



APPENDIX C2

Transportation, Traffic and Active Transportation Need and Justification Assessment

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*Environmental Assessment Study
Kirby Road Extension
(From Dufferin Street to Bathurst Street)
City of Vaughan*

*Transportation, Traffic and Active Transportation
Need and Justification Assessment*

September 2018

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Prepared By: Poulos & Chung Limited

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*Class Environmental Assessment Study
Kirby Road Extension (From Dufferin Street to Bathurst Street)
City of Vaughan
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1. Introduction

Poulos & Chung Limited has been retained by Rizmi Holdings LTD. Poulos & Chung Limited is part of a Project Team headed by Schaeffers Consulting Engineers.

The Project Team is to complete an Environmental Assessment Study conducted as a Schedule “C” Municipal Road Project for the Kirby Road Extension (Bathurst Street to Dufferin Street) in the City of Vaughan.

The study area and location of the extension is shown in Figure 1.

Poulos & Chung Limited is responsible to conduct an analysis of options to the undertaking and complete the need and justification component of the assessment work.

This report summarizes the detailed analysis that was undertaken. The information contained in this report will be used by the Project Team to:

- Complete the screening and evaluation of alternatives (road alignments);
- Contribute to the detailed engineering criteria of the alternative alignments;
- Assist in the selection of recommended alternative design concept for the Kirby Road extension.

The following sections present the transportation, traffic, transit and active transportation analysis details. Key conclusions and recommendations provided to the Project Team are also presented.

2. The Undertaking

The City of Vaughan published the Transportation Master Plan (TMP) in 2013.

Appendix I of the Transportation Master Plan presented “Satisfying EA Requirements”. Excerpts from the document are presented in Appendix A.

Appendix A contains:

- Figure A1 which classifies the Kirby Road extension as a Schedule C project;
- Figure A2 which identifies the Kirby Road extension as one of several projects to be completed;
- Figure A3 which details Kirby Road specifics including:
 - A project need from Keele Street to Bathurst Street, of which this project is conducting the Dufferin Street to Bathurst Street segment;
 - A new four (4) lane roadway requirement involving widening the current two lanes west of Dufferin Street and a new road segment between Dufferin Street and Bathurst Street;
 - A proposed timeline of 2021 to 2031;
 - The new Kirby Road extension is to be a part of the York Region arterial road grid.

The 2016 York Region Transportation Master Plan also identified a timeline for proposed improvements and additions to the regional transportation system. Appendix A of the 2016 Transportation Master Plan provided details and summary sheets for the identified road projects. The project sheets pertaining to this Kirby Road segment is also presented in Appendix A:

- Figure A4 identifies the Kirby Road segment between Dufferin Street and Bathurst Street. A brief description of the natural, land use and built environment is provided;
- Figure A5 presents the preliminary problem or opportunity statement. Preliminary alternatives are considered and then a preliminary recommendation and justification is provided. The preliminary recommendation provided is to construct four lane missing link between 2027 and 2031;
- Figure A6 presents an aerial photograph of the existing intersection conditions of Kirby Road with Dufferin Street and Bathurst Street.

The undertaking (or Problem Statement) is very clearly defined in the context of north eastern Vaughan. This is presented in Figure 2. The study focus is solely between Dufferin Street and Bathurst Street. The extension will support development and redevelopment in the area.

The above was taken as direction to complete the transportation, traffic, transit and active transportation assessment.

3. Basis of Analysis

Numerous studies were used for information purposes to ensure that the most up – to –date information was available to complete the assessment and evaluation.

These studies included:

- York Region Transportation Master Plan (TMP) 2016;
- City of Vaughan Transportation Master Plan, 2013 and;
- The relevant Appendices to the Transportation Master Plan;
 - Appendix F Model Development and Application;
 - Appendix I Satisfying EA Requirements;
- City of Vaughan Pedestrian and Bicycle Master Plan Study, January 2007;
- North Vaughan and New Communities Transportation Master Plan Draft Report, HDR Inc. February 2018;
- Relevant Metrolinx Studies including;
 - Mobility Hub Guidelines, September 2011;
 - New Station Analysis, Methodology and Process September 22, 2015.

Additional background information included:

- Current background traffic – Existing vehicle turning movement information was obtained from area intersection turning movement counts conducted by York Region and Poulos & Chung Limited. The date which the intersections were counted is shown in Figure 5;
- Existing lane configurations as recorded by field observations;
- Transportation for Tomorrow Survey 2011 data information. A cooperative effort by local and provincial government agencies to collect information about urban travel in Southern Ontario. Custodian of the data sets is the Data Management Group of the Department of Civil Engineering at the University of Toronto;

- EMME II transportation software model outputs as provided by York Region.

4. Existing Conditions

4.1 Transit

York Region Transit provides extensive transit service throughout York Region.

The York Region Transit map is shown in Figure 3. (Source: YRT Web Site PDF).

Currently transit is available on Kirby Road in a short section at Keele Street and along Bathurst Street.

4.2 Active Transportation

Active transportation infrastructure is limited within the study area.

A sidewalk, path, trail (Multi Use Path) of approximately 2.0 meters in width is available on the south side of Kirby Road west of Dufferin Street.

Exclusive bike lanes are available on both sides of the roadway on Gamble Road.

No other active transportation infrastructure is available within the study area although bicyclist can make use of Dufferin Street and the Bathurst Street road shoulders.

4.3 Roads and Traffic

The existing area roadway network and lane configuration is shown in Figure 4.

Existing intersection vehicle turning movements are shown in:

- Figure 5 - the AM weekday peak hour movements;
- Figure 6 - the PM weekday peak hour movements.

Also shown in Figures 5 and 6 is the resulting vehicle flow pattern (estimated diversion pattern) resulting from the lack of a Kirby Road extension.

It is evident during each typical weekday several of the intersections experience fairly high vehicle turning movements in each of the roadway peak hours. These fairly high vehicle turning movements form a pattern circumventing the unavailable Kirby Road segment. This circuitous vehicle flow in each of the typical weekday roadway peak hours is causing vehicle delay and congestion to all four of the primary intersections studied.

The extent of vehicle delay and congestion was analyzed.

Table 1 summarizes the existing roadway intersection operating conditions and presents overall intersection level of service, vehicle delay and volume to capacity ratio.

**Table 1
Calculated Intersection Performance
Existing Condition**

Performance Measure	Kirby Road and Dufferin Street		Kirby Road and Bathurst Street	
	AM Peak	PM Peak	AM Peak	PM Peak
Overall Level of Service	B	C	B	B
Vehicle Delay (in Seconds)	15	20	14	20

Overall Level of Service is calculated based on the optimum signal timing in the AM and PM peak hour.

Level of Service for signalized intersections is defined in terms of delay, which is measure of driver discomfort and frustration, fuel consumption and lost travel time. Alpha – numeric descriptors are provided to assist in understanding the intersection analysis and outputs normally produced using Highway Capacity Software. (Appendix B). The following table is provided to explain the performance of intersection operations.

Table 2

Highway Capacity Manual (2000) Level of Service Definitions for Intersections

LOS	Signalized Intersection Average Vehicle Control Delay	Unsignalized Intersection Average Vehicle Control Delay	LOS Recommendation
A	<= 10 sec	<= 10 sec	Acceptable
B	10 – 20 sec	10 – 15 sec	Acceptable
C	20 – 35 sec	15 – 25 sec	Acceptable
D	35 – 55 sec	25 – 35 sec	Somewhat Undesirable
E	35 – 80 sec	35 – 50 sec	Undesirable
F	>= 80 sec	>= 50 sec	Undesirable

Upon reviewing the above results it can be concluded that:

- As shown in Figures 5 and 6;

- Kirby Road forms “T” intersections with Dufferin Street and Bathurst Street. Even though the intersections benefit from no east west opposing traffic flows and Kirby Road westbound at Bathurst Street employs a double left turn lane; still in the PM peak hour vehicle delays are reasonable and over capacity condition exist in the PM roadway peak hour at the Kirby Road and Bathurst Street intersection;
- The Kirby Road traffic flows impose increased vehicle demands on Teston Road and the intersections with Dufferin Street and Bathurst Street.

5. Factors Influencing the Undertaking

5.1 Population and Employment Growth

York Region provided currently available information for the forecast growth in population and employment in the immediate vicinity of the study area.

Figure 7 identifies the planned growth in population for four time periods up to 2041.

Figure 8 identifies the planned growth in employment for four time periods up to 2041.

It is evident that population and employment growth will continue in the immediate area surrounding the undertaking, particularly in the area of Kirby Road and Hwy 400 area.

York Region as a whole will continue to experience growth in population and employment.

The following table presents a summary of the population and employment growth within York Region.

Table 3

Growth Plan Schedule 3 Forecasts

York Region	2014	2031	2036	2041
Population	1,133,900	1,590,000	1,700,000	1,790,000
Employment	564,600	790,000	840,000	900,000

Source: Growth Plan for the Greater Golden Horseshoe (2017).

5.2 Planned Transportation System Improvements and Additions

The City of Vaughan and York Region have both identified significant planned improvements and additions to the transportation system.

Of significance to this assessment are the following identified transportation system improvements and additions.

Roads

The City of Vaughan has identified the need for several additions and improvements to roads currently under their jurisdiction. (Source: City of Vaughan Transportation Master Plan, December, 2012).

The planned improvements and additions are illustrated in Figure 9.

As indicated in Section 1, Kirby Road is one of the identified roads requiring improvement.

Kirby Road although currently under the jurisdiction of the City of Vaughan is contemplated to play an important role and function in the overall York Region road network. As a result York Region may take control of Kirby Road in the future.

Kirby Road is to play a very important role and function in the future. This role and function is illustrated in the following Figures. The Figures are Transportation Schedules excerpted from the 2016 York Region Transportation Master Plan.

Figure 10 illustrates the overall planned long term roadway network for York Region. It is evident that Kirby Road is an integral component of the regional arterial grid in northern Vaughan. Figure 11 shows greater detail of the long term roadway network including a potential Kirby Road interchange with Highway 400. It is also evident that Kirby Road is planned to be improved in years 2027 to 2031. This includes the missing link which is the subject of this Environmental Assessment Study.

Goods Movement

Figure 12 illustrates the long term strategic goods movement network. Kirby Road is identified as a primary arterial goods movement corridor. It is evident that Kirby Road is to play an important role.

Transit

Figure 13 illustrates the Transit Network anticipated in 2027 – 2031. It is evident that Kirby Road will be served by frequent transit service.

Cycling

Figure 14 illustrates the long term cycling network and dedicated cycling facilities between Dufferin Street and Bathurst Street. It is evident that the Kirby Road extension is to contain dedicated bicycle lanes.

5.3 Future Urban Area

Future development is contemplated on lands between Dufferin Street and Bathurst Street. It is likely that development of this land will seek access onto the Kirby Road extension.

The potential development could consist of (Concept Plan by Lucas & Associates dated April 20, 2016):

- 486 townhouse / condominium dwelling units;
- 52,000 square feet of office;
- 30,000 square feet of retail / commercial.

The amount of vehicle flow to be generated by this potential development was estimated. The estimation was conducted using vehicle trip generation rates contained in the Trip Generation Manual (8th Edition) published by the Institute of Transportation Engineers.

The resultant traffic flow generated by this proposed development is presented in Figure 15. Also shown is the directional distribution of these trips. The distribution is general and is based upon Transportation for Tomorrow Survey results.

Figure 16 presents the assignment of the proposed development traffic flow (typical weekday AM and PM peak hour) to Kirby Road and the major intersections.

6. Determining the Need

Section 5 of this assessment identifies the important role and function that Kirby Road is going to provide not only for the City of Vaughan but for York Region as well.

This role and function can be summarized as a solution to serve the need of:

- Goods Movement;
- Transit;
- Active Transportation, and;
- Vehicle Flow.

The vehicle flow need has been further examined.

York Region provided EMME II (Transportation Model) software outputs for horizon years 2021 and 2031.

A specific select link analysis was conducted in order to identify the forecast vehicle flows on Kirby Road. The select link analysis effectively identifies how forecast traffic arrives to and departs from Kirby Road in the AM roadway peak hour. As these vehicle flows complete their direction of travel a total accumulated vehicle flow is given along each segment of Kirby Road.

Figure 17 presents the select link analysis for horizon year 2021. In this horizon year the proposed GTA West freeway is not part of the roadway network.

Figure 18 presents the select link analysis for horizon year 2031. The GTA West freeway is assumed to be a part of the roadway network in this horizon year.

Upon examining the two Figures it is evident that:

- Kirby Road will accommodate significant vehicle flows in both 2021 and 2031;
- The 2031 forecast does not diminish the Kirby Road vehicle flows, it is evident that vehicle flows are still significant but the inclusion of the future GTA West freeway will assist to re – redistribute and reduce north south vehicle flow movements;

A further analysis was done to specifically identify the forecast vehicle flows and vehicle directions of travel on Kirby Road between Dufferin Street and Bathurst Street.

Figure 19 presents the 2021 and 2031 vehicle flows on this segment of Kirby Road.

Several important conclusions can be made upon examining the magnitude of each vehicle flow movement. These conclusions are:

- By 2021 and until 2031 when the GTA West freeway is forecast to be in place, this segment of Kirby Road, between Dufferin Street and Bathurst Street, facilitates the directional distribution of AM peak hour vehicle flows. It provides a link to complete intersection turning movements facilitating vehicles to secure their travel destination;
- The 2021 AM peak hour peak direction of travel (westbound on Kirby Road between Dufferin Street and Bathurst Street) is in excess of 1,400 vehicles. The typical vehicle carrying capacity of a single arterial traffic lane is in the order of 900 to 950 vehicles per hour. As a result it is evident that two (2) traffic lanes will be required in the westbound direction on Kirby Road by 2021;
- The 2021 roadway PM peak hour will accommodate a vehicle flow in the reverse direction (eastbound). The magnitude of this vehicle flow will be equal or greater than the forecast AM roadway peak hour vehicle flow. As a result it is evident that

two (2) traffic lanes will be required in the eastbound direction on Kirby Road by 2021.

- By 2031 the peak hour peak direction vehicle flows on Kirby Road will not diminish. The need for two (2) traffic lanes in each direction of travel is confirmed;
- To satisfy the vehicle turning flows, the Kirby Road intersections with Dufferin Street and Bathurst Street will require exclusive left turn lanes with adequate vehicle storage and taper lengths.

In February 2018 the Ministry of Transportation announced that Ontario will not be proceeding with a proposed highway in the GTA West Corridor and would be moving forward with an assessment of infrastructure needs through the Northwest GTA Corridor Identification Study. As a result of this a further 2031 horizon year analysis was undertaken.

Figure 19A presents the select link analysis for horizon year 2031. In this horizon year the proposed GTA West freeway is not part of the roadway network.

An update to Figure 19 is now presented in Figure 19B.

In Figure 19B the forecast peak hour peak direction vehicle flows on this segment of Kirby Road is presented for:

- Horizon year 2021 (AM peak hour) with no GTA West freeway;
- Horizon year 2031 (AM peak hour) with GTA West Freeway;
- Horizon Year 2031 (AM peak hour) with no GTA West Freeway.

It is evident that by 2031 even without the GTA West freeway that this segment of Kirby Road will require two (2) traffic lanes in each direction of travel to serve the anticipated vehicle demand.

7. Evaluating the Justification

The available EMME II transportation software outputs were evaluated for the roadway AM peak hour in horizon years 2021 and 2031.

Figure 20 summarizes and compares the roadway AM peak hour condition (Volume to capacity ratios by roadway segment) in horizon year 2021. It is evident that:

- The forecast horizon year 2021 operating condition with and without (this can be considered to be the “Do Nothing” option) the Kirby Road segment between Dufferin Street and Bathurst Street indicates:
 - Without the Kirby Road connection the parallel arterial roads north and south of Kirby Road will experience significant delay and congestion. It is evident that the roadway segments have volume to capacity ratios of 1.28 and greater;
 - The introduction of the Kirby Road connection materially benefits the immediate east west arterial roads. The volume to capacity ratios by roadway segment have been reduced to reasonable operating levels.

Figure 21 summarizes and compares the roadway AM peak hour condition (Volume to capacity ratios by roadway segment) in horizon years 2021 and 2031 with the Kirby Road connection in place. It is evident that:

- By 2031 with the GTA West freeway in place and with the Kirby Road connection available the area roads examined prove to be capable of accommodating primary peak hour peak direction demand flows. Of importance is the fact that growth in population and employment has continued to the year 2031 however, the north south and east west roads examined continue to operate with comparable levels of service between 2021 and 2031, and;
- By 2031 the planned connecting link, Teston Road (Keele Street to Yonge Street) is in place.
- Optimum boundary road operations are secured. The volume to capacity ratios by roadway segment have been reduced to reasonable operating levels.

As indicated in Section 6 the GTA West Freeway corridor has been removed by the Ministry of Transportation. The forecast 2031 traffic flows without the GTA West Freeway were examined.

Figure 21A summarizes and compares the roadway AM peak hour condition (Volume to capacity ratios by roadway segment) in horizon years 2021 and 2031 with the Kirby Road connection in place. It is evident that:

- By 2031 with the Kirby Road connection available but excluding the GTA West Freeway the area roads examined prove to be capable of accommodating primary peak hour peak direction demand flows. Of importance is the fact that growth in population and employment has continued to the year 2031 however, the north south and east west roads examined continue to operate with comparable levels of service between 2021 and 2031. Some re – orientation of vehicle flows has occurred because the GTA West freeway is not in place but overall the performance is acceptable by 2031, and;
- By 2031 the planned connecting link, Teston Road (Keele Street to Yonge Street) is assumed to be in place. It is noted that this connecting link is subject to approval by the Minister of the Environment and Climate Change through the individual EA process. On June 7, 2018 York Region submitted the proposed Terms of Reference for the project to the Ministry of the Environment and Climate Change.
- Optimum boundary road operations are secured. The volume to capacity ratios by roadway segment have been reduced to reasonable operating levels.

The above analyses present link traffic flow volumes. The link traffic flow volumes describe the number of cars that pass through a certain segment (mid – block) of a roadway network over a period of time. This link traffic volume is divided by the capacity of the roadway segment to develop ratios for each roadway link during the AM and PM peak hours. The volume – to – capacity ratio reflects peak hour traffic demand measured against the roadway capacity. A description of the volume – to – capacity ratios is provided in the following table.

Table 4

Link Volume to Capacity Ratios and Operating Condition

Volume to Capacity Ratio	Level of Service (LOS)	Operating Condition
Less than 0.85	LOS A – C	Free Flow Very Little to Moderate Delay
Between 0.85 and 0.99	LOS D – E	Approaching or at Capacity, Users Experience Delays and Queuing
Greater than 1.0	LOS F	Over Capacity, Severe Delays and Queuing

In March 2018 HDR Inc. completed the North Vaughan and New Communities Transportation Master Plan Draft Final Report. This study is a long range plan that recommends policies, programs and infrastructure required to meet existing and future mobility needs and provide

context for transportation decisions within North Vaughan. The North Vaughan area (essentially the study area is bounded by King – Vaughan Road to the north, Bathurst Street to the east, Major Mackenzie Drive to the south and Highway 27 to the west.

A key transportation corridor essentially in the middle of the study area is Kirby Road.

The study followed the Transportation Master Plan (TMP) process, an open public process following the Municipal Class Environmental Assessment Guidelines, so that the study results can properly serve as direct input to any subsequent Environmental Assessment (EA) studies for specific infrastructure projects.

The study utilized York Region's updated EMME Transportation software model as the starting point in preparing transportation forecasts and conducting analyses. Poulos & Chung Limited in conducting this Transportation, Traffic and Active Transportation Need & Justification Assessment, Kirby Road (Dufferin Street to Bathurst Street) also used the same transportation model. Poulos & Chung Limited can confirm that the forecast traffic flows on the Kirby Road corridor for each area roadway network and transit condition examined is very comparable and almost identical in both studies.

The North Vaughan and New Communities Transportation Master Plan detailed:

- The transportation system requirements for numerous communities within the study area;
- The operational performance of the study area arterial grid network with and without the GTA Freeway;
- A assessment and evaluation of the missing links in the arterial grid network including the Kirby Road missing link between Dufferin Street and Bathurst Street;
- The active transportation system (bicycles and pedestrian infrastructure including transit services to provide total mobility options;
- A recommended phasing plan to implement the transportation system (roads, transit, pedestrian and bicycle) improvements and additions.

Specific to Kirby Road the North Vaughan and New Communities Transportation Master Plan identified:

- That the addition of the Kirby Road missing link (between Dufferin Street and Bathurst Street helps alleviate traffic from parallel arterial roads,
 - Minimizes the kilometres travelled and hours spent in congestion;
 - Assists to accommodate increased public transit services, and;
 - Facilitates pedestrian and bicycle flows through the inclusion of sidewalks and bicycle lanes;
- The need for York Region to assume jurisdiction of Kirby Road in the City of Vaughan;

- The timing to improve Kirby Road from Highway 27 to Bathurst Street (including elimination of the missing link) is 2017 – 2026.

8. Verifying Travel Demands

8.1 Transit

As shown in Figure 13 Kirby Road will be a component of the overall transit network for York Region.

It's designation as a corridor with frequent transit service requires and justifies the need to incorporate design standards sufficient to accommodate buses in mixed traffic.

The Kirby Road extension will use City of Vaughan, York Region and Transportation Association of Canada standards to provide:

- Appropriate lane widths, curb radii, centre line radius, and;
- Sufficient boulevard dimension to permit the installation and satisfy transit facility requirements.

8.2 Active Transportation

As shown in Figure 14 Kirby Road will be a component of the overall bicycle network for York Region.

In addition following the typical York Region standards for arterial roads sidewalks must be included within the Kirby Road Right – of –Way (R o W).

The design standards employed must follow typical York Region standards for the inclusion of exclusive bike lanes in both directions of travel.

8.3 Goods Movement

As shown in Figure 12 Kirby Road is designated to accommodate goods movement demands.

The design standards employed must follow typical York Region standards to satisfactorily accommodate the geometric requirements of tractor trailer trucks.

8.4 Traffic Flows

The EMME II outputs provided by York Region formed the basis to determine the vehicle turning movements at the intersections of Kirby Road with Dufferin Street and Bathurst Street.

The EMME II select link analysis was used as the basis to calculate forecast turning movements for the roadway AM peak hour in horizon years 2021 and 2031. To calculate the roadway PM peak hour turning movements it was assumed that the magnitude of AM vehicle trips would be reversed. Additional adjustments were introduced reflecting existing turning movement demand.

The resultant calculated 2021 and 2031 vehicle flows and turning movements are shown in Figures 22 and 23. The vehicle turning movements are presented with and without the GTA West freeway.

The potential development traffic flows shown in Figure 16 were added to the above calculated 2021 and 2031 vehicle flows. This resulted in a total 2021 forecast traffic flow and intersection turning movement vehicle demand as shown in the top portion of Figure 24 while the 2031 forecast traffic flows are in the lower part of Figure 24.

It is evident that all left turn movement demands at each Kirby Road intersection will require exclusive left turn lanes.

The analysis technique of the Transportation Association of Canada as contained in the Transportation Geometric Design Guidelines for Canadian Roads was used to calculate left turn storage lengths. This calculation is a direct function of vehicle demand.

The calculated vehicle storage length for the exclusive left turns is shown in Figure 25.

The Synchro Software Program, Version 8 by Trafficware Inc. was used to calculate the performance of the Kirby Road intersections in horizon years 2021 and 2031.

Table 5 presents the overall intersection level of service, vehicle delay and volume to capacity ratio.

Table 5
Calculated Intersection Performance
Horizon Years 2021 and 2031

Performance Measure	Kirby Road and Dufferin Street		Kirby Road and Bathurst Street	
	AM Peak	PM Peak	AM Peak	PM Peak
Year 2021				
Overall Level of Service	D	D	E	D
Vehicle Delay (in Seconds)	48	43	59	52
Year 2031 (with GTA West)				
Overall Level of Service	D	E	F	D
Vehicle Delay (in Seconds)	36	76	82	50
Year 2031 (with no GTA West)				
Overall Level of Service	D	E	F	D
Vehicle Delay (in Seconds)	36	76	86	40

An explanation of the alpha – numeric outputs is provided in Appendix B.

The analysis indicates that very acceptable urban intersection operations can be secured. Vehicle delays are reasonable and the forecast vehicle demand can be satisfactorily accommodated. In the context of an urban environment these intersection operating conditions are deemed to be acceptable and performing very well. The operating conditions are a direct result of the increased traffic flows generated by continued growth in the immediate area and throughout York Region. The forecast traffic flows are much higher than the existing flows hence even with improvements the overall levels of service degrade but still are considered acceptable.

Upon reviewing the role and function of Kirby Road including this assessed segment; it is concluded that a minimum Right – of - Way of 36.0 meters in width is required.

8.5 Summarizing the Need and Justification

As documented in Section 2 of this report considerable work was completed by the City of Vaughan to identify the need and justification of this project. In addition, York Region as documented in Section 5.2 of this report identifies the important role and function that this project is to play in the overall regional roadway, transit and active transportation network.

Notwithstanding the significant amount of analysis completed by York Region and the City of Vaughan this report extracted relevant analysis completed by the authorities and included updated existing roadway / intersection traffic flow information.

Such an approach permitted a detailed examination of all potential “Alternative Solutions” to the undertaking in accordance with Phases 1 and 2 of the Municipal Class Environmental Assessment planning and design process.

Alternative Solutions examined included:

- “Do – Nothing” option;
- Use / Widen Parallel East – West roads;
- Provide Active Transportation Facilities including Travel Demand Management, and;
- Construct new roadway extension.

The detailed evaluation of Alternative Solutions to the undertaking is summarized below.

Examination of “Do – Nothing” Condition

The “Do - Nothing” Condition has severe implications on both existing and future vehicle travel demands. This can be ascertained by examining the following Figures:

- Figures 5 and 6 illustrate the existing roadway AM and PM peak hour area traffic flow patterns. It is very evident that the traffic flows in order to complete their direction of travel causes increased vehicle turning movements at several area intersections. These turning movements today cause increased vehicle delay and congestion. The delay and congestion will continue to increase over time as growth continues in the City of Vaughan and York Region;
- Figures 17 and 18 illustrate the forecast 2031 accumulated AM peak hour traffic flow on this project section with and without the proposed GTA West Freeway. It is evident with or without the GTA West Freeway this project road segment is forecast to carry a significant amount of traffic flow. If this project segment were not available this projected significant traffic flow would have to find alternate routes. The forecast volumes indicate that two lanes of traffic in each direction of travel would have to be found in an adjacent roadway corridor.

It is evident from examining existing roadway and intersection operations and reviewing forecast traffic flow demands that the “Do – Nothing” condition is not a viable option. Attempting to “throw – off” the existing and forecast Kirby Road traffic flow demand will have a detrimental impact on the operations of numerous area roads and intersections.

Examination of Parallel East – West Roads

Figure 20 in this report examines the parallel east – west roads. The analysis was conducted for the roadway AM peak hour in horizon year 2021. The analysis indicates that the King – Vaughan Road to the north and Teston Road to the south would both experience a vehicle demand significantly higher than the available roadway capacity that can be provided. The available capacity on these roads was assumed to be derived by widening each of the parallel roads to four lanes. In effect this assumption is based upon accelerating the timing of the planned Teston Road improvements between Keele Street and Yonge Street which is planned for beyond 2022. As planned growth continues the identified volume to capacity operating deficiency would be much worse in horizon year 2031.

It is evident that the parallel east – west roads cannot provide additional operating capacity to serve increased traffic flow demands resulting from the lack of a continuous Kirby Road condition. It can also be stated that the area intersections serving the disrupted traffic flows would provide degraded operating conditions serving to increase vehicle delay and congestion.

Examination of Transit and Active Transportation to Accommodate Forecast Demand Including Travel Demand Management (TDM)

There is no doubt that transit and active transportation (bicycling and walking) are important modes of transportation and must be available as viable options of travel. The City of Vaughan and York Region have both incorporated standards and on – going facilities, services and infrastructure in their respective jurisdictions to accommodate these modes.

Although it is evident that transit and active transportation will have an on – going important role in serving travel demands it is evident that they cannot satisfy the total travel demands.

Figure 26 illustrates the existing modal characteristics of this area of the City of Vaughan. The statistics are available from the Data Management Group and based upon the 2011 Transportation for Tomorrow Survey results.

The 2016 York Region Transportation Planning Study Update has incorporated an increase in the usage of transit and continued growth in walking and bicycling during the roadway AM peak hour.

As shown in Figure 26 the current uptake of transit and active transportation during the AM peak period is in the order of twenty – four (24) percent of all trips. Even if this percentage of non automobile travel were to double by 2031 over half of all trips will still be taken by the automobile.

It is therefore concluded that increased usage of transit and active transportation, though most welcomed, is not capable of serving the total travel demand needs.

A roadway solution must be a part of the overall transportation system to satisfactorily serve total forecast demands.

TDM will be an important tool to be used by Authorities and interested parties to continue to educate, encourage and incentivize people to use other modes of transportation instead of the single automobile / single driver to complete trips during the typical weekday roadway peak periods. TDM will continue to grow and evolve and will be complimented by the planned infrastructure both within planned communities, municipal and regional transportation systems.

Examination of Construct New Roadway Option

The ability to complete the existing and planned arterial grid system is an important consideration. This project immediately benefits the arterial grid by completing a missing section of Kirby Road.

Such an undertaking not only benefits traffic flows but also permits transit to efficiently implement direct route patterns and allows active transportation infrastructure to be implemented as part of the overall system.

Figure 24 illustrates the forecast traffic flows on this project and this segment of Kirby Road. The new roadway permits organization of traffic flows. The intersections with appropriate lane configuration permits turning movement demand to be organized and accommodated in a balanced and efficient manner.

All critical modes of transportation are accommodated in a safe and efficient manner.

The following Table 6 has been prepared to summarize the evaluation of the alternative solutions considered from a transportation perspective.

Table 6

Evaluation of Alternative Solutions
 Transportation / Technical / Operations
 Kirby Road Extension
 (From Dufferin Street to Bathurst Street
 City of Vaughan

Environmental Factor	Alternative Solution A “Do - Nothing”	Alternative Solution B “Use / Widen Parallel East West Roads”	Alternative Solution C “Provide Active Transportation Facilities including TDM”	Alternative Solution D “Construct New Roadway Extension”
Transportation/ Technical	Not Preferred	Not Preferred	Neutral	Preferred
Advantages and Disadvantages	<ul style="list-style-type: none"> • Does not address the problem • Prevents completion of the arterial grid 	<ul style="list-style-type: none"> • Does not accommodate increased traffic flow demand • Does not support completion of a balanced transportation system 	<ul style="list-style-type: none"> • Does not fully address the problem • Contributes to completion of balanced transportation system 	<ul style="list-style-type: none"> • Provides the additional operating capacity required • Supports connection of Future Urban Area • Incorporates and organizes key modes of transportation • Supports completion of a balanced transportation system
Conclusion	<ul style="list-style-type: none"> • In agreement with Municipal and Regional TMP findings. • Eliminate from further consideration 	<ul style="list-style-type: none"> • In agreement with Municipal and Regional TMP findings. • Eliminate from further consideration 	<ul style="list-style-type: none"> • In agreement with Municipal and Regional TMP findings. • Eliminate from further consideration 	<ul style="list-style-type: none"> • In agreement with Municipal and Regional TMP findings. • Carry forward to Phase 3 and 4 EA Study with elements from Alternative Solution 3

9. Conclusions and Recommendations

The assessment of the Kirby Road segment between Dufferin Street and Bathurst Street permits the following conclusions to be made:

- Both the 2013 City of Vaughan and the 2016 York Region Transportation Master Plans identified the need for the undertaking;
- The North Vaughan and New Communities Transportation Master Plan Draft Report, HDR Inc. dated February 2018 has also confirmed the need for the undertaking;
- The undertaking involved improving Kirby Road easterly from Keele Street to Bathurst Street, including the subject of this detailed assessment from Dufferin Street to Bathurst Street;
- This undertaking resolves the lack of a connection between Dufferin Street and Bathurst Street;
- This detailed assessment verifies the need to construct new roadway extension and confirms that;
- Kirby Road must be connected between Dufferin Street and Bathurst Street by 2021 and that the;
- Kirby Road connection must have two (2) lanes of traffic in each direction of travel;
- The resultant four (4) lanes of traffic on this segment of Kirby Road are sufficient to meet the forecast total modal demands for 2031 as well. The intersections of Dufferin Street and Bathurst Street will require the inclusion of exclusive left turn lanes with satisfactory storage and taper lengths and centre medians to permit installation of traffic signal hardware;
- On Kirby Road at the intersections with Dufferin Street and Bathurst Street, right turn lanes will be required in the eastbound and westbound directions of travel. York Region Transit should determine if bus stops can be located in the right turn lane or if an alternate bus stop location is to be implemented.

The assessment of the Kirby Road segment between Dufferin Street and Bathurst Street permits the following recommendations to be made:

- City of Vaughan, York Region and Transportation Association of Canada design standards can be applied to this segment of Kirby Road permitting the proper operations of:
 - Automobiles;
 - Buses;
 - Trucks;
 - Bicyclists;
 - Pedestrians.

- Exclusive left turn lanes must be provided in all directions of travel at each of the Kirby Road intersections with Dufferin Street and Bathurst Street. The calculated dimensions for vehicle storage and taper lengths at each of the intersection approaches is shown in Figure 22;

- Exclusive bicycle lanes are to be provided in both directions of travel (either on – pavement or in boulevard);

- Sidewalks are to be provided on both sides;

- Provision and satisfactory space must be made available in the boulevards for transit facilities and infrastructure as required by York Region Transit.

List of Figures



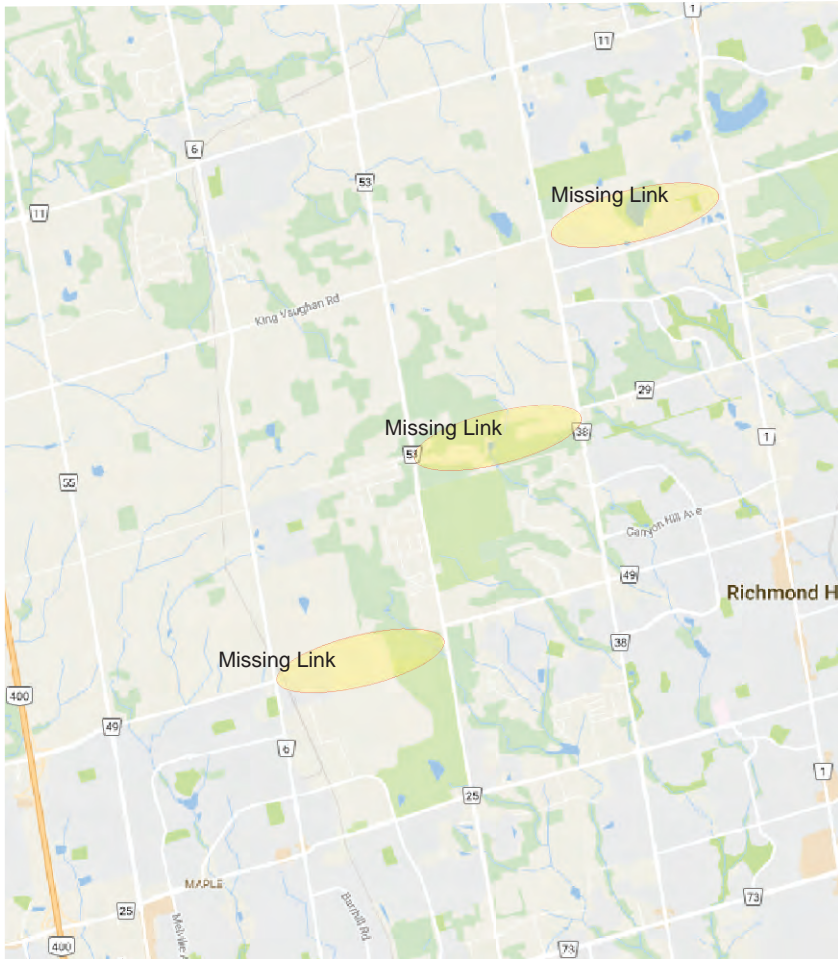
Study Area

Potential Kirby Road Connection

Study Area

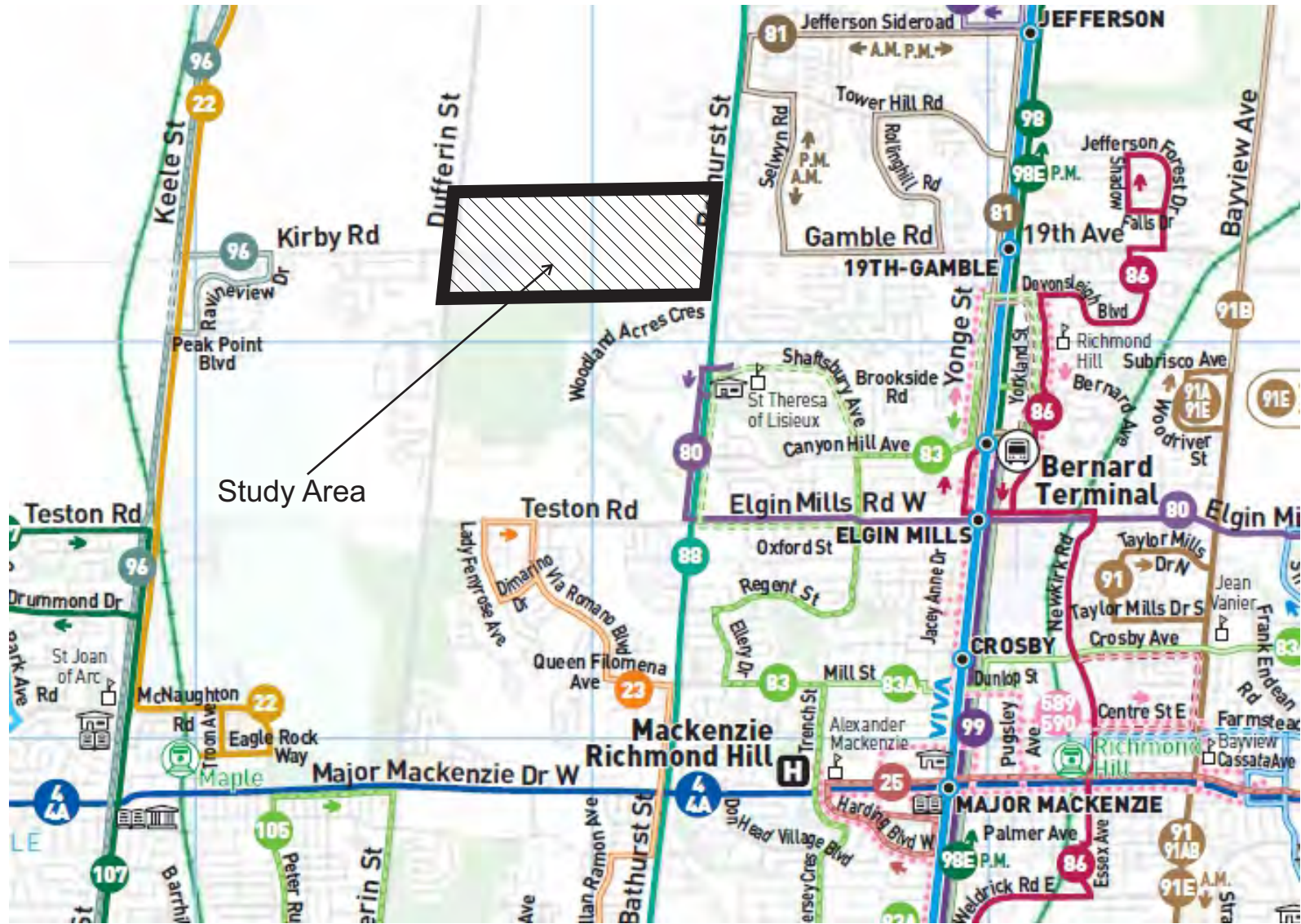
Figure 1

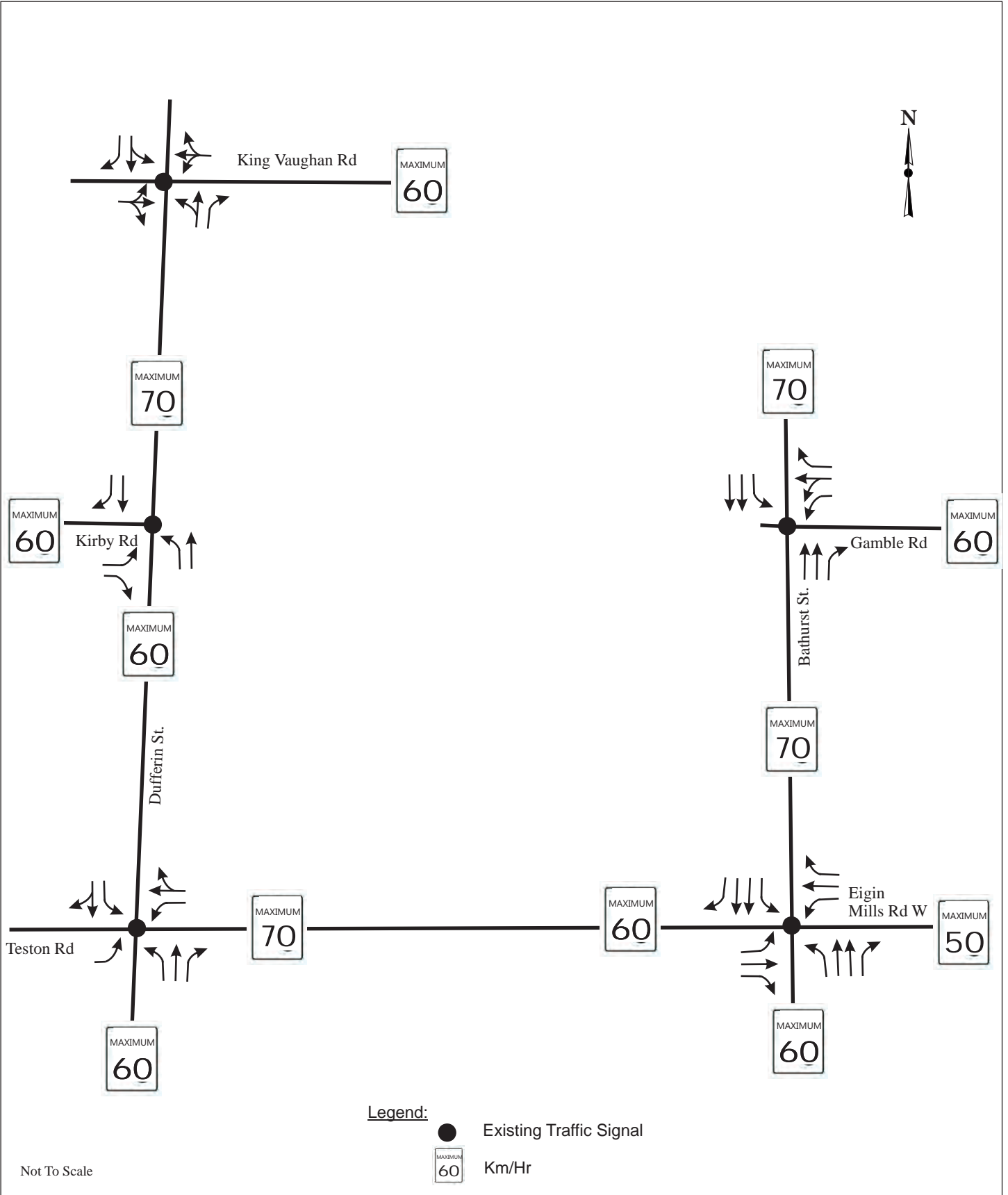
Current Road Network

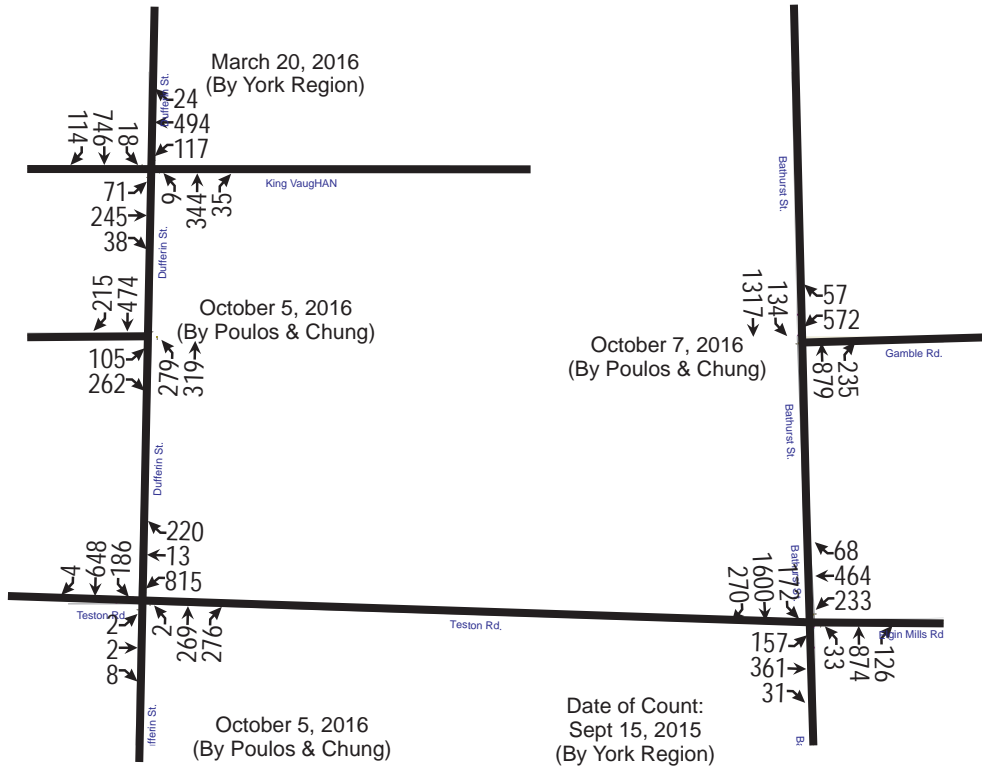


Proposed Connecting Links

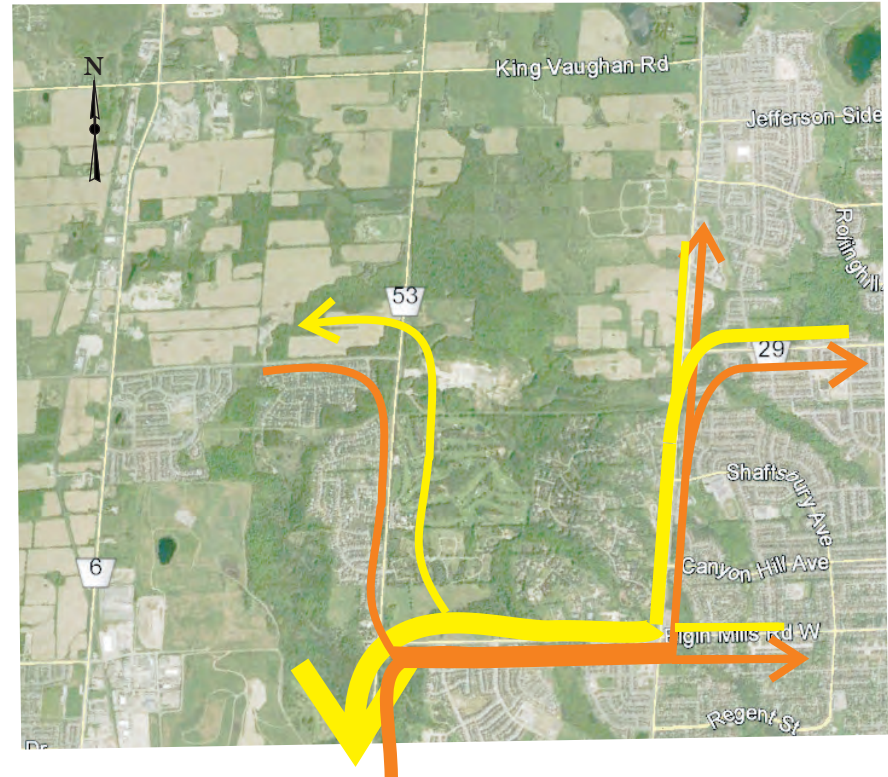




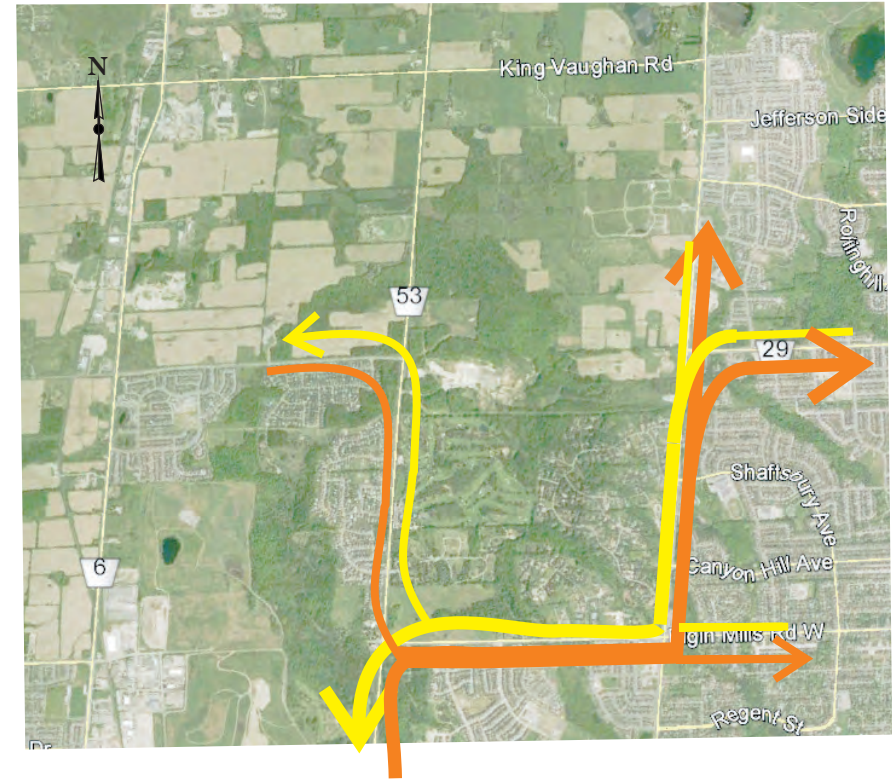
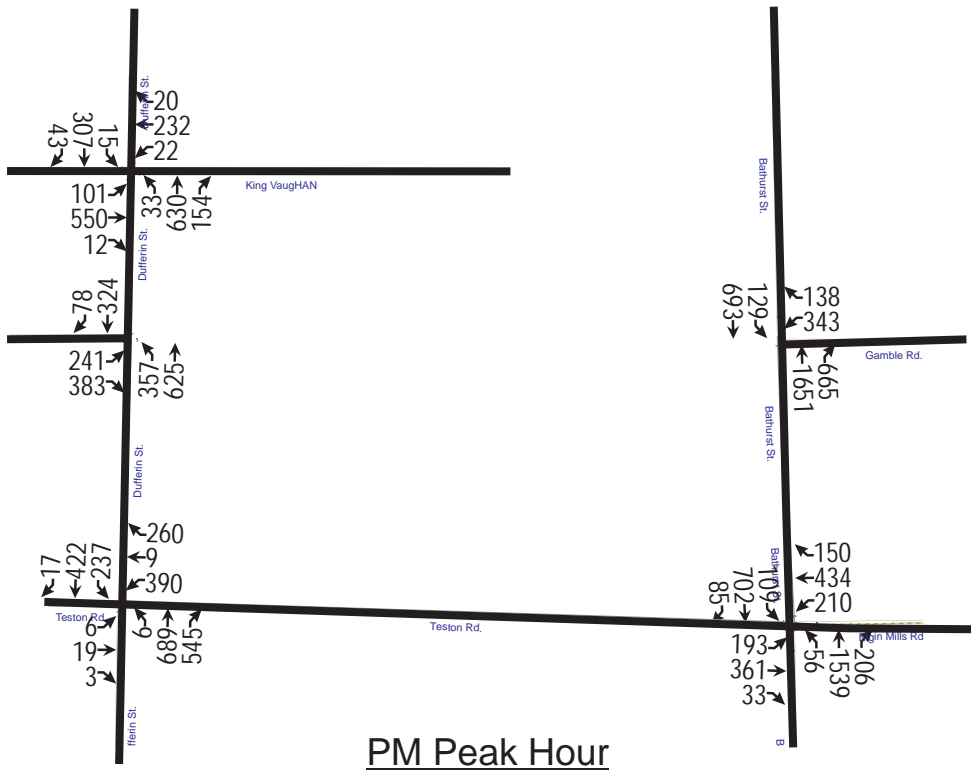




AM Peak Hour
Traffic Volumes



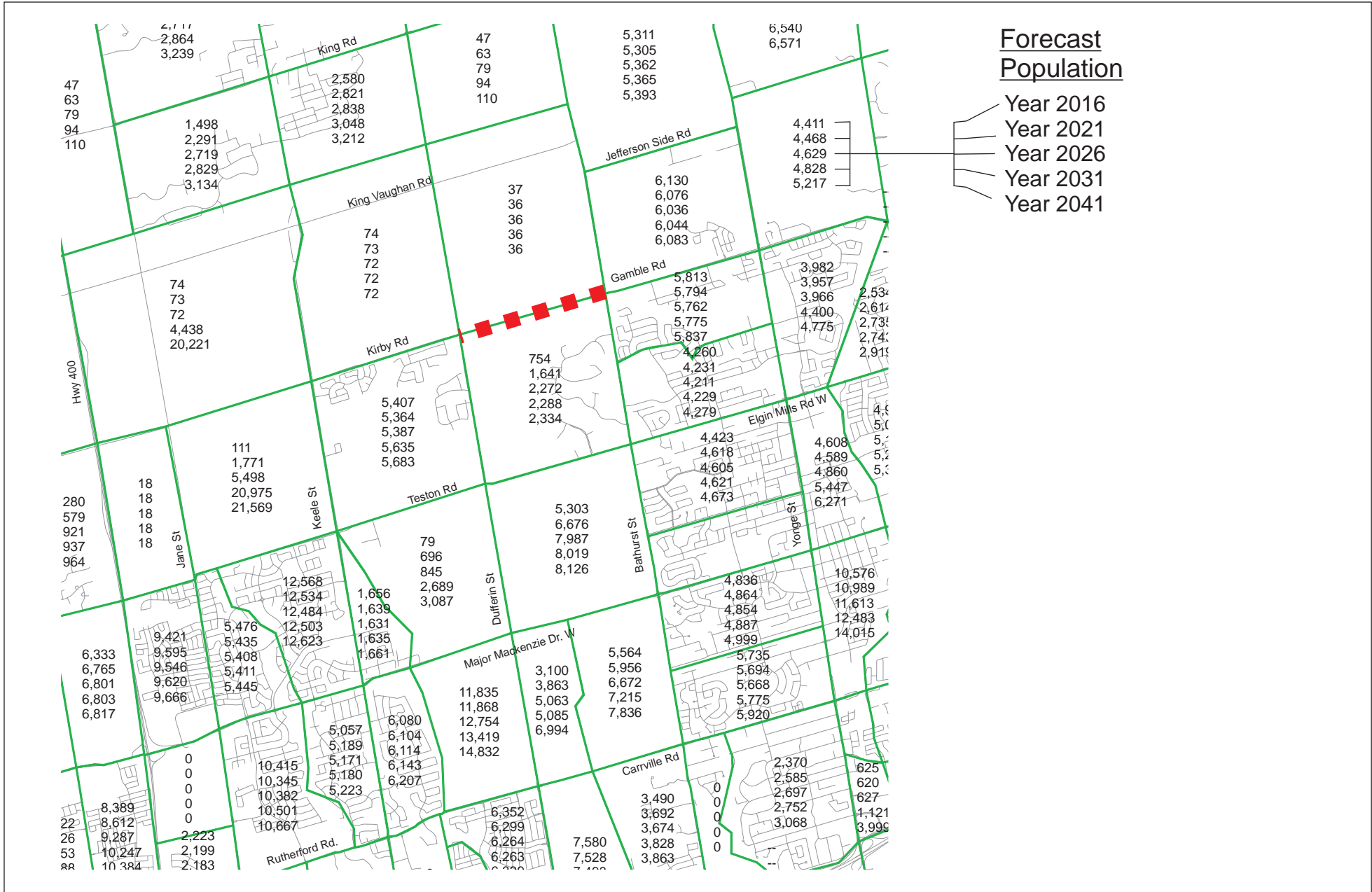
Heavy Traffic Movements
(AM Peak Hour)



Heavy Traffic Movements
(PM Peak Hour)

Existing PM Traffic Volumes

Figure 6



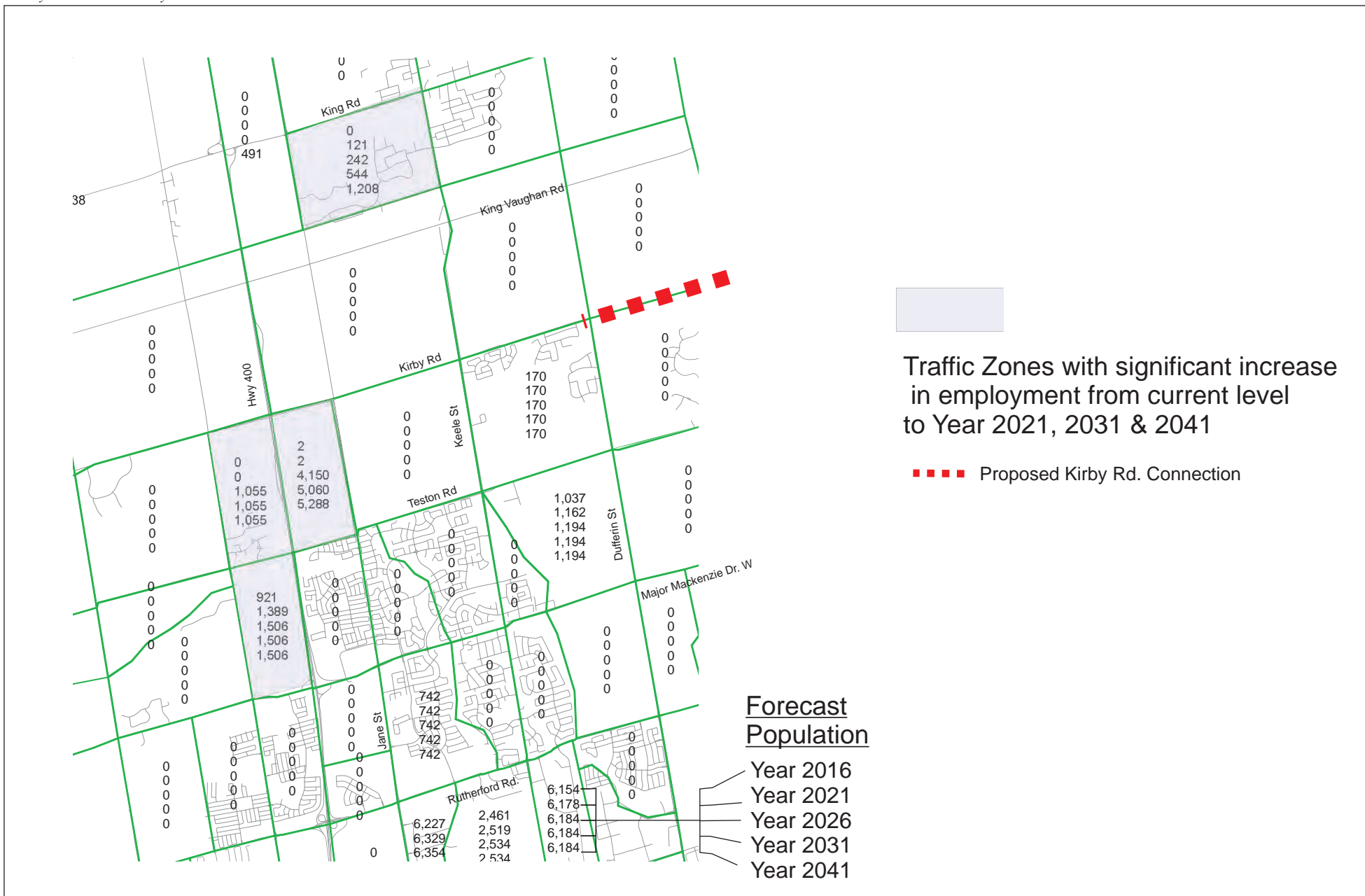
**Forecast
Population**

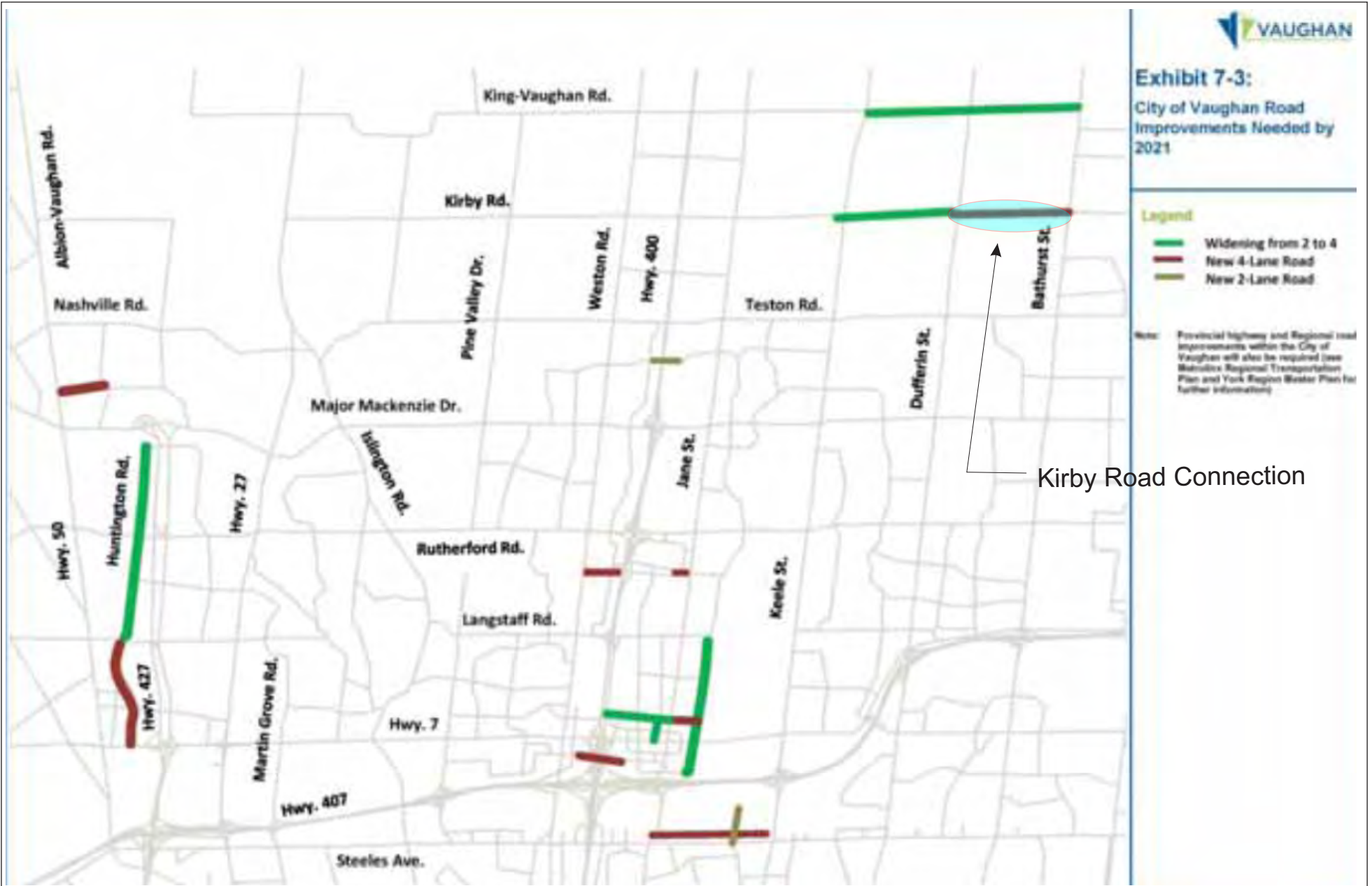
- Year 2016
- Year 2021
- Year 2026
- Year 2031
- Year 2041

■■■■ Proposed Kirby Rd. Connection

*Forecast 2016, 2021, 2026, 2031
and 2041 Population
Figure 7*

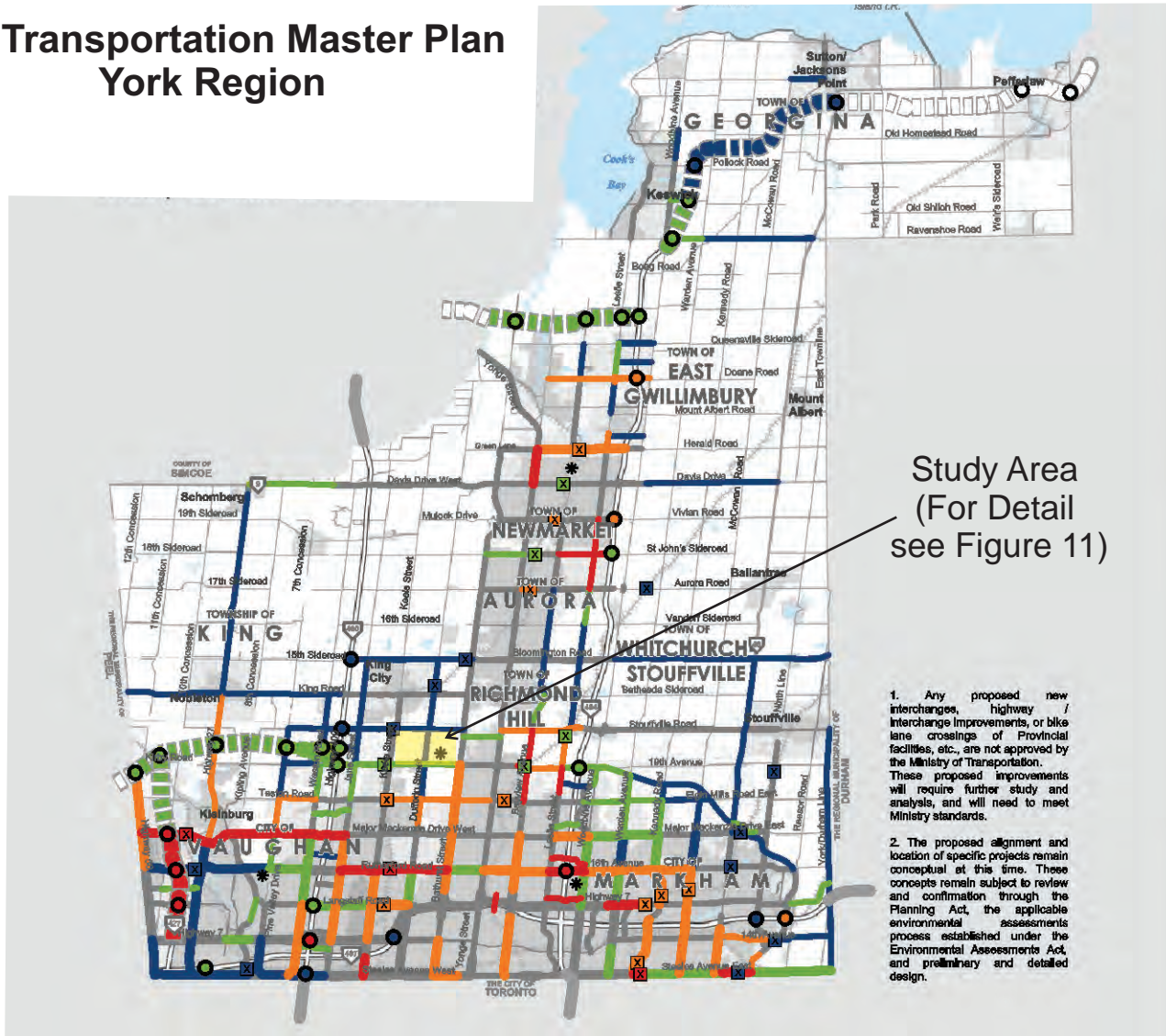






Transportation Master Plan York Region

Thursday, May 12, 2016



Study Area
(For Detail
see Figure 11)

Road Phasing

- 2017 - 2021
- 2022 - 2026
- 2027 - 2031
- 2032 - 2041

Grade Separations Phasing

- 2017 - 2021
- 2022 - 2026
- 2027 - 2031
- 2032 - 2041

Interchange Improvements Phasing (to be confirmed by MTO)

- 2017 - 2021
- 2022 - 2026
- 2027 - 2031
- 2032 - 2041

Note:

- Special Study Area

BASE MAP INFORMATION

- Provincial Freeway
- Provincial Highway
- Road
- Railway

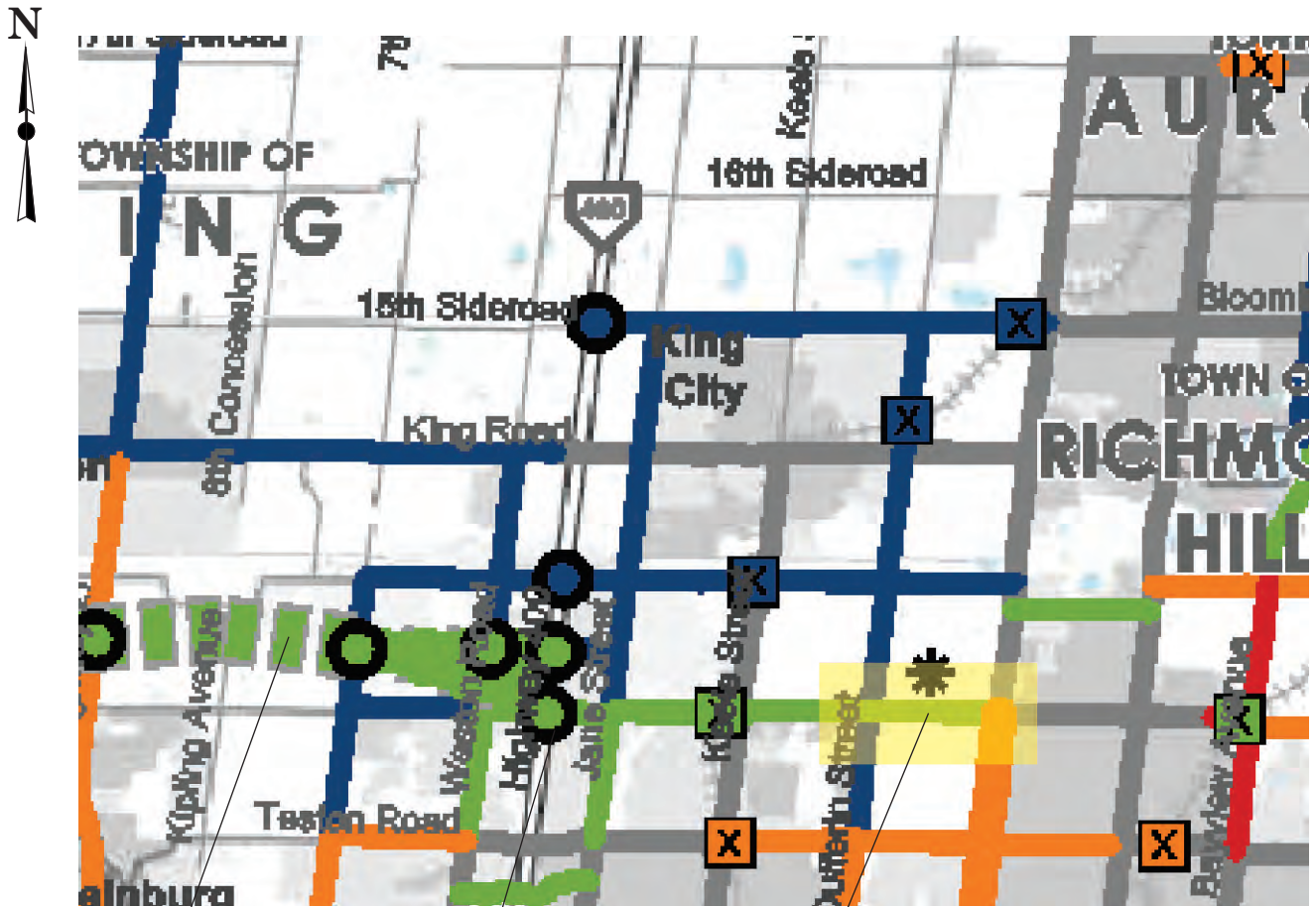


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Includes Greenbelt and Oak Ridge Moraine Boundaries and Water Features

1. Any proposed new interchanges, highway / interchange improvements, or bike lane crossings of Provincial facilities, etc., are not approved by the Ministry of Transportation. These proposed improvements will require further study and analysis, and will need to meet Ministry standards.

2. The proposed alignment and location of specific projects remain conceptual at this time. These concepts remain subject to review and confirmation through the Planning Act, the applicable environmental assessments process established under the Environmental Assessments Act, and preliminary and detailed design.



Thursday, May 12, 2016

Road Phasing

- 2017 - 2021
- 2022 - 2026
- 2027 - 2031
- 2032 - 2041

Grade Separations Phasing

- 2017 - 2021
- 2022 - 2026
- 2027 - 2031
- 2032 - 2041

Interchange Improvements Phasing (to be confirmed by MTO)

- 2017 - 2021
- 2022 - 2026
- 2027 - 2031
- 2032 - 2041

Note:

- Special Study Area

BASE MAP INFORMATION

- Provincial Freeway
- Provincial Highway
- Road
- Railway



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Boundaries and Water Features

GTA West

Kirby Road Connection

Kirby Road Interchange

Study Area

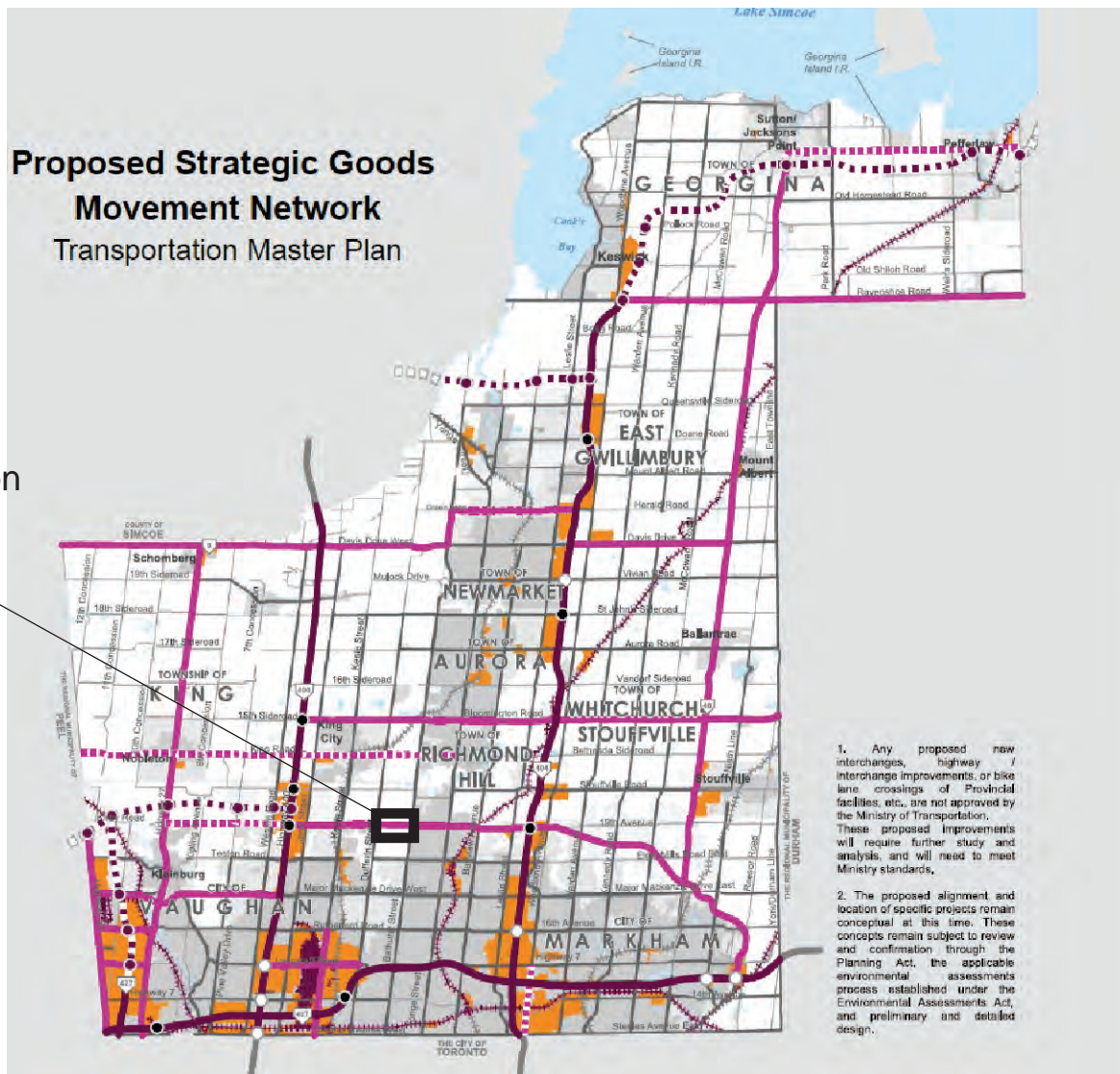


Staging Road Improvements

Figure 11

**Proposed Strategic Goods
Movement Network**
Transportation Master Plan

Kirby Road Connection



MAP 11

Thursday, May 12, 2016

Strategic Goods Movement Corridors

- Tier 1**
- Highway Goods Movement Corridor
 - Future Highway Goods Movement Corridor
- Tier 2**
- Interim Primary Arterial Goods Movement Corridor
 - Primary Arterial Goods Movement Corridor
- Tier 3**
- Secondary Goods Movement Corridor

- Interchange Improvements (to be confirmed by MTO)**
- Future Interchange on Existing Freeway
 - Future Interchange on Future Freeway
 - Other Interchange Improvement
 - Employment Areas (as of mid-2013)

BASE MAP INFORMATION

- Provincial Freeway
- Provincial Highway
- Road
- Railway



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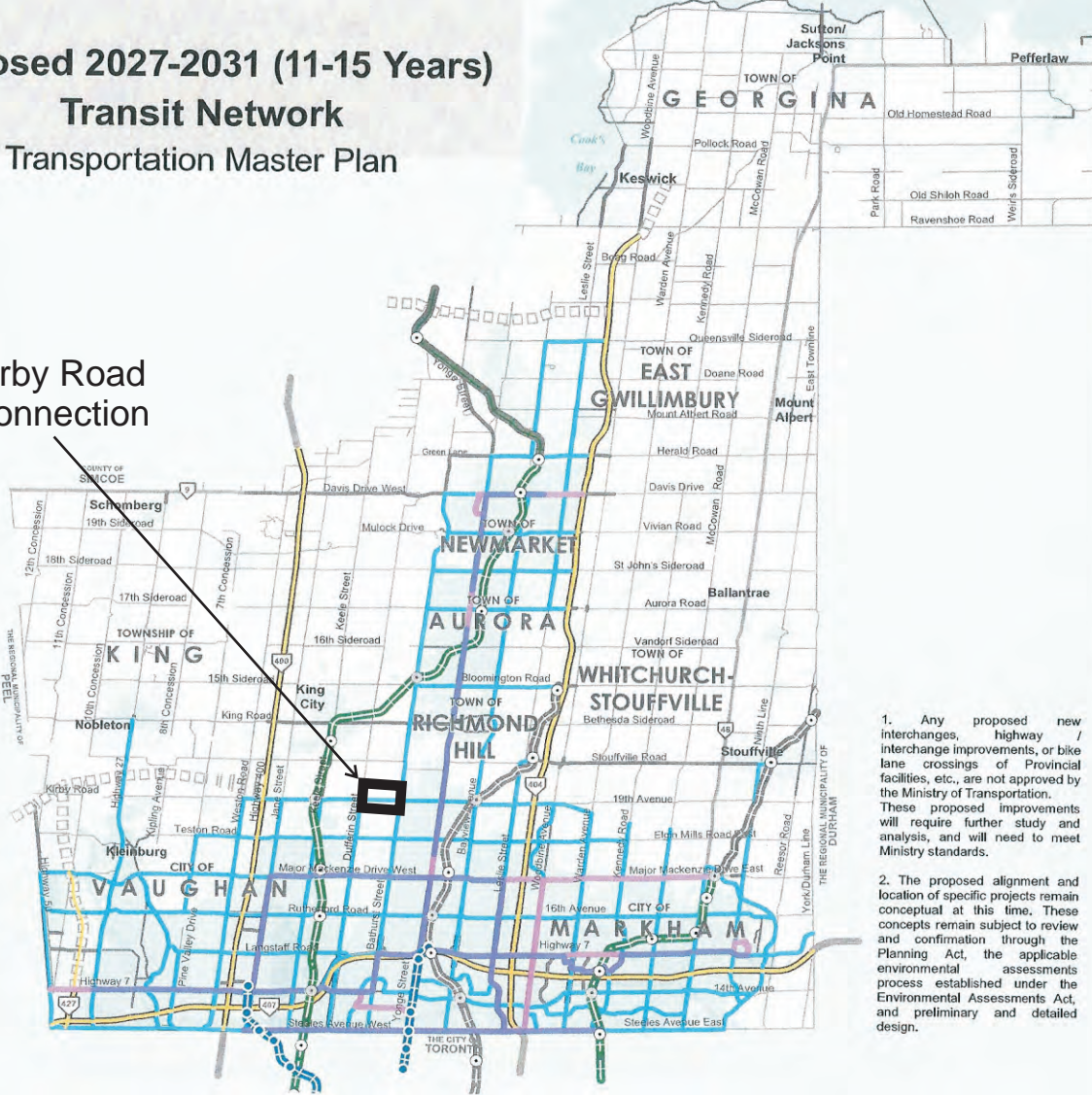
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1. Any proposed new interchanges, highway interchange improvements, or bike lane crossings of Provincial facilities, etc. are not approved by the Ministry of Transportation. These proposed improvements will require further study and analysis, and will need to meet Ministry standards.
2. The proposed alignment and location of specific projects remain conceptual at this time. These concepts remain subject to review and confirmation through the Planning Act, the applicable environmental assessments process established under the Environmental Assessments Act, and preliminary and detailed design.

Kirby Road is a primary arterial Good Movement Corridor as identified in York Region TMP 2016

Proposed 2027-2031 (11-15 Years) Transit Network Transportation Master Plan

Kirby Road Connection



1. Any proposed new interchanges, highway / interchange improvements, or bike lane crossings of Provincial facilities, etc., are not approved by the Ministry of Transportation. These proposed improvements will require further study and analysis, and will need to meet Ministry standards.
2. The proposed alignment and location of specific projects remain conceptual at this time. These concepts remain subject to review and confirmation through the Planning Act, the applicable environmental assessments process established under the Environmental Assessments Act, and preliminary and detailed design.

MAP 14

Thursday, May 12, 2016

2027 - 2031 Transit Network

- Dedicated Rapidway
- VIVA Curbside Service
- Frequent Transit Network
- Highway Bus Service (YRT/Viva, GO)

Subway Extensions

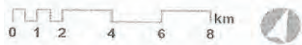
- Subway Extension
- Subway Extension Station

GO Rail

- GO Train, 15-min Two Way All Day Service
- GO Train, Two Way All Day Service
- GO Train, Rush Hour Service
- Existing GO Station
- Potential GO Station

BASE MAP INFORMATION

- Provincial Freeway
- Provincial Highway Road
- Railway



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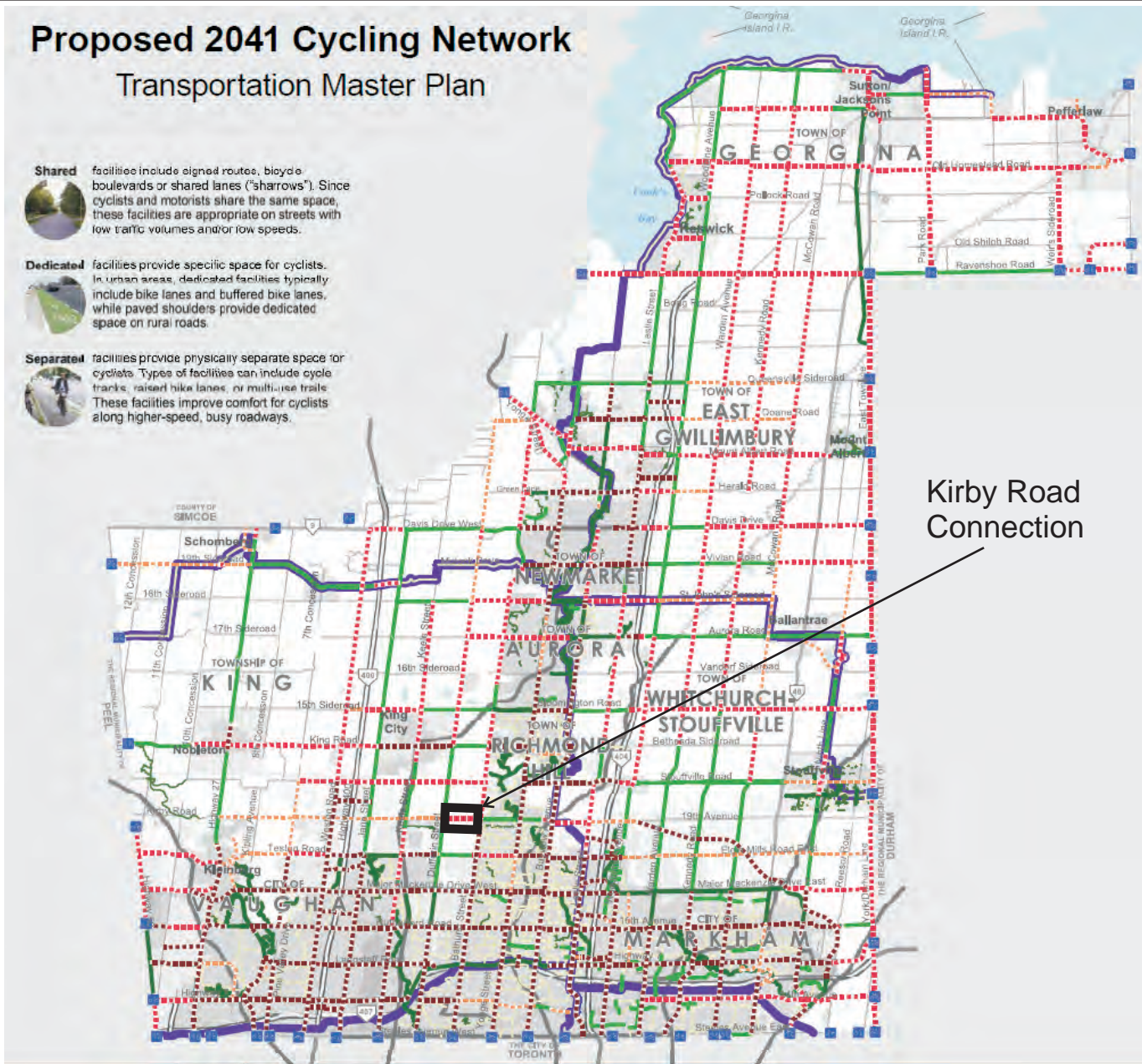
Proposed 2041 Cycling Network

Transportation Master Plan

Shared facilities include signed routes, bicycle boulevards or shared lanes ("sharrows"). Since cyclists and motorists share the same space, these facilities are appropriate on streets with low traffic volumes and/or low speeds.

Dedicated facilities provide specific space for cyclists. In urban areas, dedicated facilities typically include bike lanes and buffered bike lanes, while paved shoulders provide dedicated space on rural roads.

Separated facilities provide physically separate space for cyclists. Types of facilities can include cycle tracks, raised bike lanes, or multi-use trails. These facilities improve comfort for cyclists along higher-speed, busy roadways.



Kirby Road Connection

MAP 9

Thursday, May 12, 2016

Existing Cycling Network

- Shared Facility
- Dedicated Facility
- Separated Facility

Proposed Cycling Facilities

- Local Cycling Route of Regional Significance
- Dedicated
- Separated
- Conceptual Region-Wide Trail System
- External Connection

GO Rail

- Rapid Transit / GO Corridor

BASE MAP INFORMATION

- Provincial Freeway
- Provincial Highway
- Road
- Railway



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Boundaries and Water Features

ITE Trip Generation Rates (9th Edition)

Land use	Units	ITE code	AM Peak			PM Peak			Saturday Peak		
			IN	OUT	Total	IN	OUT	Total	IN	OUT	Total
Townhouse/condo	Dwellings	230	0.07	0.37	0.44	0.35	0.17	0.52	0.25	0.22	0.47
Office	1000 sqft	710	1.37	0.19	1.56	0.25	1.24	1.49	0.23	0.20	0.43
Shopping Centre	1000 sqft	820	0.60	0.36	0.96	1.63	2.08	3.71	2.41	2.41	4.82

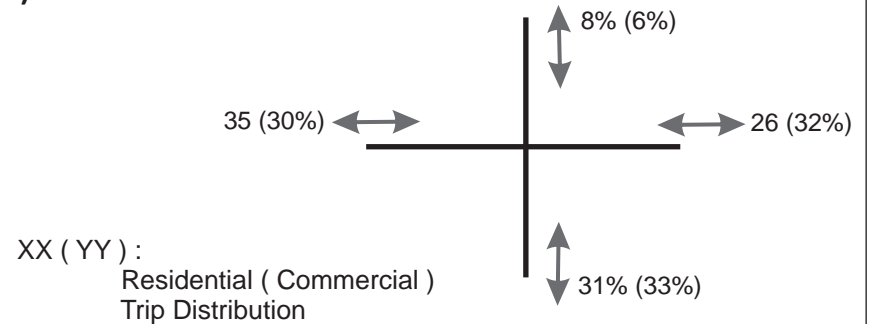
Estimated Vehicle Trips

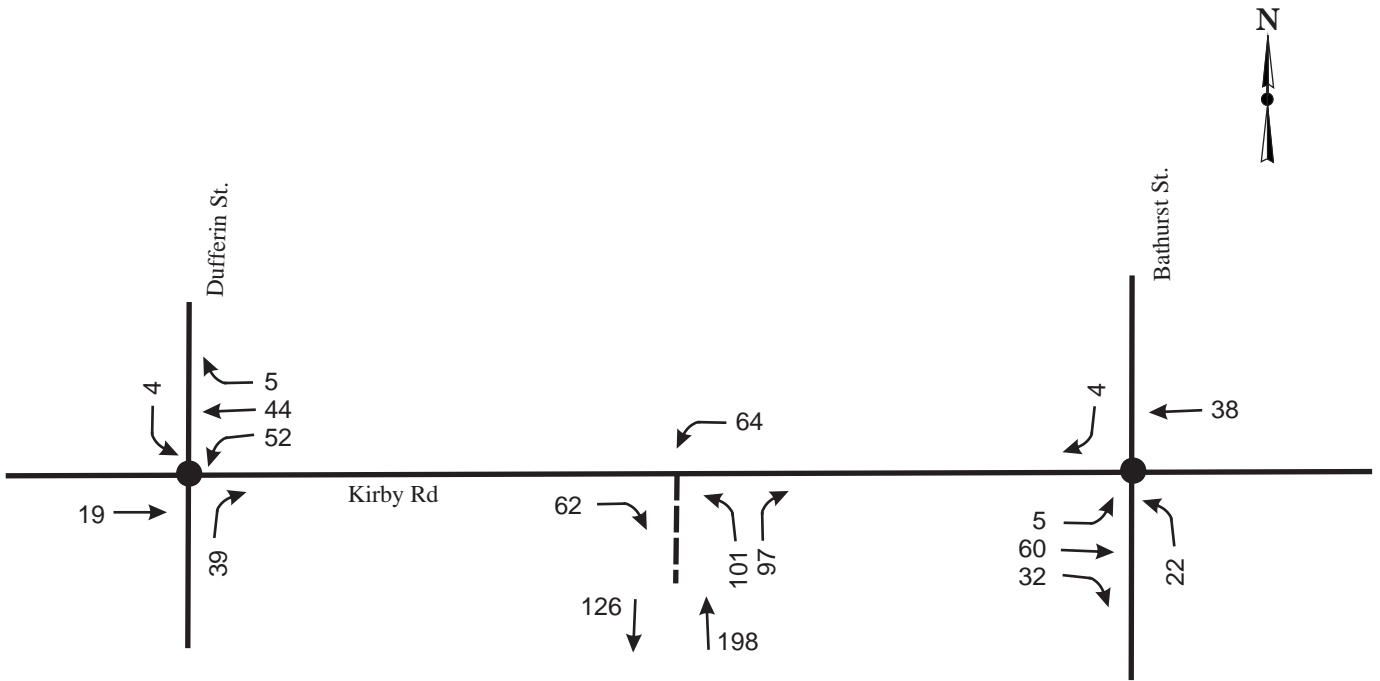
East of Dufferin Street			AM Peak			PM Peak			Saturday Peak		
Land use	Units		IN	OUT	Total	IN	OUT	Total	IN	OUT	Total
Townhouse/condo	486		36	177	214	169	83	253	123	105	228
Office	52.2		72	10	81	13	65	78	12	10	22
Retail	30		18	11	29	49	62	111	72	72	145
TOTAL			126	198	324	232	210	442	208	188	395

Assumption of Office/ Retail Area Calculation

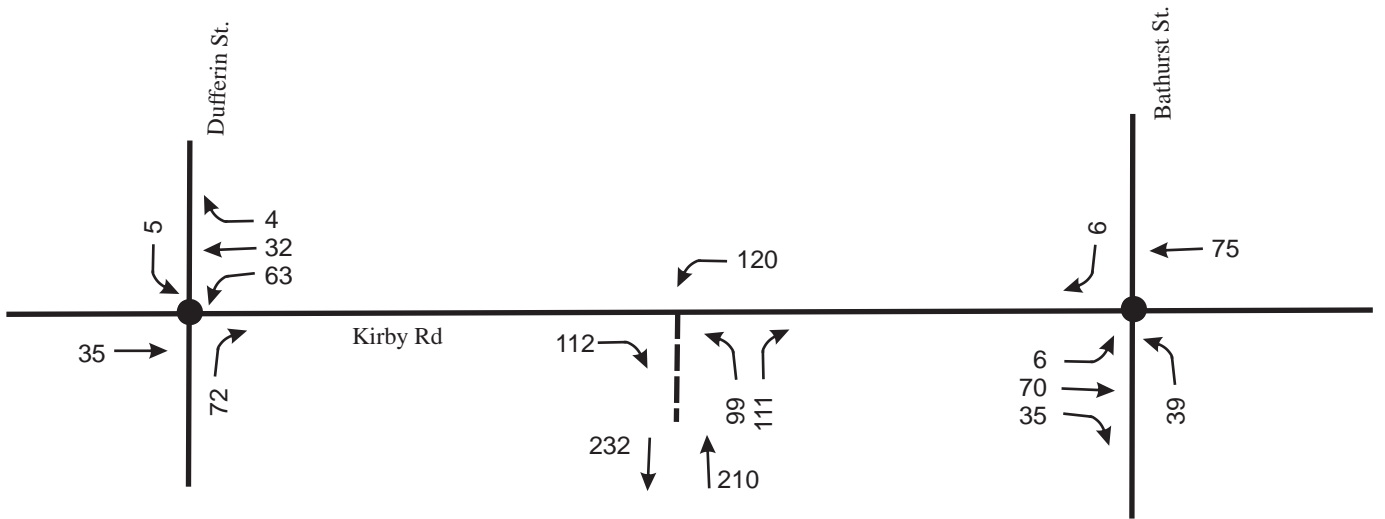
	ha	ac	Sq. Ft	FSI	Area (Sq. Ft)
Office	0.24	0.6	26,136	2	52,272
Retail	0.28	0.69	30,056	1	30,056

Vehicle Trip Distribution



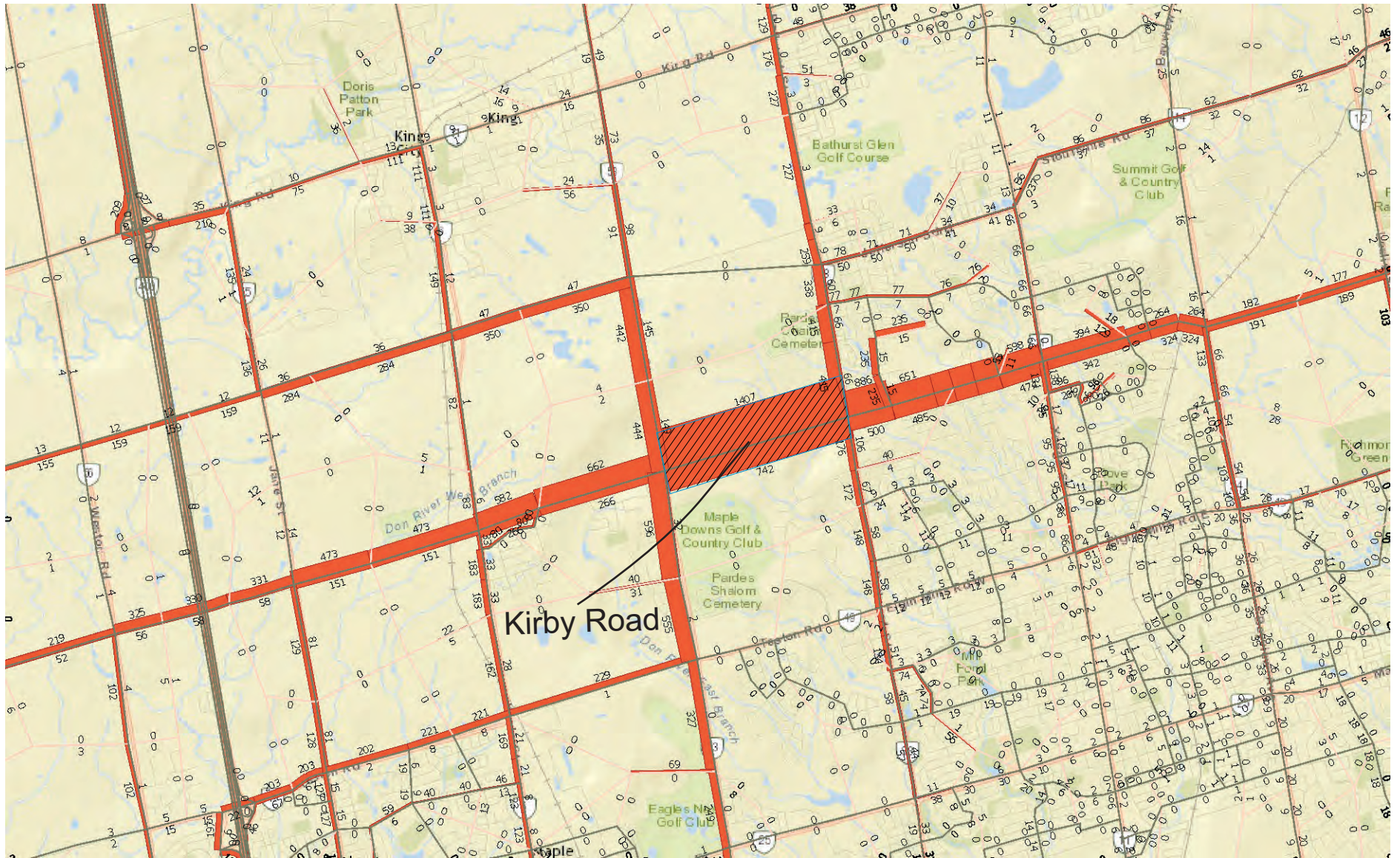


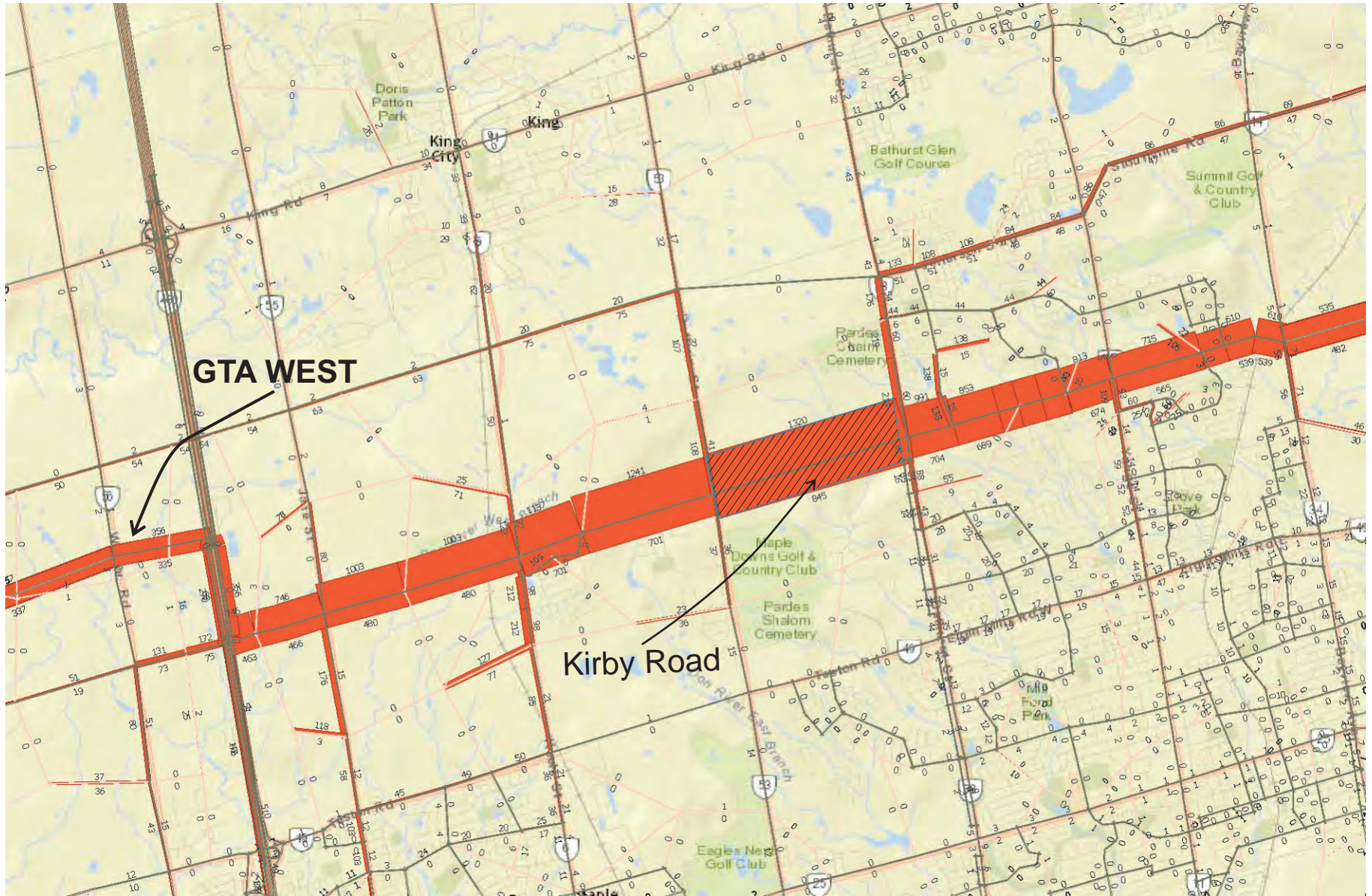
Site Entrance(s) Am Peak Hour



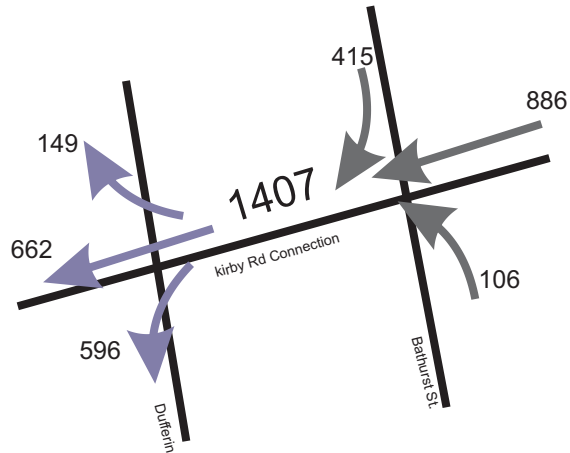
Site Entrance(s) PM Peak Hour

Not To Scale

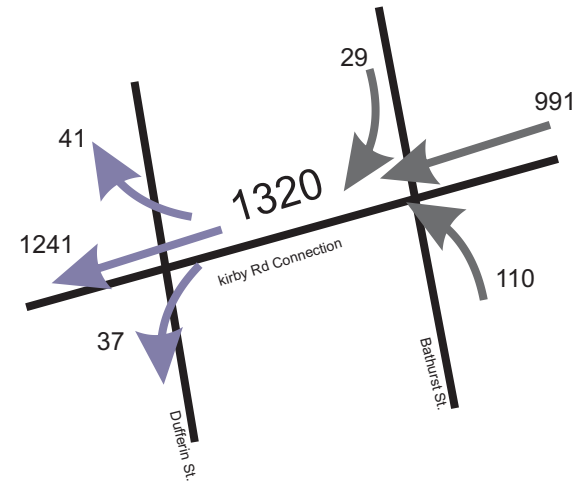




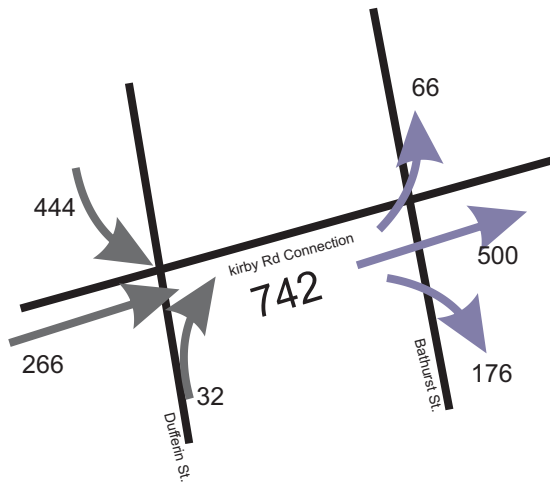
2021 AM Peak Hour Westbound Volumes on Kirby Road Connection



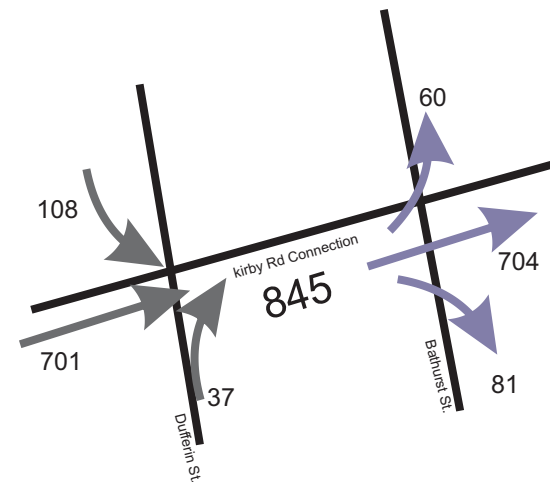
2031 AM Peak Hour Westbound Volumes on Kirby Road Connection (with GTA West)



2021 AM Peak Hour Eastbound Volumes on Kirby Road Connection



2031 AM Peak Hour Eastbound Volumes on Kirby Road Connection (with GTA West)



2031 Kirby Select Link - with Kirby no GTA West



YRTDE Model-2031_Jun-2016 (1./EMME/Projects/DC Study/Model-2031_June-2016/emmebank)

Scenario 3010: cp3000, with Kirby ext. no GTA West

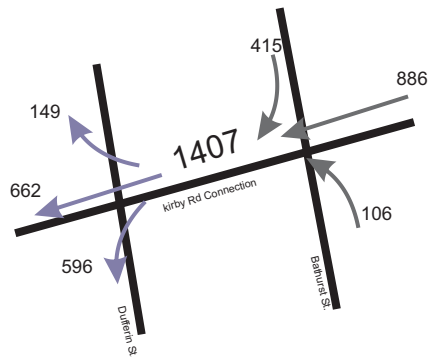
2018-07-26



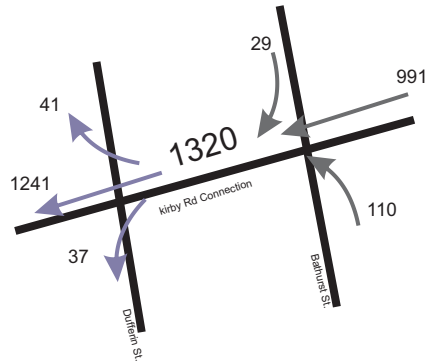
Accumulated
Total Traffic Flow
Am Peak Hour

2031 Selected Link analysis
(Without GTA West Connection)
Figure 19A

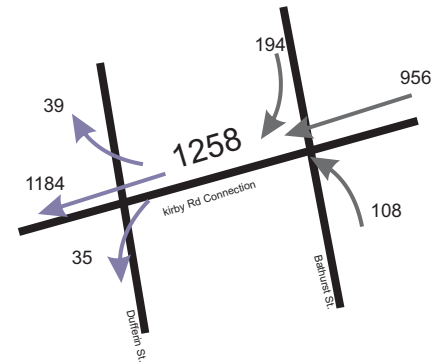
2021 AM Peak Hour Westbound Volumes on Kirby Road Connection



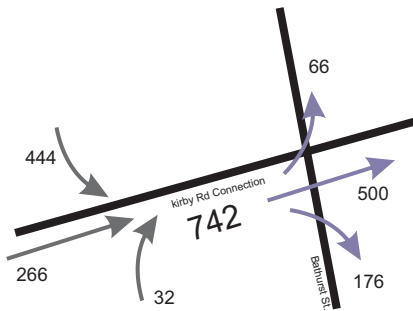
2031 AM Peak Hour Westbound Volumes on Kirby Road Connection (with GTA West)



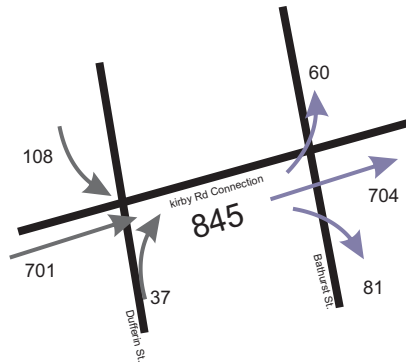
2031 AM Peak Hour Westbound Volumes on Kirby Road Connection (with NO GTA West)



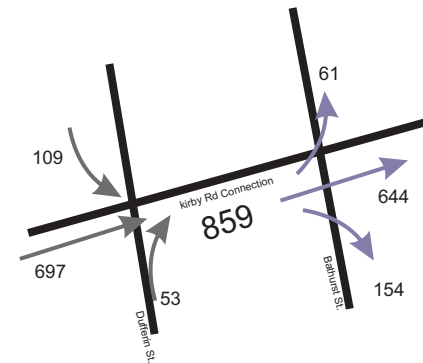
2021 AM Peak Hour Eastbound Volumes on Kirby Road Connection



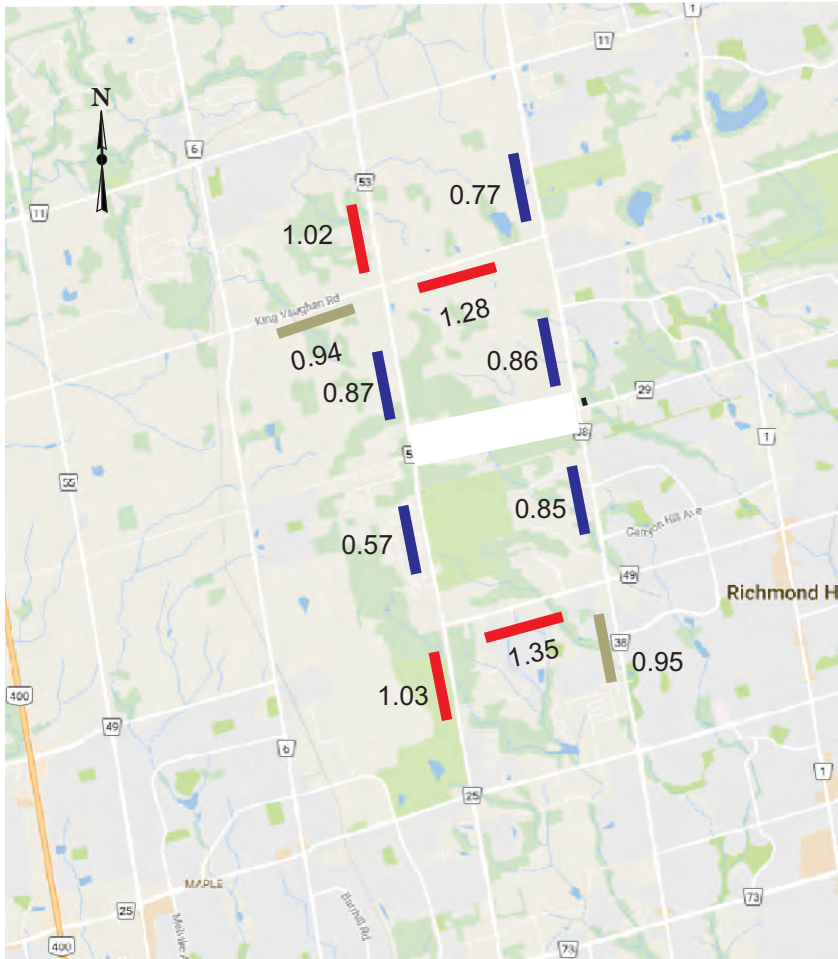
2031 AM Peak Hour Eastbound Volumes on Kirby Road Connection (with GTA West)



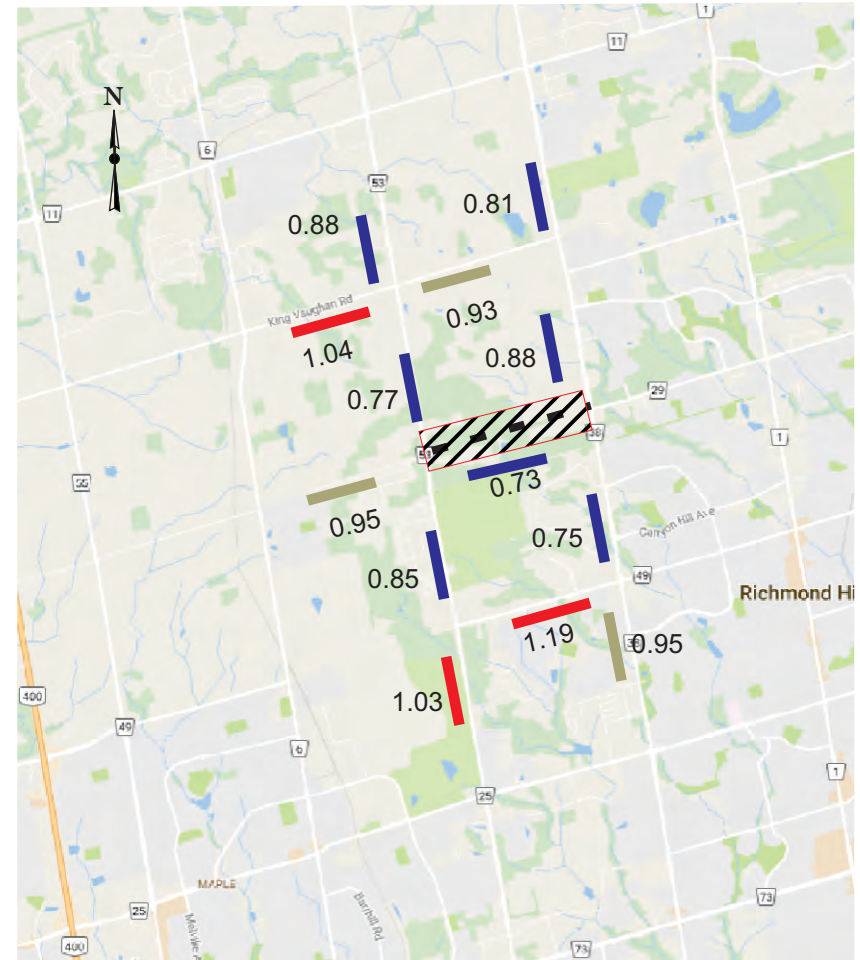
2031 AM Peak Hour Eastbound Volumes on Kirby Road Connection (with NO GTA West)



No Kirby Road Connection

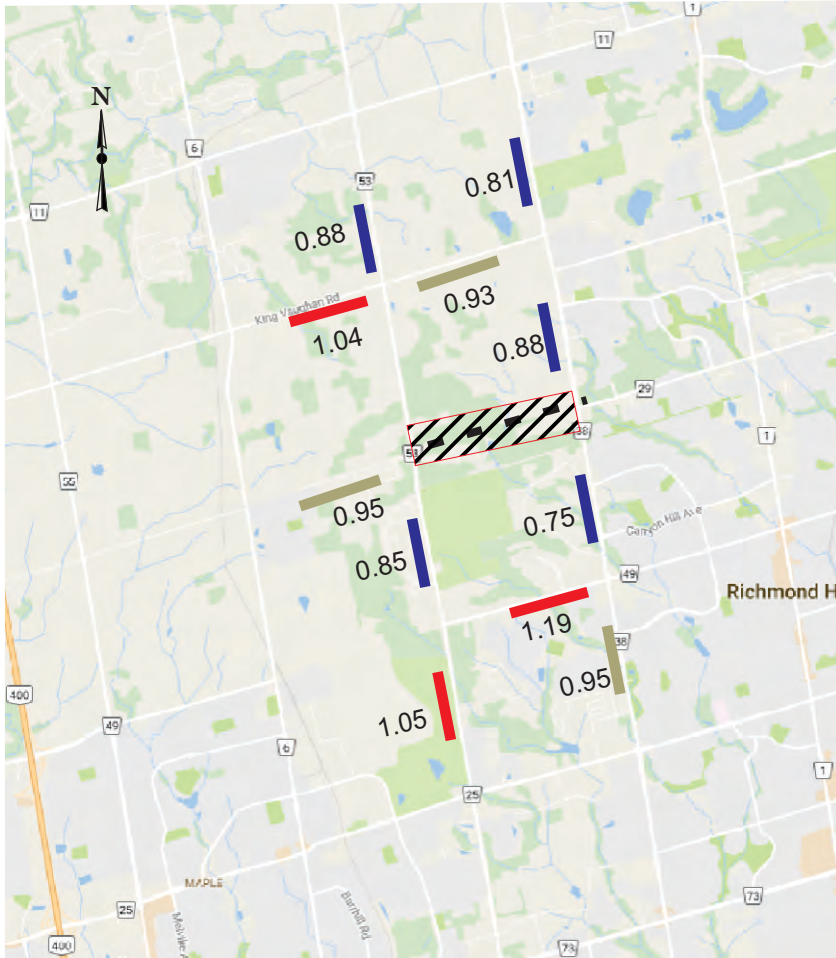


With Kirby Road Connection

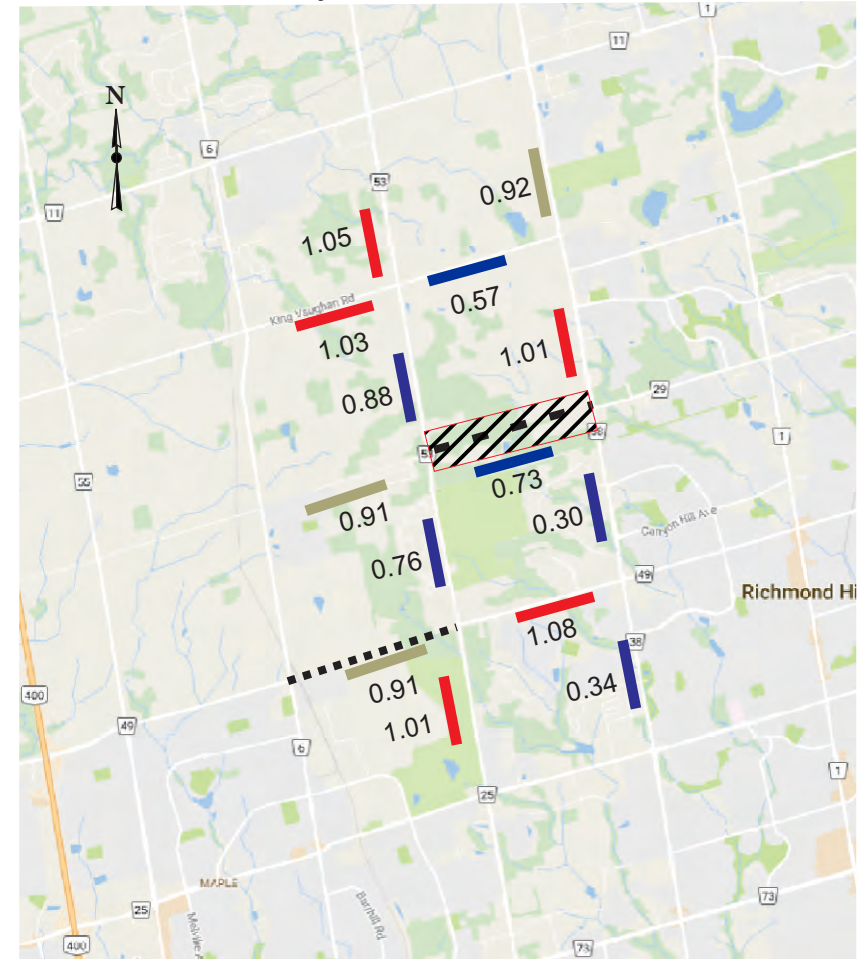


Kirby Road Segment

2021 Volume/Capacity With Kirby Road Connection



2031 Volume/Capacity With Kirby Road Connection & GTA West



XX V/C Ratio

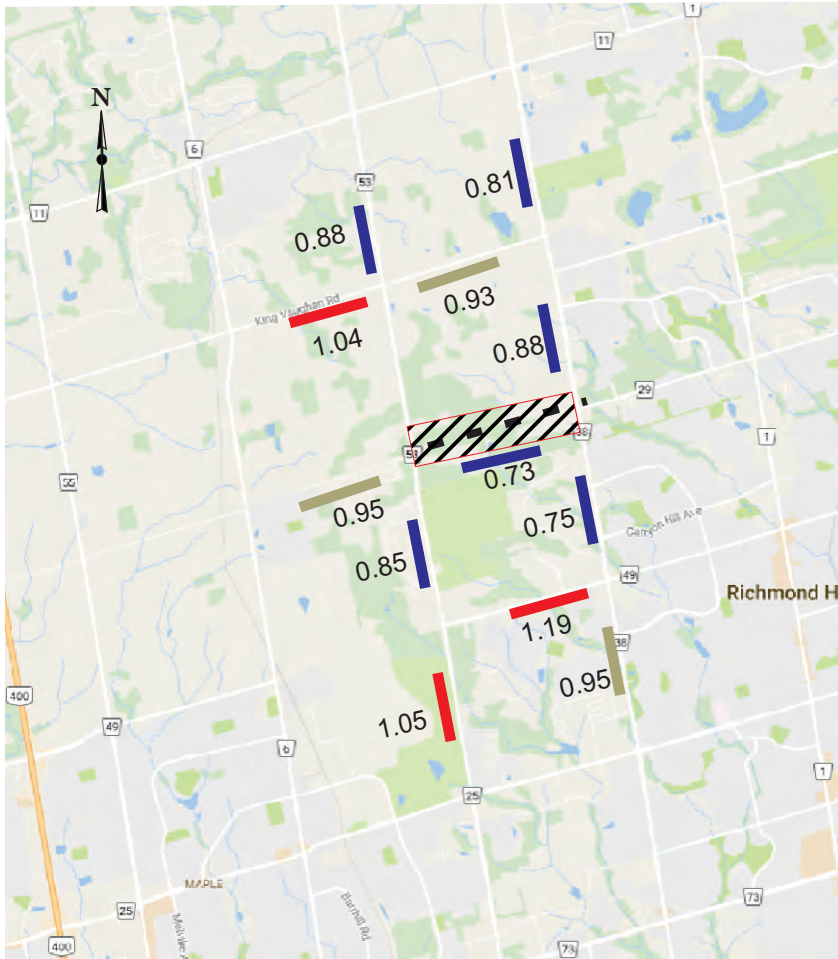


Kirby Road Segment

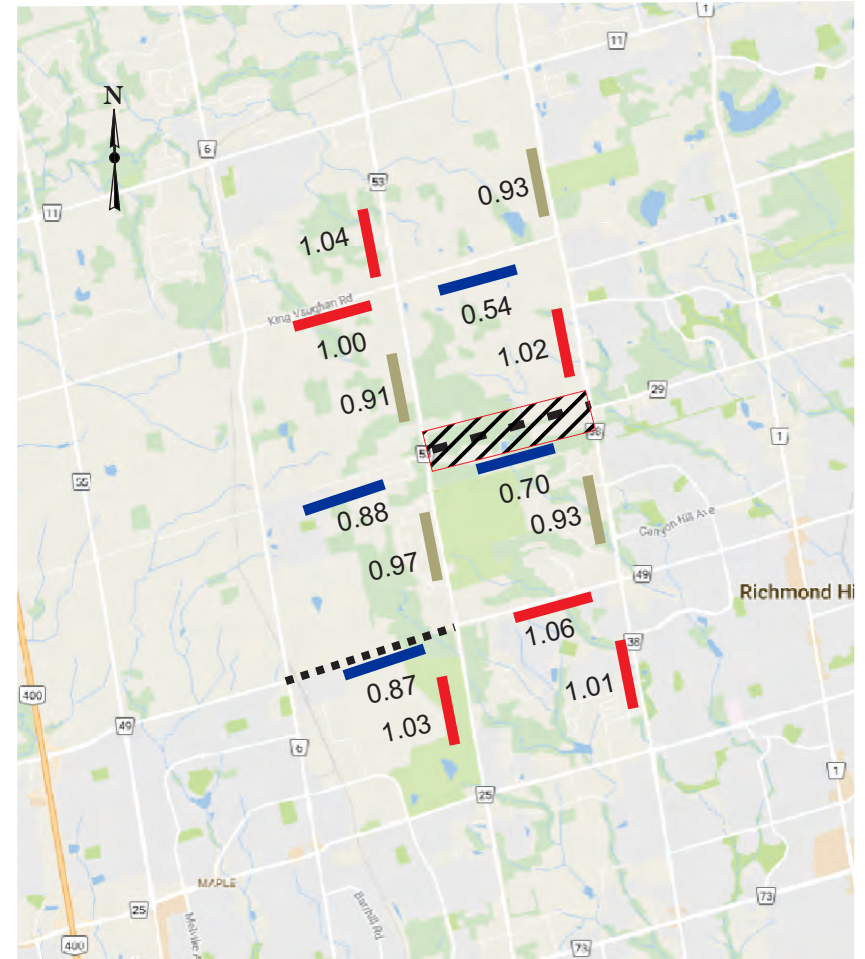
- Planned Connecting Link
- █ Road Section with Volume/Capacity Ratio Exceeds 1.0
- █ Road Section with Volume/Capacity Ratio Exceeds 0.9 Less than 1.0
- █ Road Section with Volume/Capacity Ratio Less than 0.9

Comparison of 2021 and 2031
Volumes/Ratios -Peak Direction
(AM Peak Hour - with GTA West)
Figure 21

2021 Volume/Capacity
With Kirby Road Connection



2031 Volume/Capacity
With Kirby Road Connection & without GTA West



XX V/C Ratio



Kirby Road Segment

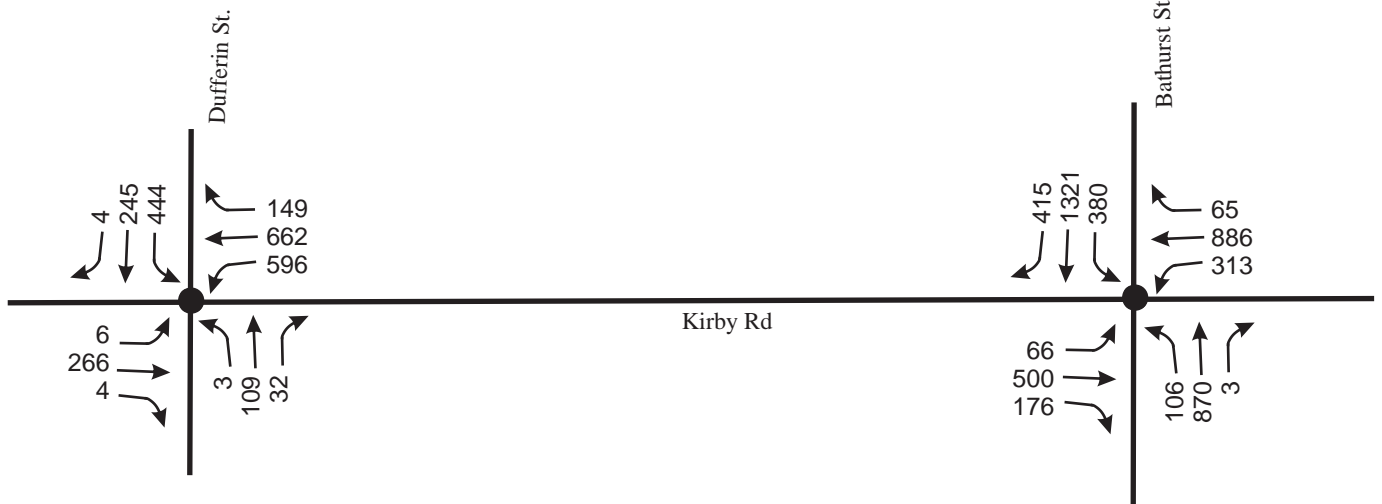


- Planned Connecting Link
- █ Road Section with Volume/Capacity Ratio Exceeds 1.0
- █ Road Section with Volume/Capacity Ratio Exceeds 0.9 Less than 1.0
- █ Road Section with Volume/Capacity Ratio Less than 0.9

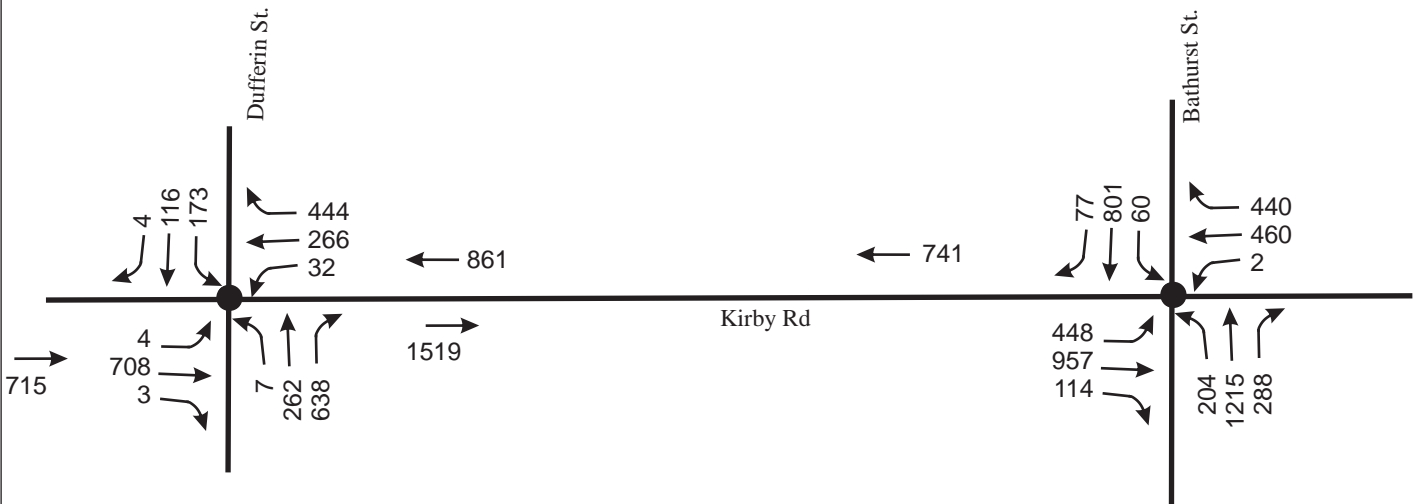
Comparison of 2021 and 2031
Volumes/Ratios -Peak Direction
(AM Peak Hour - No GTA West)
Figure 21A



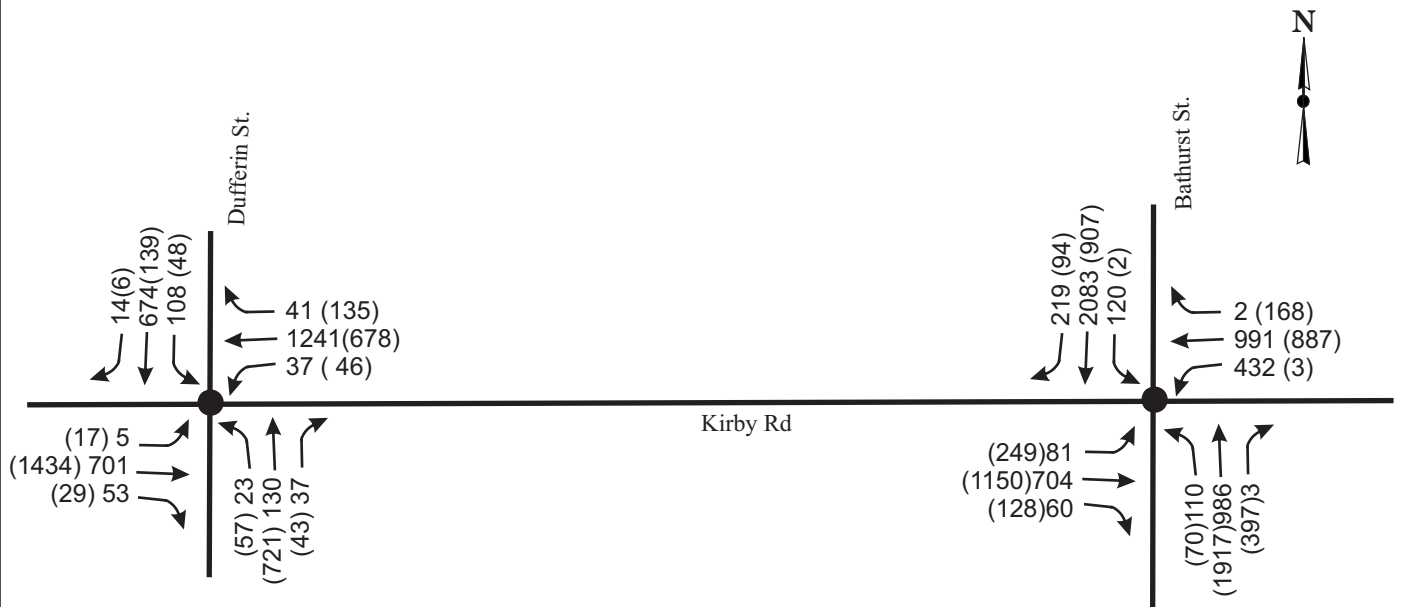
AM



PM

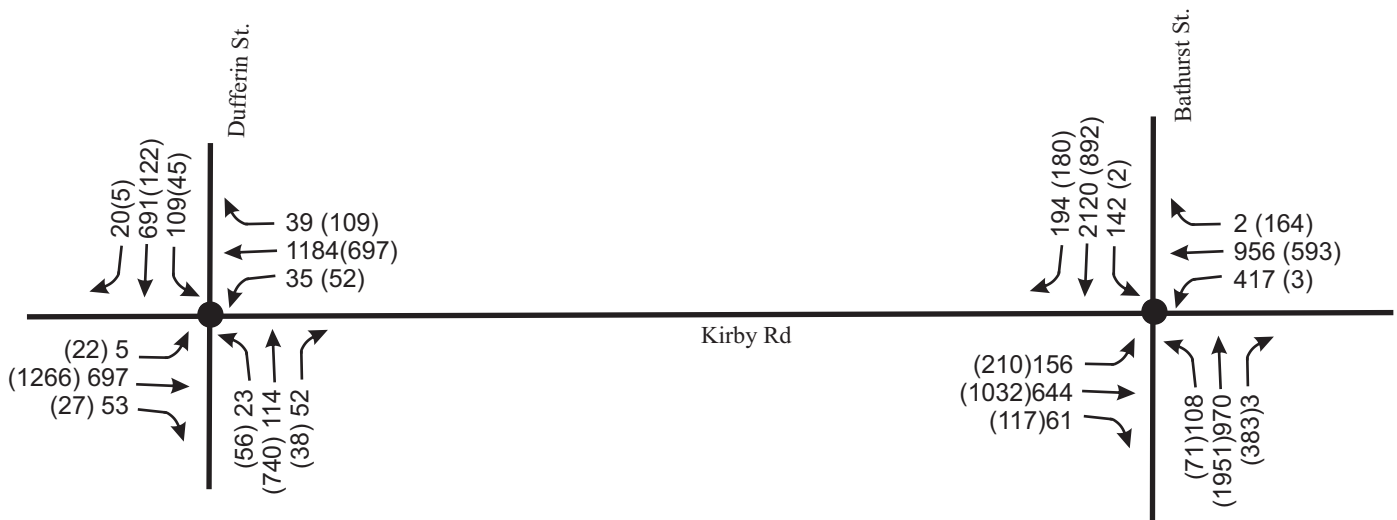


Not To Scale



AM (PM) Turning Volumes - with GTA West

AM Volumes - Derived from EMMII Selected Link 2031 Output
PM Volumes - Derived from AM Reversed Flow adjusted with Existing AM/PM Flow Ratio Where Applicable)



AM (PM) Turning Volumes - without GTA West

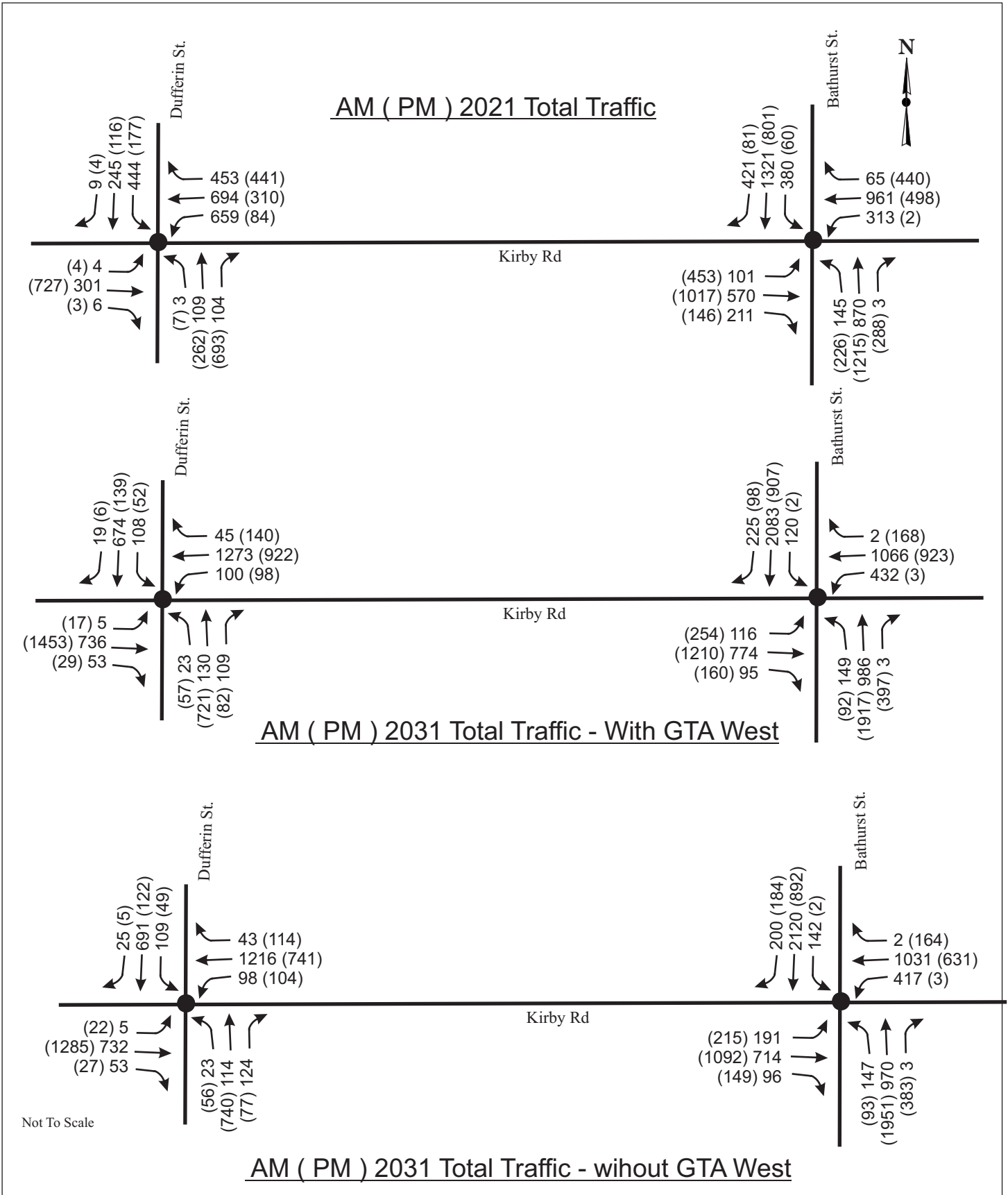
AM Volumes - Derived from EMMII Selected Link 2031 Output
PM Volumes - Derived from AM Reversed Flow adjusted with Existing AM/PM Flow Ratio Where Applicable)

Legend
xx (yy) AM (PM) Traffic Volumes

Not To Scale



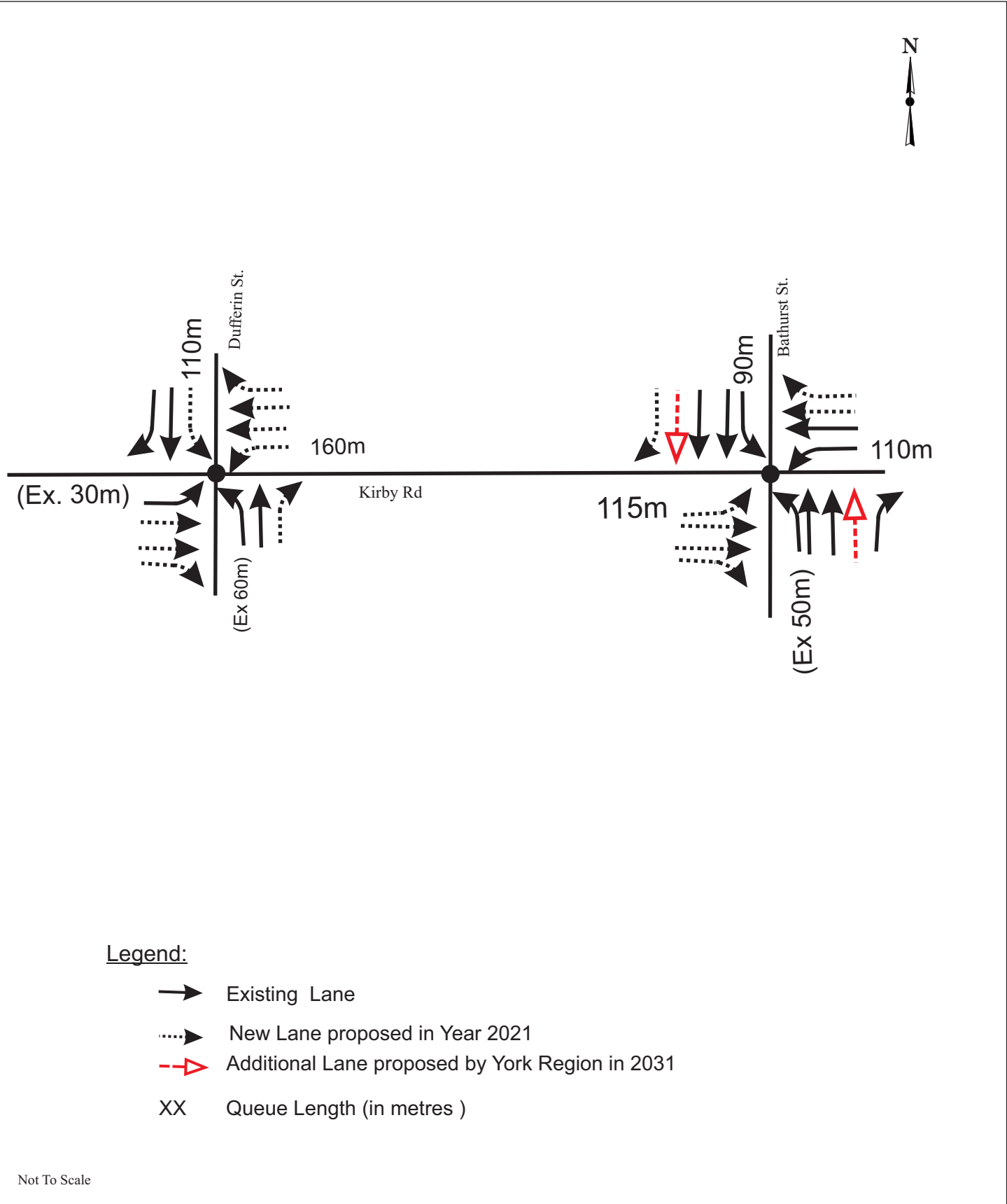
Forecast 2031 Background Vehicle Traffic Flow
with and without GTA West - AM (PM) Peak Hours
Figure 23



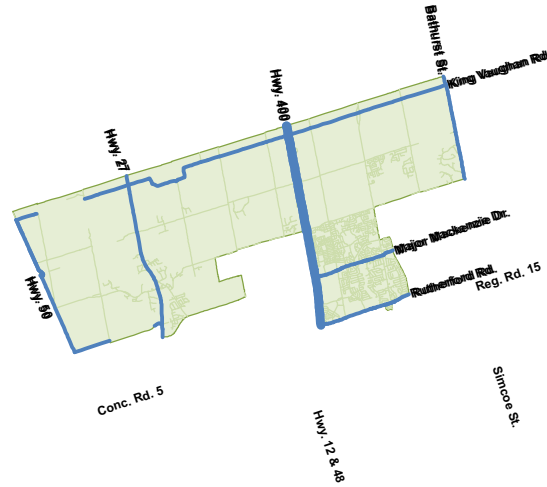
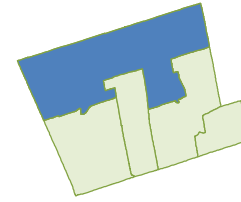
Legend
xx (yy) AM (PM) Traffic Volumes

Total 2021 and 2031 Traffic Volumes

Figure 24



CITY OF VAUGHAN WARD 1



HOUSEHOLD CHARACTERISTICS																		
Households	Dwelling Type			Household Size					Number of Available vehicles					Household Averages				
	House	Townhouse	Apartment	1	2	3	4	5+	0	1	2	3	4+	Persons	Workers	Drivers	vehicles	Trips/day
18,300	80%	10%	10%	9%	22%	21%	29%	18%	4%	29%	49%	13%	5%	3.3	1.9	2.2	1.9	7.1

POPULATION CHARACTERISTICS																		
Population	Age							Daily Trips per Person (age 11+)	Daily Work Trips per Worker	Population	Employment Type			Student	Licenced	Transit		
	0 - 10	11 - 15	16 - 25	26 - 45	46 - 64	65+	Median				Full Time	Part Time	At Home					
											Male			Female				
											29,300	45%	7%	5%	29%	70%	8%	
61,100	13%	9%	15%	28%	25%	10%	37.6	2.5	0.75	31,800	33%	12%	3%	28%	64%	7%		

TRIPS MADE BY RESIDENTS OF CITY OF VAUGHAN - WARD 1																
Time Period	Trips	% 24 hr	Trip Purpose				Mode of Travel						Median Trip Length (km)			
			HB-W	HB-S	HB-D	N-HB	Driver	Pass.	Transit	GO Train	Wlk & Cy	Other	Driver	Pass.	Transit	GO Train
6-9 AM	34,400	26.4%	43%	25%	22%	11%	63%	15%	6%	3%	7%	5%	8.6	3.1	17.5	25.3
24 Hours	130,100		32%	15%	38%	15%	68%	17%	6%	2%	4%	3%	7.4	4.7	11.1	25.1

TRIPS TO CITY OF VAUGHAN - WARD 1																
Time Period	Trips	% 24 hr	Trip Purpose				Mode of Travel						Median Trip Length (km)			
			Work	School	Home	Other	Driver	Pass.	Transit	GO Train	Wlk & Cy	Other	Driver	Pass.	Transit	GO Train
6-9 AM	18,600	19.4%	32%	30%	10%	28%	62%	18%	3%	*	11%	6%	3.6	1.7	2.8	*
24 Hours	96,300		10%	6%	57%	27%	68%	18%	5%	1%	6%	3%	6.1	3.7	10.0	25.4

Appendix A

Excerpts from Appendix I of the Transportation Master Plan



Satisfying Municipal Class EA Requirements

An important component of the Vaughan Transportation Master Plan (TMP) is fulfilling the requirements of the Municipal Class Environmental Assessment (EA) process to comply with the Environmental Assessment Act, a provincially legislated document governing all public undertakings that have the potential to affect the environment. The Municipal Class EA master planning process recognizes a framework for planning associated with Master Plans that integrate infrastructure requirements for existing and future land use with environmental assessment planning principles.

The Municipal Class EA process consists of five general phases, depending on the complexities of the undertaking. At a minimum, Master Plans address Phases 1 and 2 of the Municipal Class EA process which comprise:

- ▶ **Phase 1 – Problem or Opportunity:** Identify the problem, deficiency or opportunity and develop a clear statement of the issues that are to be addressed; and,
- ▶ **Phase 2 – Alternative Solutions:** Identify the reasonable alternative solutions that could be implemented to address the issues. Establish the preferred solution based on an assessment of the environmental impact, including consideration of stakeholder input.

Depending on the project timing and the scope and complexity of the related environmental impacts, Phases 1 and 2 may have to be revisited as individual projects are examined.

Projects are categorized into different schedules (A, A+, B or C) based on their level of complexity and anticipated environmental effects. Projects identified in the Vaughan TMP are primarily classified as Schedule B or Schedule C undertakings, described as follows:

1. **Schedule B** projects generally include improvements and minor expansions to existing facilities. These projects have some potential for adverse environmental impacts, and consultation with those who may be affected is required. Examples of Schedule B projects include the installation of traffic control devices, or smaller road-related projects. These kinds of projects require only the completion of Phases 1 and 2 of the Class EA process.
2. **Schedule C** projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the Class EA document. Examples of Schedule C projects typically include new roads or road-widenings. In addition to fulfilling the requirements of the first two phases of the Municipal Class EA process, Schedule C undertakings also require the need to complete:
 - ▶ **Phase 3 – Alternative Design Concepts for the Preferred Solution:** Identify alternative designs for the preferred solution and their potential effects on the environment, evaluate the alternative designs and select and confirm a preferred solution.



- ▶ **Phase 4 – Environmental Study Report (ESR):**
Complete the ESR which documents the study process.
- ▶ **Phase 5 – Implementation:**
Complete the contract drawings, proceed to construction and operation and monitor for environmental provisions and commitments.

It is within this master planning context that the Vaughan TMP addresses Phases 1 and 2 of the Municipal Class EA requirements of identified individual and/or grouped local road improvement projects. These projects will improve connections to local and Regional infrastructure, improve access to future residential developments, support transit-oriented nodes and corridors, and enhance transit ridership, cycling and walking. **Exhibit 1** illustrates these individual and/or grouped projects and is followed by a summary of each outlining the project purpose, description, justification, potential effects, alternatives considered and conclusions. Cost estimates are approximate only based on similar projects elsewhere or per unit averages.

Generally all projects are growth-related and will be eligible for Development Charge funding. A more detailed review of development charge funding eligibility will be completed as part of the City's Development Charges Update / Background Study.

Summaries for the following projects, for which the City of Vaughan has some or all responsibility and for which environmental studies have not already begun, are included in this appendix:

List of Project EA Summaries

1. Highway 7/Highway 400 Interchange Modifications
2. Creditstone Road Widening
3. Colossus Drive Extension Across Highway 400
4. Portage Parkway Widening and Easterly Extension to Creditstone Road
5. Vaughan Metropolitan Centre Collector Road Network
6. Huntington Road Improvements
7. McGillivray Road Improvements
8. West Vaughan Employment Area Collector Road Improvements
9. Highway 400 North Employment Lands Collector Road Network
10. Kleinburg/Nashville Focus Area Collector Roads
11. Kirby Road Improvements (Bathurst Street to Keele Street)
12. King-Vaughan Road Widening
13. Snidercroft Road Extension and Railway Grade Separation
14. Jog Elimination at Pine Valley Drive and Kirby Road Intersection

Figure A 2

Kirby Road Improvements

Purpose: To serve future Highway 400 North employment area and support provision of enhanced pedestrian / cycling infrastructure; improve network continuity and the effectiveness of the existing network.

Project Description

Name	• Kirby Road Extension/Widening
Project Limits	• West of Keele Street to Bathurst Street
Length	• 4.5 km
Project Type	• New 4-lane roadway between Bathurst and Dufferin Streets; Roadway widening to 4 lanes between Dufferin and Keele Streets; railway grade separation west of Keele Street
Proposed Phasing	• 2021 – 2031
Cost	• \$19.5 M, including railway grade separation west of Keele Street

Project Location and Environmental Features



Justification:

- These are strategic road improvements needed to enhance network connectivity and the effectiveness of existing network, including for pedestrian and cycling modes. Corridor deficiency analysis indicates that the Kirby Road corridor will be approaching capacity and will need to be improved given its proximity to the urbanized area and its potential to serve east-west travel oriented to the future Highway 400 North employment area.

Alternatives Considered

- | | |
|----------------|---|
| Transit | • Improved transit services in the Kirby Road corridor are not warranted given that the immediate area is not being proposed for urbanization. |
| Roads | • Regional road improvements along King Vaughan Road and Teston Road were considered in the corridor needs analysis, and have also been incorporated into the recommended TMP road network. |

Potential Socio-economic and Environmental Impacts: This project is within the Green Belt, and will therefore impact portions of the natural heritage network, requiring further environmental assessment and appropriate mitigation measures. Also, the residential areas located south of Kirby Road may be impacted by adverse effects from increased traffic flow requiring suitable mitigation measures to be considered.

Conclusion: This and other corridor improvements will be required by 2031, with some being required by 2021. Further study with the Region is needed to determine the sequence of corridor improvements. The requirement for additional improvements to Highway 400 should be assessed in the context of the Region's Mid York East-West study and the GTA West Corridor in the vicinity of Highway 400. Recommended for Phase 3 and 4 EA Study.

Appendix B

Levels Service Definition

Highway Capacity Manual, 2000

Signalized intersection level of service (LOS) is defined in terms of the average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Specifically, LOS criteria are stated in terms of average delay per vehicle during a specified time period (for example, the PM peak hour). Vehicle delay is a complex measure based on many variables, including signal phasing (i.e., progression of movements through the intersection), signal cycle length, and traffic volumes with respect to intersection capacity. Table 1 shows LOS criteria for signalized intersections, as described in the *Highway Capacity Manual* (Transportation Research Board, Special Report 209, 2000).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (sec/veh)	General Description (Signalized Intersections)
A	≤10	Free Flow
B	>10 - 20	Stable Flow (slight delays)
C	>20 - 35	Stable flow (acceptable delays)
D	>35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 - 80	Unstable flow (intolerable delay)
F	>80	Forced flow (jammed)

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop-controlled and two-way stop-controlled. All-way, stop-controlled intersection LOS is expressed in terms of the average vehicle delay of all of the movements, much like that of a signalized intersection. Two-way, stop-controlled intersection LOS is defined in terms of the average vehicle delay of an individual movement(s). This is because the performance of a two-way, stop-controlled intersection is more closely reflected in terms of its individual movements, rather than its performance overall. For this reason, LOS for a two-way, stop-controlled intersection is defined in terms of its individual movements. With this in mind, total average vehicle delay (i.e., average delay of all movements) for a two-way, stop-controlled intersection should be viewed with discretion. Table 2 shows LOS criteria for unsignalized intersections (both all-way and two-way, stop-controlled).

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (sec/veh)
A	0 - 10
B	>10 - 15
C	>15 - 25
D	>25 - 35
E	>35 - 50
F	>50