volumes along King Street (due to background traffic growth) and the resultant decrease in overall gaps for turning vehicles to use.

As requested by the Town of Lincoln, a signal warrant analysis for the intersection of Bartlett Road and John Street was undertaken to determine if a traffic control signal is currently warranted, or will be warranted, when the planned by-pass is implemented. This is discussed in greater detail further below.

Traffic operations analysis was conducted to determine future intersection performance under the 2024 Future Conditions (75% Rerouting) scenario. The study area signalized intersections are anticipated to continue operating below critical capacity thresholds during the Weekday AM and Weekday PM Peak hours under the 75% rerouting scenario. No new critical movements are identified under the 2024 Future Conditions (75% rerouting) scenario, when compared to the 2024 Future Conditions (Do Nothing) scenario.

The only exception is the northbound approach at King Street & Bartlett Road / Aberdeen Road during the PM peak hour, where the delays of the northbound movements are anticipated to increase by three seconds from 25 seconds to 28 seconds. This suggests that the rerouting of trucks away from and around the Beamsville core area will likely not have a significant impact on traffic operations at the study area unsignalized intersections.

The most conservative impacts of truck rerouting (i.e., the 100% truck rerouting scenario) were analyzed to determine future intersection performance under the 2024 Future Conditions (100% Rerouting) scenario.

The existing signalized intersections are expected to continue operating below critical capacity thresholds during the Weekday AM and Weekday PM Peak hours under the 2024 Future Conditions (100% rerouting) scenario. No new critical movements are identified under the 2024 Future Conditions (100% rerouting) scenario, when compared to the 2024 Future Conditions (Do Nothing) scenario.

The only exception is the northbound approach at King Street & Bartlett Road / Aberdeen Road during the PM peak hour, where the delays of the northbound movements are anticipated to increase by less than four seconds from 25 seconds to 28.8 seconds. This suggests that the rerouting of 100% of the trucks away from and around the Beamsville core area (with the exception of local delivery truck traffic) will have not have a significant impact on traffic operations at the study area unsignalized intersections.

In addition to the 2024 Future Conditions (75% Rerouting) and 2024 Future Conditions (100% Rerouting) analyses, a supplementary analysis was undertaken under the 75% Rerouting scenario and a horizon year of 2034 to

determine future intersection performance when the proposed truck by-pass route and corresponding truck diversions are in place and have had sufficient time for implementation to stabilize. Results from this traffic operational assessment indicate that a majority of the constraints anticipated under the 2024 Future Conditions (75% Rerouting) scenario are expected to continue to 2034. While there are a few additional movements that are expected to exceed critical operational thresholds by 2034, all movements within the by-pass route implementation area are expected to operate within their theoretical capacity under 2034 Future Conditions. Signal Warrant Analysis – Bartlett Road and John Street

A signal warrant analysis, consistent with the Ontario Traffic Manual Book 12: Traffic Signals, was conducted to determine if a traffic control signal is warrant at the intersection of Bartlett Road and John Street. Based on the analysis, a traffic control signal is anticipated to be warranted in 2024 under the scenario where 100% of the truck traffic is rerouted to the proposed by-pass.

The results of the full warrant analysis are summarized in **Appendix E**.

6.5 Potential Geometric Improvements

IBI Group completed a review of each of the intersections along the proposed by-pass route and identified recommended mitigation measures to each intersection and the corridor in general i.e. curbs, drainage, wider lanes, etc.

6.5.1 King Street and Durham Road

This intersection functions well in its current configuration, allowing trucks to complete the required turning movements. No upgrades are proposed.

6.5.2 Durham Road and the South Service Road

At this intersection we are proposing to widen the road along the radii to allow additional space for the trucks to complete the turning movements without crossing into other lanes, as illustrated in **Exhibit 6.11**.

Exhibit 6.11: Proposed Durham Road and South Service Road Upgrades

6.5.0 Ontario Street and South Service Road

This is a busy intersection with traffic coming from the business centre, QEW, South Service Road and customers looking to access the businesses on each corner. We are recommending upgrades that will allow the intersections to operate more efficiently and reduce potential delays for truck movements, as illustrated in **Exhibit 6.12**.

On the east leg, we recommend that the west bound lanes be shifted to the north to allow the traffic island to shift north. This will widen the east bound lane to help facilitate the south bound left turn and the north bound right turn. The existing traffic island should be extended to the east, to prevent vehicles from turning out of the Esso property.

On the west leg we are recommending that the existing driveway to the Pioneer gas station be narrowed to allow for right in/right out access only. This will reduce the potential of vehicles turning out in front of trucks making the south bound right turn at the intersection.

Given that the recommendations include work that will change the existing access to the businesses, the owners should be consulted during the detailed design.

Exhibit 6.12: Proposed Ontario Street and South Service Road Upgrades

6.5.1 South Service Road and Bartlett Road

At this intersection we are recommending widening the road on the radii to allow trucks to complete the turning movements without crossing into other lanes, as illustrated in **Exhibit 6.13**.

6.5.2 Greenlane and Bartlett Road

Greenlane has been identified as a route that truck drivers use to avoid the scales on the QEW. The recommended upgrades are for the west intersection to help prevent trucks turning on to Greenlane to get to Ontario Street, as illustrated in **Exhibit 6.14**. We are proposing to reduce the radii on the NW corner so that it is more difficult for trucks to complete the turning movement.

Exhibit 6.13: Proposed South Service Road and Bartlett Road Upgrades

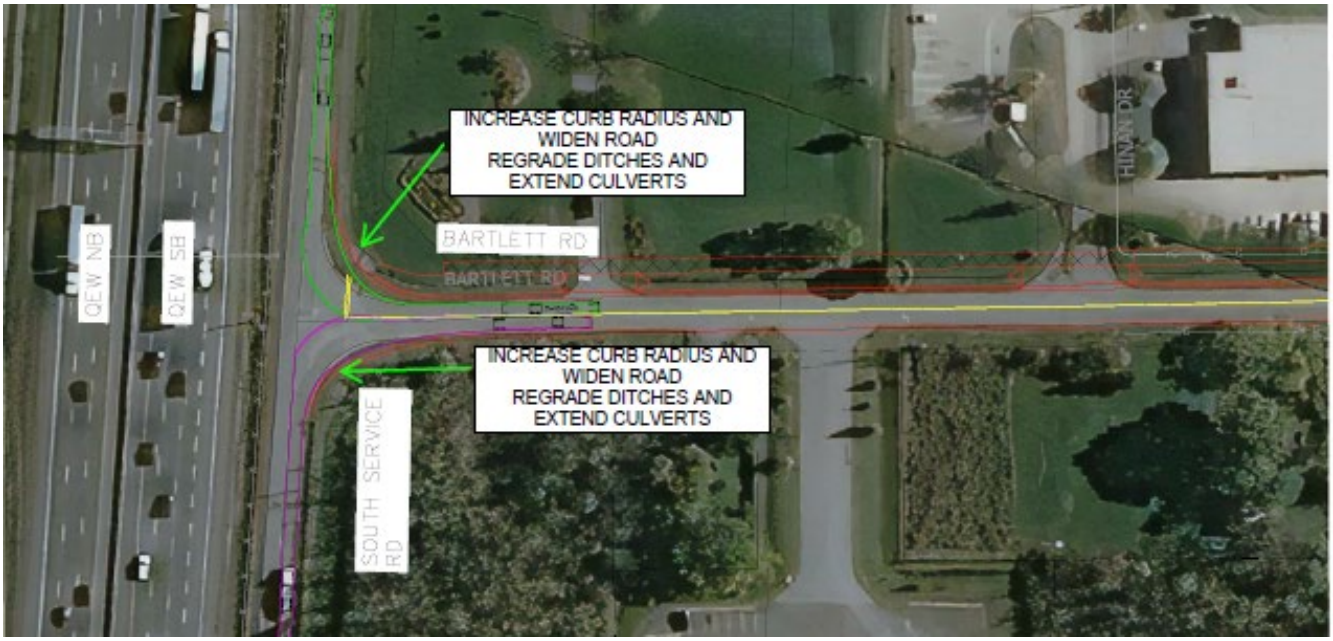


Exhibit 6.14: Proposed Greenlane and Bartlett Road Upgrades

6.5.3 King St and Bartlett Road

This intersection has a low traffic volume, but there is a lot of truck traffic due to the Dufferin concrete plant and the industrial area on the north end of Bartlett. Proposed recommendations are illustrated in **Exhibit 6.15.**

On the north leg, we are proposing to relocate the stop bar further back from King Street and create a painted median. This will allow the rear wheels of a truck completing the east bound left turn movement to clear the vehicles. The merge lane for south bound trucks turning right will be eliminated so trucks do not need to merge into traffic while accelerating. This will create a better approach angle to King Street for better visibility.

The existing trees on all corners of the intersection should be trimmed to allow better visibility for stopped vehicles.

Bicycle lanes can also be added to King Street.

Exhibit 6.15: Proposed King Street and Bartlett Road Upgrades

6.5.4 Bartlett Road Truck Enforcement Bay

We have included a rough design for a truck enforcement bay on the west side of Bartlett, north of 4509 Bartlett Road, as illustrated in **Exhibit 6.16**. In this area

the right of way widens, allowing for the installation without having to purchase additional land. This has been installed to allow MTO or police to pull trucks over who are trying to avoid the scales on the QEW or to perform safety inspections.

Exhibit 6.16: Proposed Truck Enforcement Bay Upgrades

6.5.5 Multi-Use Trail on Bartlett Road

Part of the truck route review included the construction of a multi use trail on Bartlett Road. The multi-use trail is being advocated for by the AT committee and they have already been consulted with during this study. This trail on the east side of Bartlett Road, as there are less conflicts and a continuous trail can be provided so users do not need to cross the road several times. However, the location of the multi-use trail can be confirmed during detailed design.

Given the existing right of way width, additional land may need to be purchased to allow the trail to be installed. At the intersections of King Street and Bartlett Road and the rail crossing, fill will need to be brought in to raise the grade and existing culverts will need to be extended to convey stormwater, as illustrated in **Exhibit 6.17**.

A proper rail crossing with maze gates and pedestrian matting will need to be installed and approved by the rail authority. Keeping the trail on the east side of the road will allow it to be constructed behind the ditch, so a storm sewer is not required, as illustrated in **Exhibit 6.18**.

The trail can be constructed on the west side of the road, but there are more conflicts with utilities, existing sidewalks and areas where the roadside ditch will need to be filled in, as illustrated in **Exhibit 6.19**. This will require the construction of a storm sewer and outlet, which will increase costs. Land costs will also be higher as this is inside the urban boundary.

Exhibit 6.17: Proposed Multi-Use Trail along Bartlett Road – Northeast Corner Ditch (Facing South)

Exhibit 6.18: Proposed Multi-Use Trail along Bartlett Road – 200 metres north of At-Grade Rail Crossing (facing South)

Exhibit 6.19: Proposed Multi-Use Trail along Bartlett Road – Conflicts along West Side of Bartlett Road (at Greenlane facing West)

Given the changing right of way profile along Bartlett Road, there are areas where the road will need to be lowered to provide positive drainage to the roadway. In other areas there appears to be sufficient fall from the back of the properties. This will need further review during detailed design.

A review of Bartlett should be completed with the Active Transportation committee to determine if the trail needs to be constructed along the entire length of the road. Once the final location is selected and the detailed design completed, construction of the trail can be phased to help spread the costs out over several budget cycles.

Given the cost of the trail, it is our recommendation that further discussions are had with the user groups, approval authorities and public input is sought to ensure this is the ideal location for a multi use trail or would a standard sidewalk be sufficient. A table summarizing the “pros and cons” of the location of the trail is provided in **Section 6.7**.

6.5.6 King Street and Mountain Road

The most challenging intersection on the truck route is the King Street and Mountain Road intersection. This intersection is located in the centre of Beamsville's downtown core and sees a variety of vehicles from cyclists to full size trucks. There is also a crossing guard to assist school children with crossing, on street parking near the intersection and delivery trucks that frequent the area. These factors all contribute to the overall complexity of the intersection and the proposed upgrades.

Prior to implementing any of the following recommended upgrades, Town staff should review the recommendations with Regional staff as both roads are Regional roads. IBI Group staff had a preliminary discussion with Mr. Nick Rosati on July 26, 2021, to discuss the proposed upgrades to the intersection to satisfy the needs identified below in the needs hierarchy. Mr. Rosati said the Region will provide comments after a formal submission has been made for their review.

In order to assist with the review and recommendations for this intersection, a needs hierarchy was established to prioritize the required upgrades, as shown in **Exhibit 6.20**.

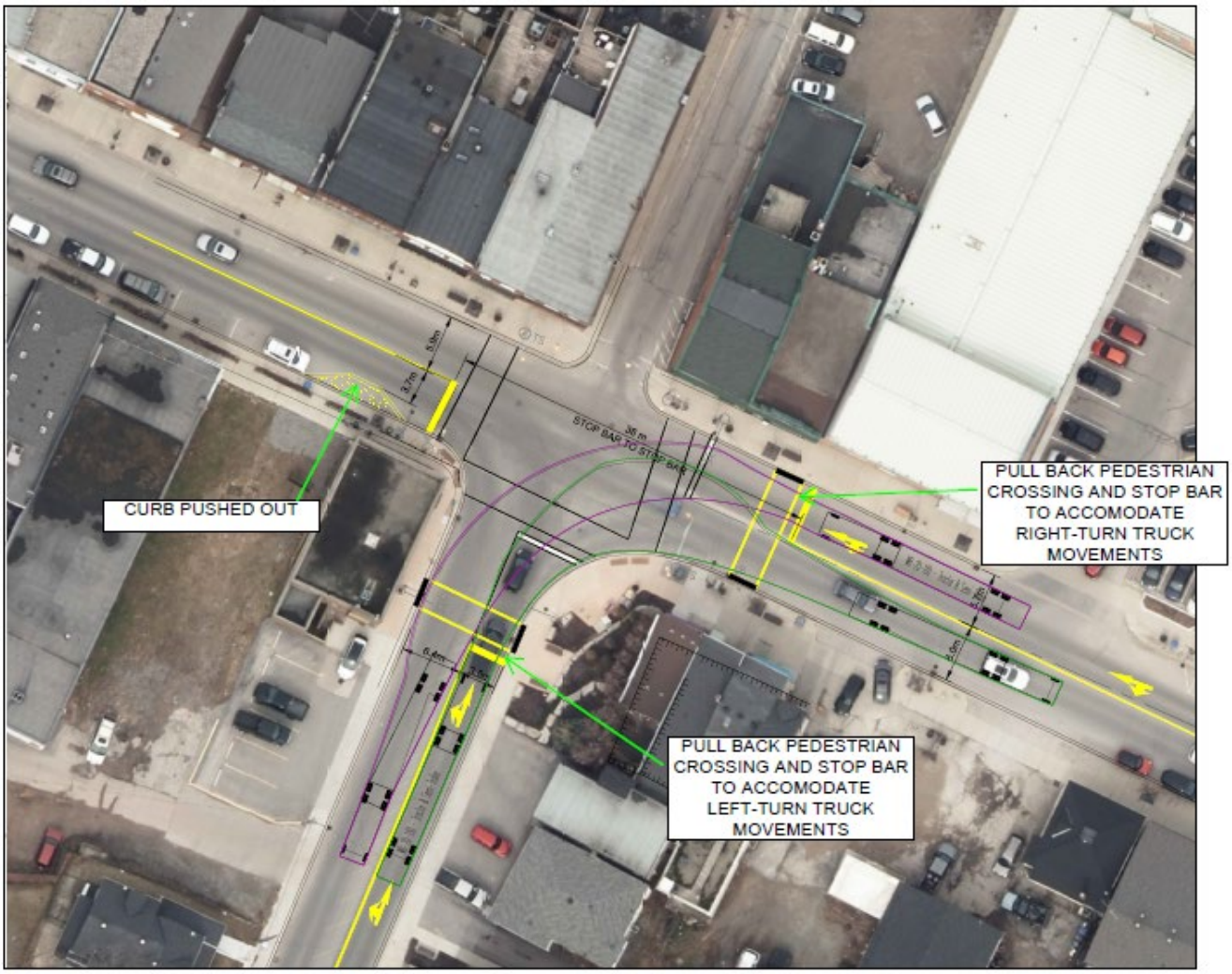
Exhibit 6.20: Needs Hierarchy to Prioritize Upgrades

User Group	Needs	Wants	Implications
Pedestrians	• Maintain existing sidewalk widths. • Protect against vehicle encroachment.	• Protected sidewalk area on the SE and SW corner. • Maintain or reduce current crossing distances.	• Protected area of sidewalk on the SW corner of King and Mountain. • Removal of building on the SW corner (Long Term).
By-Pass Trucks	• Feasible truck movements WB left turn and NB right turn for control vehicle (WB-20).	• Accommodate design vehicle without over tracking of opposing lanes. • Accommodate control vehicle with minimal over tracking of opposing lanes.	• Elimination of over tracking could necessitate smaller design vehicles (and restriction on larger vehicles). • Intersection widening, which could involve reduced sidewalk widths and/or removal of buildings on the SW and SE corners (long term). • Deep stop bar setbacks (associated delays, sightline obstructions, and turning movement restrictions and right-turn-on-red restrictions).

User Group	Needs	Wants	Implications
On Street Parking	• Parking for King St businesses.	• No on-street parking removed.	• On street parking may restrict truck turning movements. • Parking will be affected by long term intersection widening.
General Traffic	• Single lane approaches • Reasonable buffer from turning by-pass trucks. • No backing up of stopped vehicles from stop bars to accommodate turn path of design vehicles.	• Minimal signal delays (e.g., short cycle, permissive phasing, minimal turning restrictions, etc.). • Dedicated turn lanes.	• Intersection widening, which could involve reduced sidewalk widths and/or removal of buildings on the SW and SE corners (long-term). • Compromise on all higher-priority “wants”. • Potential deep stop-bar setbacks to accommodate turning movements without needing to back up.
Non-by-Pass Trucks	• Minimum one feasible truck movement (could be through or turn only) per approach for control vehicle (WB-20).	• All movements feasible for control vehicle (WB-20).	• Intersection widening, which could involve reduced sidewalk widths and/or removal of buildings on the SW and SE corners (long term). • Compromise on all higher-priority “wants”.
Cyclists	• Buffered bike lanes on King St east and west of Mountain Rd.	• Buffered bike lanes on King St east and west of Mountain Rd. • Protection from vehicle/truck encroachment. • Buffered from on-street parking.	• Reduced vehicle lanes widths on Kings St. • Removal of on-street parking • Smaller design vehicle to avoid encroachment. • Intersection widening, which could involve reduced sidewalk widths and/or removal of buildings on the SW and SE corners (long-term). • Potential stop-bar setbacks to avoid turning vehicle encroachment into lane of waiting cyclists.
Loading Areas	• Access to businesses for deliveries.	• Delivery parking in front of businesses.	• Impact on bike lanes and turning movements near intersection.

Based on this needs hierarchy, we have proposed short-term upgrades to the intersection, as illustrated in **Exhibit 6.21**. The goal of these recommendations is to improve the overall operation of the intersection while minimizing the implementation costs.

Exhibit 6.21: King Street and Mountain Road - Proposed Short-Term Upgrades



The design vehicle used for the turning analysis is a WB-20-180 Tractor and Semi Trailer.

On the east and south legs of the intersection, the stop bars and crosswalks have been moved back to allow trucks to complete the turning movements and return to the travel lane. This has been done to eliminate the need for trucks requiring other vehicles to move to complete their turns. The crosswalks have been moved with the stop bars to prevent motorists from encroaching on the area between the stop bar and intersection.

On the east leg, the stop bar and crosswalk have been moved back from the intersection to accommodate the north bound right turn. This was identified as the key turning movement for the intersection to allow trucks to access the by-pass route. The west bound lane was left wider to allow the trucks to setup for the left turn.

On the south leg, the stop bar and crosswalk have been moved back from the intersection to accommodate the west bound left turn. Relocating the crosswalk will eliminate pedestrians standing on the SW corner where the rear trailer tires have passed over the sidewalk.

On the west leg, the stop bar and crosswalk have been left in their original location, as trucks should not be proceeding west down King Street. All truck traffic should be following the truck route. The crosswalk has been eliminated and the pedestrian fence extended to prevent pedestrians from crossing and standing on the south west corner. A bump out was added to prevent cars from driving around vehicles to turn right. Parking has been maintained.

Exhibit 6.22 demonstrates how the proposed upgrades address many of the needs in the hierarchy table above.

Exhibit 6.22: Results of Proposed Upgrades

User Group	Results of the Proposed Upgrades
Pedestrians	• The pedestrians have been relocated away from the SE and SW corners where there were potential conflicts with turning trucks. • Crosswalks have been located at the limits of the truck turning movements. • The west leg crosswalk has been eliminated to prevent pedestrians waiting on the SW corner. • Crosswalks will be activated by the pedestrian buttons.
By-Pass Trucks	• Relocating the stop bars and crosswalks allows sufficient space for the trucks to execute the priority movements on each leg of the intersection. • This will allow trucks to access the by pass route and not travel through the downtown and Ontario Street.
On Street Parking	• A small number of on street parking spaces will be affected by the relocation of the stop bars and crosswalks. A parking study should be completed to determine if there is sufficient parking in the surrounding area to accommodate the lost spots.
General Traffic	• The reconfiguration of the intersection will prevent motorists from needing to move their vehicle for a truck to complete a turn. • The crosswalks have been moved with the stop bars to represent a standard intersection, so motorists will not try and stop beyond the stop bar. • Single through lanes have been provided in the east and west bound directions. • There will be a learning curve for motorists in the area.
Non-By-Pass Trucks	• Smaller trucks using the intersection will be able to complete all turning movements.
Cyclists	• Bike lanes have not been added to the intersection due to their impact on turning movements.
Loading Areas	• The businesses immediately adjacent to the intersection will have to relocate their loading areas.

6.5.7 Summary of Potential Geometric Improvements

A summary of the potential geometric improvements is found in **Exhibit 6.23**.

Exhibit 6.23: Potential Geometric Improvements

Location	Potential Geometric Improvements
Durham Road and South Service Road	• Increase road width.
Ontario Street and South Service Road	• Eliminate left turn movements egressing from Esso station by extending the existing island beyond the access. • Narrow the northwest driveway into Pioneer Gas Station to a right-in only configuration.
South Service Road and Bartlett Road	• Increase the road widths.
Greenlane and Bartlett Road	• Reduce the northwestern corner curb radius to discourage truck turning movements.
King Street and Bartlett Road	• Relocate stop bar further back from intersection. • Add a painted median. • Remove southbound right channelization island to allow for more desirable approach angles for trucks executing a southbound right turn movement.
Multi Use Trail on Bartlett Road	• Install a multi-use trail on the east side of Bartlett Road.
King Street and Mountain Road	**Short Term:** • Move back all stop bars and crosswalks to the limits of truck turning movements. • Narrow the east and west legs to single lane shared movements in order to discourage vehicles from by-passing turning trucks at the intersections. • Install pedestrian buttons and heads at the newly relocated crosswalks. • Adjust signal timing to account for the new intersection clearances. **Long Term:** • Roadway expansion/widening as part of intersection reconstruction.
Bartlett Road	• Existing road removal. • 7.0m wide road with curbs and subdrain. • 1.5m wide sidewalks on both sides. • 650mm granular base with 65mm base asphalt and 40mm top asphalt. • 450mm diameter storm sewer, with manholes and catchbasins. • 3.0m wide multi-use trail King Street to Greenlane.

Location	Potential Geometric Improvements
Durham Road	• Existing road removal. • 7.0m wide road with curbs and subdrain. • 1.5m wide sidewalks on both sides. • 650mm granular base with 65mm base asphalt and 40mm top asphalt. • 450mm diameter storm sewer, with manholes and catchbasins.

The anticipated cost estimates for the recommended geometric improvements are found in **Section 7**.

6.6 Sight Distance Analysis: Bartlett Road and Greenlane

The Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads (June 2017) (the "TAC guidelines") was used to determine if the minimum stopping sight distance and the minimum departure sight distances are present at both legs of Greenlane at Bartlett Road. The full analysis is found in **Appendix E**.

A design speed of 60 km/h was used (i.e., the posted speed limit of 50 km/h for Bartlett Road, plus 10 km/h to account for driver speed variances under rural conditions) in this analysis.

Stopping sight distance refers to the distance necessary for a driver travelling on Bartlett Road to avoid a collision, by coming to a complete stop in reaction to a vehicle departing from the Proposed Site Access. The observed stopping sight distance meets the minimum distances required by TAC guidelines for vehicles approaching both the west and east legs of Greenlane from both the south and the north (northbound and southbound travelling vehicles).

Departure sight distance (also known as Intersection Sight Distance) refers to the sight distance necessary for a driver to depart from Greenlane and merge into traffic without causing a vehicle travelling along Bartlett Road to have to take evasive action (e.g. speed change, lane change). The observed departure sight distances exceed the minimum distances required by TAC guidelines for automobiles making left or right turns from the western leg of Greenlane when looking north. Similarly, the minimum distances for automobiles making left from the eastern leg of Greenlane when looking north meets requirements within the TAC guidelines.

With respect to looking south at the eastern leg of Greenlane, the minimum distance requirements of 130 metres within the TAC guidelines are not met. It is recommended that 'hidden intersection' signage be placed on Bartlett Road

ahead of the eastern leg of Greenlane that identifies that there is a hidden intersection ahead.

6.7 Active Transportation Infrastructure

An active transportation strategy was completed as part of the Town of Lincoln TMP (WSP, 2019). The intent of the strategy was to provide the Town with the process and tools to address the demand for infrastructure, programs, and initiatives that support alternative forms of transportation. As previously mentioned, the Town of Lincoln Active Transportation Citizen Advisory Committee was engaged in this study.

As part of this study, the following active transportation recommendations have been considered:

- Installation of a multi-use trail along Bartlett Road;
- Addition of bike lanes along King Street; and
- Pedestrian-activated signals at the crosswalks of the intersection of King Street and Mountain Road / Central Avenue.

A pros and cons comparison of installing a multi-use trail on the east side vs. the west side of Bartlett Road is presented in **Exhibit 6.24**.

Exhibit 6.24: Multi-Use Trail East Side vs. West Side Bartlett Road - Comparison

Scenario	Pros	Cons
Multi-use trail on east side	• Fewer conflicts with utilities and existing sidewalks. • Land costs are potentially less expensive because the urban boundary ends before the east side of Bartlett Road.	• Grade separation near the rail crossing and at the intersection of King Street and Bartlett Road need to be filled in. • Multi-use trail will need to provide several crossing opportunities along the route.
Multi-use trail on west side	• Multi-use trail users in the residential developments on the west side will not need to cross Bartlett Road to connect to the trail.	• Utilities need to be relocated and existing sidewalks need to be removed and replaced with the multi-use trail. • Roadside ditch will need to be filled in. This will require the construction of a storm sewer and outlet. • Land costs will also be potentially higher as this is inside the urban boundary.

6.8 Improvements to Railway Grade Crossings

This section summarizes the two existing at-grade railway crossings within the study area, as well as recommended mitigation measures that are to be implemented prior to the implementation of the Beamsville truck by-pass route.

As noted, there are two existing at-grade railway crossings along the proposed by-pass route:

- Durham Road, approximately 300 metres south of South Service Road, and
- Bartlett Road, approximately 950 metres south of South Service Road.

These at-grade railway crossings were reviewed against the Transport Canada **Grade Crossing Handbook** (Transport Canada, 2016) and guidance from the 2014 American Railway Engineering and Maintenance-of-Way Association (AREMA).

The following assumptions were applied to both crossings for this assessment:

- The existing road profile is acceptable, and all road grades will be maintained;
- Existing crossing signal equipment is operational and in good condition;
- Proximity of existing intersections and entranceways to the grade crossings are acceptable and will be maintained;
- Existing posted speed limit of Durham Road and Bartlett Road will not increase;
- Existing sightline conditions will remain unchanged and unimpeded;
- Existing drainage system is functional; Drainage direction and courses will be maintained; and
- The existing signal bungalow can remain unless directed otherwise by CP Rail.

6.8.1 Durham Road

Durham Road crosses a single track at a slightly skewed angle of approximately 75 degrees. A comparison table of existing and proposed crossing characteristics is presented in **Exhibit 6.25** (based on measurements made from site photos and aerial imagery).

Exhibit 6.25: Recommended Modifications to Durham Road Crossing

	Railway Crossing Characteristic	Existing Condition	Proposed Condition
1.	Number of Tracks	1	1
2.	Crossing Signal	Yes	Yes
3.	Gate Arm	Yes	Yes
4.	Number of Lanes	2	2
5.	Lane width	+/-2.7m	3.5m
6.	Shoulder width	+/-0.5m	1.5m
7.	Multi-use Path	No	No
8.	Max Speed Limit	50 km/h	50 km/h

The proposed at-grade crossing requires two lanes at 3.5 metres each and a 1.5m shoulder on either side for a total roadway width of 10.0 metres.

1. The crossing surface is required to extend a minimum 0.5 metres beyond either side of the roadway width. As a result, the crossing surface needs to be extended to a minimum of 11.0 metres[4].
2. The existing crossing signal equipment can be reused but must be relocated so that it is between 0.3 metres and 2.0 metres from the proposed outer edge of the road approach shoulder and remain no closer than 3.0 metres from the nearest rail[5].
3. With the relocation of the existing crossing signal, the associated gate arm will need to be replaced with a longer one to align with the road centreline, but not extend beyond 1.0 metres past.
4. Pavement markings including the stop bar and roadway painting will need to be repainted to suit proposed road modifications. Pavement markings to be in accordance with Section 8.8 of the **Grade Crossing Handbook** (Transport Canada, 2016).

6.8.2 Bartlett Road

Bartlett Road crosses a single track at a slightly skewed angle of approximately 75 degrees. A comparison table of existing and proposed railway crossing characteristics is presented in **Exhibit 6.26** (based on measurements made from site photos and aerial imagery).

[4] Refer to Figure 3.1 of the Grade Crossing Handbook (Transport Canada, 2016)
[5] Refer to Figure 3.2 of the Grade Crossing Handbook (Transport Canada, 2016)

Exhibit 6.26: Recommended Modifications to Bartlett Road Crossing

Railway Crossing Characteristic	Existing Condition	Proposed Condition
1. Number of Tracks	1	1
2. Crossing Signal	Yes	Yes
3. Gate Arm	Yes	Yes
4. Number of Lanes	2	2
5. Lane width	+/-3.5m	3.5m
6. Shoulder width	+/-0.5m	1.5m
7. Multi-use Path	No	Yes (3.0 m)
8. Max Speed Limit	50 km/h	50 km/h

The proposed at-grade crossing requires two lanes at 3.5 metres each, a 3.0-metre Multi-use path (MUP) on the east side, and a 1.5-metre shoulder on either side for a total roadway width of 13.0 metres.

1. The crossing surface is required to extend minimum 0.5 metres beyond either side of the roadway width. As a result, the existing crossing surface needs to be extended to a minimum 14.0 metres[6].
2. The existing crossing signal equipment can be reused but must be relocated so that it is between 0.3 metres and 2.0 metres from the proposed outer edge of the road approach shoulder and remain no closer than 3.0 metres from the nearest rail[7].
3. With the relocation of the existing crossing signal, the associated gate arm will need to be replaced with a longer one to align with the road centreline, but not extend beyond 1.0 metre past.
4. Pavement markings including the stop bar and roadway painting will need to be repainted to suit proposed road modifications. Pavement markings to be in accordance with Section 8.8 of the **Grade Crossing Handbook** (Transport Canada, 2016).
5. Along the east side where the MUP is proposed, two lights are required on the gate arm so that the lights are over the two points dividing the path into thirds. The lights must flash alternatively.

6.8.3 General Commentary

The following additional commentary is presented, based on IBI Group's assessment of railway grade crossings:

- If we choose to separate the MUP, additional crossing signs will be required if the centreline is greater than 3.6 metres. The gate arm is

[6] Refer to Figure 3.1 of the Grade Crossing Handbook (Transport Canada, 2016)
[7] Refer to Figure 3.2 of the Grade Crossing Handbook (Transport Canada, 2016)

not necessary, but installation of a proper crossing surface is necessary.

- According to the 2017 grade crossing study, prepared by MMM Group and shared by the Town of Lincoln staff (the 'MMM report'), train volumes are approximately 6 per day for both the Durham Road and Bartlett Road crossings; the AADT volumes noted in the report were approximately 1,500 and 3,000, respectively. In both cases, the cross product of train volume by AADT is far below the 1,000,000 threshold for grade separation[8]. The crossings also fall short on the other criteria with thresholds. Even with the proposed truck by-pass traffic, it is highly unlikely that justification for grade separation can be achieved at either crossing.
- According to the MMM report, it is recommended that the approach grades be flattened (must be 2% or less) at the Durham Road crossing. This will be accounted for in our preliminary cost estimates.
- As discussed in **Section 6.6**, geometric improvements are recommended to improve sight visibility constraints for drivers stopped on the eastern leg of Greenlane at Bartlett Road, looking south for opportunities to turn left or right.

6.9 Street Lighting Improvements

IBI Group completed an assessment of the current existing lighting conditions of the roadways and intersections along the proposed truck by-pass route. Relevant intersections and roadways along the truck by-pass route have been selected and their corresponding existing lighting conditions were investigated through a photometric analysis.

Existing luminance and illuminance values for roadways and intersections respectively, in conjunction with uniformity ratios, have been compared against the RP-8-18 roadway lighting criteria. The results were analyzed, and proposed lighting upgrades have been recommended.

Based on the photometric analyses undertaken, it was determined that the vast majority of study area intersections, roadway segments, and the railway crossings did not meet the lighting criteria, as prescribed in industry standards.

Therefore, lighting upgrades are recommended to improve lighting levels along the truck by-pass route. **Exhibit 6.27** summarizes the proposed lighting upgrades. The full lighting study, which includes the data sources, methodology and full photometric analysis results, is presented in **Appendix F**.

[8] Refer to the Transport Canada Grade Separation Assessment Guidelines

6.10 Traffic Noise Study

As part of this study, IBI Group undertook an environmental noise assessment to evaluate the environmental noise impacts of the truck traffic diversion on adjacent sensitive receivers (i.e., residential properties).

A Free-Field analysis was completed using STAMSON to determine the maximum limits (offset distance from centreline of road) of impact on each of the eight identified routes. This analysis is an assessment of noise impacts without consideration for any physical mitigation (e.g., topographical features, noise barriers, etc.) that would provide reduction of noise levels. This analysis facilitates a worst-case review (i.e., without any mitigation), and thus identifies any areas of potential concern that can be further investigated if needed.

The Free-Field analysis considered two noise levels:

- 60 dBA: This is the lower noise limit where possible noise mitigation might be warranted; and
- 65 dBA: This is the limit above which would require mitigation.

Additionally, the criteria states that the increase must exceed 5 dBA and be above 60 dBA to warrant noise mitigation.

The noise study concludes that the increase in noise level between the Do Nothing (i.e., no rerouting) and the 100% Rerouting scenarios is below 5 dBA (max increase is 3.3 dBA), and the 100% Rerouting noise level remains below 65 dBA at the OLA receiver location. Accordingly, no noise mitigation is warranted based on the noise criteria. The full noise study is presented in **Appendix G**.

Exhibit 6.27: Proposed Lighting Upgrades for Failed Cases

Truck Route - Failed Existing Intersection Lighting				
Case Details		Intersection Example	Number of Cases	Proposed Lighting Upgrade
Criticality	Classification			
Medium Pedestrian Traffic	Arterial/Collector - Medium	King Street and Mountain Street	1	Upgrade 4 intersection lights from 64W Type 3 to 118W Type 2
	Arterial/Local - Medium	King Street and Cherry Heights Boulevard	4	Add light to existing hydro pole on King Street
Turns at intersection	Arterial/Collector - Low	King Street and Bartlett Road	1	Upgrade to be analyzed in conjunction with King Street luminance *
	Collector/Collector - Low	South Service Road and Bartlett Road	2	Add 1 light pole and Upgrade existing fixture to new 74W Type 3 CREE fixture

Truck Route - Failed Existing Roadway Lighting					
Criticality	Classification	Roadway Name	Roadway Boundary	Number of Cases	Proposed Lighting Upgrade
Medium Pedestrian Traffic	Major - Medium	Mountain Street	From King St to Beam St	1	Upgrade existing light fixtures to improve veiling luminance ratio (glare)*
	Major - Medium	King Street	From Mountain St to East Av	1	Upgrade existing light fixtures to improve veiling luminance ratio (glare)*
			From East Av to Bartlett Rd		Combination of joint-use hydro and staggered poles with upgraded light fixtures*

Truck Route - Failed Rail Crossing Lighting					
Criticality	Classification	Roadway Name	Roadway Boundary	Number of Cases	Proposed Lighting Upgrade
Rail Crossing	Collector - Low	Durham Road	Rail crossing 30m, in each traffic direction	2	Add 2 light poles with 74W Type 3 CREE Fixtures 10m away from rail tracks at approach in each direction

Note: (*) High level recommendation. Further lighting analysis required.

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7 Cost Estimates

Exhibit 7.1 provides a summary of the proposed cost estimates to implement the recommended modifications identified in this study. Detailed calculations are found in **Appendix H**.

Exhibit 7.1: Proposed Cost Estimates

Intersection/Trail	Estimated Costs
Durham Road and South Service Road	$25,000
Ontario Street and South Service Road	$80,000
Bartlett Road and South Service Road	$45,000
Greenlane and Bartlett Road	$350,000
King Street and Bartlett Road	$300,000
Bartlett Road Truck Enforcement Bay	$50,000
King Street and Mountain Road	$550,000
Multi Use Trail Construction	$600,000
Total (Estimated)	**$2,000,000**

Budget Category	Estimated Costs	
	Bartlett Road	Durham Road
Storm Sewer	$2,850,000	$850,000
Water	$TBD	$TBD
Sanitary Sewer	$TBD	$TBD
Road	$4,850,000	$1,450,000
Contingency	$2,300,000	$200,000
Total (Estimated)	**$10,000,000**	**$2,500,000**

Year	Location	Estimated Construction Cost
2023	Durham Road	$2,500,000.00
2024/2025	Bartlett Road	$10,000,000.00
2024/2025	Niagara Region Intersections	$1,000,000.00
	Total:	**$13,500,000.00**

Several municipalities in the Niagara Region are reporting that the effects of the COVID 19 pandemic on manufacturing, have resulted in increased tender pricing. Suppliers will only hold pricing for a short period of time and contractors are increasing bid prices to cover potential increases in material costs. The Town will need to monitor the industry to determine if pricing is returning to past levels. Cost estimates should be adjusted accordingly to reflect the industry trends prior to tendering.

8 Conclusions and Recommendations

8.1 Conclusions

The implementation of the Truck Route By-Pass network will provide capacity for economic growth, flexibility in the routing, and redundancy to manage truck traffic in the event of incidents.

The input received through the stakeholder engagement was considered in the preparation of the implementation plan.

Based on the results of the field review, safety review, and existing geometric and operational assessments, preliminary roadway geometric mitigation measures were identified, and additional traffic operational assessments were conducted to determine the potential operational impacts of the study area when the proposed truck by-pass route is implemented.

Intersection operations analysis was reconducted with the effects of the preliminary mitigation measures, based on the two truck rerouting scenarios (i.e., the 2024 Future Conditions (75% Rerouting) and the 2024 Future Conditions (100% Rerouting) scenarios). The results of these assessments indicate that the proposed truck by-pass route and resultant changes in truck travel patterns are not anticipated to create any new operational constraints within the by-pass implementation area. However, the anticipated operations constraints identified under the 2024 Future Conditions (Do Nothing) scenario are expected to continue, regardless of any truck diversion (i.e., 75% or 100% Rerouting).

A supplementary analysis was undertaken under the 75% Rerouting scenario and a horizon year of 2034 to determine future intersection performance when the proposed truck by-pass route and corresponding truck diversions are in place and have had sufficient time for implementation. Results from this traffic operational assessment indicate that a majority of the constraints anticipated under the 2024 Future Conditions (75% Rerouting) scenario are expected to continue to 2034. While there are a few additional movements that are expected to exceed critical operational thresholds by 2034, all movements within the by-pass route implementation area are expected to operate within their theoretical capacity under 2034 Future Conditions.

A signal warrant analysis was also undertaken, to determine if a traffic control signal is warranted at the intersection of Bartlett Road and John Street. Under the 2024 Future Conditions (100% Truck Rerouting) scenario, the results of the signal warrant analysis indicate that a traffic control signal is warranted at this intersection.

A review of two existing at-grade railway crossings along the proposed truck by-pass route was also conducted against the standards prescribed in industry standards and guidance. Overall improvements to railway signal equipment, at-

grade crossing surfaces, pavement markings, and other at-grade railway crossing features were identified.

An assessment of existing lighting conditions at the roadways and intersections along the proposed truck by-pass route was also conducted. Based on this assessment, upgrades to the existing lighting infrastructure are warranted to improve lighting levels along the proposed truck by-pass route.

Recommendations with respect to active transportation infrastructure, as per the active transportation strategy within the Town of Lincoln Transportation Master Plan, include the installation of a multi-use trail along Bartlett Road, the addition of bicycle lanes along King Street, and the provision of pedestrian-activated signals at the crosswalks of the intersection of King Street and Mountain Road / Central Avenue.

Lastly, an environmental noise assessment to evaluate the noise impacts of the proposed truck diversion on adjacent sensitive receivers was undertaken. The findings from the noise assessment, which are based on the traffic volumes from the 2024 Future Conditions (Do Nothing) and 2024 Future Conditions (100% Rerouting) scenarios, indicate that no noise mitigation measures are warranted.

8.2 Recommendations

8.2.1 Policies and Strategies

- **Truck Route Signage:** The Town of Beamsville could include in their by-law that permissive signage can have a mandatory function to help guide trucks, allowing a hybrid signage system to be used and so that prohibitive signs are not required at every intersection. Use of both permissive and prohibitive signage on Town of Lincoln roads at key decision points along the network will be an important measure, ensuring that the signs are sufficiently large, not cluttered with other signage, and providing advance signage where sight lines are limited.
- **Truck Route Information:** Aside from signage, provide other means of disseminating truck route information to truck drivers, including posting a truck route map on the Town of Lincoln website, and working with Niagara Region and the Province to disseminate Town of Lincoln truck route information as part of a larger truck route context.
- **Scale Avoidance:** Continue working with the MTO enforcement branch to understand the by-pass issue and support local blitzes by MTO officers to identify scale avoidance. Continue to explore resource-efficient and cost-effective options to identify scale by-passing vehicles.
- **Exceeding Vehicle Weight Limits:** Support Niagara Region training more Niagara Regional Police Services officers trained in commercial

vehicle safety as an important step in having more consistent enforcement of commercial vehicle weight limits.

- **Speeding:** Measure speeds at selected current and proposed truck route by-pass locations to determine the extent to which speeding is an issue, and where necessary, implement design changes, increase signage and messaging, or focus police enforcement on these areas to enforce speed limits. Bartlett Road, Beamsville, is one location that currently seems to have a speeding issue to address, while measures have been taken to help address speeding concerns on Mountain Street. The data indicates that the speeding issue is generally not related to truck traffic.

8.2.2 Roadway Geometric Improvements

Recommended roadway geometric improvements, including railway crossing and street lighting infrastructure upgrades, are summarized in **Exhibit 8.1**.

Exhibit 8.1: Recommendations

Location	Recommended Improvements
Durham Road and South Service Road	• Increase road width.
Ontario Street and South Service Road	• Eliminate left turn movements egressing from Esso station by extending the existing island beyond the access. • Narrow the northwest driveway into Pioneer Gas Station to a right-in only configuration.
South Service Road and Bartlett Road	• Increase the road widths. • Add 1 light pole and upgrade existing fixture to new 74 W Type 3 CREE fixture.
Greenlane and Bartlett Road	• Reduce the northwestern corner curb radius to discourage truck turning movements. • Add ‘hidden intersection’ signage on Bartlett Road ahead of the eastern leg of Greenlane to address existing sight visibility constraints.
King Street and Bartlett Road	• Relocate stop bar further back from intersection. • Add a painted median. • Remove southbound right channelization island to allow for more desirable approach angles for trucks executing a southbound right turn movement. • Upgrades to be analyzed in conjunction with King Street luminance*.
King Street and Cherry Heights Boulevard	• Add light to existing hydro pole on King Street.
Multi Use Trail on Bartlett Road	• Install a multi-use trail on Bartlett Road.

Location	Recommended Improvements
King Street and Mountain Road	**Short Term:** • Move back all stop bars and crosswalks to the limits of truck turning movements. • Narrow the east and west legs to single-lane shared movements to discourage vehicles from by-passing turning trucks at the intersections. • Install pedestrian buttons and heads at the newly relocated crosswalks. • Adjust signal timing to account for the new intersection clearances. • Upgrade 4 intersection lights from 64W Type 3 to 118W Type 2. **Long Term:** • Roadway expansion/widening as part of intersection reconstruction.
John Street and Bartlett Road	• Perform another traffic signal warrant assessment in 2024, to determine if necessary to install a traffic control signal at the intersection to account for the 2024 Future Conditions (100% Rerouting) scenario.
Durham Road Crossing	• Widen the two at-grade crossing lanes to 3.5 m each and include a 1.5 m shoulder on either side. • Increase crossing surface by 0.5 m beyond either side of the roadway width. • Relocate existing crossing signal equipment. • Replace gate arm with a longer one to align with the road centerline. • Repaint pavement markings. • Add 2 light poles with 74W Type 3 CREE fixtures 10 m away from rail tracks at the approach in each direction.
Bartlett Road Crossing	• Widen the two at-grade crossing lanes to 3.5 m each and include a 1.5 m shoulder on either side. • Construct a 3 m multi-use path (MUP) on the east side. • Relocate existing crossing signal equipment. • Replace gate arm with a longer one to align with the road centerline and add two lights on the gate arm where the MUP is proposed; the lights should flash alternatively. • Repaint pavement markings.
Mountain Street (From King Street to Beam Street)	• Upgrade existing light fixtures to improve veiling luminance ratio (glare)*.

Location	Recommended Improvements
King Street (From Mountain Street to East Avenue)	• Upgrade existing light fixtures to improve veiling luminance ratio (glare)*.
King Street (From East Avenue to Bartlett Road)	• Install combination of joint-use hydro and staggered poles with upgraded light fixtures*.
Bartlett Road	• Existing road removal. • 7.0m wide road with curbs and subdrain. • 1.5m wide sidewalks on both sides. • 650mm granular base with 65mm base asphalt and 40mm top asphalt. • 450mm diameter storm sewer, with manholes and catchbasins, granular. • 3.0m wide multi use trail King Street to GreenLane.
Durham Road	• Existing road removal. • 7.0m wide road with curbs and subdrain. • 1.5m wide sidewalks on both sides. • 650mm granular base with 65mm base asphalt and 40mm top asphalt. • 450mm diameter storm sewer, with manholes and catchbasins, granular.

Note: (*) High level recommendation. Further lighting analysis required.

8.2.3 Implementation Plan

8.2.3.1 Class EA Process

The Beamsville Truck –By-Pass Implementation Study is a Schedule A+ under the Municipal Class Environmental Assessment (Class EA) for the following reasons:

- The Beamsville Truck By-Pass was a recommendation included in the approved Town of Lincoln Transportation Master Plan;
- There will be construction of localized operational improvements;
- Addition of signage for the preferred route;
- Addition of active transportation facilities; and
- Road resurfacing of the preferred route.

Any further assessment of impacts will be conducted as part of the detailed design phase.

8.2.3.2 Stakeholder Engagement

The Town of Lincoln, Niagara Region, and the consultant study team should meet with the Stakeholder group to summarize the findings of the study, and next steps, and to seek comments.

8.2.3.3 Detailed Design

Niagara Region staff are generally supportive of the proposed implementation plan, Prior to proceeding to detailed design, Town staff should ensure the MTO and CP Rail have reviewed and approved the proposed intersection improvements and road reconstructions. This will allow for the coordination of work and avoid work on a newly constructed road. A cost sharing agreement should be proposed to help offset the costs to the Town.

The Town should then prepare an RFP for the detailed design of Durham Road, Bartlett Road and the proposed intersection improvements. The RFP should include full topographic survey, underground infrastructure condition review, coordination with utilities, user group consultation, detailed cost estimates, submissions for the required approvals, proposed detour routes and recommendations on phased construction. The successful consultant should prepare the scope of work for a full geotechnical investigation including preparation of the RFP, review of the submissions and recommendations on award.

Design should be completed in 2022, this will give Town staff detailed cost estimates for budgeting purposes. Construction should start in 2023 and can be completed over several years as the Towns capital budget allows.

8.2.3.4 Implementation Phasing

The intersection of King Street and Mountain Road should be addressed at the same time as the improvements are constructed on Bartlett Road Construction.

The section of road that needs to be upgraded first is Durham Road. This is a surface treatment road that is in poor condition and it will not stand up to the heavy loading of the trucks. This road should be reconstructed to a cross section that will withstand the truck loading. The estimated cost of reconstruction is $2,300,000. The estimated cost for detailed design is $126,000, based on a cost of $140 per metre. We typically estimate design and inspection at 10% of the construction costs. This results in a cost of inspection of $105,000. This does not include replacing the watermain or sanitary sewer.

Bartlett Road is in much better condition and is currently carrying truck traffic. It is for these reasons we have recommended that it be reconstructed after Durham Road. The construction cost estimate for a full reconstruction of Bartlett Road is $7,600,000. The estimated cost for detailed design is $420,000, based on $140 per metre. We typically estimate design and inspection at 10% of the construction costs. This results in a cost of inspection of $345,270. This does not include any work on the sanitary sewer or watermain.

The reconstruction of Durham Road and Bartlett Road should not be completed at the same time. This will make it difficult for trucks to traverse the route and they will look for short cuts around the construction. The contractor should provide flagging or a posted detour route during construction.

Recently closed tenders in Ontario have seen an increase in the bid prices. At this time, it is difficult to determine if the increases are due to the pandemic and/or that the tenders were called later in the year and contractors are busy. Town staff should continue to monitor the pricing they are receiving and verify with other municipalities and the Heavy Construction Association, to determine if construction pricing will continue to rise.

Please note, the costs shown above differ from the costs shown in Section 7 of the report. Those differences result from contingency amounts that have been added to the reconstruction of Bartlett Road and Durham Road. The contingency amounts will be used for utility relocations, geotechnical testing, culvert replacement etc. Costs for these items will be obtained during detailed design of the project when the full impact of the construction will be better known.

Appendix A – Turning Movement Count and Automatic Traffic Reader Data

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Appendix B – Vehicle Speed Plots

Appendix C – CVS Survey Traffic Profile

Appendix D – Collision Data

Appendix E – Traffic Operational Assessment

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Appendix F – Lighting Study

Appendix G – Noise Study

Appendix H – Cost Estimates