Transportation Analysis Report

Clark Boulevard / Eastern Avenue from Kennedy Road to Rutherford Road Class Environmental Assessment Study

FINAL

City of Brampton
April 21, 2021

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1 Introduction

The City of Brampton has initiated a Schedule 'C' Municipal Class Environmental Assessment (EA) study for transportation improvements along Eastern Avenue and the extension of Clark Boulevard. This corridor is referred to as the EA study corridor and is comprised of two distinct sections:

- Existing Eastern Avenue from Kennedy Road to Hansen Road South
- Clark Boulevard-Eastern Avenue Extension from Hansen Road South to Rutherford Road

The purpose of this report is to document the methodology, analysis, and recommendations of the transportation assessment study for Clark Boulevard between Kennedy Road and Rutherford Road.

1.1 Study Area

Figure 1-1 shows the location of the EA study area. In addition to the EA study corridor, a modelling focus area has been identified which is bounded by the adjacent arterial roads, Queen Street, Steeles Avenue, Kennedy Road, and Bramalea Road. The impacts and benefits of the Clark Boulevard and Eastern Avenue improvements for the EA study corridor will be considered within this broader area.

Figure 1-1: Study Area and Modelling Focus Area

Immediately adjacent to the EA study corridor the City of Brampton had completed an Environmental Assessment Study in 2012 for Clark Boulevard Improvements from Rutherford Road to east of Dixie Road (hereinafter referred as 2012 EA study). The 2012 EA recommended widening the road to five through lanes (three westbound and two eastbound) from Rutherford Road to Highway 410 east ramp and six through lanes from Highway 410 east ramp to the easterly project limit. The City is currently undertaking a reassessment of the 2012 EA recommendations referred to as the Traffic Reassessment (TR) study. Improvements to this Eastern Avenue / Clark Boulevard EA study corridor between Kennedy Road and Rutherford Road documented in this report were assessed in parallel to alternatives considered for the TR Study.

The broader transportation study area, considers both the EA study corridor and the TR study corridor as shown in **Figure 1-2** , however the focus of this transportation report is on the EA study corridor.

Figure 1-2: Study Area for EA Study Area and TR Corridor and Modelling Focus Area

1.2 Study Context

The City's Transportation Master Plan (TMP), 2015 Update recommends the extension of Clark Boulevard from Rutherford Road to Hansen Road to a 4-lane cross-section by 2021. The TMP also recommends the widening of Eastern Avenue from Hansen Road South to Kennedy Road to a 4-lane cross-section by 2021.

The EA study considers the Brampton Vision 2040 though a multimodal lens. It includes a detailed transportation and multimodal level of service (MMLOS) analysis

for all modes of travel, including auto, transit, bicycle, walk, and truck to address transportation capacity from the perspective of moving people safely and efficiently.

Further, it is recognized that the City continues to evolve as a rapidly-growing municipality transitioning from a historically “suburban” to a more “urban” development context. To accommodate this growth, new infrastructures, transportation services, and travel demand management (TDM) measures should be provided. The study should reflect direction from the Provincial Growth Plan and the Brampton 2040 Vision that speaks to curbing sprawl, developing “complete, sustainable, and well-designed communities”, and providing travel choices as alternatives to the car and reclaiming road space for other modes of transportation and other activities.

While road widening remains a legitimate option to address transportation capacity constraints, there is a need to balance and reconsider it in the context of directions that speak to a more comprehensive and multimodal approach in accommodating and designing for travel, goods movement demands, cycling and pedestrians.

This report documents the analysis of existing and future do nothing conditions, 2041 alternatives and evaluation, and the recommendations for Clark Boulevard between Kennedy Road and Rutherford Road.

2 MMLOS Methodology

The following section documents the study's assessment of various travel modes in the study corridor, specifically for vehicle, transit, bicycle, walk, and truck. The methodology used to assess the existing multi-modal infrastructure and identify targets for future improvements to each mode are outlined. The assessment of the existing multi-modal infrastructure is documented in later sections of this report.

The methodology employed for this study is primarily based on the City of Ottawa Multi-Modal Level of Service (MMLOS) Guidelines [1]. The methodology includes all modes of travel: vehicle, transit, bicycle, walk, and truck. Rather than examining the ability of a road to "move vehicles", the methodology recognizes the mobility, comfort, safety, and convenience of all modes with an emphasis on "moving people". Methodology for each mode is described in subsequent sections, with additional details found in **Appendix A MMLOS Methodology**.

2.1 Vehicular Level of Service

The Vehicular level of service (VLOS) is based on the modelled segment volume and travel times in the PM peak hour. A microsimulation model using VISSIM software was developed and calibrated specifically for the study area to assess average vehicular travel time, capturing delays experienced at both intersection and segment level. The PM peak hour is used as it tends to have higher volumes than the AM peak, and compared to the AM peak where most trips are home based work (HBW) trips, the PM peak also tends to capture trips with more diverse purposes, such as shopping and recreational trips.

The Vehicular LOS is calculated based on the ratio of the average congested travel speed over the free-flow speed for the study corridor:

$$\frac{Total\ vehicle\ kilometers\ travelled\ (VKT)\ /\ total\ vehicle\ hour\ travelled\ (VHT)}{Free{-}flow\ speed}$$

→ Average Congested Travel Speed

It is noted that the congested/free-flow speed ratio is directly related to volume/capacity ratio, as illustrated in **Figure 2-1**.

The relationship between congested/free-flow speed ratio and VLOS is described in **Table 2-1**. From a user perspective, the VLOS approach suggests that a 43% increase in travel times is generally acceptable to drivers during peak periods (i.e. LOS C = 10 minute drive becomes 14 minutes), and that a 120% increase or more is generally unacceptable (i.e. LOS F = 10 minute drive becomes 22 minutes). Between these thresholds, perceptions of delay relative to LOS D and E likely vary by user.

[1] Multi-Modal Level of Service (MMLOS) Guidelines, City of Ottawa, 2015
http://app05.ottawa.ca/sirepub/cache/2/pdwh4kw1cx5zejkujpxihx3q/31504612102017052352250.PDF

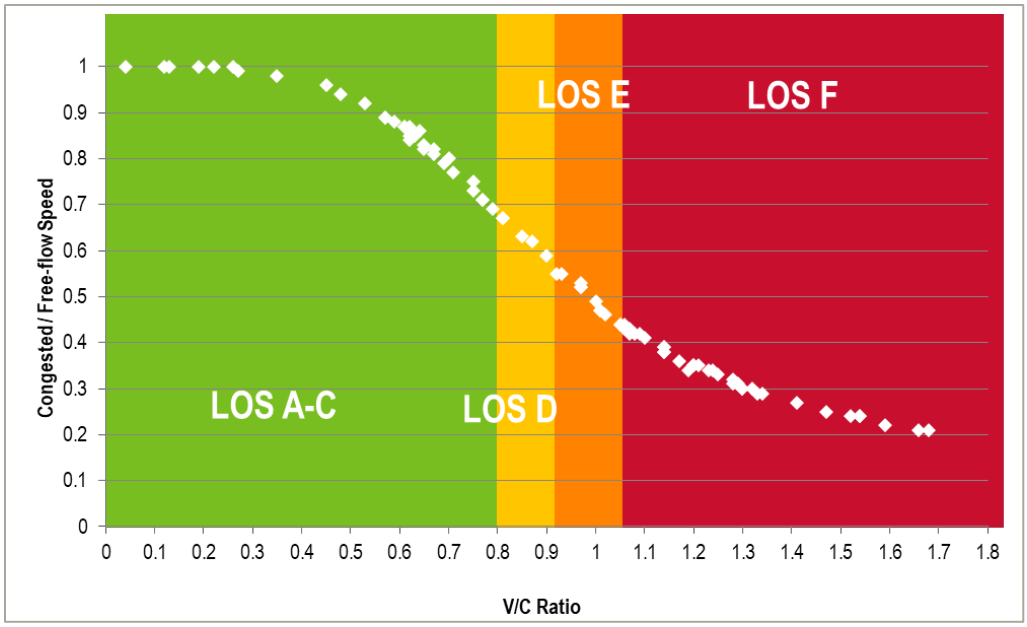


Figure 2-1: Relationship between Congested/Posted Speed Ratio and V/C Ratio

Table 2-1: Vehicular Level of Service

Congested Travel Speed over Free-flow Speed Ratio	Level of Service	Operating Condition
Greater than 0.70	LOS A-C	Free-flow, very little, to moderate delay
Between 0.69 to 0.55	LOS D	Approaching or at capacity, users experience some delays and queuing
Between 0.54 to 0.45	LOS E	Approaching or at capacity, users experience delays and queuing
Less than 0.45	LOS F	Over capacity, severe delays and queuing

2.2 Transit Level of Service

The transit level of service (TLOS) evaluates the LOS for the entire transit line, and the methodology uses a look-up table approach and examines both in-vehicle experience and the station (waiting) experience of transit users. The methodology is based on the Transit Capacity and Quality of Service Manual (TCQSM) and the Ottawa MMLOS Guidelines and modified based on available information and the specific context of this study. The inputs include headway, transit-auto travel time ratio, and stop amenities such as bus shelters, seating, and real-time information. Detailed TLOS evaluation methodology can be found in **Appendix A MMLOS Methodology**.

The scoring ranges are as follows:

- **TLOS 'A'** – very high frequency (5 minutes or better), high capacity transit with *operating speeds equal to or better than automobile travel*. Transit stations/stops

include shelter, seating, and amenities and real-time information if possible. This type of transit service provides the most stable and reliable service to users.
  - **Examples**: Exclusive right-of-way transit service such as subway, commuter rail, or partially exclusive right-of-way service with queue jumps, TSP.

- **TLOS 'B' to 'C'** – high frequency (typically 5-10 minutes), high capacity transit with operating speeds *between 1 and 2x automobile travel times*. All or most transit stations/stops should include shelter, seating, and amenities and real-time information if possible.
  - **Examples**: Partially exclusive right-of-way service or in mixed traffic but with high frequency and speeds such York Region Transit VIVA service.

- **TLOS 'D'**- moderate frequency (typically 10-15 minutes), high capacity transit with operating speeds typically *between 1.5 and 2x automobile travel times*. The majority of transit stops should include shelter, seating, and real-time information.
  - **Examples**: Transit operating in partially exclusive or mixed traffic with high frequency.

- **TLOS 'E' to 'F'** – transit operated in mixed traffic, usually with low service frequency (headway higher than 15 minutes) and operating speed (i.e. *transit travel times exceed 2x auto travel times*). Lack of amenities at bus stops.
  - **Examples**: Transit operating in mixed traffic.

Transit operating speeds and travel times are assessed for future alternatives using VISSIM.

Examples of the different levels of Transit LOS are shown in **Figure 2-2**.

Figure 2-2: Examples of Transit LOS

2.3 Bicycle Level of Service

The bicycle level of service (BLOS) is calculated at the intersection and mid-block (segment) in recognition that a cyclist's experience is determined by the conditions both between crossings and at the crossing itself.

The methodology is based on the Ottawa MMLOS Guidelines and modified based on the information that is available and the specific context of this study. Modifications to the methodology included:

- Taking the average of the Level of Service scores at intersection approaches to depict conditions at the intersection level, as opposed to following the Ottawa MMLOS Guidelines, which assign the intersection LOS based on the score at the worst approach. This holistic view offers a better indication of overall conditions at the intersection, allows to capture nuances and prevents the loss of information caused by aggregating to the worst approach. For instance, the average of approaches method helps avoid situations where the intersection of two major arterials and the intersection of a major arterial and a local road receive the same score despite different physical experiences.
- Adapting the Ottawa MMLOS Guidelines to assess conditions at unsignalized and at T-intersections, which were not outlined in the Ottawa methodology.

For unsignalized intersections, the assumptions made were consistent with the Ottawa MMLOS methodology, and based on the understanding that stop and yield controlled approaches affect the pedestrian experience the same way a "permissive" signalized movement does (more details in the following subsections), T-intersections, also missing in the Ottawa Guidelines, were treated as a 4-way intersection while ignoring the missing leg to account for the missing approach, but no other penalties or upgrades were applied.

The segment BLOS utilizes a look-up table approach based on roadway characteristics and facility type and quality. The methodology measures each segment's and intersection's level of traffic stress (LTS) experienced by the cyclist, established in the Mineta Transportation Institute report (no. 11-19)[2]. Each LTS score is associated with a category of cyclist (e.g. "all ages" to "very confident cyclists only") and score (A to F). **Segment BLOS** considers facility type, street width, operating speed, and parking characteristics.

At the intersection level, a similar look-up table approach is used to evaluate the left and right turning conditions as well as the average score of the all intersection approaches (north, south, east, west) to determine the overall intersection BLOS. Using the average intersection score as opposed to the worst approach score (per the Ottawa MMLOS Guidelines suggestion) allows for a more nuanced examination of conditions and helps better distinguish the different intersection performances.

The input of the BLOS is shown in **Figure 2-3**.

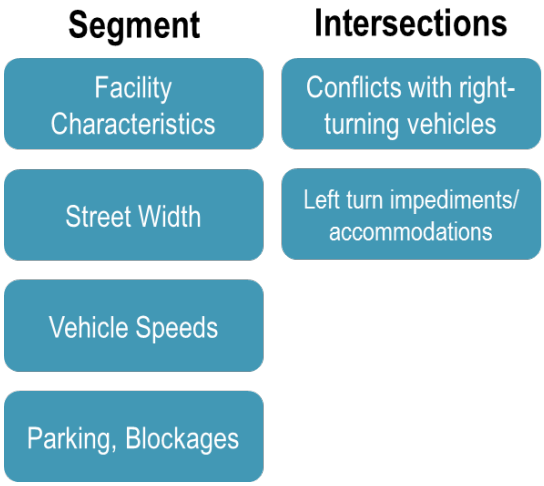


Figure 2-3: Inputs for Bicycle LOS

Segment BLOS is most sensitive to facility type, with physically separated bikeways such as cycle tracks, protected bike lanes and multi-use paths receiving a score of 'A,' while cycling in mixed traffic conditions with varying operating speeds and street widths generally scoring lower – 'D' to 'F'. The scoring ranges as follows:

[2] Low-Stress Bicycling and Network Connectivity, Report 11-19, Mineta Transportation Institute (MTI), http://transweb.sjsu.edu/PDFs/research/1005-low-stress-bicycling-network-connectivity.pdf

- **BLOS 'A' to 'C' –** Physically separated facilities such as cycle tracks, protected bike lanes, and multi-use paths are attractive to most cyclists. At intersections, continuous cycling facilities are provided and separated from vehicles and pedestrians.
- **BLOS 'D' to 'E' –** Designated bike lanes adjacent to high speed traffic lanes or shared facilities on low volume, low speed streets with wide curb lanes provide some comfort, but the majority of potential cyclists typically will not cycle. Greater conflicts at intersections with turning vehicles are experienced.
- **BLOS 'F –** Non-separated, shared roadways with high traffic volumes and speeds, and no accommodations at intersections.

Examples of the segment Bicycle LOS are shown in **Figure 2-4**.

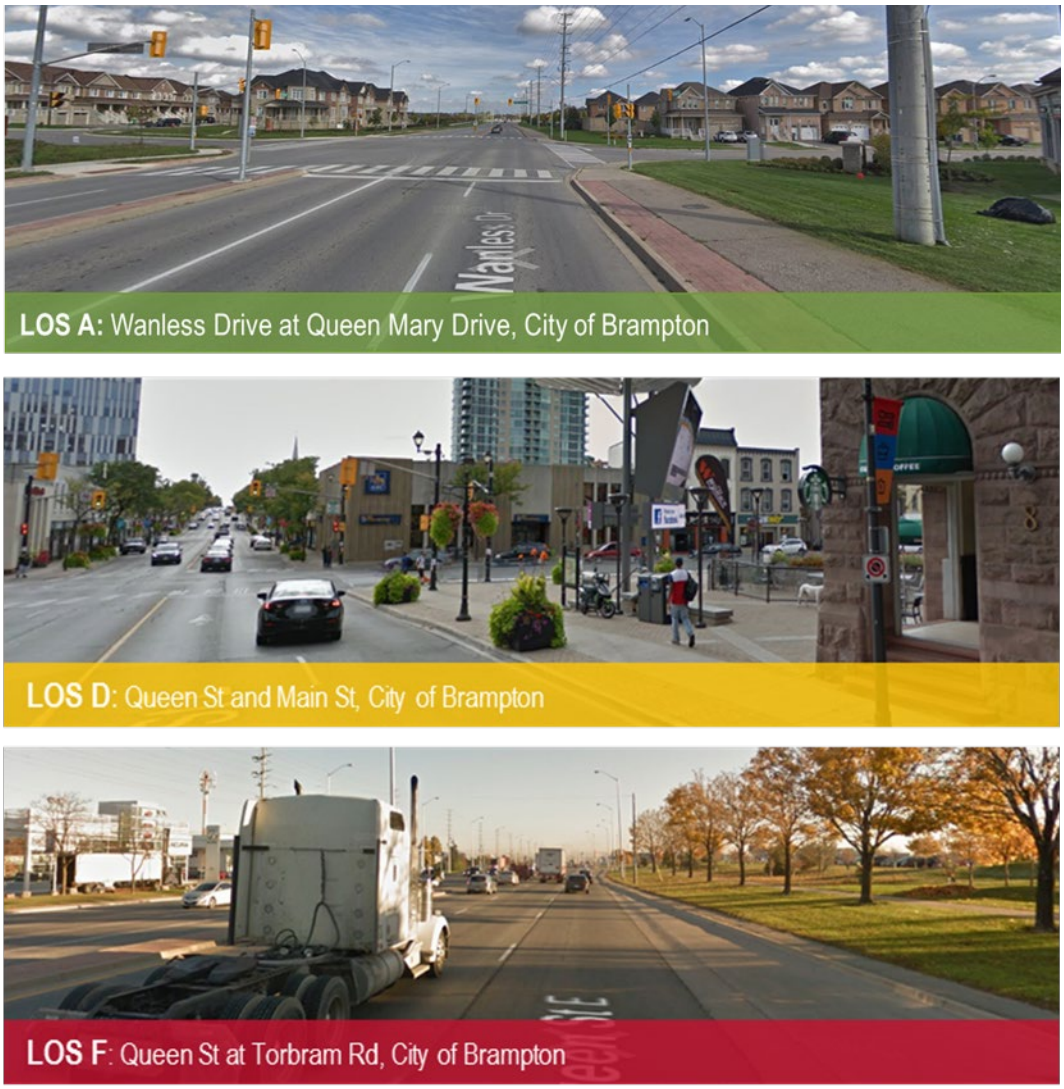


Figure 2-4: Examples of Bicycle Level of Service

2.4 Pedestrian Level of Service

Similar to BLOS, pedestrian level of service (PLOS) is calculated at the intersection and mid-block in recognition that a pedestrian's experience is determined by the conditions both between crossings and at the crossing itself.

The methodology is based on the Ottawa MMLOS Guidelines and modified based on the information that is available and the specific context of this study. Modifications to the methodology included:

- Taking the average of the Level of Service scores at intersection approaches to depict conditions at the intersection level, as opposed to following the Ottawa MMLOS Guidelines, which assign the intersection LOS based on the score at the worst approach. This holistic view offers a better indication of overall conditions at the intersection, allows to capture nuances and prevents the loss of information caused by aggregating to the worst approach. For instance, the average of approaches method helps avoid situations where the

intersection of two major arterials and the intersection of a major arterial and a local road receive the same score despite different physical experiences.

- Adapting the Ottawa MMLOS Guidelines to assess conditions at unsignalized and at T-intersections, which were not outlined in the Ottawa methodology. For unsignalized intersections, the assumptions made were consistent with the Ottawa MMLOS methodology, and based on the understanding that stop and yield controlled approaches affect the pedestrian experience the same way a "permissive" signalized movement does (more details in the following subsections), T-intersections, also missing in the Ottawa Guidelines, were treated as a 4-way intersection while ignoring the missing leg to account for the missing approach, but no other penalties or upgrades were applied.

The segment PLOS utilizes a look-up table approach based on cross-section and roadway characteristics (e.g., sidewalk and boulevard width, traffic volumes, presence of on-street parking, and operating speed).

Intersection PLOS uses the Pedestrian Exposure to Traffic at Signalized Intersections (PETSI) and assigns points based on a number of crossing characteristics (e.g. crossing distance, presence of a median, presence of a crossing refuge, turning restrictions, right hand turn characteristics, curb radii, etc.). The score of each intersection approach is averaged to determine the overall intersection PLOS. Using the average intersection score as opposed to the worst approach score (per the Ottawa MMLOS Guidelines suggestion) allows for a more nuanced examination of conditions and helps better compare the different intersections. For example, since PLOS relies heavily on the crossing width, evaluating based on the worst approach would assign the same score for an intersection between two major arterials and an intersection between a major arterial and a minor street. Taking the average of all approaches helps avoid such situations.

The inputs for the PLOS is shown in **Figure 2-5**.

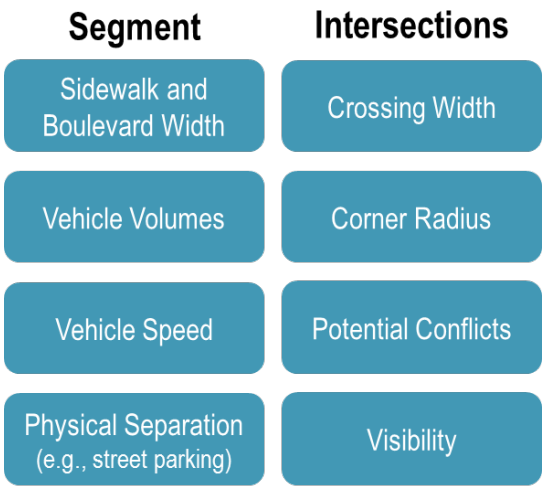


Figure 2-5: Inputs for Pedestrian LOS

Scoring ranges as follows:

- **PLOS 'A' to 'C' –** Attractive to most pedestrians, including locations where lower speeds and volumes, wider sidewalks, and larger boulevards with ample separation from moving traffic are present. Crosswalks are provided on all four legs of the intersections and with shorter crossing distances at intersections.
- **PLOS 'D' to 'E'** – Elements may not appeal to pedestrians due to narrow sidewalks, lack of separation from traffic, longer crossing distances, etc.
- **PLOS 'F' –** Not adequate – locations without any facility or where no buffer is provided adjacent to high speed and high volume traffic. No crosswalks provided and long crossing distances at intersections.

Higher segment scores are characterized by locations where lower vehicle speeds and volumes, wider sidewalks, and larger boulevards with ample separation from moving traffic are present. Lower segment scores are observed in locations where high vehicle speeds, narrow sidewalks, and minimal separation from traffic are present.

Examples of the Pedestrian LOS are shown in **Figure 2-6**.

Figure 2-6: Examples of Pedestrian Level of Service

2.5 Truck Level of Service

The truck level of service (TkLOS) is based on the City of Ottawa's MMLOS guidelines. While VLOS does take into account truck volumes, TkLOS focuses on how the street layout can facilitate efficient and safe truck operation. TkLOS are applied along Clark Boulevard from Rutherford Rd to West Drive as they are indicated as Connector Truck Route based on Peel Region's Goods Movement Network, and parts of the study corridor.

The evaluation is done on a segment level – requiring street width and curb lane width, and at a signalized intersection level – requiring the effective turning radius and the number of receiving lanes on the departing leg of each turn. Details can be found in **Appendix A MMLOS Methodology**.

2.6 Minimum Level of Service Target

The following section outlines the minimum level of service target's identified for the different modes (vehicle, transit, pedestrian, bicycle, truck) in the study corridor. It is noted that:

- The targets are minimum desirable LOS.
- Efforts should be made to exceed the minimum targets wherever possible, without negatively impacting the ability to achieve the minimum targets for other modes.
- Where the targets cannot be achieved, a summary or rationale for why this is so should be documented. In addition, mitigation measures may be required as appropriate.

The minimum level of service target for different modes are based on the land use and planning context such as the City's Transportation Master Plan (TMP), Official Plan (OP), Secondary Plan (SP) and City's 2040 Vision. Based on the City's Secondary Plan 36 (shown in **Figure 2-7**), the corridor is envisioned as a dividing line between lands designated as Central Area Mixed Use to the North and Industrial to the South. In addition, there are opportunities for development and intensification of the employment lands, including Peel Memorial Centre for Integrated Health and Wellness (west of the study corridor) and Bramalea City Centre.

Considering the road characteristics based on the City's TMP and land use designations, the desired minimum LOS targets for each mode are summarized in **Table 2-2**. The VLOS has a relatively low target – E between Kennedy Road and Rutherford Road (travel speed higher than 45% of the free-flow speed). PLOS and BLOS targets range between A and C to reflect the corridor's potential to support the land use and active transportation connections. While the existing condition is largely industrial, its proximity to the Queen Street corridor and potential Major Transit Station Areas may warrant good pedestrian and cyclist service. Although there is no current transit service or future transit service planned for the corridor, there may still be opportunities to re-route local transit service to the corridor with a LOS D.

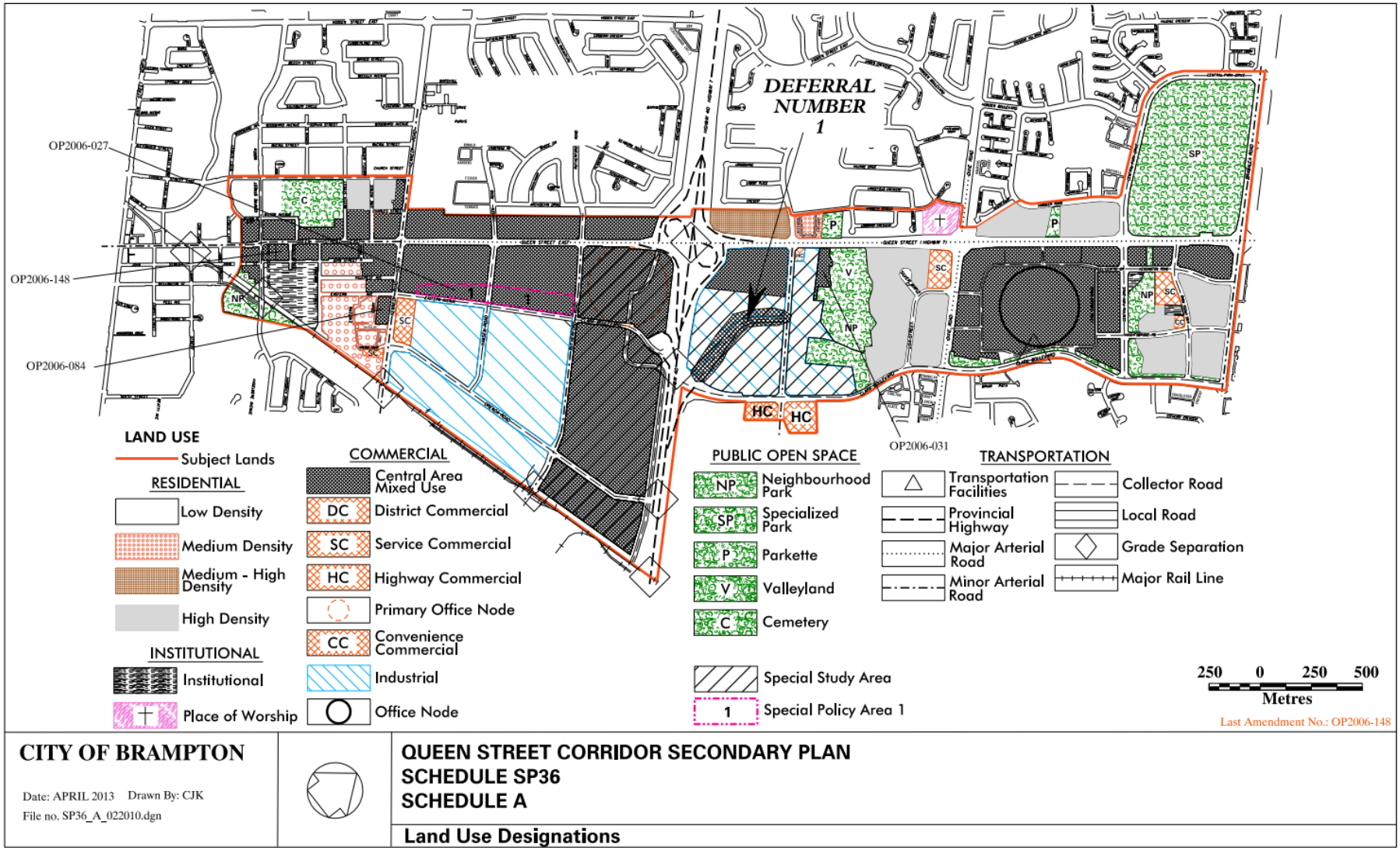


Figure 2-7: Queen Street Corridor Secondary Plan 36

Table 2-2: Road Characteristic and Minimum LOS Targets

Road	From / To	Road Class-ification	Land Use [1]	Transit Functions [2]	Walking and Cycling Functions [3]	Minimum LOS Targets[6]				
						VLOS	TLOS	PLOS	BLOS	TkLOS [4]
Eastern Ave and Clark Blvd Ext.	Kennedy Rd to Rutherford Rd	Minor arterial	Central Area Mixed Use to the North, Industrial to the South	No transit service	Future in right-of-way (on-road or in-boulevard) cycling route	**E**	**D**	**C**	**B**	**D**

[1] Source: City of Brampton Secondary Plan Area (SPA) 36. The study corridor is within close proximity (800m) to the Queen Street Rapid Transit.

[2] Currently there is only transit service operating from the east of West Drive

[3] Source: City of Brampton 2015 TMP Update

[4] Connector Truck Route from Kennedy to West Drive based on Peel Region's Goods Movement Network. No targets are set for Clark Boulevard east of West Drive since it is not a designated truck route.

[6] The following assumptions were used to establish the Minimum LOS Targets

- Vehicle LOS target: Referenced "Central Area" and "Within 600m of a rapid transit station" in the Ottawa Guide, LOS E
- Truck LOS target: Connector Truck Route from Kennedy Rd to West Dr, referenced "Central Area" and "Within 600m of a rapid transit station" Truck Route in the Ottawa Guide, LOS D
- Pedestrian LOS target: For areas along residential / commercial mixed use, referenced "Central Area" and "Within 600m of a rapid transit station" in the Ottawa Guide as LOS A has been relaxed to LOS C for Brampton context. For areas along industrial (Clark between Heart Lake and West Dr, south side of Eastern and Clark Extension), referenced "Employment Area" in the Ottawa Guide, LOS C
- Bicycle LOS target: Central Area arterial and collector, mixed use centre arterial and collector, employment area arterial, and within 600m of a rapid transit station, in the Ottawa Guide LOS B
- Transit LOS target: For segments with transit service, referenced "Central Area" and "Within 600m of a rapid transit station", TP - Isolated Measures in the Ottawa Guide, LOS D

3 Existing Conditions

3.1 Vehicular Level of Service

This section summarizes the existing vehicular level of service using results from the 2011 travel demand model and the existing (2018) Synchro and VISSIM model between Kennedy Road and Rutherford Road. Details can be found in **Appendix B Travel Demand Modelling Memo** and **Appendix C Traffic Analysis Memo**.

3.1.1 Existing Road Network

The travel demand modelling work includes the entire modelling focus area as shown in **Figure 1-1**. The modelling focus area is bounded by the adjacent arterial roads, Queen Street, Steeles Avenue, Kennedy Road, and east of Dixie Road.

The existing road classification, number of lanes, posted speed, and the lane capacity assumption used in the travel demand model are summarized in **Table 3-1**. The corridor has 4 lanes (both directions) with 50km/h posted speed.

Table 3-1: 2011 Road Network

Road	To	From	# Lanes (both directions)	Free-Flow Speed (km/h)	Lane Capacity (veh/hour)
Eastern Ave / Clark Blvd Corridor					
Eastern Ave	Trueman St	Hansen Rd S	2	50	500
Clark Blvd	Rutherford Rd S	West Dr	4	50	700
Clark Blvd	West Dr	Dixie Rd	4	50	700
Clark Blvd	Dixie Rd	Bramalea Rd	4	50	500
North-South Road					
Centre St S	Queen St	Clarence St	2	50	500
Trueman St	Queen St	Eastern Ave	2	50	500
Kennedy Rd	Queen St	Steeles Ave	4	60	700
Hansen Rd S	Queen St	Orenda Rd	2	50	500
Rutherford Rd	Queen St	Orenda Rd	4	50	500
Rutherford Rd	Orenda Rd	Steeles Ave	4	60	700
Highway 410	Queen St	Steeles Ave	8	110	1800
West Dr	Queen St	Steeles Ave	4	60	700
Dixie Rd	Queen St	Clark Blvd	6	60	800
Dixie Rd	Clark Blvd	Steeles Ave	4	60	800
Bramalea Rd	Queen St	Steeles Ave	4	60	800
East-West Road					
Queen St	Centre St S	Kennedy Rd	4	50	700
Queen St	Kennedy Rd	Rutherford Rd	4	60	800
Queen St	Rutherford Rd S	Bramalea Rd	6	60	900
Orenda Rd	Kennedy Rd	Dixie Rd	4	50	500
Orenda Rd	Dixie Rd	Bramalea Rd	2	60	600
Clarence St	Centre St S	Kennedy Rd	2	50	500

Road	To	From	# Lanes (both directions)	Free-Flow Speed (km/h)	Lane Capacity (veh/hour)
Clarence St	Kennedy Rd	Rutherford Rd	4	50	500
Steeles Ave	Kennedy Rd	Rutherford Rd	6	70	700
Steeles Ave	Rutherford Rd S	Bramalea Rd	6	70	900

3.1.2 Existing Travel Demand Model

The City's travel demand model was further calibrated to the study area. Detailed calibration can be found in **Appendix B Travel Demand Modelling Memo**. A comparison of westbound (peak direction) modelled volumes, observed volumes, and the results from the 2011 EA study in the PM peak hour is shown in **Figure 3-1**. The modelled volumes were adjusted to match counts closest to 2011 since the base year of the travel demand model is 2011. After the adjustment, the modelled volumes are closer to the observed volumes. Some locations remain slightly below counts but the differences were within a reasonable range.

Several screenlines were used to understand the overall traffic conditions on parallel roads next to the study corridor and are listed as follows:

1. East of Kennedy Rd
2. West of Rutherford Rd
3. West of Hwy 410
4. East of Hwy 410
5. East of Dixie Rd
6. North of Clark Blvd/Eastern Ave
7. South of Clark Blvd/Eastern Ave

The volume over capacity ratios at these screenlines in the PM peak period are summarized in **Table 3-2** and illustrated in **Figure 3-2**. The peak westbound traffic screenline east of Highway 410 (screenline 4) and the peak northbound screenline south of Eastern Avenue / Clark Boulevard (screenline 6) are close to capacity (V/C between 0.85 and 1), while the rest of screenlines are under capacity. It is noted that Steeles Avenue tends to be most congested east-west corridor, with most locations approaching or over capacity west of Highway 410. Most segments on Queen Street are approaching capacity east of Highway 410.

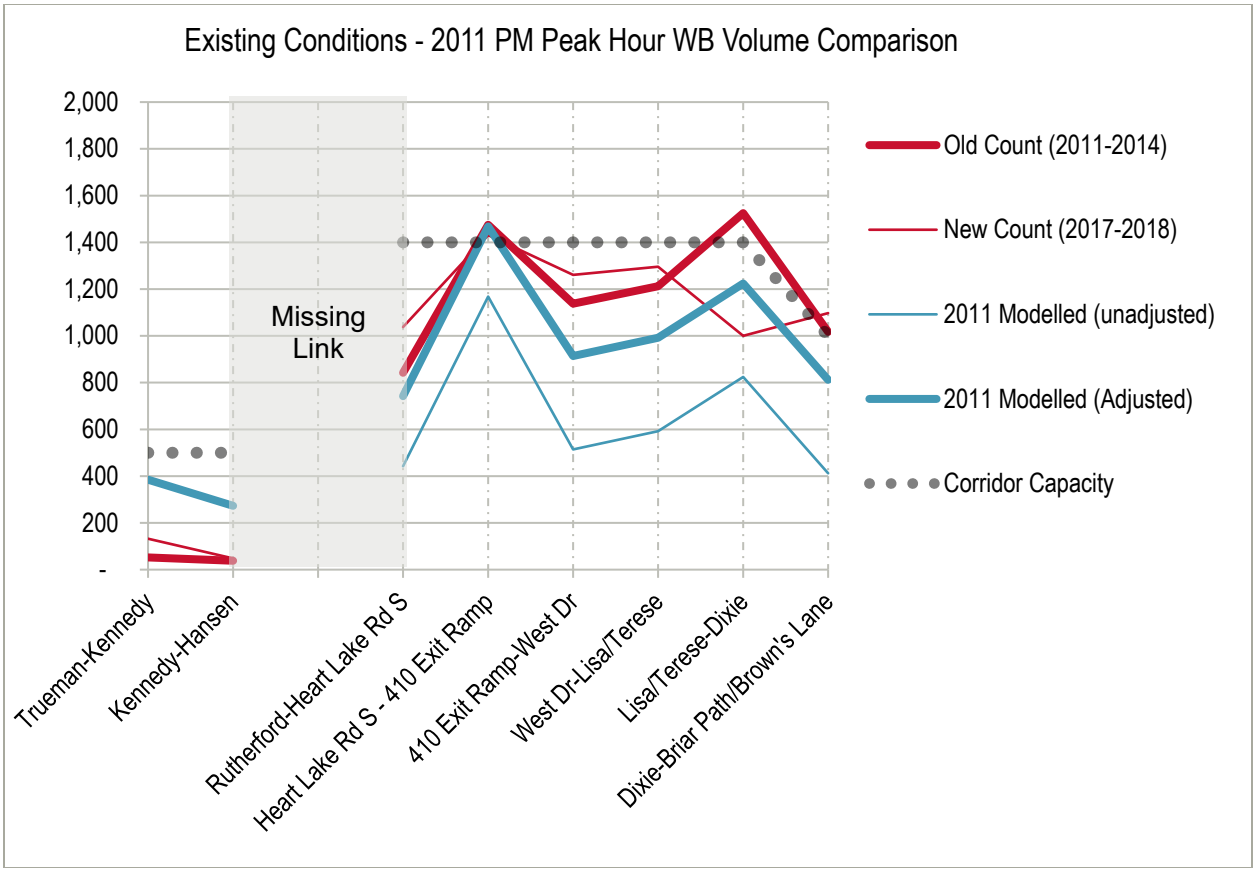


Figure 3-1: Comparison of the Observed Volumes (Count) and Existing Modelled Volumes – Westbound, 2011 PM Peak Hour

Table 3-2: Screenline V/C Ratio, 2011 Peak Hour, Peak Direction

#	Screenline	Road	2011			
			Volume (Unadjusted)	Volume (adjusted)	Capacity	V/C
1	East of Kennedy Rd	Queen St	1,261	1,261	1,600	0.79
		Eastern Ave	273	273	500	0.55
		Orenda Rd	534	534	1,000	0.53
		Clarence St	775	775	1,000	0.78
		Glidden Rd	371	371	500	0.74
		Steeles Ave	2,239	2,239	2,100	1.07
		Total	**5,453**	**5,453**	**6,700**	**0.81**
2	West of Rutherford Rd	Queen St	1,338	1,338	1,600	0.84
		Orenda Rd	822	822	1,000	0.82
		Clarence St	775	775	1,000	0.78
		Total	**2,935**	**2,935**	**3,600**	**0.82**
3	West of Hwy 410	Queen St	1,930	1,930	2,700	0.71
		Clark Blvd	442	742	1,400	0.53
		Orenda Rd	796	796	1,000	0.80
		Glidden Rd	272	272	500	0.54
		Steeles Ave	2,500	2,500	2,700	0.93
		Total	**5,940**	**6,240**	**8,300**	**0.75**
4	East of Hwy 410	Queen St	2,679	2,679	2,700	0.99
		Clark Blvd	1,126	1,526	1,400	1.09
		Orenda Rd	822	822	1,000	0.82
		Glidden Rd	715	415	1,000	0.42
		Steeles Ave	2,672	2,672	2,700	0.99
		Total	**8,014**	**8,114**	**8,800**	**0.92**
5	East of Dixie Rd	Queen St	1,750	2,350	2,700	0.87
		Clark Blvd	412	912	1,000	0.91
		Orenda Rd	604	304	600	0.51
		Steeles Ave	2,251	1,951	2,700	0.72
		Total	**5,017**	**5,517**	**7,000**	**0.79**
6	North of Clark Blvd/Eastern Ave	Kennedy Rd	1,213	1,713	1,400	1.22
		Hansen Rd S	279	279	500	0.56
		Rutherford Rd	953	1,153	1,000	1.15
		West Dr	935	935	1,400	0.67
		Dixie Rd	1,475	1,475	2,400	0.61
		Total	**4,855**	**5,555**	**6,700**	**0.83**
7	South of Clark Blvd/Eastern Ave	Kennedy Rd	1,403	1,403	1,400	1.00
		Hansen Rd S	340	240	500	0.48
		Rutherford Rd	583	1,133	1,000	1.13
		West Dr	1,376	1,376	1,400	0.98
		Dixie Rd	1,178	1,578	1,600	0.99
		Total	**4,880**	**5,730**	**5,900**	**0.97**

Legend

V/C < 0.85	0.85 < V/C < 1	V/C > 1

Figure 3-2: Screenline V/C Ratio, 2011 Peak Hour, Peak Direction

This model will be used to forecast travel volumes for future horizon years and provide inputs to microsimulation models including Synchro and VISSIM, in order to conduct detailed analysis for the alternatives.

Detailed analysis of the existing model calibration and results can be found in **Appendix B Travel Demand Modelling Memo**.

3.1.3 Existing Intersection Operations Analysis

Synchro and VISSIM models were developed for the study corridor to examine the existing intersection operations in both AM and PM peak hours. This section summarizes the analysis results with details documented in **Appendix C Traffic Analysis Memo**.

Synchro, a deterministic software, and VISSIM, a stochastic software, tend to provide different approaches to the studies, Synchro is used to estimate the volume to capacity (v/c) ratio for individual intersection movements. VISSIM (microsimulation software) is used to analyze existing vehicle delay, Level of Service (LOS), and queue length (95th percentile)

Synchro Model

The majority of signalized and unsignalized intersections within the study area are operating at overall v/c 1.00 or better with reserve capacity during both the AM and PM peak hours. The results are shown in **Table 3-3**.

Table 3-3: Existing (2018) Synchro Model Results

Intersection	Approach/Movement		AM Peak Hour	PM Peak Hour
			v/c	v/c
Eastern Avenue & Kennedy Road South (Unsignalized)*	EB	EBLTR	0.27	0.27
	WB	WBLTR	0.14	0.55
	NB	NBL	0.04	0.16
		NBTR	0.19	0.46
	SB	SBL	0.05	0.07
		SBTR	0.42	0.27
	Overall Intersection		**0.49**	**0.62**
Eastern Avenue & Hansen Road South (Unsignalized)*	EB	EBLTR	0.09	0.11
	WB	WBLTR	0.00	0.01
	NB	NBLTR	0.01	0.02
	SB	SBLTR	0.00	0.00
	Overall Intersection		**0.27**	**0.60**
Clark Boulevard & Rutherford Road South (Signalized)	WB	WBL	0.79	0.79
		WBR	0.13	0.66
	NB	NBTR	0.23	0.77
	SB	SBL	0.42	0.64
		SBT	0.31	0.19
	Overall Intersection		**0.53**	**0.76**

Critical Movement (V/C > 1)

Based on the intersection capacity analyses results, all of signalized and unsignalized intersections within the study area are operating well at overall v/c ratio of less than 1 with reserved capacity during both the AM and PM peak hours.

VISSIM Model

The VISSIM model was analyzed for the peak hour including a thirty minute warm up period. Based on the average of five runs, the results are summarized in **Table 3-4**.

Table 3-4: Existing (2018) VISSIM Model Results, PM Peak Hour

Intersection	Intersection Movement	Delay (s)	LOS Delay[1]	95th Percentile Avg. Queue (m)	95th Percentile Max Queue (m)
Eastern Avenue & Kennedy Road South (Unsignalized)	EBL	16	C	1	19
	EBT	16	B	1	19
	EBR	6	A	1	18
	WBL	18	C	1	31
	WBT	15	B	1	31
	WBR	10	A	1	31
	NBL	4	A	1	57
	NBT	0	A	0	52
	NBR	1	A	0	52
	SBL	1	A	0	0
	SBT	0	A	0	0
	SBR	1	A	0	0
	Intersection LOS		**A**		
Eastern Avenue & Hansen Road South (Unsignalized)	EBL	7	A	1	18
	EBT	0	A	1	21
	EBR	5	A	1	21
	WBL	0	A	0	18
	WBT	14	B	0	22
	WBR	0	A	0	13
	NBL	1	A	0	32
	NBT	0	A	0	40
	NBR	0	A	0	28
	SBL	4	A	0	8
	SBT	0	A	0	0
	SBR	0	A	0	0
	Intersection LOS		**A**		
Clark Boulevard & Rutherford Road South (Signalized)	WBL	46	D	33	148
	WBR	18	B	33	148
	NBT	21	B	38	129
	NBR	18	B	38	129
	SBL	19	B	5	41
	SBT	8	A	5	41
	Intersection LOS		**C**		

[1]The LOS is comparable to the LOS defined in the American Highway Capacity Manual of 2010.

Legend

Signalized Intersection Delay (s):

A: ≤ 10	**B: > 10 to 20**	**C: > 20 to 35**	**D: > 35 to 55**	**E: > 55 to 80**	**F: > 80**

Non-signalized Intersection Delay (s):

A: ≤ 10	**B: > 10 to 15**	**C: > 15 to 25**	**D: > 25 to 35**	**E: > 35 to 50**	**F: > 50**

Based on the results, all individual movements are operating at LOS E or better in the PM Peak Hour.

3.1.4 Existing Vehicular Level of Service

The existing vehicular LOS for the study corridor is summarized in **Table 3-5.** Between Kennedy Road and Hansen Road, users are expected to experience very little delay. The congested speed is the same as the free-flow speed. The segment has a good VLOS A, which meets the existing VLOS target (LOS E).

Table 3-5: Existing Vehicular LOS – PM Peak Hour Peak Direction (Westbound)

Segment	Length (km)	Posted Speed (km/h)	Free-flow Travel Time (min)	Congested Speed (km/h) [1]	Congested Travel Time (min) [1]	Ratio	VLOS
Eastern Ave (EA Segment) – Kennedy Road to Hansen Road	0.45	50	0.5	50	0.5	100%	**A**

[1] Based on real-life travel times on Google Maps in the PM peak hour, weekday in June 2019

3.2 Transit Level of Service

Currently, transit operates along Kennedy Road within the study area. There are no transit routes which operate along Eastern Avenue. There is an opportunity to provide connectivity for transit routes to operate east-west along the study corridor. The transit LOS is summarized in **Table 3-6**.

Table 3-6: Existing Transit LOS

Segment	BLOSTLOS
Kennedy Rd to Rutherford Rd	**F, no transit service**

3.3 Bicycle Level of Service

3.3.1 Existing Cycling Network

There is no are no existing, dedicated cycling facilities along the study corridor.

3.3.2 Existing Bicycling Level of Service

Figure 3-3 illustrates the BLOS along the study corridor. As a result of the lack of cycling infrastructure, intersections and segments experience a BLOS of C or worse. Detailed analysis can be found in **Appendix D MMLOS Analysis**.

Figure 3-3: BLOS

Table 3-7: Segment BLOS

Segment	BLOS
Eastern Avenue	
Kennedy to Hansen	**C**

Table 3-8: Intersection BLOS

Street A	Street B	Intersection BLOS (Avg)
Eastern Ave	Kennedy Rd	**E**
Eastern Ave	Hansen Rd	**D**
Clark Blvd	Rutherford Rd S	**E**

3.4 Pedestrian Level of Service

3.4.1 Existing Sidewalks

There are no pedestrian facilities along the study corridor.

3.4.2 Existing Pedestrian Level of Service

Figure 3-4 illustrates the existing PLOS in the Study Area. As a result of the lack of pedestrian facilities, the existing segment is operating with a PLOS F, and the intersection of Kennedy Rd and Eastern Ave is operating with LOS E. The segment

and overall (average) intersection PLOS are summarized in **Table 3-9** and **Table 3-10**, respectively. Detailed analysis can be found in **Appendix D MMLOS Analysis**.

It is noted that although the intersection at Eastern Avenue and Hansen Road receives a LOS B, it simply indicates the low level of stress a person would experience when crossing this intersection. It is a three-way intersection currently with two lanes in all approaches and low traffic volumes (shown in **Figure 3-5**). However, combined with the lack of sidewalk on a segment level (LOS F), there are still major opportunities for improvements of the pedestrian facilities in the study area and improvements at the segment level are still warranted with features such as coloured or textured crosswalks.

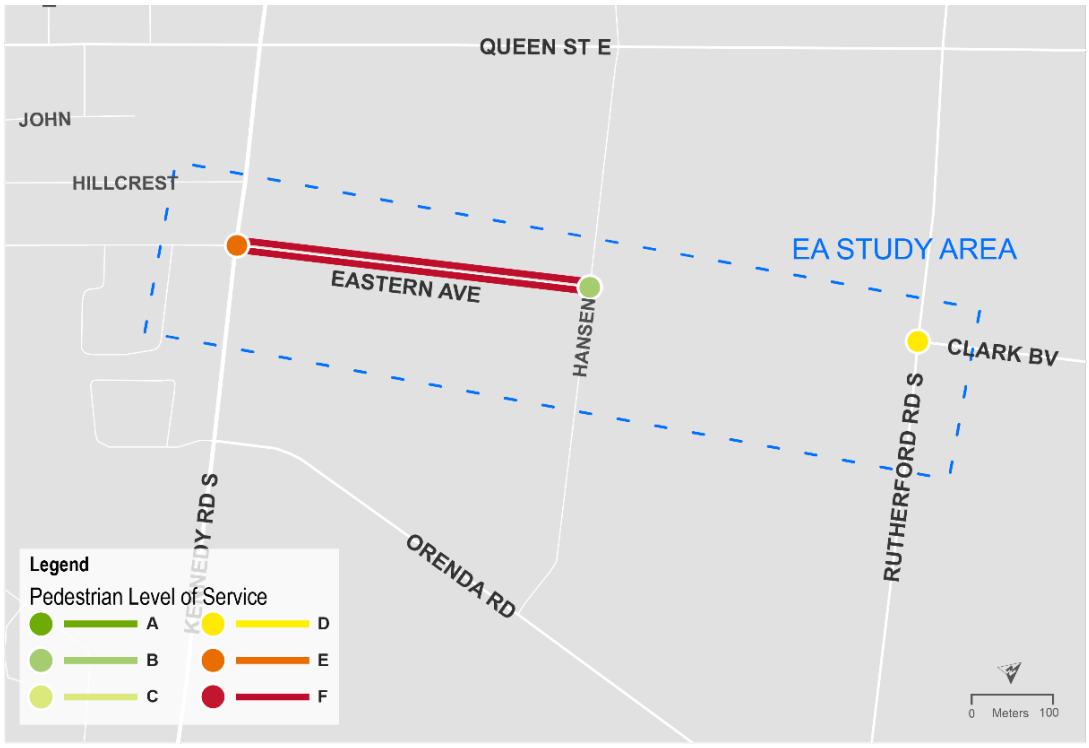


Figure 3-4: PLOS

Table 3-9: Segment PLOS

Segment	North Side	South Side
Eastern Avenue		
Kennedy to Hansen	F	F

Table 3-10: Intersection PLOS

Street A	Street B	Intersection PLOS (Avg)
Eastern Ave	Kennedy Rd	E
Eastern Ave	Hansen Rd	B
Clark Blvd	Rutherford Rd S	D

Figure 3-5: Intersection at Eastern Avenue and Hansen Road

3.5 Truck Level of Service

Truck LOS (TkLOS) is summarized by segment and by intersection within the study area in **Table 3-11** and **Table 3-12**, respectively**.** Overall the corridor has good truck LOS, due to wide curb lane width and large corner radii at intersections. Intersections are operating at a TkLOS of A to D. The segment operates at a TkLOS of B within the study area. It is noted that there are no minimum TkLOS targets for these segments or intersections as discussed in **Section 2.6**.

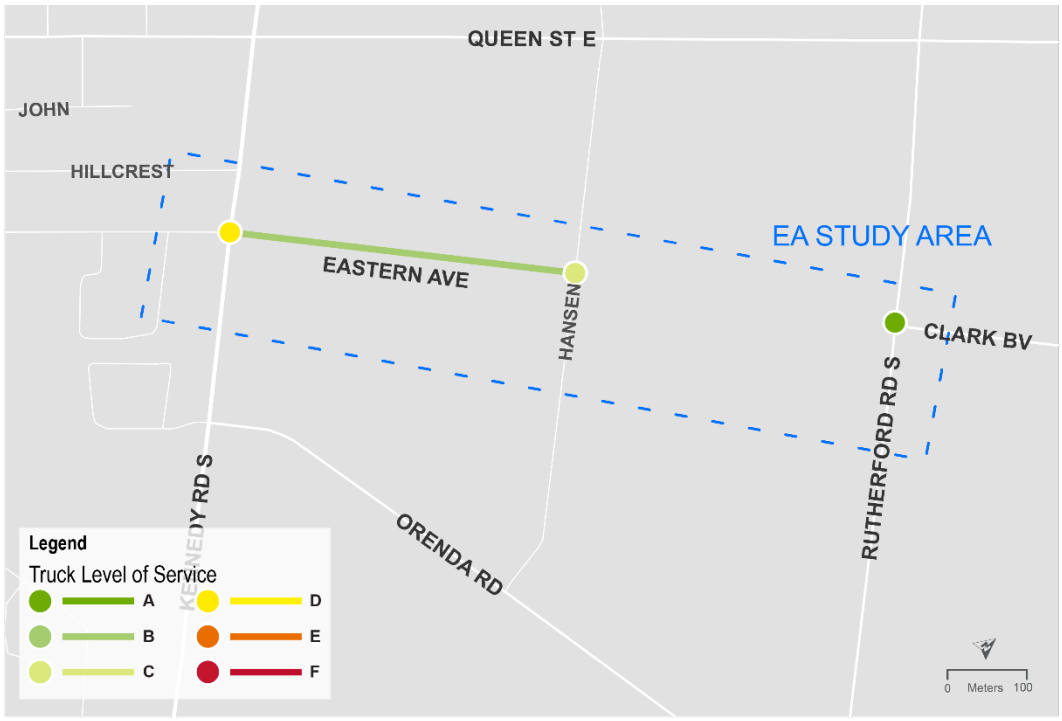


Figure 3-6: TkLOS

Table 3-11: Segment TkLOS

Segment	TkLOS
Eastern Avenue	
Kennedy to Hansen	**B**

Table 3-12: Intersection TkLOS

Street A	Street B	Intersection TkLOS
Eastern Ave	Kennedy Rd	**D**
Eastern Ave	Hansen Rd	**C**
Clark Blvd	Rutherford Rd S	**A**

3.6 Minimum Level of Service Target – Existing Conditions

Table 3-13 summarizes the existing LOS conditions compared with the minimum LOS target. The vehicular LOS and truck LOS satisfies the target. On the other hand, the pedestrian, bicycle, and transit LOS are worse than the minimum targets, indicating the needs for improvements.

Table 3-13: Existing LOS Conditions Compared with Minimum LOS Target

Road	From / To	Road Class-ification	Land Use [1]	Transit Functions [2]	Walking and Cycling Functions [3]	Minimum LOS Targets					LOS Analysis Results				
						VLOS	TLOS	PLOS	BLOS	TkLOS	VLOS	TLOS	PLOS	BLOS	TkLOS
Eastern Ave	Kennedy Rd to Hansen	Minor arterial	Central Area Mixed Use to the North, Industrial to the South	No transit service	Future in right-of-way (on-road or in-boulevard) cycling route	**E**	**D**	**C**	**B**	**D**	**A**	**F (no transit service)**	**Seg: F Int: B-E**	**Seg: C Int: D-E**	**Seg: B Int: C-D**
Clark Boulevard Ext	Hansen to Rutherford	Minor arterial	Central Area Mixed Use to the North, Industrial to the South	No transit service	Future in right-of-way (on-road or in-boulevard) cycling route	**E**	**D**	**C**	**B**	**D**	**N/A +**	**N/A +**	**Seg: N/A + Int: B-D**	**Seg: N/A + Int: D-E**	**Seg: N/A + Int: A-C**

+ Missing Link

[1] Source: City of Brampton Secondary Plan Area (SPA) 36. The study corridor is within close proximity (800m) to the Queen Street Rapid Transit.

[2] Source: City of Brampton Official Plan and 2015 TMP Update

[3] Source: City of Brampton 2015 TMP Update

Legend:

Meets target	Does not meet target	N/A

4 Future Do Nothing Conditions

This section is focused on the traffic conditions in the 2031 and 2041 Do Nothing scenarios. In future Do Nothing scenarios, no roadway improvements for the study corridor are assumed relative to the existing conditions for Eastern Avenue / Clark Boulevard between Kennedy Road and Rutherford Road.

4.1 2031 and 2041 Network Assumptions

The 2031 and 2041 network assumes all planned improvements based on the City's 2015 TMP Update, with two exceptions:

- The study corridor is the same as existing conditions.
- Queen Street has been changed to 4 general purpose lanes and 2 dedicated bus rapid transit (BRT) lanes, based on Brampton's 2040 Vision for the "Queen's Boulevard" – from Etobicoke Creek to West of Highway 410, as well as the current status of the Queen Street Rapid Transit Project which will be subject to further study by Metrolinx.

Changes from the 2011 model to the 2031 model for the road network and transit network in proximity of the study corridor are summarized in **Table 4-1**.and **Table 4-2**, respectively. There are no additional network changes from the 2031 to 2041 Do Nothing scenario in the study area. Details of the network assumptions can be found in **Appendix B Travel Demand Modelling Memo**.

Table 4-1: 2031 Do Nothing Road Network Changes from 2011

Road	To	From	Type of Change	# Lanes (both directions)
North-South				
Highway 410	Queen St	Steeles	8 to 10	10
Bramalea Rd *	Queen St	Steeles	4 to 6	6
East-West				
Queen St	Kennedy Rd	West of Highway	6 lanes to 4	4 general purpose lanes

Table 4-2: 2031 Do Nothing Transit Network Changes from 2011 (PM Peak Period)

Transit Line	Change from 2011	Mode	Headway (min)	Vehicle Capacity	Total Capacity (passenger per hour)	Length (km)	Average Speed (km/h)
Higher Order Transit							
Züm Queen	Changed from BRT Lite to BRT	BRT	10	70	420	57	24
Züm Queen A (via Hwy 407)		BRT	10	70	420	59	31
Züm Main		BRT	5	70	840	20	24
Züm Bramalea	New Line	BRT Lite	10	70	420	40	24
Züm Kennedy	New Line	BRT Lite	10	70	420	28	24
Hurontario LRT	New LRT Line on Main/ Hurontario from Square One to Brampton GO	LRT	5	336	4032	24	27
GO Rail **							
Inbound Bramalea-Union		GO Rail	15	1900	7600	28	53
Outbound Union-Bramalea		GO Rail	15	1900	7600	28	53
Outbound Union – Mt. Pleasant		GO Rail	30	1900	3800	39	50
Outbound Union - Kitchener (express to Bramalea)		GO Rail	30	1900	3800	100	63

* It is noted that a recent Bramalea Road Environmental Assessment Study has identified Bramalea Road to remain a four-lane cross section, with transit queue jump lanes at intersections and transit lanes south of East Drive. It is expected that there will be a shift in auto demand from Bramalea Road to adjacent parallel corridors (Dixie Road and Torbram Road), but the impact on our study corridor is expected to be minimum.

** This will provide 15-minute, two-way service between Bramalea and Union Station, combined 15-minute service from Union Station to Mt. Pleasant, and 30-minute express service between Union and Kitchener.
Source: Metrolinx RER Planning Kitchener GO Line (http://www.metrolinx.com/en/regionalplanning/rer/rer_kitchener.aspx)

4.2 2031 and 2041 Travel Demand Model

The future Do Nothing alternative for the EA study assumes no modifications to the existing network (except for the existing Clark Blvd from Rutherford Rd to Dixie Rd to remain as 4 lanes). Traffic volumes along the study corridor for the 2031 and 2041 Do Nothing (EA) are shown in **Figure 4-1**. In the 2041 Do Nothing (EA) scenario, most segments are expected to be operating with traffic volumes exceeding the road capacity. However, it is noted that the forecasted volumes are significantly lower than the modelled volumes in the 2012 EA (about 20-30% lower varying along the corridor), likely due to the improved mode share estimations in the City's latest travel demand model, and thus traffic demands are not as high in comparison to the work completed in 2012.

At a screenline level (shown in **Table 4-3** and **Figure 4-2**), all screenlines are either approaching capacity or exceeding capacity, clearly indicating the need for transportation improvements.

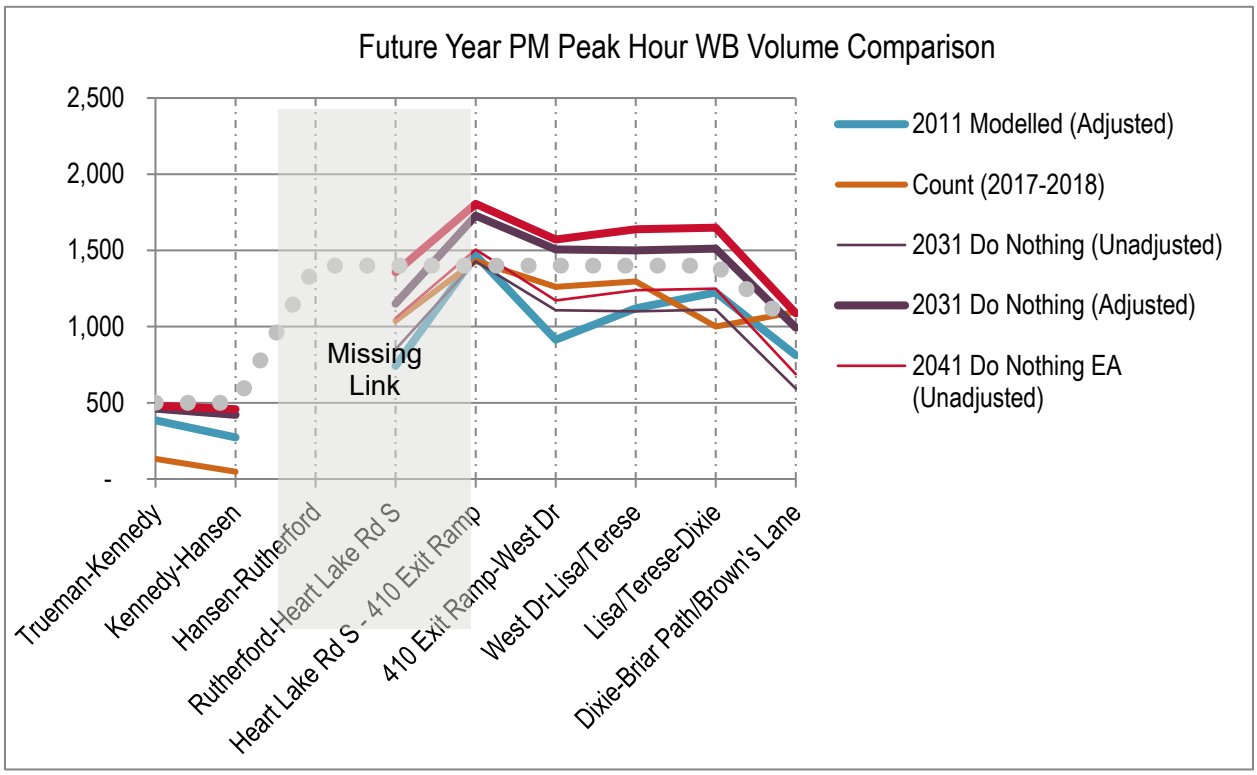


Figure 4-1: 2031 and 2041 Do Nothing (EA) Traffic Volumes, PM Peak Hour

Table 4-3: Screenline V/C Ratio, 2031 and 2041 Do Nothing EA Alternative, Peak Hour, Peak Direction

#	Screenline	Road	2031				2041			
			Volume (unadjusted)	Volume (adjusted)	Capacity	V/C	Volume (unadjusted)	Volume (adjusted)	Capacity	V/C
1	East of Kennedy Rd	Queen St	1,497	1,497	1,600	0.94	1,631	1,631	1,600	1.02
		Eastern Ave	421	421	500	0.84	458	458	500	0.92
		Orenda Rd	785	785	1,000	0.79	869	869	1,000	0.87
		Clarence St	910	910	1,000	0.91	955	955	1,000	0.96
		Glidden Rd	374	374	500	0.75	400	400	500	0.80
		Steeles Ave	2,635	2,635	2,100	1.25	2,823	2,823	2,100	1.34
		Total	**6,622**	**6,622**	**6,700**	**0.99**	7,136	7,136	6,700	**1.07**
2	West of Rutherford Rd	Queen St	1,601	1,601	1,600	1.00	1,587	1,587	1,600	0.99
		Orenda Rd	944	944	1,000	0.94	958	958	1,000	0.96
		Clarence St	910	910	1,000	0.91	955	955	1,000	0.96
		Total	**3,455**	**3,455**	**3,600**	**0.96**	3,500	3,500	3,600	**0.97**
3	West of Hwy 410	Queen St	2,151	2,151	1,800	1.20	2,358	2,358	1,800	1.31
		Clark Blvd	851	1,151	1,400	0.82	1,056	1,356	1,400	0.97
		Orenda Rd	893	893	1,000	0.89	857	857	1,000	0.86
		Glidden Rd	445	445	500	0.89	461	461	500	0.92
		Steeles Ave	2,738	2,738	2,700	1.01	2,999	2,999	2,700	1.11
		Total	**7,078**	**7,378**	**7,400**	**1.00**	7,732	8,032	7,400	**1.09**
4	East of Hwy 410	Queen St	2,898	2,898	2,700	1.07	3,088	3,088	2,700	1.14
		Clark Blvd	1,107	1,507	1,400	1.08	1,172	1,572	1,400	1.12
		Orenda Rd	1,039	1,039	1,000	1.04	1,106	1,106	1,000	1.11
		Glidden Rd	950	650	1,000	0.65	1,016	716	1,000	0.72
		Steeles Ave	3,040	3,040	2,700	1.13	3,128	3,128	2,700	1.16
		Total	**9,034**	**9,134**	**8,800**	**1.04**	9,510	9,610	8,800	**1.09**
5	East of Dixie Rd	Queen St	2,009	2,609	2,700	0.97	2,171	2,771	2,700	1.03
		Clark Blvd	593	1,093	1,000	1.09	688	1,188	1,000	1.19
		Orenda Rd	831	531	600	0.89	887	587	600	0.98
		Steeles Ave	2,615	2,315	2,700	0.86	2,930	2,630	2,700	0.97
		Total	**6,048**	**6,548**	**7,000**	**0.94**	6,676	7,176	7,000	**1.03**
6	North of Clark Blvd/Eastern Ave	Kennedy Rd	1,338	1,838	1,400	1.31	1,352	1,852	1,400	1.32
		Hansen Rd S	406	406	500	0.81	526	526	500	1.05
		Rutherford Rd	1,069	1,269	1,000	1.27	1,480	1,680	1,000	1.68
		West Dr	1,226	1,226	1,400	0.88	1,303	1,303	1,400	0.93
		Dixie Rd	1,886	1,886	2,400	0.79	2,015	2,015	2,400	0.84
		Total	5,925	**6,625**	**6,700**	**0.99**	6,676	7,376	6,700	**1.10**
7	South of Clark Blvd/Eastern Ave	Kennedy Rd	**1,549**	1,549	1,400	1.11	1,677	1,677	1,400	1.20
		Hansen Rd S	323	223	500	0.45	647	547	500	1.09
		Rutherford Rd	707	1,257	1,000	1.26	1,298	1,848	1,000	1.85
		West Dr	1,515	1,515	1,400	1.08	1,620	1,620	1,400	1.16
		Dixie Rd	1,870	2,270	2,400	0.95	2,025	2,425	2,400	1.01
		Total	**5,964**	**6,814**	**6,700**	**1.02**	7,267	8,117	6,700	**1.21**

Legend

V/C < 0.85	0.85 < V/C < 1	V/C > 1

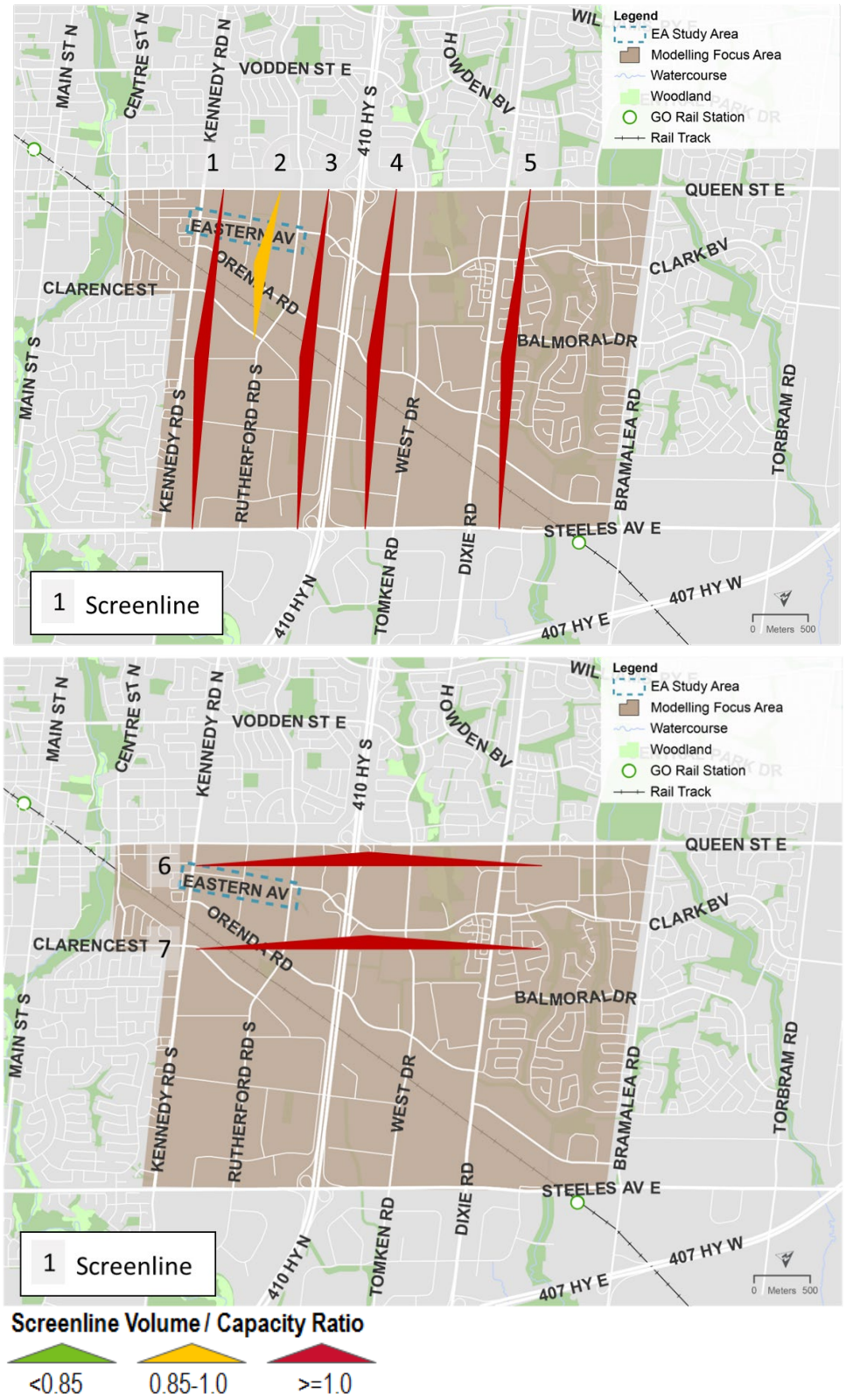


Figure 4-2: Screenline V/C Ratio, 2041 Do Nothing (EA) Peak Hour, Peak Direction

4.3 2041 Intersection Operation Analysis

The difference of 2011 and 2041 traffic volumes from the EMME travel demand model was used to calculate growth, which were applied to observed turning movement counts (TMCs) along the study corridor. This section documents the Synchro and VISSIM analysis results for the 2041 Do Nothing EA alternative.

Synchro Model

The 2041 Do Nothing Alternatives Synchro results are shown in **Table 4-4**.

Table 4-4: 2041 Do Nothing PM Peak Hour Synchro Model Results

Intersection	Approach/Movement		Do Nothing EA PM Peak Hour v/c[1]
Eastern Avenue & Kennedy Road	EB	EBLTR	Err
	WB	WBL	Err
		WBTR	
	NB	NBL	0.12
		NBTR	0.52
	SB	SBL	0.31
		SBTR	0.29
	Overall Intersection		**0.87**
Eastern Avenue & Hansen Road	EB	EBLTR	0.78
	WB	WBLTR	no link
	NB	NBLTR	0.09
	SB	SBLTR	0.00
	Overall Intersection		**0.81**
Clark Boulevard & Rutherford Road South (Signalized)	EB	EBLT/TR	no link
	WB	WBL	0.84
		WBT	-
		WBR	1.25
	NB	NBLT	1.13 (NBTR)
		NBR	
	SB	SBL	1.23
		SBT	0.26
	Overall Intersection		**1.27**

[1]"Err" is the value provided by Synchro when the calculation is too high.

The following individual movements are operating at V/C ratio 1.00 or worse in the PM Peak Hour for the Do Nothing EA scenario:

- Eastern Avenue at Kennedy Road – eastbound left/thru/right, westbound left/thru/right ("Error" is shown when delay calculation is too high at unsignalized intersections)
- Clark Boulevard at Rutherford Road – westbound right, northbound thru/right, southbound left

VISSIM Model

The 2041 VISSIM results for the Do Nothing Alternatives are summarized in **Table 4-5.** It is noted that for Do Nothing TR scenario, the Eastern Avenue and Kennedy Road intersection was signalized with an additional WBL turning lane.

Table 4-5: 2041 Do Nothing EA Alternative VISSIM Model Results, PM Peak Hour

Intersection	Intersection Movement	Delay (s)	LOS Delay	95th Percentile Avg. Queue (m)
Eastern Avenue & Kennedy Road South (Unsignalized)	EBL	19	C	5
	EBT	23	C	6
	EBR	9	A	5
	WBL	52	F	27
	WBT	51	E	27
	WBR	28	D	26
	NBL	7	A	1
	NBT	0	A	1
	NBR	1	A	1
	SBL	2	A	0
	SBT	0	A	0
	SBR	1	A	0
	Intersection LOS		**A**	
Eastern Avenue & Hansen Road South (Unsignalized)	EBL	11	B	3
	EBR	7	A	3
	NBL	4	A	3
	NBT	2	A	3
	SBT	1	A	0
	SBR	0	A	0
	Intersection LOS		**A**	
Clark Boulevard & Rutherford Road South (Signalized)	WBL	43	D	81
	WBR	23	C	81
	NBT	58	E	279
	NBR	55	E	279
	SBL	53	D	32
	SBT	13	B	32
	Intersection LOS		**D**	

Legend

Signalized Intersection:

A: ≤ 10	**B: > 10 to 20**	**C: > 20 to 35**	**D: > 35 to 55**	**E: > 55 to 80**	**F: > 80**

Non-signalized intersection:

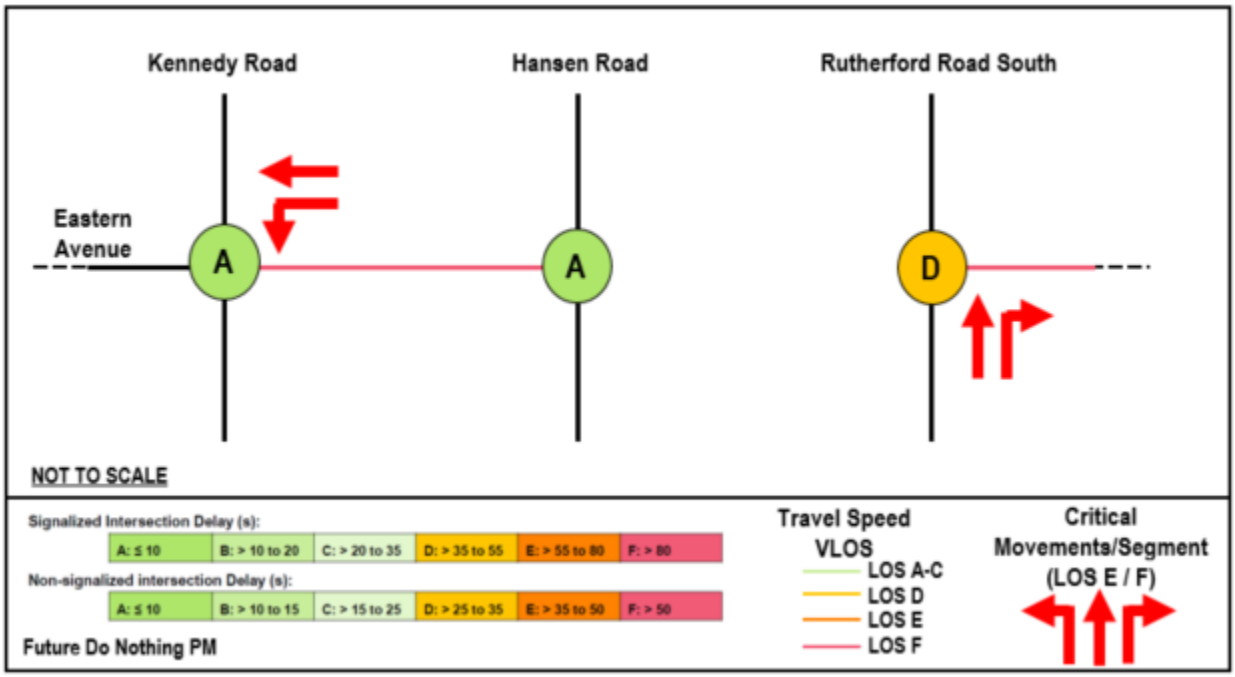
A: ≤ 10	**B: > 10 to 15**	**C: > 15 to 25**	**D: > 25 to 35**	**E: > 35 to 50**	**F: > 50**

The following individual movements are operating at LOS E or worse in the PM peak hour in the Do Nothing scenario:

- Eastern Avenue at Kennedy Road South – westbound left, westbound thru
- Clark Boulevard at Rutherford Road South – northbound thru, northbound right

A summary of VISSIM critical movements for the Do Nothing scenario is provided in **Figure 4-3**.

Figure 4-3. Future Do Nothing (EA) VLOS and Critical Movements Diagram



4.4 2041 Vehicular Level of Service

The 2041 Do Nothing EA and TR alternatives vehicular LOS is summarized in **The east-west** screenlines between Kennedy and Rutherford are expected to be operating over capacity (v/c>1), and significant congestions are expected for Queen Street and Steeles Avenue. This indicates the need for the missing link between Hansen Road and Rutherford Road to provide additional capacity for east-west movements.

Table 4-6**.** In the Do Nothing scenario, Clark Boulevard between Kennedy Road and the Rutherford Road users are expected to experience some delay (approximately one minute of delay), mainly due to turning movements at the intersection of Eastern Avenue and Kennedy Road as discussed in **Section 4.3**. The congested travel speed is approximately 50% compared to the free flow speed. The vehicular level of service is E, which still meets the minimum level of service target. However as discussed in **Section 4.2**, traffic is congested on a screenline level. The east-west screenlines between Kennedy and Rutherford are expected to be operating over

capacity (v/c>1), and significant congestions are expected for Queen Street and Steeles Avenue. This indicates the need for the missing link between Hansen Road and Rutherford Road to provide additional capacity for east-west movements.

Table 4-6: 2041 Do Nothing Vehicular LOS – PM Peak Hour Peak Direction (Westbound)

Segment	Length (km)	Posted Speed (km/h)	Free-flow Travel Time (min)	Congested Speed (km/h) [1]	Congested Travel Time (min) [1]	Ratio	VLOS
Do Nothing EA							
Clark Boulevard (EA Segment) – Kennedy Road to Hansen Road	0.45	50	0.5	25	1.0	50%	E

[1] Based on travel time outputs from VISSIM model

4.5 Minimum Level of Service Target – 2041 Do Nothing Conditions

Table 4-7 summarizes the 2041 LOS conditions compared with the minimum LOS target for the Do Nothing scenario. It is noted that the transit, pedestrian, and cycling LOS stay the same as the existing conditions in the Do Nothing scenario. The vehicular LOS and truck LOS satisfies the target, although there is the need to improvement the east-west movement capacity on a screenline level. The pedestrian and bicycle LOS are much worse than the minimum targets, indicating the needs for improvements.

Table 4-7: Future Do Nothing EA Alternative LOS Conditions Compared with Minimum LOS Target

Road	From / To	Road Class-ification	Land Use [1]	Transit Functions [2]	Walking and Cycling Functions [3]	Minimum LOS Targets					LOS Analysis Results				
						VLOS	TLOS	PLOS	BLOS	TkLOS	VLOS	TLOS	PLOS	BLOS	TkLOS
Eastern Ave and Clark Blvd Ext.	Kennedy Rd to Rutherford Rd	Minor arterial	Central Area Mixed Use to the North, Industrial to the South	No transit service	Future in right-of-way (on-road or in-boulevard) cycling route	**E**	**D**	**C**	**B**	**D**	**E**	**F (no transit service)**	**Seg: F** **Int: B-E**	**Seg: C** **Int: D-E**	**Seg: B** **Int: C-D**
Clark Boulevard Ext	Hansen to Rutherford	Minor arterial	Central Area Mixed Use to the North, Industrial to the South	No transit service	Future in right-of-way (on-road or in-boulevard) cycling route	**E**	**D**	**C**	**B**	**D**	**N/A +**	**N/A +**	**Seg: N/A +** **Int: B-D**	**Seg: N/A +** **Int: D-E**	**Seg: N/A +** **Int: A-C**

+ Missing Link

[1] Source: City of Brampton Secondary Plan Area (SPA) 36. The study corridor is within close proximity (800m) to the Queen Street Rapid Transit.

[2] Source: City of Brampton Official Plan and 2015 TMP Update

[3] Source: City of Brampton 2015 TMP Update

Legend:

Meets target	Does not meet target	N/A

5 2041 Alternatives

Considering the existing conditions and capacity constraints noted in the future Do Nothing conditions, the transportation assessment identified the need for the following:

- Provide an east-west link between Hansen Road and Rutherford Road from Eastern Avenue to Clark Boulevard to provide connectivity in the broader road network as recommended in the City of Brampton's Official Plan, 2015. An east-west connection would relieve congestion identified along Queen Street by providing an alternate route on a parallel road.
- Pedestrian and cyclist facilities to accommodate growth and provide connectivity in the larger network as recommended in City of Brampton's Transportation Master Plan, 2015. The lack of active transportation facilities results in low level of service which could be improved if facilities were provided.

This section documents vehicular level of service analysis to address the need for an east-west link between Kennedy Road to Rutherford Road.The detailed pedestrian and cyclist facility alternatives are analyzed in Phase 3 of the EA study. Three alternatives to improve the east-west capacity were identified with considerations of the on-going Clark Boulevard Traffic Reassessment Study and recommendations from the City's TMP. Alternative 3 considers widening of Eastern Avenue between Kennedy Road and Hansen Road from 2 to 4 lanes and the extension of Clark Boulevard between Hansen Road and Rutherford Road at 4 lanes. Alternatives 2 and 4 considers the recommendations of the 2012 EA conducted for Clark Boulevard between Rutherford Road and Dixie Road with widening to 5/6 lanes, with Alternative 2 testing the sensitivity of the impact of the Eastern Avenue configuration.

Table 5-1: 2041 Alternatives

ID	Scenario (2041 PM)	Clark-Eastern Section (Kennedy Rd to Rutherford Rd)	Clark Blvd from Rutherford to Dixie
1	Do Nothing EA	Existing conditions (Eastern Ave at 2 lanes, No Clark Blvd Extension)	Existing conditions (4 lanes)
2	With Clark Blvd Extension	Eastern Avenue at 2 lanes, Clark Blvd Extension at 4 lanes	5-6 lanes as per 2012 Clark Blvd EA between Rutherford Rd and Dixie Rd recommendation
3	Do Nothing TR With Eastern Avenue and Clark Blvd Extension at 4 lanes	Both Roads at 4 lanes	Existing conditions (4 lanes)
4	With Eastern Avenue and Clark Blvd Ext at 4 Lanes	Both Roads at 4 lanes	5-6 lanes as per 2012 Clark Blvd EA between Rutherford Rd and Dixie Rd recommendation

Note: Alternative 3 is the Do Nothing option for the traffic reassessment on Clark Boulevard between Rutherford Road and Dixie Road

5.1 Alternative Vehicular Level of Service

5.1.1 2041 Alternative Travel Demand

Each 2041 alternative was modelled in EMME, and evaluated based on study corridor and overall screenline performance. Traffic volumes along the corridor for all alternatives is shown in **Figure 5-1**, and the corridor V/C ratio is shown in **Table 5-2**. Link level volumes can be found in Appendix E. Alternative 2 with Eastern Avenue and Clark Boulevard Extension at 2 lanes is expected to be over capacity. With Eastern Avenue and Clark Boulevard Extension at 4 lanes in Alternative 3 and 4, segment within the EA study area (Kennedy Road to Rutherford Road) is expected to be flowing well under capacity.

Overall screenline V/C is summarized in **Table 5-3**. Most screenlines remain congested with a V/C over 1 in all alternatives. The exceptions are the West of Rutherford screenline (EA study segment, screenline 2), which operates close to capacity in Alternative 1 without the Clark Boulevard extension, and under capacity for Alternatives 2-4 with the extension. More detailed, road level screenline volumes for all alternatives can be found in **Appendix E Future Travel Demand Modelling Screenline Results**.

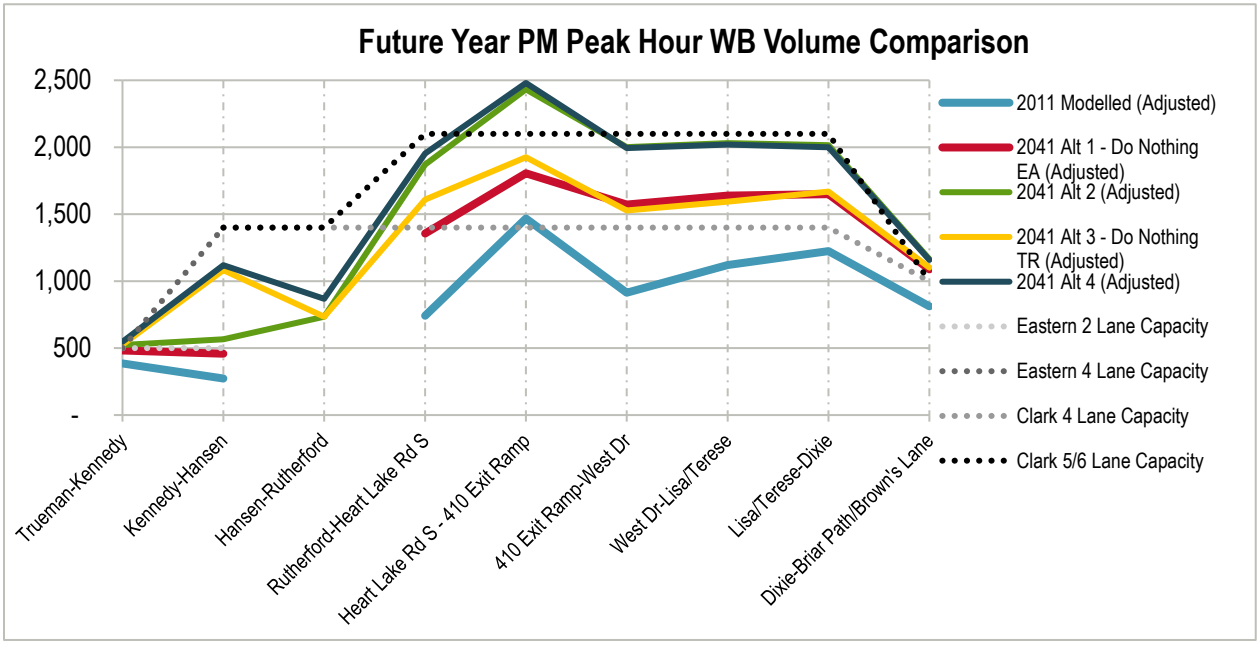


Figure 5-1: 2011 and 2041 Alternatives Traffic Volumes, PM Peak Hour

Table 5-2: Segment V/C along Clark and Eastern, 2011 and 2041 Alternatives, PM Peak Hour

Segment	V/C				
	2011	2041			
		Alt 1 – Do Nothing (EA)	Alt 2	Alt 3 – (Do Nothing TR)	Alt 4
Trueman - Kennedy	0.77	0.96	1.05	1.05	1.09
Kennedy - Hansen	0.55	0.92	1.13	0.77	0.80
Hansen - Rutherford	-	-	0.52	0.52	0.62
Rutherford - Heart Lake	0.53	0.97	0.89	1.15	0.93
Heart Lake - 410 Exit Ramp	1.05	1.29	1.16	1.38	1.18
410 Exit Ramp - West Dr	0.65	1.12	0.95	1.09	0.95
West Dr - Lisa/Terese	0.80	1.17	0.97	1.14	0.96
Lisa/Terese - Dixie	0.87	1.18	0.96	1.19	0.95
Dixie - Briar Path/Brown's Lane	0.81	1.09	1.16	1.10	1.16

Legend

V/C < 0.85	0.85 < V/C < 1	V/C > 1

Table 5-3: Screenline V/C, 2041 Alternatives

#	Screenline	V/C			
		Alt 1 – Do Nothing (EA)	Alt 2	Alt 3 – (Do Nothing TR)	Alt 4
1	East of Kennedy Rd	1.07	1.09	0.97	0.98
2	West of Rutherford Rd	0.97	0.78	0.78	0.81
3	West of Hwy 410	1.09	1.02	1.10	1.03
4	East of Hwy 410	1.09	1.05	1.10	1.05
5	East of Dixie Rd	1.03	1.04	1.02	1.04
6	North of Clark Blvd/Eastern Ave	1.10	1.15	1.15	1.16
7	South of Clark Blvd/Eastern Ave	1.21	1.19	1.20	1.19

Legend

V/C < 0.85	0.85 < V/C < 1	V/C > 1

5.1.2 2041 Alternative Intersection Operation Analysis

Intersection operations for the future 2041 PM alternatives were conducted on Synchro to obtain volume-to-capacity ratios (v/c) and provide optimized signal offsets for input into VISSIM.

In Alternative 2 to 4, with the increased volumes along Eastern Avenue and Clark Boulevard Extension, the following improvements are made:

- Signalized intersection at Kennedy Road and Eastern Avenue and Hansen Road and Eastern Avenue / Clark Boulevard Extension, based on warrants in Ontario Traffic Manual Book 12 Justification 7; and
- Additional WBL turning lane at the intersection of Eastern Avenue and Kennedy Road.

Synchro v/c ratios for future alternatives is summarized in **Table 5-4**. Full details of the methodology in developing 2041 PM volumes can be found in **Appendix F Future Traffic Analysis Results**.

Table 5-4. Synchro V/C, 2041 PM Alternatives

Intersection	Approach/Movement		Alt 1	Alt 2	Alt 3 (Do Nothing TR)	Alt 4
			v/c[1]	v/c	v/c	v/c
Eastern Road & Kennedy Road South (Signalized in Alternative 2, 3, and 4)	EB	EBLTR	Err	1.16	1.26	1.22
	WB	WBL	Err	1.43	1.48	1.31
		WBTR			0.73	0.78
	NB	NBL	0.12	0.60	0.43	0.48
		NBTR	0.52	1.36	1.27	1.34
	SB	SBL	0.31	1.05	1.51	1.29
		SBTR	0.29	0.65	0.56	0.59
	Overall Intersection		**0.87**	**1.38**	**1.59**	**1.38**
Eastern Avenue & Hansen Road South (Signalized in Alternative 2, 3, and 4)	EB	EBLT/TR	0.78	0.97	0.88	0.67
	WB	WBL	No link	0.26	0.79 (WBLT/TR)	0.88 (WBLT/TR)
		WBT		0.82		
		WBR		0.12		
	NB	NBLTR	0.09	0.76	0.72	0.70
	SB	SBLTR	0.00	0.34	0.42	0.43
	Overall Intersection		**0.81**	**0.85**	**0.78**	**0.77**
Clark Boulevard & Rutherford Road South (Signalized)	EB	EBLT/TR	No link	0.41	0.66	0.62
	WB	WBL	0.84	0.84	1.13	0.8
		WBT	No link	0.42	0.43	0.44
		WBR	1.25	0.97	0.86	0.84
	NB	NBLT	1.13	0.92	1.02	1.26
		NBR		0.45	0.2	0.35
	SB	SBL	1.23	1.13	1.03	1.32
		SBT	0.26	0.34	0.32	0.36
	Overall Intersection		**1.27**	**1.10**	**1.11**	**1.12**

[1]"Err" is the value provided by Synchro when the calculation is too high.

A summary of the VISSIM analysis results for Alternative 2 to 4 (with improvement analysis) are shown in **Table 5-5** to **Table 5-7**.

Table 5-5. Future (2041) Alternative 2 VISSIM Model Results, PM Peak Hour

Intersection	Intersection Movement	Delay (s)	LOS Delay	95th Percentile Avg. Queue (m)
Eastern Avenue & Kennedy Road South (Signalized)	EBL	28	C	19
	EBT	37	D	19
	EBR	36	D	19
	WBL	31	C	15
	WBT	30	C	15
	WBR	27	C	15
	NBL	21	C	35
	NBT	14	B	35
	NBR	16	B	35
	SBL	10	A	8
	SBT	7	A	8
	SBR	7	A	10
	Intersection LOS		**B**	
Eastern Avenue & Hansen Road South (Signalized)	EBL	17	B	17
	EBT	17	B	17
	EBR	31	C	17
	WBL	46	D	77
	WBT	60	D	77
	WBR	48	D	77
	NBL	14	B	18
	NBT	14	B	18
	NBR	17	B	18
	SBL	17	B	6
	SBT	11	B	6
	SBR	8	A	5
	Intersection LOS		**C**	
Clark Boulevard & Rutherford Road South (Signalized)	EBL	53	D	23
	EBT	51	D	17
	EBR	49	D	17
	WBL	26	C	51
	WBT	30	C	51
	WBR	23	C	51
	NBL	2	A	33
	NBT	27	C	36
	NBR	26	C	33
	SBL	13	B	20
	SBT	14	B	20
	SBR	39	D	20
	Intersection LOS		**C**	

Table 5-6: Future (2041) Alternative 3 (Do Nothing TR) VISSIM Model Results, PM Peak Hour

Intersection	Intersection Movement	Delay (s)	LOS Delay	95th Percentile Avg. Queue (m)
Eastern Avenue & Kennedy Road South (Signalized)	EBL	50	D	12
	EBT	38	D	12
	EBR	39	D	12
	WBL	27	C	18
	WBT	23	C	18
	WBR	24	C	18

Intersection	Intersection Movement	Delay (s)	LOS Delay	95th Percentile Avg. Queue (m)
	NBL	41	D	257
	NBT	39	D	251
	NBR	41	D	252
	SBL	35	C	17
	SBT	11	B	17
	SBR	8	A	15
	Intersection LOS		**C**	
Eastern Avenue & Hansen Road South (Signalized)	EBL	36	D	19
	EBT	26	C	19
	EBR	25	C	19
	WBL	27	C	6
	WBT	10	A	6
	WBR	14	B	6
	NBL	11	B	15
	NBT	12	B	15
	NBR	10	A	15
	SBL	7	B	6
	SBT	10	B	6
	SBR	6	A	5
	Intersection LOS		**B**	
Clark Boulevard & Rutherford Road South (Signalized)	EBL	43	D	23
	EBT	42	D	18
	EBR	44	D	19
	WBL	39	D	24
	WBT	19	B	24
	WBR	11	A	24
	NBL	22	C	47
	NBT	28	C	44
	NBR	2	A	44
	SBL	55	E	30
	SBT	13	B	30
	SBR	14	B	30
	Intersection LOS		**C**	

Table 5-7. Future (2041) Alternative 4 VISSIM Model Results, PM Peak Hour

Intersection	Intersection Movement	Delay (s)	LOS Delay	95th Percentile Avg. Queue (m)
Eastern Avenue & Kennedy Road South (Signalized)	EBL	26	C	12
	EBT	38	D	12
	EBR	38	D	12
	WBL	22	C	20
	WBT	19	B	15
	WBR	20	C	22
	NBL	45	D	92
	NBT	37	D	92
	NBR	39	D	92
	SBL	10	A	18
	SBT	12	B	19
	SBR	43	D	19
	Intersection LOS		**C**	

Intersection	Intersection Movement	Delay (s)	LOS Delay	95th Percentile Avg. Queue (m)
Eastern Avenue & Hansen Road South (Signalized)	EBL	42	D	14
	EBT	19	C	14
	EBR	17	B	14
	WBL	23	C	8
	WBT	9	A	8
	WBR	10	B	8
	NBL	14	B	16
	NBT	13	B	16
	NBR	22	C	16
	SBL	8	B	4
	SBT	13	B	5
	SBR	4	A	4
	Intersection LOS		**B**	
Clark Boulevard & Rutherford Road South (Signalized)	EBL	55	E	25
	EBT	54	D	20
	EBR	51	D	20
	WBL	24	C	53
	WBT	21	C	53
	WBR	32	C	53
	NBL	44	D	103
	NBT	41	D	99
	NBR	3	A	99
	SBL	68	E	43
	SBT	18	B	43
	SBR	19	B	43
	Intersection LOS		**C**	

Legend

Signalized Intersection:

A: ≤ 10	**B: > 10 to 20**	**C: > 20 to 35**	**D: > 35 to 55**	**E: > 55 to 80**	**F: > 80**

Non-signalized intersection:

A: ≤ 10	**B: > 10 to 15**	**C: > 15 to 25**	**D: > 25 to 35**	**E: > 35 to 50**	**F: > 50**

There are no individual movements operating at LOS E or worse in the PM peak hour in Alternative 2.

The following individual movements are operating at LOS E or worse in the PM peak hour in Alternative 3 (Do Nothing TR scenario):

- Clark Boulevard at Rutherford Road South – southbound left

The following individual movements are operating at LOS E or worse in the PM peak hour in Alternative 4:

- Clark Boulevard at Rutherford Road – eastbound left, southbound left

VISSIM analysis results summary Alternative 2 to 4 are shown in **Figure 5-2** to **Figure 5-4**, respectively. A summarized comparison of all alternatives is provided in **Table 5-8.**

Figure 5-2. 2041 PM Alternative 2 VLOS Diagram

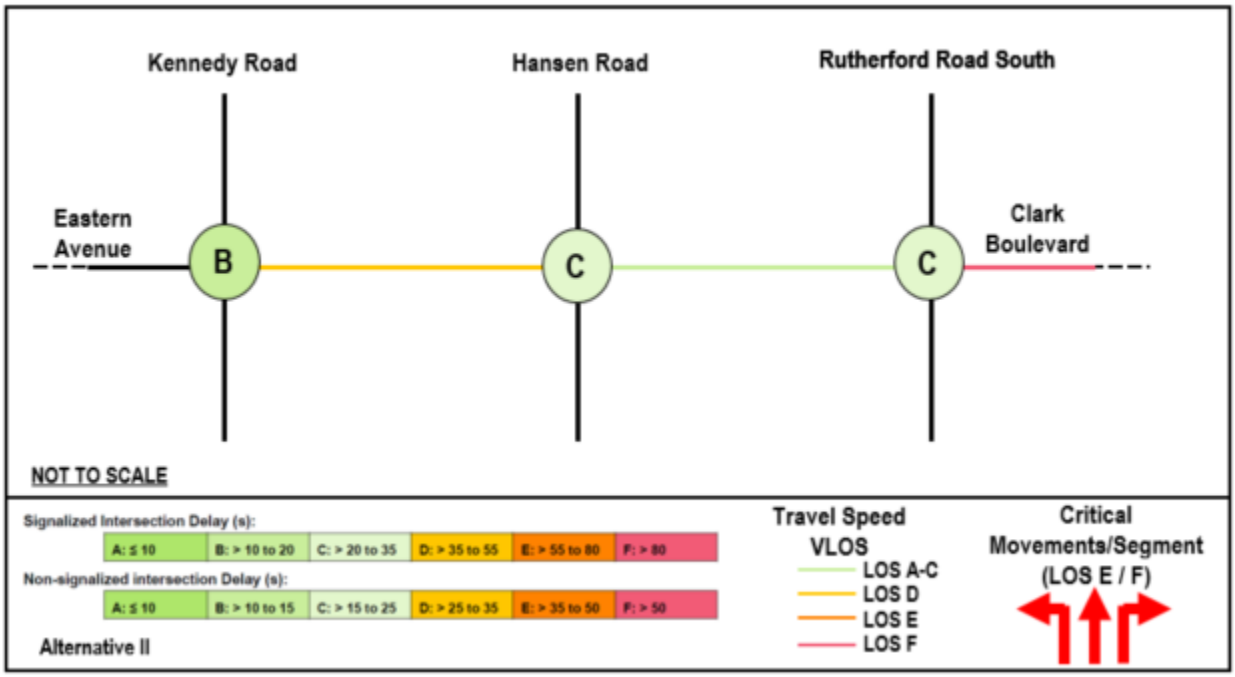


Figure 5-3. 2041 PM Alternative 3 (Do Nothing TR) VLOS Diagram

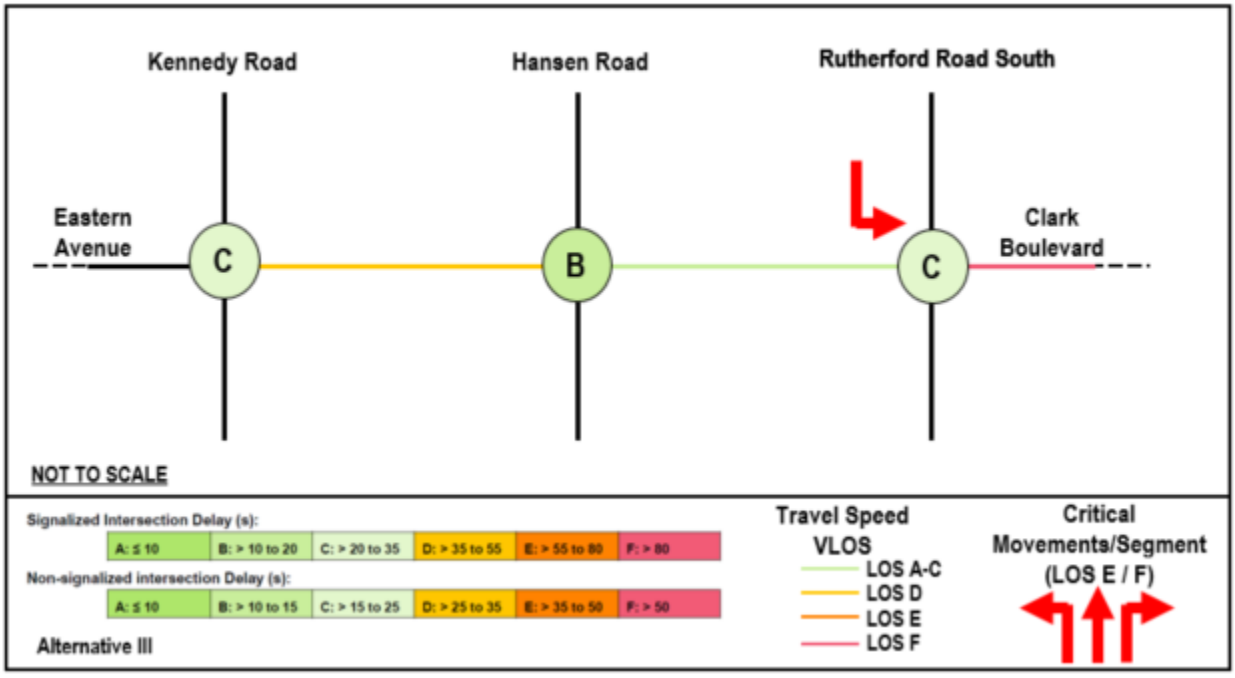


Figure 5-4. 2041 PM Alternative 4 VLOS Diagram

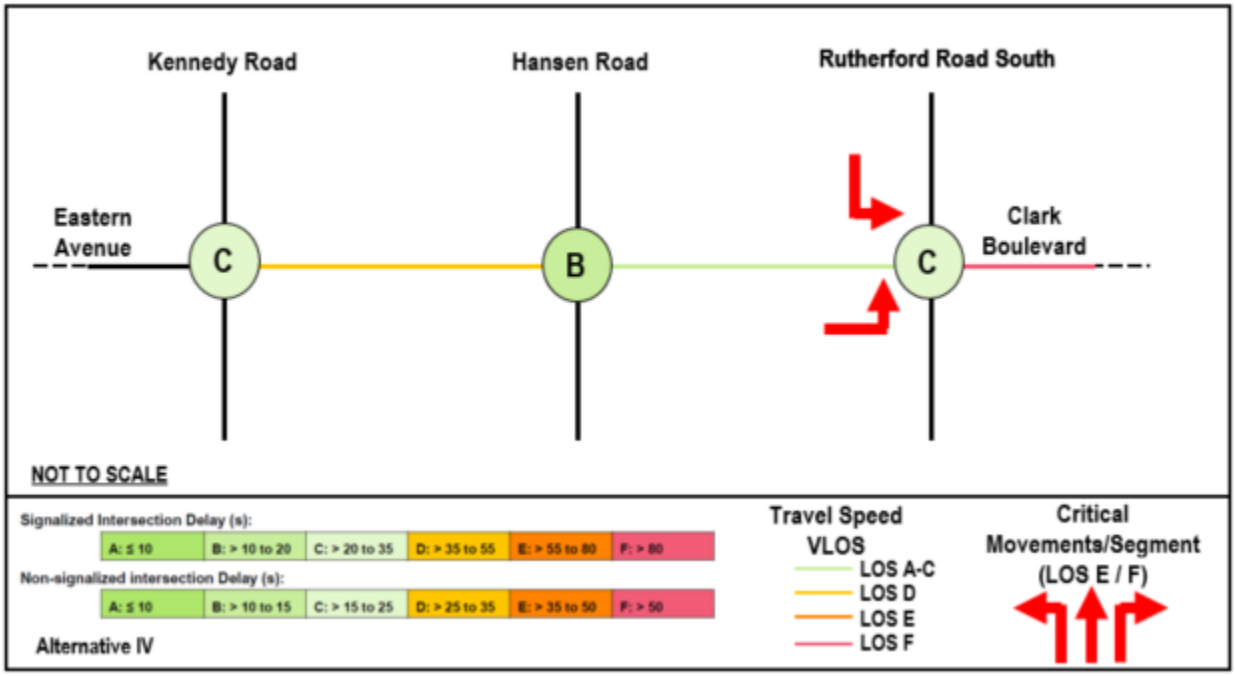


Table 5-8. 2041 Alternative Overall Intersection Operations Summary

Intersection	Alt 1	Alt 3	Alt 3	Alt 4
	Do Nothing (EA)	With Clark Blvd Extension	With Eastern Avenue and Clark Blvd Extension at 4 Lanes (Do Nothing TR)	With Eastern Avenue and Clark Blvd Extension at 4 Lanes
Eastern Avenue & Kennedy Road South (Signalized)[1]	A	B	C	C
Eastern Avenue & Hansen Road South (Signalized)[1]	A	C	B	B
Clark Bouelvard & Rutherford Road South (Signalized)	D	C	C	C

[1]These intersections are unsignalized for Alternative 1 – Do Nothing (EA)

Signalized Intersection:

A: ≤ 10	B: > 10 to 20	C: > 20 to 35	D: > 35 to 55	E: > 55 to 80	F: > 80

Non-signalized intersection:

A: ≤ 10	B: > 10 to 15	C: > 15 to 25	D: > 25 to 35	E: > 35 to 50	F: > 50

5.1.3 2041 Vehicular Level of Service

The congested travel time, congested travel speed, and the associated vehicular LOS are summarized in **Table 5-9**. Comparing the travel times and speeds on Clark Boulevard between Kennedy Road and Rutherford Road, speeds are faster in

Alternatives 3 and 4 with Eastern Avenue and Clark Boulevard Extension at 4 lanes. Differences between these two alternatives are marginal, with an average speed of 35 km/h and travel time of 1.5 minutes. Alternative 2 performs the worse at a speed of 27 km/h and 1 minute travel time for the segment between Kennedy Road and Hansen Road.

Table 5-9. 2041 Alternative Vehicular Level-of-Service Summary

Alt	Scenario (2041 PM)	Number of Lanes		Congested Speed	
		EA Segment		EA Segment	
		Eastern Avenue from Kennedy to Hansen	Clark Blvd Ext from Hansen to Rutherford	Eastern Avenue from Kennedy to Hansen	Clark Blvd Ext from Hansen to Rutherford
Posted Speed (km/h)				50	50
1	Do-Nothing (EA)	2	0	25 (1.1 min travel time)	n/a
2	With Clark Blvd Extension	2	4	27 (1.0 min travel time)	38 (0.7 min travel time)
3	Do-Nothing (TR) With Eastern Avenue and Clark Blvd Extension at 4 lanes	4	4	30 (0.9 min travel time)	41 (0.7 min travel time)
4	With Eastern Avenue and Clark Blvd Ext at 4 Lanes	4	4	32 (0.8 min travel time)	39 (0.7 min travel time)

Note: Alternative 2, 3, and 4 assumed signalized intersection at Eastern Avenue and Kennedy Road and Eastern Avenue / Clark Boulevard Extension and Hansen Road intersections. An additional WBL turning lane is added at the intersection of Eastern Avenue Kennedy Road due to increased traffic demand with the road extension.

Legend

LOS	LOS A-C	LOS D	LOS E	LOS F
Congested / Free-flow Speed	> 0.7	0.55 - 0.69	0.45 - 0.54	< 0.45

5.2 Preferred Alternative Supporting Analysis and Recommendations

Based on the analysis in Section 5.1, Alternative 3 with Eastern Avenue and Clark Boulevard Extension at 4 lanes (2 lanes per direction) between Kennedy Road and Rutherford Road is carried forward. Additional traffic analysis was conducted to understand requirements for queue lengths or turning lanes for both AM and PM peak hour and is documented in this section.

To assess potential roadway configurations for Alternative 3 for Eastern Avenue / Clark Boulevard between Kennedy Road and Rutherford Road, travel patterns for the 2041 AM peak hour need to also be considered to account for any deficiencies

not observed in the 2041 PM peak hour analyzed. The following methodology was used to develop 2041 AM volumes:

- A screenline analysis was conducted for the study area to compare travel patterns between existing AM and PM counts.
- Patterns would be applied to grow existing AM counts to future AM counts
- Manual adjustments were made per intersection to address any anomalies

The screenline analysis revealed that the peak direction for AM was eastbound, whereas the peak direction for PM was westbound. As a result, 2041 AM volumes were developed by considering equal and opposite movement growth between the existing PM counts and 2041 PM volumes. Synchro analysis was then conducted for the 2041 AM, with results for both AM peak and PM peak provided in **Table 5-10**.

Table 5-10. 2041 Alternative 3 AM and PM Peak Hour Synchro Model Results

Intersection	Approach/Movement		Alt 3 AM Peak v/c	Alt 3 PM Peak v/c
Eastern Avenue & Kennedy Road Signalized)	EB	EBLTR	0.56	1.26
	WB	WBL	0.34	1.48
		WBTR	0.92	0.73
	NB	NBL	0.23	0.43
		NBTR	0.95	1.27
	SB	SBL	0.96	1.51
		SBTR	0.79	0.56
	Overall Intersection		**1.00**	**1.59**
Eastern Avenue & Hansen Road (Signalized)	EB	EBLT/TR	0.85	0.88
	WB	WBLTR	0.32	0.79
	NB	NBLTR	0.18	0.72
	SB	SBLTR	0.58	0.42
	Overall Intersection		**0.68**	**0.78**
Clark Boulevard & Rutherford Road South (Signalized)	EB	EBLT/TR	0.44	0.66
	WB	WBL	0.96	1.13
		WBT	0.18	0.43
		WBR	0.21	0.86
	NB	NBLT	0.47	1.02
		NBR	0.11	0.20
	SB	SBL	0.79	1.03
		SBT	0.68	0.32
	Overall Intersection		**0.92**	**1.11**

Based on the results shown for the preferred alternative for both the AM and PM peak hours in **Table 5-10**, there are some shared through-turn lanes that are at capacity.

High v/c ratios are also observed at the Eastern Avenue and Kennedy Road intersection during the PM Peak for the westbound left and southbound left movements. Additional storage lanes, changes to cycle length, and modifications to signal phasing were all tested with very little noticeable improvements due to the high demand between both north-south volumes along Kennedy Road and east-west volumes along Eastern Avenue. It is recognized that some of these volumes on

Eastern Avenue pertain to access to and from Highway 410 and Kennedy Road could divert to Queen Street instead in the future. No additional changes are recommended at this time.

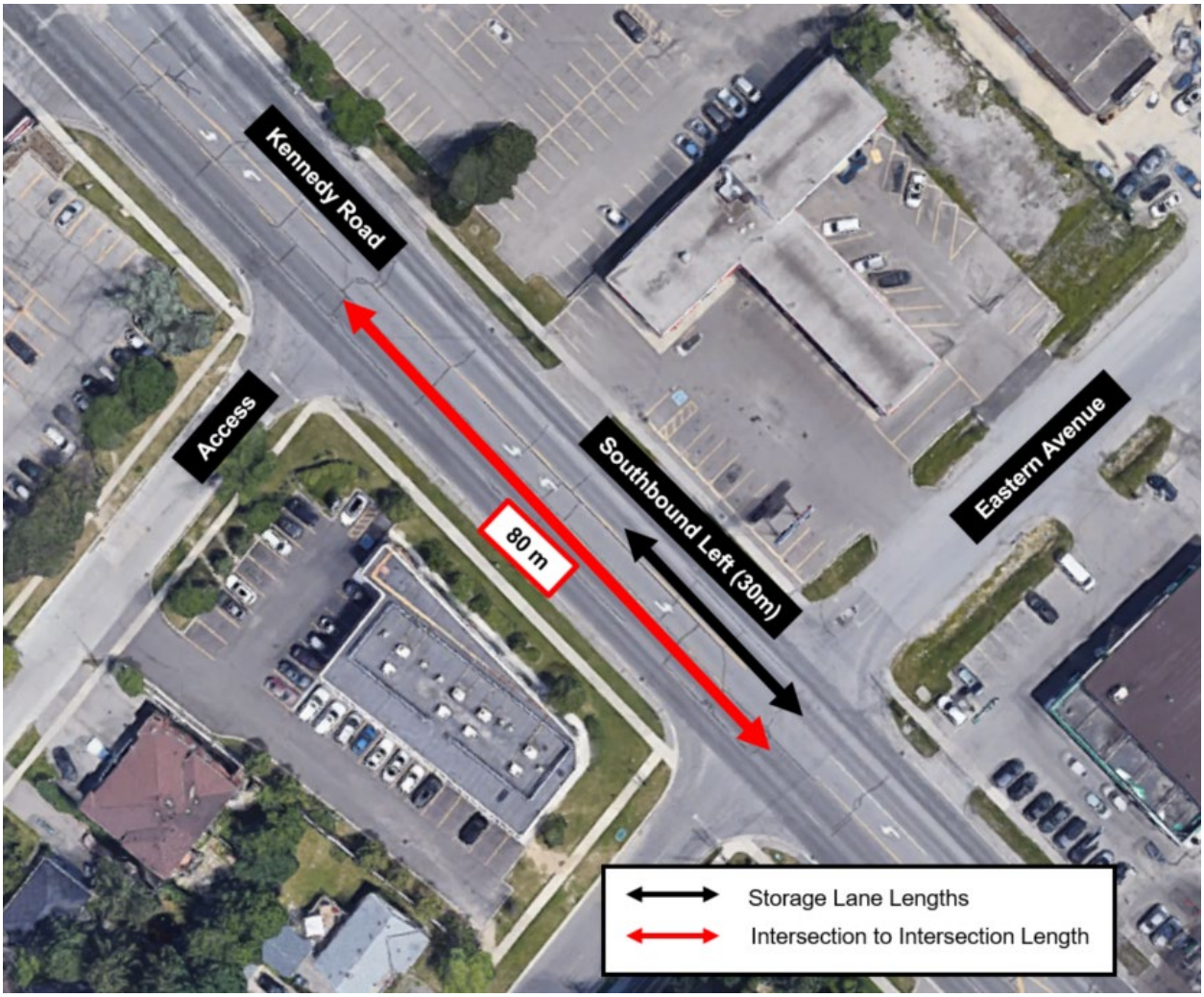
In addition, 95th percentile queue lengths for existing storage lanes were investigated to identify the need for extending storage lengths where possible. This includes the east-west turning storage lengths along Eastern Avenue/Clark Boulevard, and north-south turning storage lengths for future reconfigured intersections at Rutherford Road, Hansen Road, and Kennedy Road as a result of the extension and recommended signalization. Changes to storage lengths are shown in **Table 5-11**.

Table 5-11. Storage Length Change Considerations

Intersection (Movement)	Existing Storage Length (m)	2041 AM 95th Queue Length (m)	2041 PM 95th Queue Length (m)	Storage Length to be Considered (m)
Kennedy Road (SBL)	30	95	70	30 (no change)
Rutherford Road (SBL)	40	100	100	**110**
Storage lengths rounded to the nearest 5m				

It is to be noted that the southbound left 95th queue length for the 2041 AM peak hour (95m) at Kennedy Road and Eastern Avenue exceeds the intersection length to the adjacent access (80m) and therefore is not recommended to be further extended. The use of the two-way-left-turn lane (TWLTL) along Kennedy Road in the future should be assessed prior to consideration of storage lane extension. This is further shown in **Figure 5-5**.

Figure 5-5. Queue Length Constraint at Kennedy Road and Eastern Avenue



6 Conclusion

This report documents the methodology of the transportation analysis for the existing conditions and 2041 Do Nothing scenarios for Clark Boulevard between Kennedy Road and Rutherford Road. For the existing conditions, the vehicular and truck LOS perform well, meet or exceed the LOS target. On the other hand, the conditions for pedestrian and bicycle environment are poor. There are no designated pedestrian or cyclist facilities along the study corridor. As a result, the pedestrian and bicycle LOS do not meet the minimum targets, indicating the need for improvements. There is currently not transit service running along the EA study corridor therefore the transit LOS also performs lower than the minimum target at LOS E.

In the 2041, with planned population and employment growth, traffic conditions are expected to worsen. Three alternatives with improvements were considered in order to provide person moving capacity on the corridor. The recommendation is to widen existing Eastern Avenue from 2 lanes to 4 lanes between Kennedy Road to Hansen Road, extend Clark Boulevard from Hansen Road to Rutherford Road as a four lane road. Signalized intersection is recommended at both the Eastern Avenue and Kennedy Road intersection and the Eastern Avenue / Clark Boulevard Extension and Hansen Road intersection. Additional storage length configuration is recommended for Eastern Avenue and Kennedy Road (SBL) and Eastern Avenue and Rutherford Road (SBL). Lastly, based on the existing conditions, there is a need for continuous pedestrian and cycling facilities, and opportunities to improve transit connectivity are carried forward.