

Final Report

Grand River Street North Corridor Transportation Study



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1 Introduction

IBI Group has been retained by the County of Brant to review the Grand River Street North corridor and provide recommendations to improve traffic operations and safety and better accommodate pedestrians and cyclists. The corridor is located within the community of Paris, which is experiencing strong growth from several development areas including two large proposed subdivision developments along the corridor, as well as regional background traffic growth. The recommended long-term solution detailed in the County of Brant's Transportation Master Plan is for a bypass to divert traffic, however a bypass remains a long-term plan.

Additionally, in support of the new developments, the County is moving forward with the installation of a new watermain and upgrades to the sanitary sewer and stormwater management system along Grand River Street North. Thus, there is an opportunity to reduce overall construction costs by coordinating construction between projects.

This study presents a transportation study of the road corridor and improvement alternatives to accommodate the projected traffic growth and enhance future corridor operations for all modes of transportation.

1.1 Study Area

The study area determined in consultation with the County of Brant and is bounded by St Patrick Street to the south and Watt's Pond Road to the north along Grand River North as shown further on in Exhibit 2-1. The corridor has mainly a mix of residential and retail developments, most with direct access to the roadway. The roadway serves as the main north - south corridor through the community, and is used by background traffic to access Highway 403, south of Paris and Waterloo Region north of Paris.

1.2 Objective and Scope

The objective of the study is to provide input into alternative road concepts due to planned growth along and near the corridor. The study assesses the existing operating conditions of Grand River Street North, develops alternatives for potential improvements, and provide recommendations for corridor improvements. Considerations for better pedestrian access, particularly the area around Paris District High School near Paris Links Road, as well as truck diversion was undertaken with input from the County of Brant. The existing year for analysis was 2016 with a future horizon of 2031.

1.3 Prior Studies

A number of prior studies have considered growth and development in the corridor and form the need and basis of the current study. Prior studies that have been done within the study area include the following, and the results have been incorporated into this study.

County of Brant Transportation Master Plan Update (IBI Group, January 2016) - IBI Group prepared the update to the Master Plan (TMP) in 2016. It included updates to the transportation demand model, aggregate guide and other items.

As part of the TMP update in 2016, a travel demand assessment was completed to assess the operational effects of a truck by-pass referred to as the east or Green Lane bypass. The bypass would provide an alternate and more direct route for traffic going to and coming from Highway 403 to the south without passing through downtown Paris and Grand River Street North. Furthermore, it allows traffic from the south to by-pass Paris to head north to the Region of Waterloo. The conceptual alignment of this bypass is shown in Exhibit 1-1. The assessment also

focused on new developments within Paris, and the overall impacts of both the development traffic and a bypass. The study found that there would be approximately 30% traffic diversion from Grand River Street North and South with the implementation of the bypass.

Exhibit 1-1: Conceptual East Bypass Alignment, IBI Group's Transportation Master Plan Update, March 2016



Paris on the Grand Transportation Impact Study (Paradigm Transportation Solutions Limited, January 2013) - This study completed by Paradigm Transportation Solutions Limited (PTSL) in 2013 presented the impacts of the proposed residential development to be built on the current Paris Grand Golf and Country Club on Paris Links Road. Future horizons of 2017 and 2022 were provided for the 412 low density residential developments, which included 290 single family detached and 122 townhouses. Intersections on Grand River Street North that were analyzed include Watt's Pond Road, Scott Avenue, and Silver Street. Exhibit 1-2 illustrates the site map.

The study recommended expanding Grand River Street North to a five lane cross section with a centre two-way left-turn lane between north of Bradbury Crescent and south of St Patrick Street, as well as considering aligning Paris Links Road as an east leg to the intersection of Silver Street and Grand River Street North.

Further analysis was completed in September 2014 by PTSL as requested by the County of Brant due to concern over poor operations at Paris Links Road and Grand River Street North. The analysis included additional data collected in June 2014 when the local high school was in session. New recommendations indicate an installation of a northbound right turn (NBR) storage lane (45 metres) at the intersection of Paris Links Road and Grand River Street North, as well as considerations of a future alignment of Paris Links Road as an east leg to either the intersection of Silver Street and Grand River Street North or Capron Street and Grand River Street North.

Exhibit 1-2: Paris on the Grand Site, GSP Group's Paris Grand Golf Club Area Study, October 2011



A peer review of the Paris on the Grand TIS was conducted by Ainley Group on behalf of the County of Brant on July 2016. Ainley Group presented disagreements toward PTSL's proposal of revisions to the pavement markings at the Grand River Street North and Paris Links Road intersection as unacceptable delays were expected with the addition of development-generated trips. The following issues at the intersection of Grand River Street North and Paris Links Road were discussed between the County of Brant, Ainley Group, and PTSL in September 2016:

- The County of Brant is not accepting any solution where the westbound approach resulted in LOS F despite acceptable volume-to-capacity (v/c) ratios;
- There is potential northbound queue spillback from Silver Street blocking Paris Links Road; and
- A signalization analysis shows no improvements to the Silver Street signal;

There are other potential alternatives to solve the issues at Paris Links Road and Grand River Street North under consideration in the ongoing studies by PTSL. Given the context of this development, this report comments on the impacts of potential alternatives on Grand River Street North. Alternative analysis of solutions for Paris Links Road is expected to be completed as part of this developments transportation study.

Northwest Paris Secondary Plan Area Transportation Impact Study (February 2012) - The Northwest Paris study also completed by PTSL in 2012 presented impacts of the proposed mixed use land use development bounded by Watt's Pond Road to the north, Pinehurst Road to the east, Scott Avenue to the south and wetlands to the west. The proposed development will primarily be low density residential homes (528 units) along with townhouses (85 units), medium density homes (276 units), offices, and other commercial purposes. Intersections on Pinehurst Road / Grand River Street North that were analyzed include Watt's Pond Road, Woodslee Avenue, Scott Avenue, Trillium Way, Silver Street and Paris Links Road. Exhibit 1-3 shows the subject site of the originally proposed development in Northwest Paris.

Exhibit 1-3: Northwest Paris Site Map, PTSL's Northwest Paris TIS, February 2012



During the a.m. peak, existing conditions at the mentioned intersections were operating at satisfactory levels. Total future conditions in 2022 showed acceptable operation levels apart from eastbound movements at the intersection of Woodslee Avenue and Pinehurst Road. Delays were most notably seen coming from west of Pinehurst Road / Grand River Street North due to the new development.

Existing conditions at the p.m. peak also show acceptable levels of operations. 2022 total conditions showed LOS F in the northbound approach at Paris Links Road and Grand River Street North, eastbound approach at Woodslee Avenue and Pinehurst Road and both northbound and eastbound approaches at Watt's Pond Road and Pinehurst Road.

Recommendations based on the result of the study include installing a 30m northbound left turn lane at the intersection of Watt's Pond Road and Pinehurst Road, as well as monitoring Pinehurst Road / Grand River Street North between Watt's Pond Road and Paris Links Road to identify the potential need of future signalization at unsignalized intersections.

Ainley Group Peer Review - Ainley Group was retained by the County of Brant to conduct a peer review of PTSL's Northwest Paris TIS. The following summarizes Ainley's review on April 2014 of PTSL's responses to the original comments:

- Upgrades to existing road links near northwest Paris will be needed to match urban standards;
- The analysis of the Pinehurst Road / Woodslee Avenue intersection should be revisited after significant development occupancy to review the feasibility of an eastbound right turn lane;
- Review the traffic impact onto Grand River Street North as it is minimally mentioned and addressed only in background growth;
- Review the estimated number of trucks onto Pinehurst Road / Grand River Street North as a result of the Dufferin aggregate pit;
- Analyzing traffic impact for horizons of 15 or 20 years due to the large scale of the project. Growth rate of 1% with South West Paris Urban Expansion Area (SWPUEA) is acceptable; and
- Inclusion of detailed statistics of commercial and employment lands, parking restrictions, and pedestrian activity to more accurately analyze impact.

2 Existing Conditions

2.1 Study Area Description

The study corridor is bounded by Watt’s Pond Road to the north and St Patrick Street to the south. The full study area and aerial imagery is shown in Exhibit 2-1. The following intersections on Grand River Street North are included in the analysis:

• Watt’s Pond Road at Pinehurst Road	• Trillium Way (signalized)
• Woodslee Avenue	• Bradbury Crescent
• Scott Avenue (signalized)	• Home Building Centre/Home Hardware Access
• Sobeys Access	• Silver Street (signalized)
• Tim Hortons Access	• Parks Link Road
• McDonalds / Dollarama Access	• Capron Street
• Canadian Tire Access	• St Patrick Street (signalized)

Exhibit 2-1: Corridor Study Limits



Grand River Street North is a major north-south county road (24A) in the community of Paris within the County of Brant. Within the study area, it primarily has a 3 lane cross section, consisting of one northbound, one southbound, and one two-way left-turn centre lane. It connects Dundas Street in the south to Woodslee Avenue in the north and passes through downtown Paris. Grand River Street North and South is also the main road within Paris that provides access to large trip destinations including Highway 403 (to the Greater Toronto Area), Brantford and Cambridge. It also serves many local needs such as residential areas, a large retail strip, a hospital, and a high school. A sidewalk exists on both sides of Grand River Street North from St Patrick Street to Silver Street, where the east side continues to the McDonalds access. There is a posted speed limit of 50 km/h.

Scott Avenue is a two lane east-west local road that connects MacPherson Drive in the west to Grand River Street North in Paris. It primarily serves an industrial area and the Fairview Heights residential subdivision, with a posted speed of 50 km/h. Exhibit 2-2 shows a street view of the intersection, viewing south.

Trillium Way is a two lane east-west local road that connects Forest Drive in the west to Grand River Street North. Past Grand River Street North, it connects to Bradbury Crescent. Trillium Way serves a residential area and has a speed limit of 50 km/h.

Silver Street is a local two lane east-west road connecting Oak Avenue to Grand River Street North in the east. At the intersection with Grand River Street North, the west approach is the Camp Tekahionwake (Girl Guides of Canada) Access. Silver Street is posted at 50 km/h and serves a residential area with Paris. Exhibit 2-3 shows a street view of the intersection, viewing north.

St Patrick Street is a two lane east-west road connecting Grand River Street North to Riverview Terrace in the east. It serves Paris District High School as well as a residential area with a speed limit of 50 km/h. Exhibit 2-4 shows a simplified representation of the existing lane configuration along Grand River Street North within the study area.

2.2 Data Collection

Signal timing data and turning movements counts (TMC) were provided by the County of Brant. Some counts did not provide volumes for the a.m. peak and a field visit conducted on November 4, 2016 showed that volumes were generally low at these locations. For the McDonalds access, there did appear to be traffic during the a.m. peak hour, however the p.m. peak hour is likely to have a higher volume and as a result would be used to determine design requirements. The following is the list of intersections not assessed for the a.m. peak hour.

- Home Hardware Access
- McDonald's/Dollarama Access
- Canadian Tire Access
- Sobey's Access

Exhibit 2-2: Grand River Street North at Scott Avenue, Google Street View, Viewing South



Exhibit 2-3: Grand River Street North at Silver Street, Google Street View, Viewing Northbound



Exhibit 2-4: Existing Lane Configuration



2.4 Field Observations and County Input

A field visit was conducted during the a.m. peak hour of November 4, 2016. The corridor appeared to operate well, and the following was observed:

- Pedestrian facilities are available on the east side of the roadway, however there are several discontinuities due to multiple driveways along the corridor;
- There are high pedestrian flows during school start, lunch and end times due to the Paris District High School located at St Patrick Street and Grand River Street North;
- There are multiple conflicting accesses near Tim Hortons and Sobey's located just south of Scott Avenue, where vehicles do not have designated entrance and exit points, leading to some issues with weaving and through traffic flows. The issue appears minor at the present time, however increased through volumes on Grand River Street North would likely deteriorate the conditions;

Input was also gathered from the County of Brant to discuss preliminary concepts, issues and other considerations:

- The proposed improvements are to take advantage of synergies with other watermain, sanitary and stormwater works needed along Grand River Street North to support proposed residential developments. As a result, the long-term horizon is to be able to support traffic until a Green Lane east bypass is implemented;
- The County noted that most property owners along the corridor would be opposed to changes to their access configuration; and,
- Trucks would be required to divert at Watt's Pond Road in the future as part of a realigned Alternative 24A truck route.

2.5 Existing Traffic Conditions

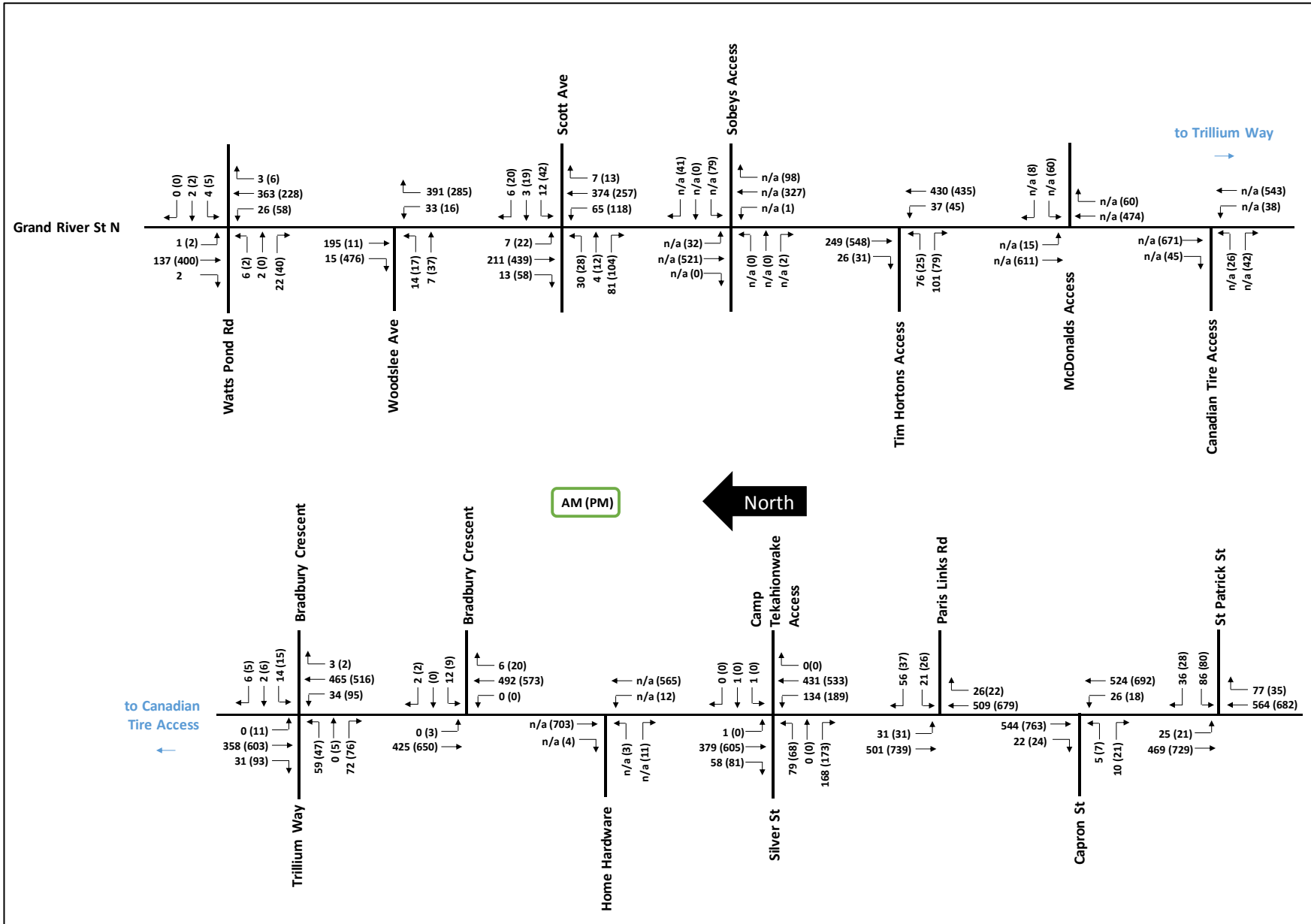
Signalized intersection operations analysis was conducted using Synchro 9, utilizing the Highway Capacity Manual (HCM) 2010 methodology to evaluate overall intersection and individual movement performances. Due to some constraints at signalized intersections, the HCM 2010 methodology in Synchro 9 does not provide adequate results, thus HCM 2000 methodology was used at the four signalized intersections. The level of service (LOS) is a measure of performance based on the control delay, defined as follows in Exhibit 2-5.

Exhibit 2-5: Intersection LOS Reference

HCM LOS	Control Delay per Vehicle (s)	
	Signalized	Unsignalized
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

The existing conditions year is 2016. Analysis was conducted for weekday a.m. and p.m. peak hours. The turning movement count at Watt's Pond Road were in the year 2015 and thus scaled to 2016 using an annual compound growth rate of one percent. Existing conditions traffic volumes can be seen in Exhibit 2-6.

Exhibit 2-6: Existing Traffic Volumes



Based on the County of Brant's Traffic Impact Study (TIS) Guidelines, critical movements were identified based on the following criteria for signalized intersections:

- Overall intersection operations of volume-to-capacity (V/C) of 0.85 or greater;
- V/C ratios of 0.95 or greater for exclusive movements; and
- Queue exceeding available storage lane.

Unsignalized intersections are to be identified based on the following:

- Individual delays of Level-of-service (LOS) "E" or worse; and
- Estimated 95th percentile queue length to exceed available storage queue.

A summary of the analysis at signalized intersections is shown in Exhibit 2-7 and Exhibit 2-8 for the a.m. and p.m. peak periods respectively. A LOS diagram of is illustrated in Exhibit 2-9 to provide a visual representation, and also operations at unsignalized side streets. Full Synchro outputs can be found in Appendix B.

Overall the corridor operates well. There are also some issues with retail accesses as some entrance/exits are not clearly defined. Furthermore, although it does not pose a traffic operations issue currently, there is some pedestrian traffic primarily generated from the high school located at Grand River Street North and St Patrick Street.

Exhibit 2-7: Existing AM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River Street N & Scott Avenue	B	0.32	n/a			
Grand River Street N & Trillium Way/Bradbury Crescent	A	0.43	n/a			
Grand River Street N & Silver Street	B	0.44	n/a			
Grand River Street N & St Patrick Street	A	0.45	n/a			

Exhibit 2-8: Existing PM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River Street N & Scott Avenue	B	0.47	n/a			
Grand River Street N & Trillium Way/Bradbury Crescent	B	0.51	n/a			
Grand River Street N & Silver Street	C	0.61	n/a			
Grand River Street N & St Patrick Street	A	0.61	n/a			

Exhibit 2-9: Existing LOS Diagram



3 Alternative Planning Solutions

While this report is not a Municipal Class Environmental Assessment, a preliminary screening of all potential transportation planning alternatives was conducted for the study corridor in accordance with Phase 2 of the Class EA process. The first step is to determine corridor capacity requirements. Feasible alternatives were developed and discussed to identify their suitability for further analysis and conceptual design, presumably as part of a full corridor improvement Class EA. This Corridor Transportation Study would be the basis for the Class EA Phase 2 Problem/Opportunity Statement.

- **Do Nothing:** This option would assume no network changes made in response to new developments and growth within the study area. Although it is not anticipated that this option would provide adequate operational service, it will be carried forward as a basis of comparison.
- **Public Transportation:** The County of Brant currently does not provide conventional transit access to the community of Paris. Many of the trip generators and attractors associated with the Paris area are low density, sparse and involve large travel distances, which limits how future transit service would be provided. For example, a private taxi operated shuttle service previously connecting Paris to the Brantford Transit was cancelled due to low usage. It is not likely that any future public transit service will accommodate corridor growth on its own and as a result, this option will not be carried forward.
- **Active Transportation:** Travel patterns within the community of Paris (as reported in the County of Brant's TMP) show trip destinations to the City of Brantford, City of Cambridge / Waterloo Region and the GTA (via Highway 403). It is not anticipated that active transportation will be a viable option for these trips due to the long travel distances involved. However, provision for active transportation as a supplementary mode is an important component of the County's TMP, to be encouraged through the implementation of sidewalks, bike lanes or multi-use-trails to provide better user comfort and convenience. As such, it is not considered a viable alternative specifically to address future Grand River Street North corridor traffic management needs, although active transportation can certainly play a role in the corridor.
- **Alternative 1 Corridor Upgrades with 3-lane cross section:** This option closely reflects the existing lane configuration with improvements north of Scott Avenue. This option would improve consistency along the corridor including provision of a consistent two way left turn lane and pedestrian facilities.
- **Alternative 2 Corridor Upgrades with 4-lane cross section:** This option would consist of an additional lane between Trillium Way and Silver Street, and restriping of the entire corridor to consist of two through lanes. This option would be the most costly of all alternatives but would provide the highest traffic capacity along the corridor.

It is also uncommon to allow left turns into multiple private accesses along a 4 lane road. Additional right of way may be required to accommodate left turn lanes at the various retail accesses along the corridor, with a median to control left turns at specific locations only. For the purposes of this assessment, it was assumed that existing accesses maintain their left turn inbound and outbound capabilities. Additional consideration of access treatments are discussed in Section 6.

- **Alternative 3 Corridor Upgrades with mixed 3-4 lane cross section:** This option would not provide a consistent cross-section throughout the proposed corridor. However, it would be able to limit costs by reducing the total number of lanes in areas where it is not operationally needed. The typical cross sections would be similar to the ones for a 3-lane or 4-lane cross-section depending on location. Again, left turns along

the entire corridor to private accesses may not be feasible. However, there would be an opportunity in Alternative 3 to provide a left turn lane north of Trillium due to a reduction in through lanes, and thus allowing service for the majority of the retail plazas along the corridor.

A conceptual corridor plan provided by the County of Brant showing Alternative 1 and 2 had a southern limit of Silver Street. It is assumed for the purposes of the analysis that from Silver Street to St. Patrick Street, the road cross section would remain consistent with the rest of the corridor. Further detailed analysis of the Silver Street, Paris Links Road and St. Patrick Street intersections was completed to determine alternative solutions to existing side street alignments. It was determined based on an initial screening that four of the alternatives warranted further analysis in order to determine corridor capacity requirements as follows:

- **Do Nothing:** Will not be recommended due to anticipated incapability of providing efficient operational service but will provide basis of comparison
- **Alternative 1 – 3 Lane Cross Section:** Low cost alternative that provides small improvements to operations and pedestrian facilities.
- **Alternative 2 – 4 Lane Cross Section:** High cost alternative that provides the best operations and consistency along the entire corridor.
- **Alternative 3 Mixed 3-4 Lane Cross Section:** Provision of additional lanes only where required, but does not provide a consistent cross-section throughout the corridor.

Active transportation was not explicitly assessed due to the likelihood of low initial mode-share changes. However facilities for active transportation should be considered during the design stage to ensure that the future corridor will provide adequate pedestrian and cycling facilities in the long-term. Furthermore, pedestrian and cycling facilities would provide safer travel for non-commuter traffic in the area such as students.

4 Future Traffic Conditions

4.1 Traffic Forecasts

4.1.1 Background Traffic Growth

A regional travel demand model in the TransCAD platform was developed by IBI Group in 2014 as part of the County of Brant's Transportation Master Plan update. The purpose of the model was to develop and assess traffic growth in various areas in the County and assess long-term transportation strategies. While the model was calibrated, it is not meant to be a microscopic representation of roads in Paris. As a result, the model was used to inform background growth along the Grand River Street North corridor, and additional developments are considered explicitly.

The model scenario used to develop background growths does not include the Green Lane bypass. In order to develop traffic growth, the following steps were taken to get to the results shown in Exhibit 4-1:

- Determine difference between corridor traffic in 2031 and 2011 at 3 intersections;
- Interpolate to determine growth from 2016 to 2031 (75% of total);
- Develop a.m. to p.m. ratio based on existing counts at selected locations; and
- Apply a.m. to p.m. ratios to develop p.m. peak hour traffic growth;

Exhibit 4-1: 2016-2031 AM Model Corridor Growth

Cross Street	2011 AM Traffic		2031 AM Traffic		2016-2031 AM Growth		2016-2031 PM Growth	
	NB	SB	NB	SB	NB	SB	NB	SB
North of Watt's Pond Road	439	489	576	638	103	112	65	324
North of Silver Street	469	536	608	707	104	128	123	201
North of St Patrick Street	472	548	570	690	74	107	87	162

The a.m. and p.m. growths shown in Exhibit 4-1 are then distributed through the network based on the existing counts. This growth was added directly to existing volumes to obtain future 2031 background traffic volumes.

The proposed Green Lane extension / Paris bypass would provide relief to the growing congestion occurring on Grand River Street North and South through Paris, with diversion particularly in truck traffic. The impacts of the extension were previously analyzed as part of the County's Transportation Master Plan and thus was not reassessed in this study. As the extension is a long term plan of the County's, this study instead addresses operational deficiencies along Grand River Street North in the time horizon until such a bypass is completed.

4.1.2 Future Development Traffic

Several developments are expected within the Paris community within the horizons of this traffic study. They will contribute significant traffic volumes onto Grand River Street North. Currently there are 4 proposed developments at various stages in the planning process. Two traffic studies were provided by the County of Brant to assist with development of future traffic growth. In addition, the other two development site statistics were provided, and estimated based on ITE trip generation rates.

Northwest Paris - The North West Paris development is a mixed residential/employment within the Paris community consisting of 889 residential units, of which 412 are currently being planned for construction. It also includes office and commercial land uses, estimated to be approximately 5,425 m² and 16,825 m² respectively. The new subdivision development will have access to Pinehurst Road / Grand River Street North via Woodslee Avenue as well as the new east-west collector road Street 'A' (to be known as Hartley Avenue) north of Woodslee Avenue. Volumes from the traffic study for this development were used and included the intersections at Watt's Pond Road, Street 'A', Woodslee Avenue, Scott Avenue, Trillium Way, Silver Street, and Paris Links Road. These volumes were extended along Grand River Street North to all intersections and assumed to only affect through movements. Future volumes generated by this development can be seen in Exhibit 4-5.

Paris on the Grand - Paris on the Grand is a proposed residential subdivision to replace the Paris Grand Golf and Country Club on both sides of Paris Links Road, east of Grand River Street North. The site location is illustrated in Exhibit 1-3. Approximately 400 residential units are expected to be built. Exhibit 1-2 shows the proposed site location of the Paris on the Grand subdivision. Site generated traffic was obtained from PTSL's Paris on the Grand Transportation Impact Study for the intersections of Watt's Pond Road, Scott Avenue, Silver Street, and Paris Links Road, as shown in Exhibit 4-4. These volumes were extended along Grand River Street North to all intersections and were assumed to only affect through movements.

Other Developments - Two other developments are planned within north Paris, currently identified as the Vicano development and the Cordon Lands. Both contain a mix of commercial and residential land uses. The Vicano development is expected to be located on the northeast corner of Grand River Street North and Scott Avenue. The Cordon Lands is expected to be located on the east side of Grand River Street North between Watt's Pond Road and Woodslee

Avenue. Given that information on land uses are at a very preliminary stage, trips for commercial uses were reduced by 34% to account for pass-by reduction in the p.m. peak hour. This was to remain consistent with the Northwest Paris traffic study assumptions.

Trips were generated based on the ITE Trip Generation Manual 9th Edition as shown in Exhibit 4-2, and distributed following the same methodology as presented in the Paris on the Grand Traffic Impact Study. This includes, 30% of trips to the north, 55% to the south, 5% to the east, and 10% to the west. Results are likely conservative given that there would be some internal uses along the corridor between various developments which would reduce overall trips generated. Total trips generated are shown in Exhibit 4-3.

Exhibit 4-2: Trip Generation Rates

Type	ITE Code	Unit	AM Trips			PM Trips		
			Rate	In	Out	Rate	In	Out
Residential Condominium/Townhouse	230	Per Dwelling	0.44	17%	83%	0.52	67%	33%
Single Family Detached	210	Per Dwelling	0.75	25%	75%	1.01	63%	37%
Shopping Center	820	Per 1000 ft ² GFA	0.96	62%	38%	3.71	48%	52%

Exhibit 4-3: Additional Developments Trip Generations

Development	Development Type	Dwelling Unit/Size (ft ²)	AM Trips			PM Trips		
			Total	In	Out	Total	In	Out
Vicano	Residential Condominium/Townhouse	0	0	0	0	0	0	0
	Single Family Detached	128	96	24	72	129	81	48
	Shopping Center	68,159	65	41	25	253	121	131
	Pass By Reduction	34%				86	41	45
	Net Trips		161	65	97	296	162	135
Cordon Lands	Residential Condominium/Townhouse	436	192	33	159	227	152	75
	Single Family Detached	157	118	29	88	159	100	59
	Shopping Center	452,936	435	270	165	1680	807	874
	Pass By Reduction	34%				571	274	297
	Net Trips		744	332	413	1494	784	710

4.1.3 Retail Traffic Growth

With the exception of the Paris on the Grand development, the other 3 planned developments all contain retail/commercial land uses. Located along the Grand River Street North corridor these commercial/retail spaces would help support the expanding demand of the proposed residential developments. There would likely be some mixed uses between the different developments given their proximity to each other. However, existing retail/commercial spaces would also see an increase in traffic as a result of residential population growth. Given the large scale of the commercial developments proposed, it was assumed for the purposes of this study that no additional traffic is generated by the existing retail/commercial properties, and all demand will be fulfilled by the new developments. This ensures that retail/commercial trips are accounted for and added to the total traffic volumes, but is not overly conservative. In reality, trip generation from the new commercial developments will change dependant on the state of nearby development progress.

4.1.4 Total Future Traffic

The total future traffic was developed by combining the additional network growth from background traffic and trips generated by the 4 proposed developments. Total future traffic

volumes are illustrated in Exhibit 4-7 and includes Street 'A' from the Northwest Paris development.

Exhibit 4-4: Paris on the Grand Generated Traffic, PTSL Paris on the Grand TIS, January 2013

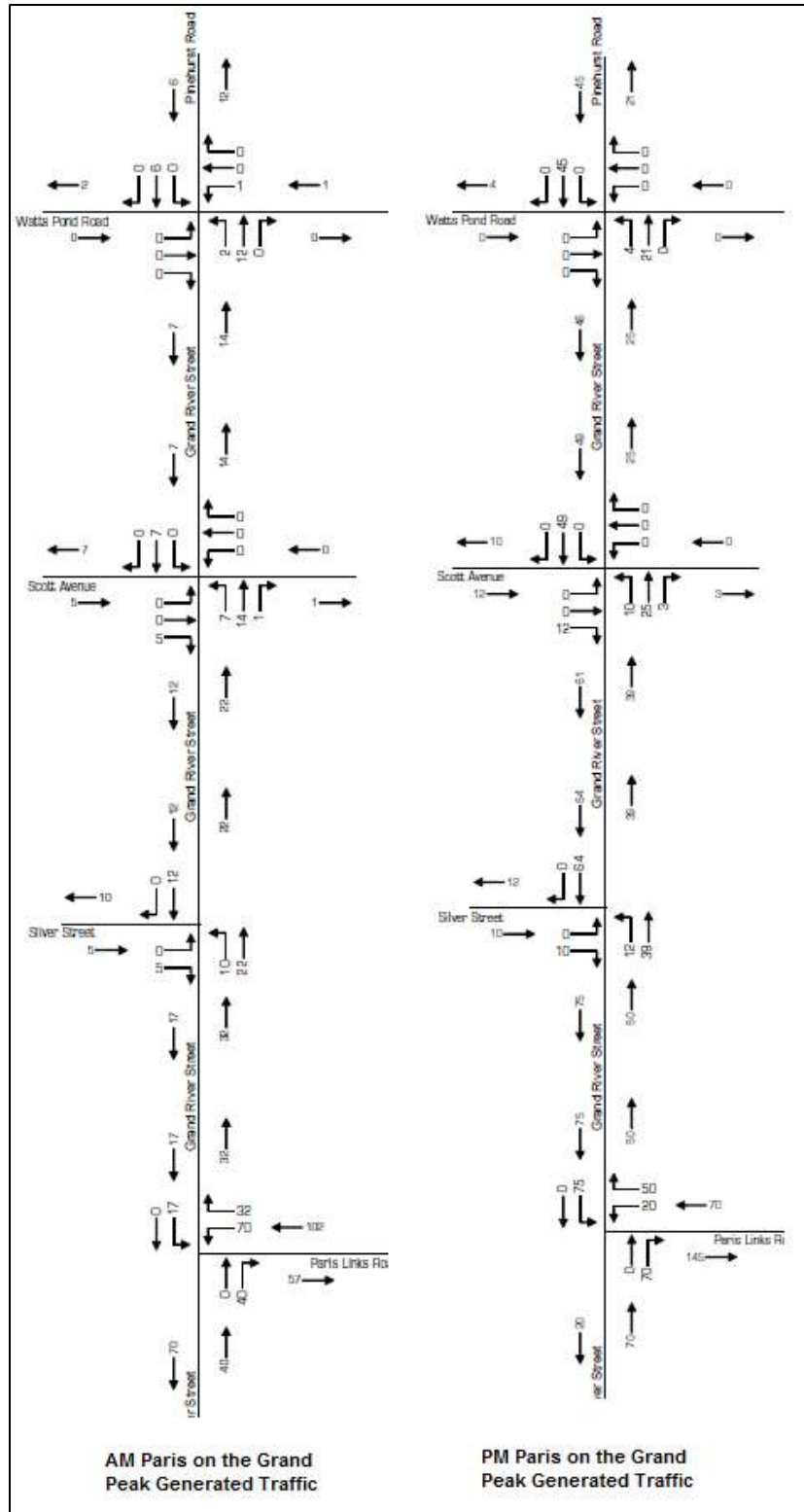


Exhibit 4-5: Northwest Paris Generated Traffic (AM left, PM right), PTSL's Northwest Paris TIS, February 2012

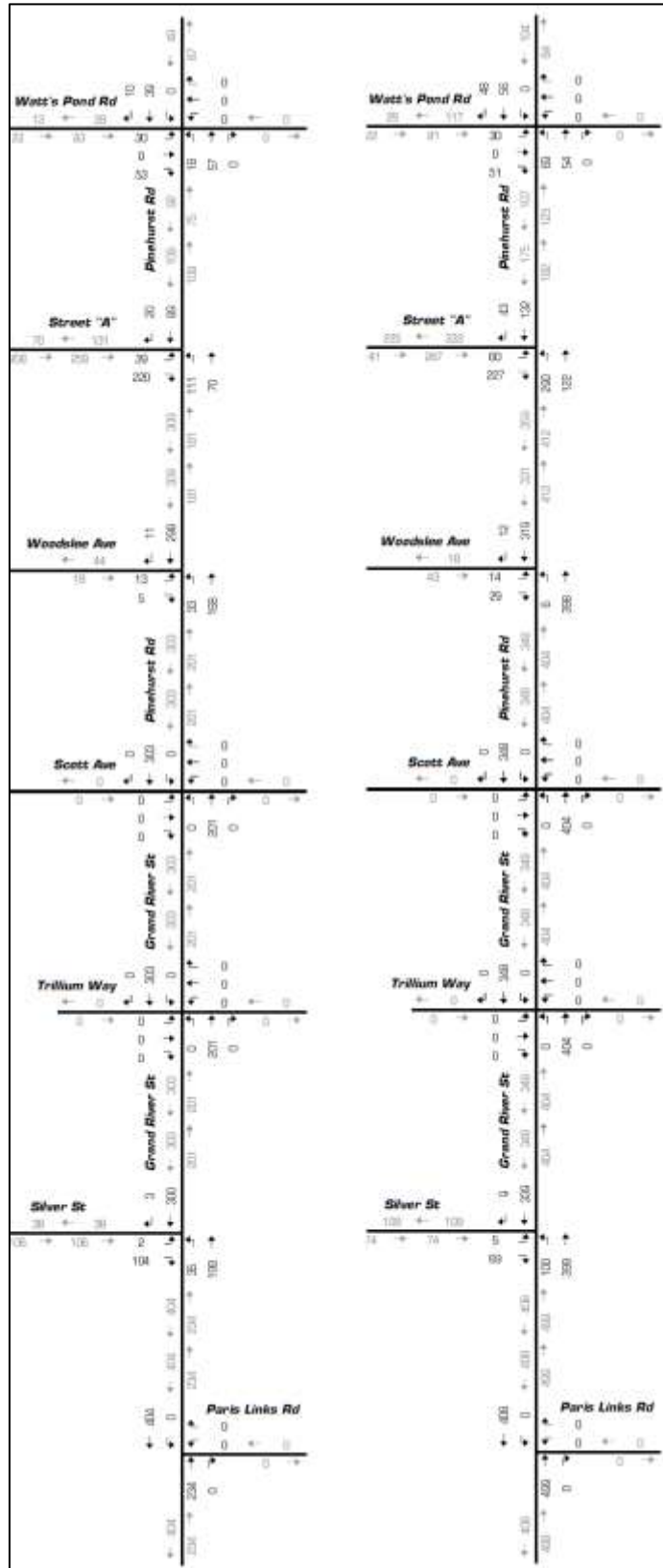


Exhibit 4-6: Future Cordon and Vicano Development Traffic

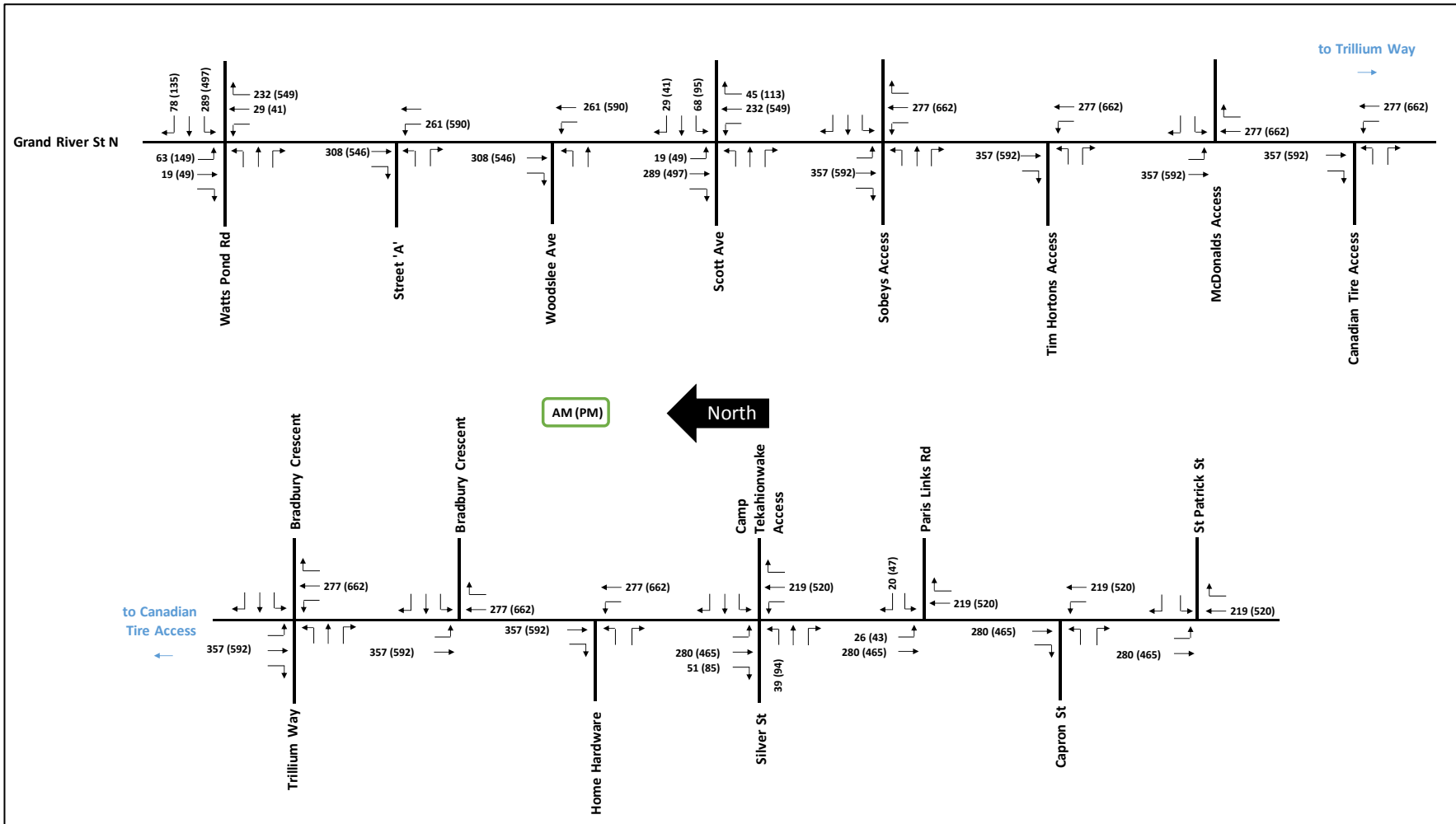
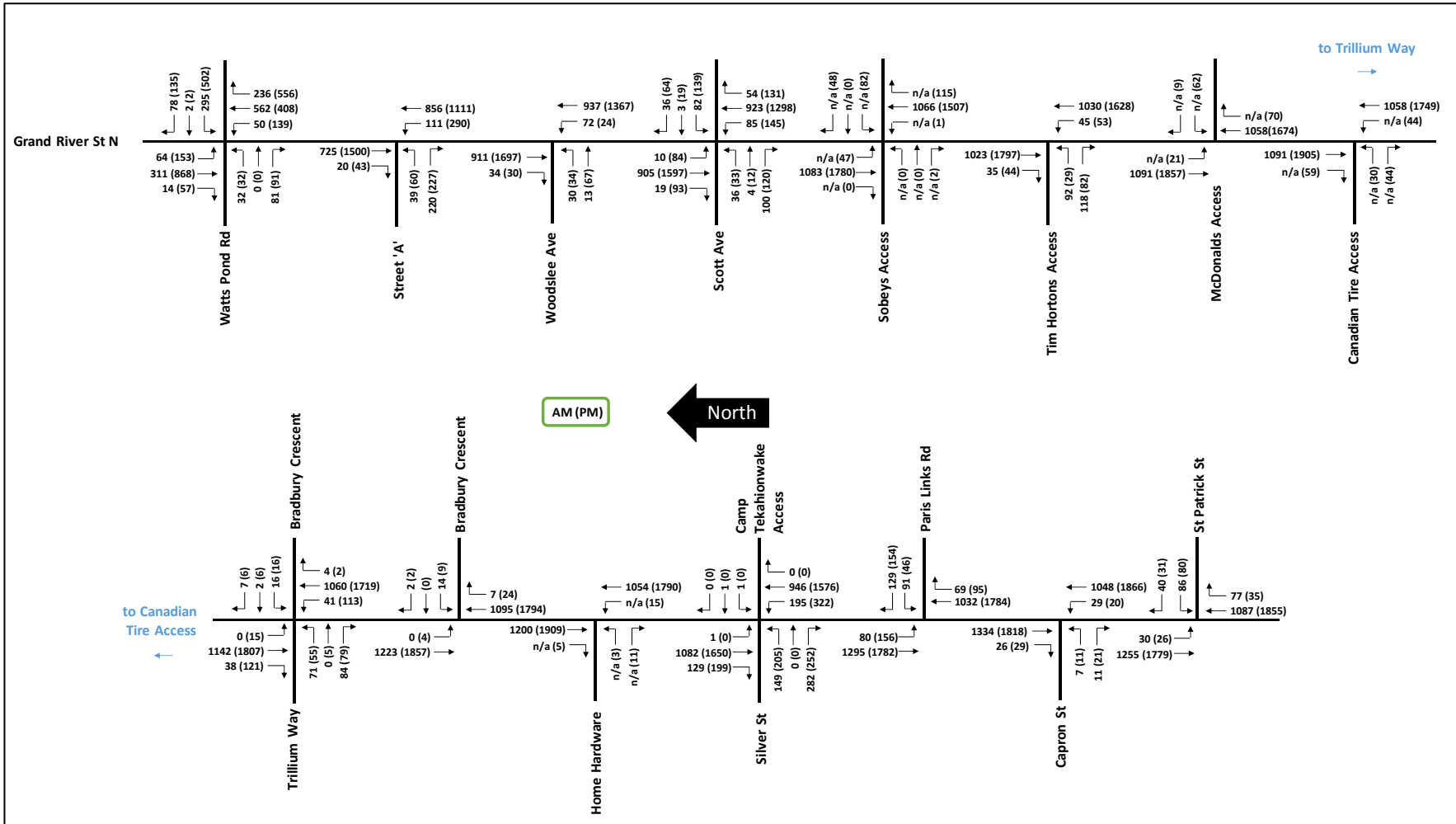


Exhibit 4-7: Total Future Traffic Volumes



4.2 Capacity Analysis

4.2.1 Do Nothing Operations

The Do Nothing, or status quo alternative consists of future projected volumes and no changes in the road network. It provides a basis for which other alternatives can be compared. All 4 signalized intersections are failing in the p.m. peak hour. In the a.m. peak hour, operations are marginally better, but in general still failing at most intersections. Major deficiencies occur along the entire corridor, as a result, this option would result in very poor future traffic operations.

A summary of signalized intersection operations is provided in Exhibit 4-8 and Exhibit 4-9 for the a.m. and p.m. peak hours respectively. An illustration of the level of service along the entire corridor is provided in Exhibit 4-10.

Full Synchro outputs can be found in **Appendix A**.

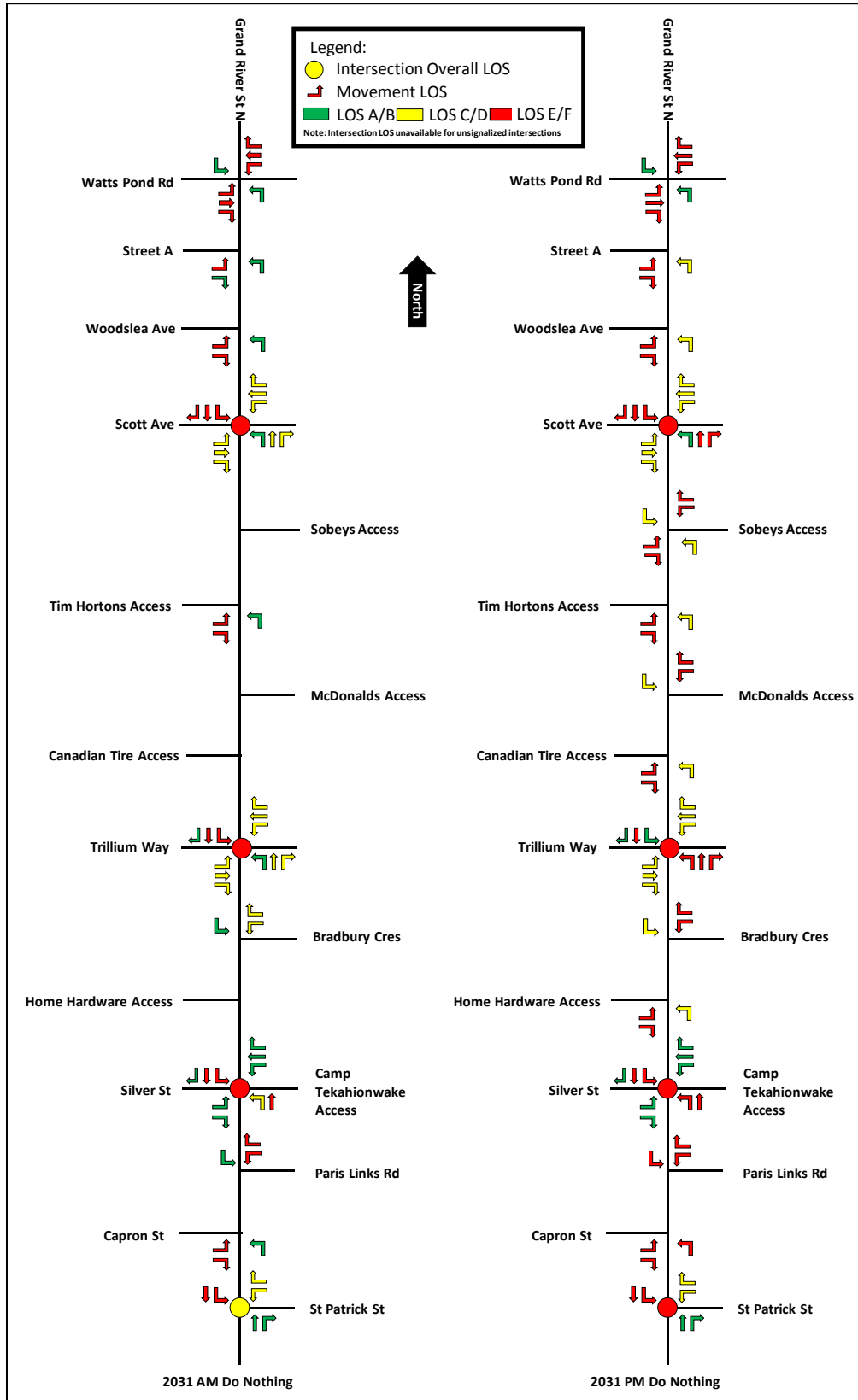
Exhibit 4-8: Future Do Nothing AM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	F	1.22	EBR	C	0.07	11
			WBL	C	0.42	21
			NBT	C	0.89	226
			SBT	F	1.55	296
Grand River St N & Trillium Way/Bradbury Cresc	E	0.98	NBT	D	1.05	274
			SBT	E	1.11	298
Grand River St N & Silver St	F	1.55	NBT	E	1.06	212
			SBT	F	2.52	321
Grand River St N & St Patrick St	D	1.05	SBT	F	1.16	342

Exhibit 4-9: Future Do Nothing PM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	F	18.71	EBR	C	0.08	12
			WBL	C	0.48	33
			NBL	B	0.51	20
			NBT	F	1.42	379
			SBT	F	33.20	640
Grand River St N & Trillium Way/Bradbury Cresc	F	1.5	NBL	F	1.12	48
			NBT	F	1.73	522
			SBT	F	1.61	510
Grand River St N & Silver St	F	1.69	NBL	F	1.18	81
			NBT	F	1.77	404
			SBT	F	2.55	462
Grand River St N & St Patrick St	F	1.59	SBT	F	1.82	542

Exhibit 4-10: Future Do Nothing LOS Diagram



4.2.2 Alternative 1: 3 Lane Cross Section

Alternative 1 reflects the lane configuration of the Do Nothing alternative with changes north of Scott Avenue. Signal timings optimization was completed to test if it is effective in resolving some of the traffic operations issues. However, similar to the do-nothing alternative, operations are failing at nearly all intersections in both peak hours. A summary of signalized intersection operations is provided in Exhibit 4-11 and Exhibit 4-12 for the a.m. and p.m. peak hours respectively. An illustration of the level of service along the entire corridor is provided in Exhibit 4-13.

Full Synchro outputs can be found in **Appendix A**.

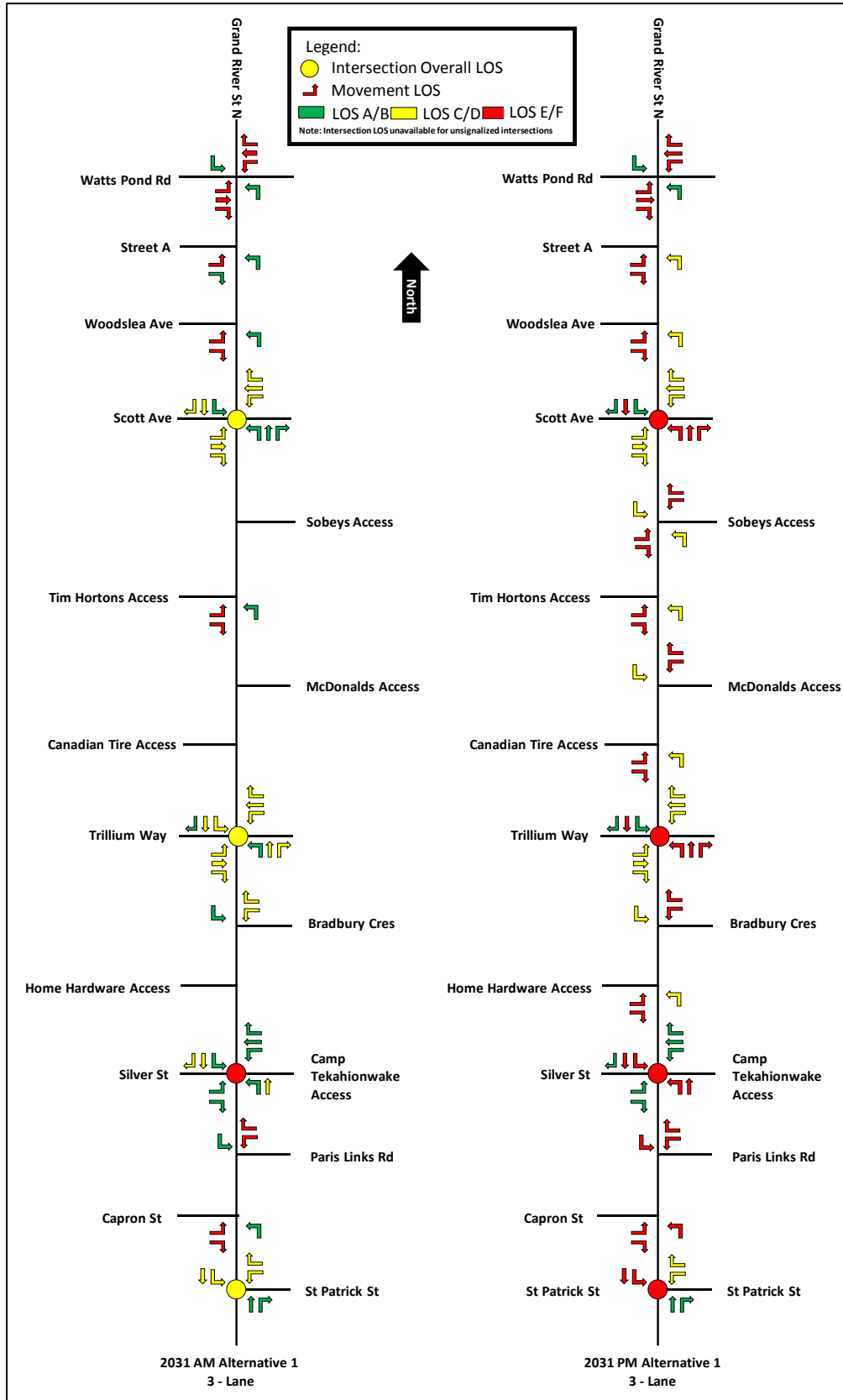
Exhibit 4-11: Future Alternative 1 AM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	C	0.85	EBR	C	0.07	10
			WBL	C	0.39	20
			SBT	D	1.01	229
Grand River St N & Trillium Way/Bradbury Cresc	C	0.9	NBT	C	0.92	246
			SBT	C	0.98	268
Grand River St N & Silver St	F	1.16	NBT	D	0.98	188
			SBT	F	1.76	274
Grand River St N & St Patrick St	C	0.95	SBT	D	1.01	313

Exhibit 4-12: Future Alternative 1 PM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	F	1.45	EBR	C	0.08	11
			WBL	C	0.56	30
			NBL	B	0.55	20
			NBT	F	1.20	341
			SBT	F	1.78	465
Grand River St N & Trillium Way/Bradbury Cresc	F	1.38	NBL	F	1.03	44
			NBT	F	1.58	478
			SBT	F	1.47	464
Grand River St N & Silver St	F	1.55	NBL	F	1.08	72
			NBT	F	1.63	366
			SBT	F	2.34	422
Grand River St N & St Patrick St	F	1.29	SBT	F	1.47	471

Exhibit 4-13: Future Alternative 1 LOS Diagram



4.2.3 Alternative 2: 4 Lane Cross Section

Alternative 2 consists of a four lane cross section throughout the corridor, with northbound and southbound turning lanes at the signalized intersections of Scott Avenue, Trillium Way / Bradbury Crescent, and Silver Street. The four lane configuration was also extended past Silver Street to improve operations at St Patrick Street and make the overall corridor consistent.

Operations are considerably better, especially in the p.m. peak hour. The only movements that are overcapacity are the northbound left turn and southbound through at Grand River Street North and Silver Street. A summary of signalized intersection operations is provided in Exhibit 4-14 and Exhibit 4-15 for the a.m. and p.m. peak hours respectively. An illustration of the level of service along the entire corridor is provided in Exhibit 4-16. Full Synchro outputs can be found in Appendix B.

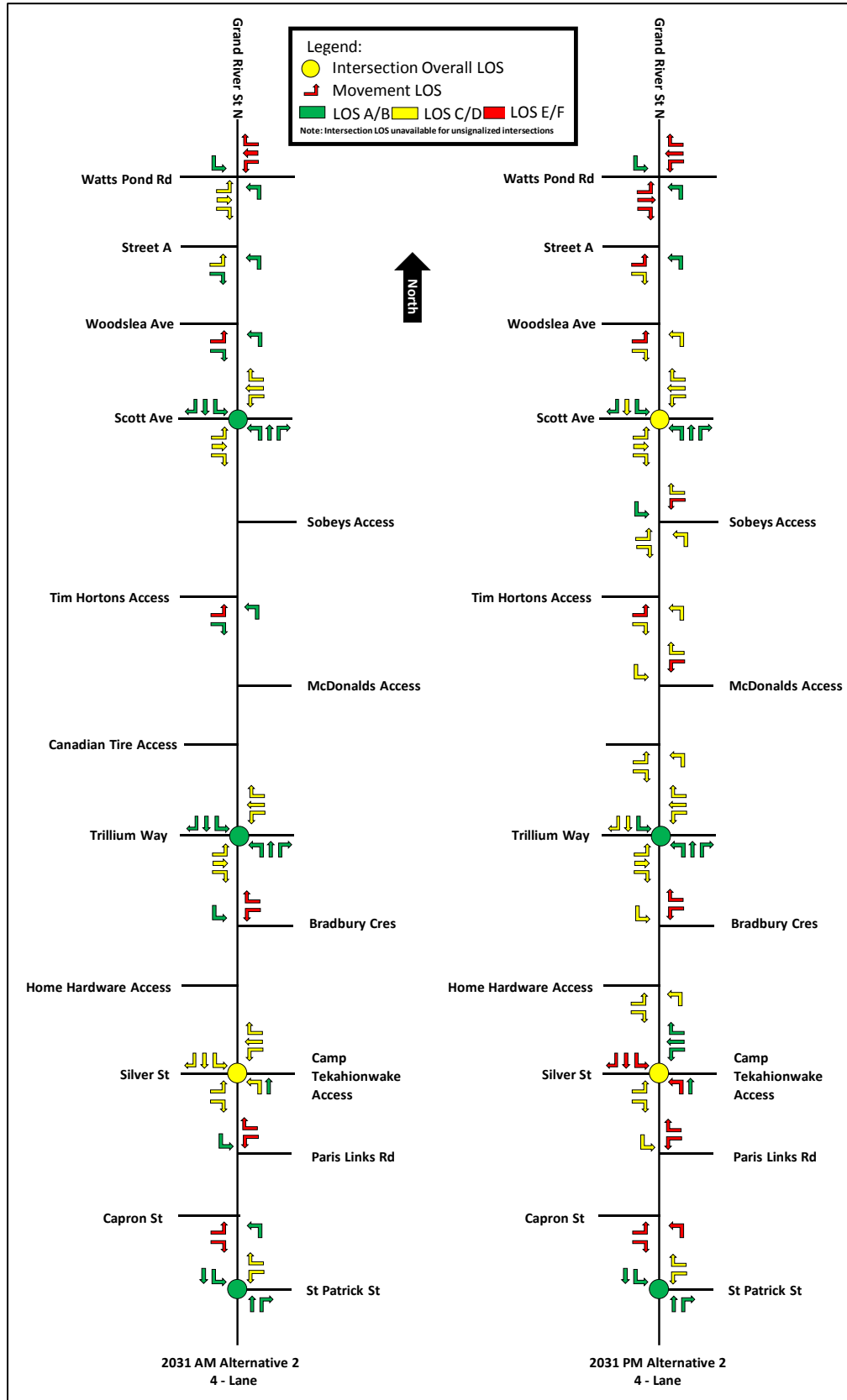
Exhibit 4-14: Future Alternative 2 AM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	B	0.49	EBR	C	0.07	10
			WBL	C	0.39	20
Grand River St N & Trillium Way/Bradbury Crescent	A	0.52	n/a			
Grand River St N & Silver St	C	0.73	SBT	C	0.87	118
Grand River St N & St Patrick Street	A	0.57	n/a			

Exhibit 4-15: Future Alternative 2 PM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	C	0.78	EBR	C	0.08	12
			WBL	C	0.51	36
			NBL	B	0.54	23
			SBT	C	0.94	187
Grand River St N & Trillium Way/Bradbury Cresc	B	0.78	SBT	C	0.92	245
Grand River St N & Silver St	D	1.05	EBL	D	0.66	60
			NBL	F	1.14	99
			SBT	E	1.08	232
Grand River St N & St Patrick Street	B	0.75	n/a			

Exhibit 4-16: Future Alternative 2 LOS Diagram



4.2.4 Alternative 3: Mixed Cross Section

The purpose of Alternative 3 is to determine areas where a three lane cross-section would be appropriate and areas where a four lane cross section would be appropriate. The proposed alternative is as follows:

- four Lane cross-section from St Patrick Street to Trillium Way
- Termination of northbound through lane between Scott Avenue and Trillium Way
- Development of southbound through lane between Woodslee Avenue and Scott Avenue

Overall, with the proposed changes, the signalized intersections are able to operate with no critical movements in the a.m. peak hour. In the p.m. peak hour, the intersection of Grand River Street North and Scott Avenue is over capacity, in particular the northbound through movement is failing.

A summary of signalized intersection operations is provided in Exhibit 4-17 and Exhibit 4-18 for the a.m. and p.m. peak hours respectively. An illustration of the level of service along the entire corridor is provided in Exhibit 4-19. Full Synchro outputs can be found in Appendix B.

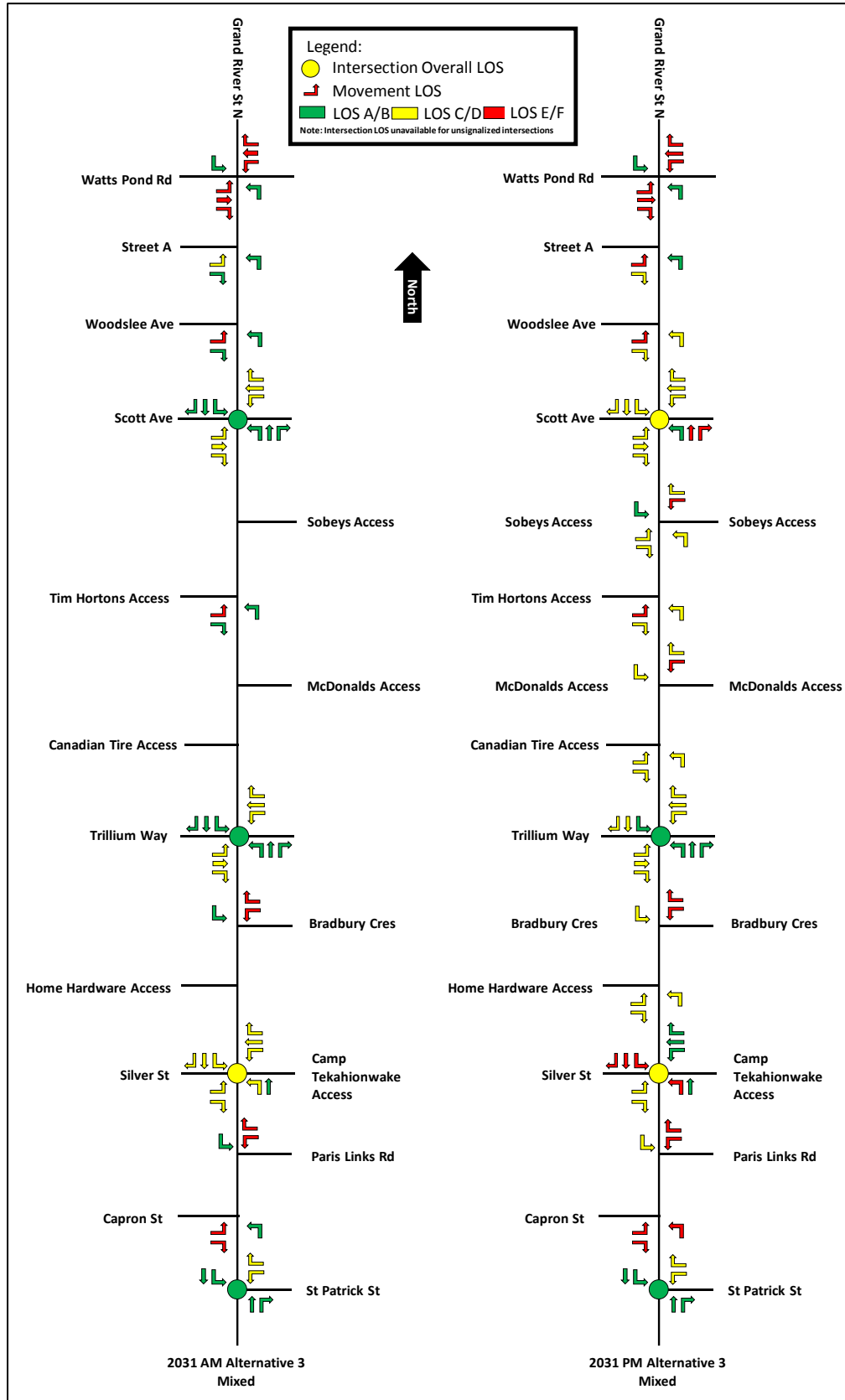
Exhibit 4-17: Future Alternative 3 AM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	B	0.77	WBL	C	0.39	20
Grand River St N & Trillium Way/Bradbury Crescent	A	0.52	n/a			
Grand River St N & Silver St	C	0.73	NBL	C	0.74	39
			SBT	C	0.87	118
Grand River St N & St Patrick Street	A	0.57	n/a			

Exhibit 4-18: Future Alternative 3 PM Peak Hour Signalized Intersection Operations Summary

Intersection	Intersection LOS	Intersection VC	Critical Movement			
			Movement	LOS	V/C Ratio	95th Percentile Queue (m)
Grand River St N & Scott Ave	F	1.12	WBL	D	0.55	39
			NBT	F	1.33	417
			SBT	C	0.89	190
Grand River St N & Trillium Way/Bradbury Cresc	B	0.78	SBT	C	0.92	245
Grand River St N & Silver St	D	1.05	EBL	D	0.66	60
			NBL	F	1.14	99
			SBT	E	1.08	232
Grand River St N & St Patrick Street	B	0.75	n/a			

Exhibit 4-19: Future Alternative 3 LOS Diagram



5 Corridor Alternatives Evaluation

A preliminary evaluation of corridor alternatives was undertaken to identify associated issues and to identify any critical flaws in any alternatives. It should be noted that environmental, social, and cost impacts must all be evaluated in further detail as part of a subsequent Class EA.

5.1 Traffic Operations

Transportation criteria includes consideration of capacity, delays experienced by minor street approaches and travel time benefits for the study area as described by the following alternatives: A comparison of travel times is shown in Exhibit 5-1.

Existing Conditions: The current corridor currently operates well and does not experience any significant operation deficiencies. Some side street accesses onto Grand River Street North conflict with through traffic and each other as they are not well defined.

Do Nothing: With no changes to the corridor, the future operations of the road becomes very poor especially in the p.m. peak hour. The travel time has broken down beyond acceptable analysis ranges, and it is expected that actual travel time would be very slow.

Alternative 1: A 3 lane cross section throughout the corridor does not differ significantly from the Do Nothing conditions. However, with some signal timing optimization and improvements at the north end, p.m. peak hour travel times in the southbound direction is approximately 26 minutes through the corridor. This is still a very slow speed given that the analysis looks at the corridor travel time across the 4 signalized intersections, which is less than 1.5 km.

Alternative 2: With the addition of northbound and southbound lanes to make the corridor a consistent 4 lane corridor, the operations improve drastically. Southbound travel time becomes similar to the existing travel times, with a minor increased delay in the p.m. peak hour.

Alternative 3: With a 3 lane cross section from Watt’s Pond Road to Scott Avenue, and a 4 lane cross section further south to St Patrick Street, the roadway is similar to Alternative 2 except in the northbound direction where delays have increased due to the intersection at Scott Avenue.

Exhibit 5-1: Travel Time Comparisons

Scenario	Travel Time (seconds)			
	AM Peak Hour		PM Peak Hour	
	Northbound	Southbound	Northbound	Southbound
Existing	131	214	136	248
Future Do Nothing	252	1270	975	15459
Future Alternative 1	187	643	733	1540
Future Alternative 2	130	226	153	310
Future Alternative 3	140	226	306	304

5.2 Property & Community

Property needed for the proposed Grand River Street North corridor alternatives primarily involves undeveloped boulevard lands with some residential front yards. The following provides a brief overview of the impacts associated with the alternatives.

Alternative 1: 3 Lane Cross Section: This option has minimal community impacts as the road widenings would occur north of Scott Avenue along a primarily retail and employment corridor. There is a gravel shoulder and sufficient right of way to accommodate this cross-section.

Alternative 2: 4 Lane Cross Section: A 4 lane cross section would have greater impacts along the corridor due to the wider right of way required. Although it appears that widening to the west would be feasible with minor property acquisition only, a more detailed assessment would be needed to confirm this finding. Given that a dedicated northbound left turn lane would be recommended at Grand River Street North and Silver Street, there may be a need for property acquisition at this location to allow for widening of the road towards the east to accommodate the additional lane.

Alternative 3: Mixed 3-4 Lane Cross Section: This would have similar social impacts as Alternative 2 as there is minimal existing development along the corridor at the north end where Alternative 3 has a 3 lane cross section, deviating from Alternative 2.

The increased traffic along Grand River Street North would have impacts for all alternatives along the corridor in terms of noise, vibration and existing property accesses. Several of the existing business frontages have large paved areas onto Grand River Street North. In these cases, more defined curbs and controlled access points are recommended as discussed further in Section 7.2. This would require coordination with the property and business owners to ensure their requirements and needs are met.

All the alternatives could include added components for active transportation such as bike lanes, sidewalks or a multi-use trail. However, given potential right-of-way constraints, Alternative 1 obviously requires the least roadway width and thus would be the most likely to accommodate active transportation facilities with the least property impacts.

5.3 Capital Cost

Given that the existing roadway is expected to be reconstructed due to watermain and sewer works, the main differences in capital cost between the alternatives relates to the road pavement width. As such, Alternative 1 would be the lowest cost solution as it has a 3 lane cross-section throughout. Alternative 2 would be the most costly solution as it has a 4 lane cross-section throughout. Finally Alternative 3 would fall in-between the other two options. Detailed cost estimates will need to be developed during the Class EA based on a further functional or preliminary design.

5.4 Evaluation Summary

All corridor alternatives would provide some operational improvements compared to taking no action (the Do Nothing alternative). As a result, the selection of the preferred alternative is based primarily on improving traffic conditions throughout the corridor.

Alternative 1: 3 lanes would not address the operational challenges, and traffic demands of the corridor. With four new subdivision developments in north Paris, there is a significant increase in traffic volumes expected. As a result, this alternative fails to address operational issues and may not be sufficient in providing acceptable traffic operations. Furthermore, Alternative 1 may not be able to accommodate proposed traffic volumes in the longer term, even if a future Green Lane by-pass is implemented.

Alternative 2: 4 lanes would provide the best traffic operations throughout the corridor, however at the highest cost. The cost increase over Alternative 1 would be highly dependent on property impacts. If there are no major property impacts, the increased cost of construction may be minimal given that the road would already need to be reconstructed due to watermain and sewer works.

Alternative 3: 3-4 lanes provides all the benefits from Alternative 2 with some cost savings by converting to a 3 lane cross section north of Scott Avenue. However it results in some increased delays, particularly at Scott Avenue and proposed new development roads further north.

As a result, **Alternative 2: 4 lanes is recommended to be carried forward** into a full Schedule 'C' EA process. Alternative 1 and 3 would also be included in that EA to compare property impacts.

6 Conceptual Design

A conceptual design was developed as part of this corridor study. This section provides traffic and operations input into the conceptual design, to be confirmed through the Class EA process.

6.1 Grand River Street North and Paris Links Road Intersection

The planned Paris on the Grand development is one of the key drivers of future traffic volumes along the Grand River Street North corridor. One of the proposed challenges with the development is that the current connection onto Grand River Street North from Paris Links Road has a skewed geometry, and is located only 60 meters south of the Grand River Street North and Silver Street intersection. As a result, northbound traffic is expected to queue back past Paris Links Road, which would significantly lower the capacity of Paris Links Road.

The purpose of this report section is to assess possible alternatives specifically for the Paris Links Road intersection, and evaluate their impacts on the Grand River Street North corridor. Improvements to Paris Links Road can be made as part of any of the corridor alternatives under study, and thus those improvements should be determined separately based on finalized development traffic volumes and phasing. The potential solutions listed below document the impact onto the Grand River Street North corridor in terms of land use, traffic volumes and constructability.

6.1.1 Do Nothing

With no changes being made to Paris Links Road, it would be very difficult for the proposed Paris on the Grand development to use Paris Links Road as its primary access. This is because turning movements onto and off Paris Links Road at Grand River Street North would be operating at a poor level of service.

6.1.2 Right-in Right-Out Access (RIRO)

One option to address this intersection deficiency would be to convert the Paris Link Road intersection to a right-in right-out (RIRO) only access at Grand River Street North. However, as shown on Exhibit 6-1, this would require all left turn traffic to divert to the St Patrick Street and Grand River Street North intersection via Bayly Drive. Increased traffic along Bayly Drive would not be desirable in the community as it is a local residential street with direct frontage of many houses. This option would also require an island at Paris Links Road and Grand River Street North to physically restrict left turns.

Conversely, overall construction requirements for a RIRO intersection would be relatively minor, and it would likely not conflict with any of the Grand River Street North corridor alternatives.

The resultant traffic diversion volumes from a RIRO intersection are shown in Exhibit 6-12. It is expected that some upgrades to St Patrick Street may be required, such as the addition of turning lanes, without reconstruction of the entire intersection. Improvements should be considered in conjunction with finalized Paris on the Grand development site plans as well phasing plans. While the affected internal streets have the physical capacity to accommodate the diverted traffic volumes, this traffic diversion would impact the abutting residential community.

Exhibit 6-1: Future Traffic Diversion Routes from RI/RO at Paris Links Road

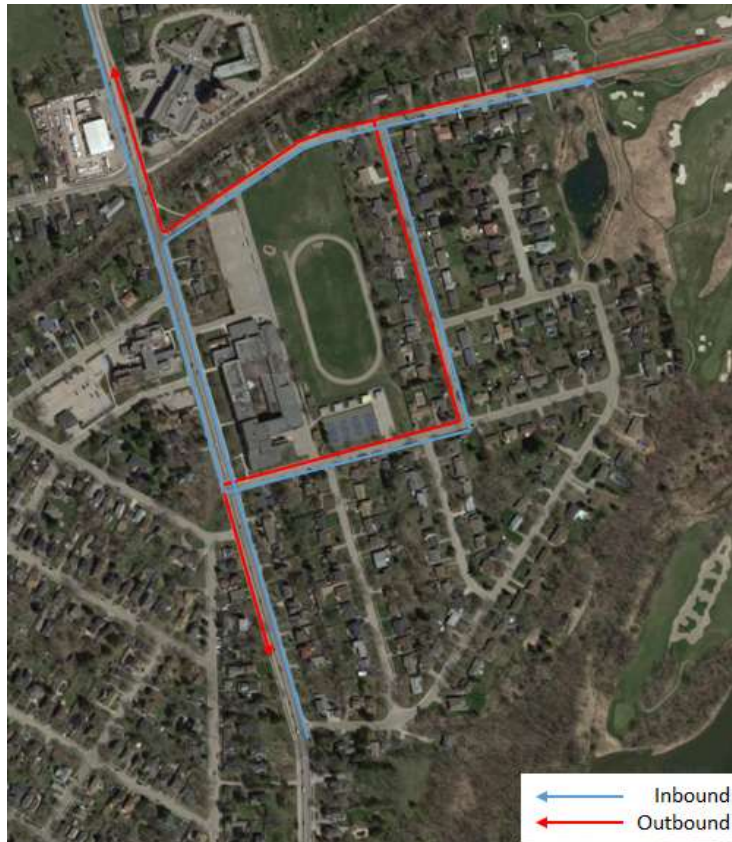
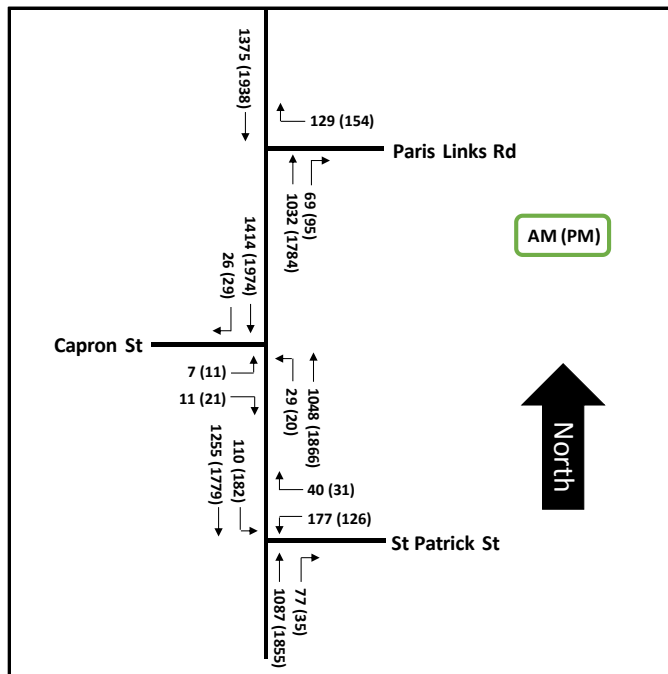


Exhibit 6-2: Future Diverted Traffic Volumes from RI/RO at Paris Links Road



6.1.3 Road Realignment

A more costly but potentially effective option would be to realign Paris Links Road to make it the east leg of the Silver Street and Grand River Street North intersection. Traffic volumes, as well as established residential properties shown in Exhibit 6-3 and Exhibit 6-4 would be impacted. However, it would significantly improve operations along Paris Links Road given that this road would now access Grand River Street North via a signalized intersection rather than a stop controlled intersection. The new traffic volumes and conceptual lane configuration at Silver Street and Grand River Street North are shown in Exhibit 6-4.

Key considerations for this option are the property impacts along Paris Links Road and the existing east leg of the Silver Street and Grand River Street North intersection. The existing east leg is also a minor trail/access road for the Girl Guide Camp Tekahionwake. This access would likely need to be altered to connect onto the realigned Paris Links Road.

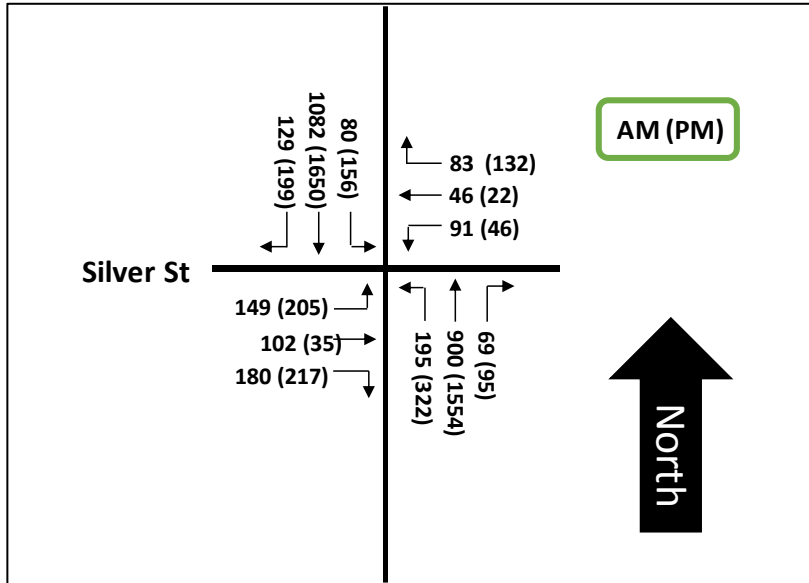
In addition to abandoned railway property shown on Exhibit 6-3 that would need to be acquired, there are seven houses along Paris Links Road with direct frontage, and at least the two most westerly homes (shown as X) would likely need to be acquired and demolished to facilitate a realignment designed to typical road design standards. Substandard design treatments may reduce property impacts but at the cost of road design speeds and safety.

This option would also have some impacts on Grand River Street North corridor improvements, as a new curb and gutter would need to be installed to close off the existing Paris Links Road access. Additionally, any improvements to the east side of the Silver Street and Grand River Street North intersection would likely be removed to facilitate the new approach.

Exhibit 6-3: Paris Links Road Realignment Concept and Property Requirement



Exhibit 6-4: Future Volumes and Lane Configuration As A Result Of Realignment



6.1.4 Elongated Roundabout

An elongated roundabout may be possible to link the existing intersections of Grand River Street North with Silver Street and Paris Links Road. It involves a double roundabout design modified specifically for the Grand River Road North location. A concept of this unique roundabout option shown on Exhibit 6-5 and Exhibit 6-6 also has the potential to be a major gateway feature for the Paris community.

Exhibit 6-5: Elongated Roundabout Concept

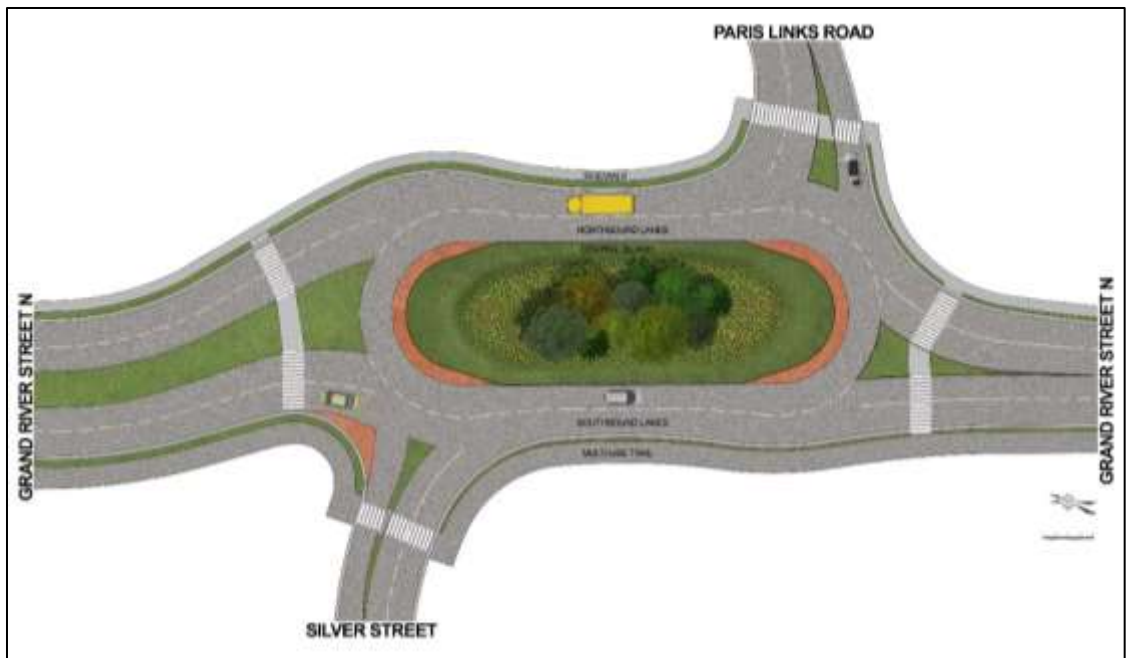
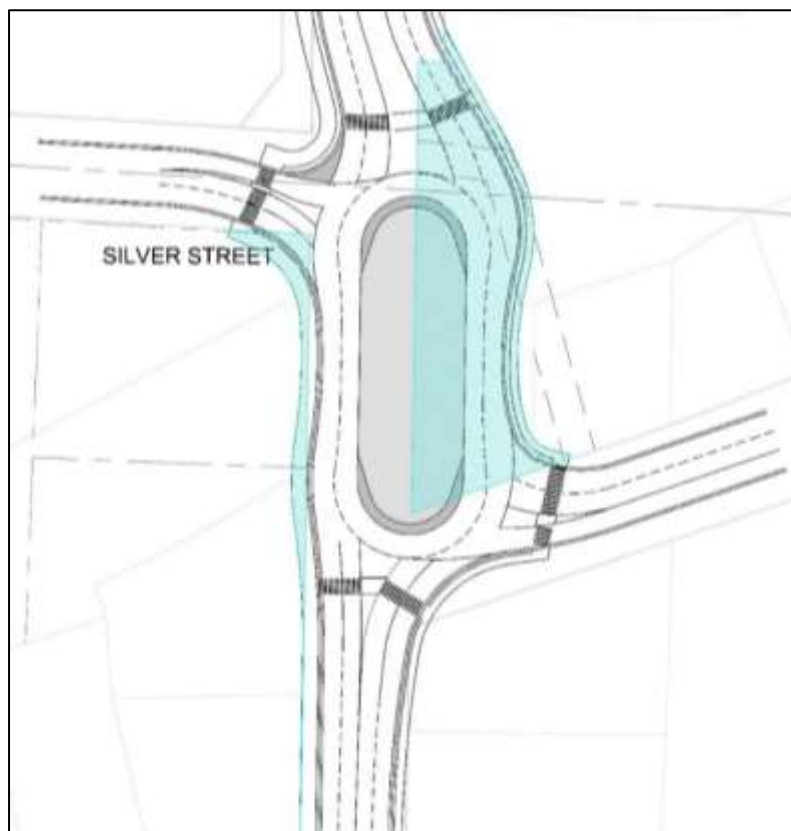


Exhibit 6-6: Elongated Roundabout Section



This elongated roundabout concept would require about 1,800 m² (0.2 ha) of property acquisition shown on Exhibit 6-7. Most of this property would be on the east side of Grand River Street North, and is owned by Dufferin Aggregates as part of abandoned railway property. Narrow road widening strips would also be required on the west side.

Exhibit 6-7: Elongated Roundabout Property Requirement (Conceptual)



Finally, in most cases elongated roundabouts are designed for minor community roads, sometimes with stop control at all approaches.

Due to the non-traditional geometry associated with an elongated roundabout, further analysis of traffic operations and geometries was conducted as part of this study using the Vissim 7 microsimulation tool. The resulting Technical Memo included as Appendix B of this report describes how an elongated roundabout would operate relative to a more conventional intersection control option at the subject location. The simulation used traffic volumes developed in this traffic study to model the intersection of Silver Street/Paris Links Road and Grand River Street North in the A.M. and P.M. in the following scenarios:

1. 2031 Future Conditions Option 1 – With signalization and re-alignment of Paris Links Road.
2. 2031 Future Conditions Option 2 – With a traditional roundabout including re-alignment of Paris Links Road.
3. 2031 Future Conditions Option 2 – With an elongated roundabout within the corridor.

Although the signalized intersection scenario appears to offer an operational advantage during the p.m. peak period, the elongated roundabout, like most roundabouts, offers the advantage of reduced stops, and generally less delay, during the off-peak periods. As discussed in Appendix B, there are additional considerations, beyond basic operational performance, that will need to be considered in selecting the preferred mode of intersection control for the junction. This includes pedestrian crossing safety at a roundabout compared to intersection signals, and roundabout design considerations to enhance performance.

The Vissim 7 analysis concludes that:

- Both scenarios will experience similar operations during the a.m. peak period, with all movements operating at a LOS D or better;
- Both scenarios will operate over capacity during the p.m. peak period, with numerous movements operating at a LOS F; and
- The proposed Green Lane extension / Paris bypass is expected to divert a significant amount of northbound and southbound through volume away from Grand River Street North and South. With an assumed 30% reduction in through traffic, both scenarios operate well, with the signalized scenario experiencing slightly better operations along Grand River Street during the p.m. peak.

The elongated roundabout offers additional advantages over a signalized intersection configuration, primarily through increased vehicular and pedestrian safety. The unique configuration of the proposed elongated roundabout is such that care must be taken in any future design iterations to ensure the potential safety benefits are realized. Some design considerations include:

- Implementing Level 2 – Type B pedestrian crossovers on key approaches;
- Increasing deflection of entry and exit lanes;
- Increasing curvature of circulating lanes; and

Implementing a two-phase design to avoid overdesigning the intersection before traffic volumes warrant increase capacity.

6.1.5 Recommended Intersection Approach

Given the options, it is clear that Do Nothing would not address the operational issues at the Paris Links Road and Grand River Street North intersection. Converting the existing access to a right-in right-out would be undesirable given the diversion of significant traffic onto local

residential road. The Paris Links Road realignment approach would require some residential property with associated traffic impacts.

This evaluation recommends that both the Road Realignment and Elongated Roundabout concept options warrant further investigation as part of a Municipal Class EA, compared against each other as the two most feasible treatment options to confirm the best approach.

6.2 Private Property Access and Median Staging

One of the stated objectives of the County of Brant is to ensure that future access on Grand River Street North will eventually be limited. This will ensure that the operations and safety of the road are not negatively affected by the multitude of private accesses along the roadway. Even under existing conditions, there are some accesses that should be consolidated and/or reassigned to side streets. This can result from property consolidation and redevelopment in the future when through traffic volumes along Grand River Street North will conflict with turning movements to/from driveways and side streets.

In order to meet this objective, the four lane roadway concept recommended in Section 5.4 of this report should either include a two way left turn lane (TWLTL) or a raised median. However, if a raised median was to be implemented, property access along the corridor would be limited to right in/right-out movements due to left turn access restrictions on and off the road. In this case, U-turn provisions or strategically located roundabouts could be needed to retain full existing property access along the road.

Full property access provided by a continuous centre Two-Way Left Turn (TWLTL) lane along the road can be an interim solution, providing time for policy amendments and land use changes to help consolidate and alter existing property accesses. Over time, where property access is consolidated as part of property redevelopment, sections of the continuous TWLTL could then be closed and converted to a centre median with limited left turn opportunities.

Provided that a sufficient road width is constructed, future reconstruction costs would be minimized to install a centre median, and could take place during scheduled resurfacing. Thus in summary, two options are available to address the property access needs along the corridor:

1. Centre Median with Turnaround Opportunities - Provide turnaround opportunities at intersections, and develop a 2m wide solid centre median to restrict left turns along the corridor. This would convert all existing property accesses into RIRO only. Existing unsignalized side streets only would be provided a median break. Turnaround opportunity would need to be provided at around Scott Avenue and Silver Street, which captures the majority of existing commercial properties. This would be in the form of a roundabout at both locations. The advantage of this approach would be a reduced roadway width and immediate resolution of conflicting property accesses. However, there would be notable property impacts at the roundabout locations.
2. Interim / Ultimate Centre Median - Provide an interim TWLTL along the corridor to preserve existing accesses, with policy changes and redevelopment approvals that ultimately consolidate accesses along the roadway over time. Once existing access issues are addressed through redevelopment, sections of the TWLTL can be converted into a raised median, with provision for left turn lanes at signalized intersections and strategically located property entrances. Roadway width would need to accommodate five total lanes, but access and side street operations would not change until a centre median is installed.

6.3 Active Transportation Facilities

The County of Brant does not have an approved Active Transportation (AT) Master Plan on which to base AT planning along Grand River Street North. A final draft Trails Master Plan was

completed in August 2010 but not endorsed by Council.¹ This draft plan does not include a cycling or multi-use trail along Grand River Street North between Paris Links Road and Watt's Pond Road. South of Silver Street a paved on-road cycling route was proposed.

The AT options for the Grand River Street North corridor include on-road cycling lanes, off-road multi-use trail and off-road sidewalks. A sidewalk is recommended in the corridor to address pedestrian volumes and safety. On-road cycling lanes and off-road multi-use trails each have their own advantages and disadvantages such as:

- Marked bike lanes would be preferred by daily commuters, especially those travelling long distances due to low conflicts with side streets and accesses. In the context of the corridor, bike lanes would require an extra 1.5 m total road width on each side of the road, but the resulting 3.0 m is the same as a 3.0 m wide multi-use trail on one side of the road right-of-way.
- A multi-use trail is preferred generally by recreational users for shorter distances of travel. It provides enhanced separation and safety for cyclists to vehicle traffic. If provided on one side of the road right-of-way, the 3.0 m width is the same as two marked on-road bike lanes.

6.4 Conceptual Design Options

Based on the operational capacity analysis conducted as part of this study, four through traffic lanes are ultimately required along the corridor with full buildout of the current four subdivision proposals in north Paris. At the intersections of Scott Avenue, Trillium Way/Bradbury Crescent, and Silver Street, northbound and southbound, dedicated left turning lanes would be needed. There are two basic options that would address the overall objectives for the corridor.

Option 1 TWLTL: Provide a 4m wide interim TWLTL along the corridor, with 2 northbound and 2 southbound travel lanes. The TWLTL would convert into a dedicated left turn lane at signalized intersections. An example of how a cross section with some of the proposed sub-options would look along one section of the corridor near Trillium Way is provided in

Exhibit 6-8 with the following sub-options:

- Sub-option A: 5 lanes with multi-use trail on the west side, sidewalk on east.
- Sub-option B: 5 lanes with marked on-road bike lanes.

Option 2 Median: Provide 2 northbound and 2 southbound travel lanes with a 2m wide raised median along the centerline of the roadway. Roundabouts would be needed at Silver Street and an intersection to the north of existing developments to provide turnaround opportunities. However, roundabouts at these location are not considered feasible due to property impacts and right-of-way requirements. An example of a typical cross section with some of these potential features near Trillium Way is provided in

¹ EDA Collaborative

Exhibit 6-9 with two sub-options.

- Sub-option A: 4 lanes with an off-road multi-use trail on the west side and sidewalk on east.
- Sub-option B: 4 lanes with marked on-road bike lanes.

Exhibit 6-8: Option 1 TWLTL Cross-Section

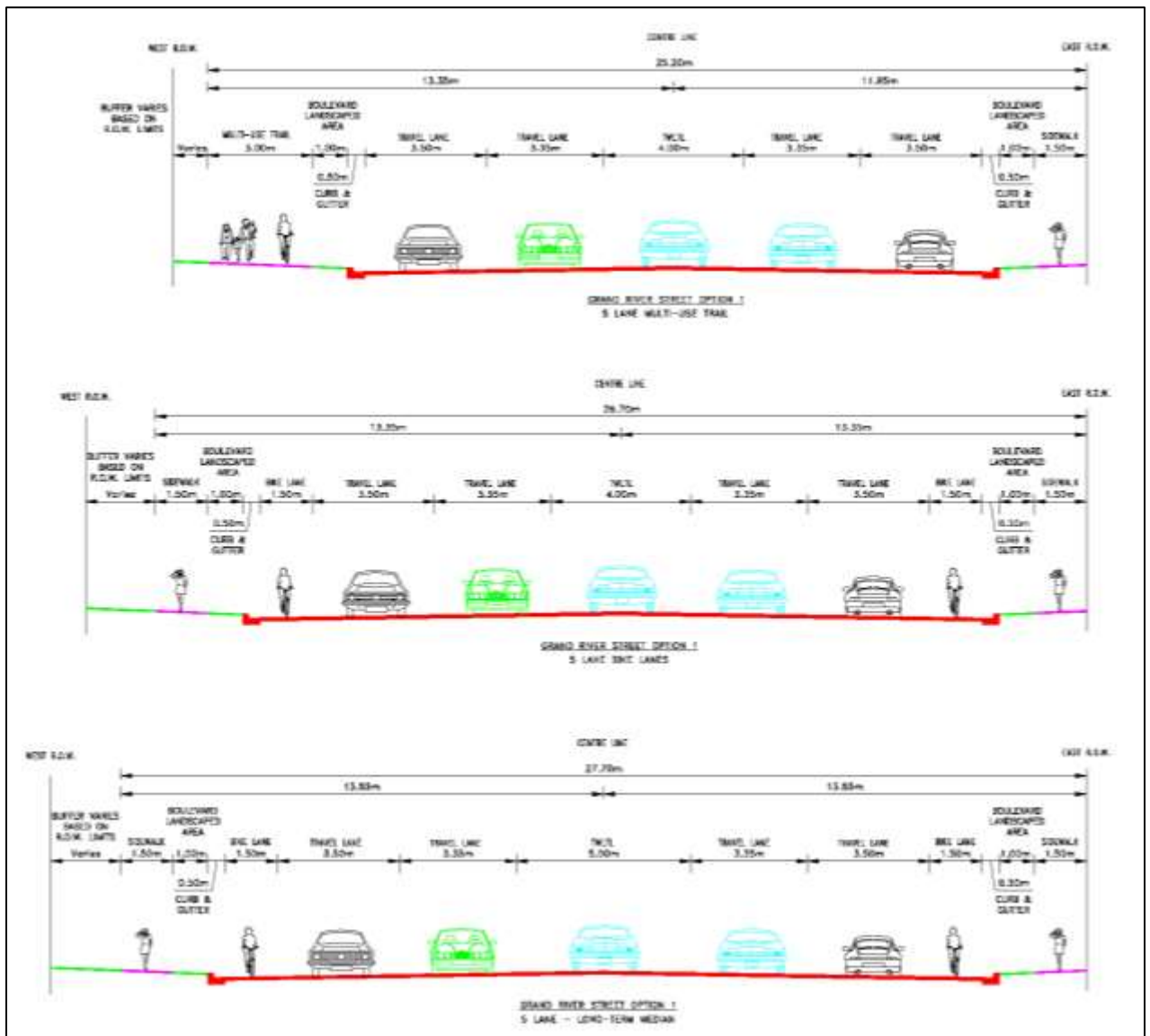
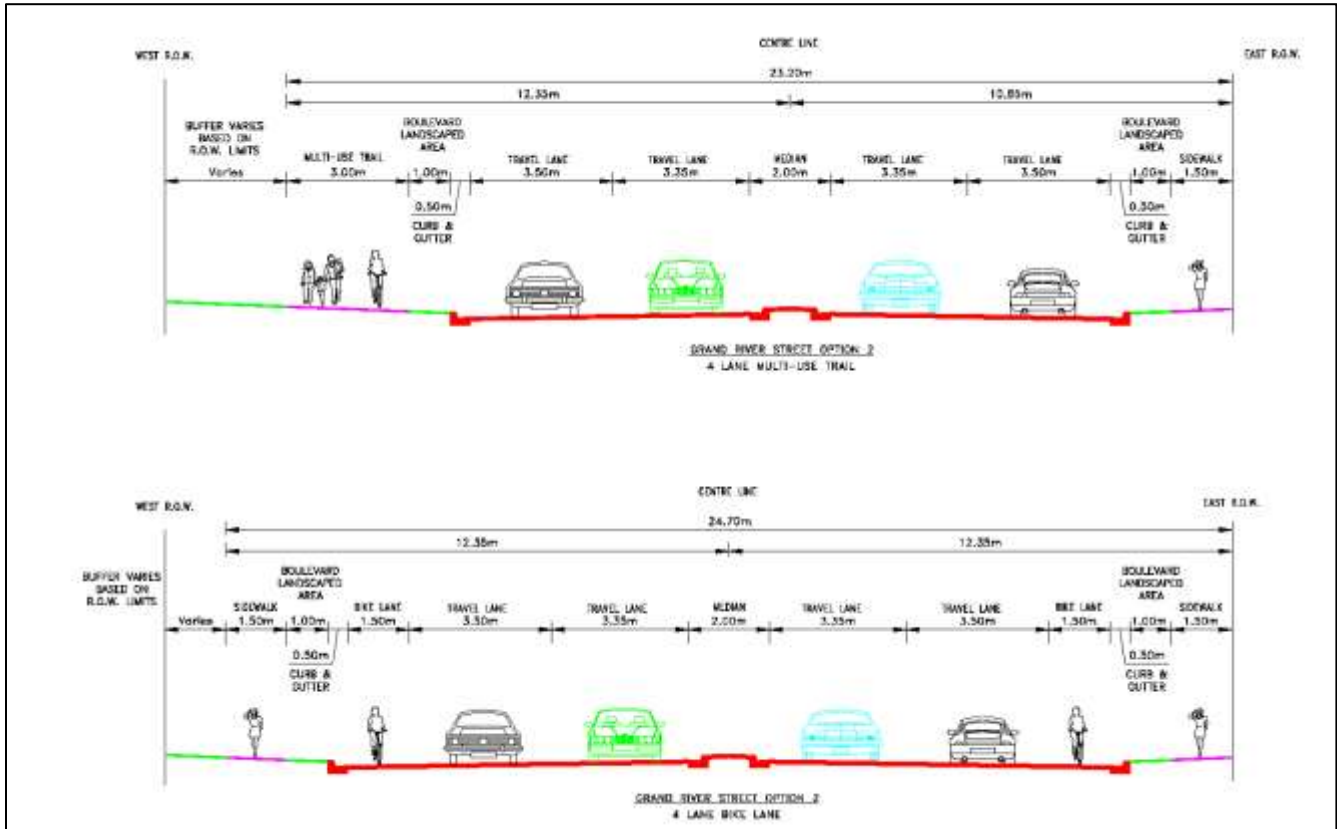


Exhibit 6-9: Option 2 Median Cross-Sections



7 Recommendations

Corridor Option 1 with 4 travel lanes, a fifth TWLTL, multi-use trail on the west side and sidewalk on the east side is the recommended corridor option for the interim period. As shown on Exhibit 7.1, this interim treatment eventually becomes the ultimate design with a center median and strategically located turn lanes as the corridor redevelops over time.

The Option 2 Median approach is not recommended in the interim owing to significant challenges and property acquisition costs to provide roundabouts at the north end of the corridor to facilitate functionality of Option 2. The following documents in greater detail the recommendations that should be further developed and evaluated in the Municipal Class EA process to successfully implement the preferred conceptual design.

7.1 Active Transportation

7.1.1 Cycling Facilities

Owing to the existing and forecasted traffic volumes along Grand River Street North and the amount of heavy vehicles, this report does not recommend any on-road Active Transportation (AT). Although on-road bike lanes may be preferred by some cycling commuters in the context of the corridor traffic volume and type, an off-road multi-use trail is preferred.

The recommended approach has a 3.0 m wide asphalt multi-use trail along the west side of the road, and a 1.5m wide concrete sidewalk on the east side. The multi-use trail is expected to be preferred by the general public and recreational users for shorter distances of travel.

The multi-use trail provides enhanced separation and safety for cyclists from vehicle traffic. Both the trail and sidewalk would be separated from the active travel lanes by a 1.0 m wide landscaped boulevard on each side of the road.

Further evaluation during a Class EA process is needed, including input from the public and stakeholders that could impact this recommendation.

7.1.2 Pedestrian Crossings

The four signalized intersections at Scott Avenue, Trillium Way/ Bradbury Crescent, Silver Street, and St Patrick Street represent the only controlled pedestrian crossings of the corridor. The intersection spacing ranges from approximately 345-435 m. This spacing of the controlled crossings is not excessive, but coupled with the setback distances of some land uses and the natural pedestrian desire lines, many pedestrians are likely to make midblock crossings.

For example, Paris District High School is a significant pedestrian generator, with students travelling to/from the surrounding residential areas. Of particular concern are the pedestrians coming from the residential neighbourhoods on the west side of Grand River Street North. The intersections of Grand River Street North at St Patrick Street and Silver Street are the closest signalized intersections, located approximately 360 m apart, which technically negates the need for a controlled crossing in between (as per Ontario Traffic Manual – Book 15). However, given the likely desire lines, and recommended changes to the intersection controls at Silver Street/ Paris Links Road, consideration should be given to installing a pedestrian crossing at Alexander Avenue or Capron Street to accommodate students crossing. At a minimum, consideration should be given to providing an opening in the future raised median to accommodate pedestrians.

As part of active transportation accommodations, other potential controlled pedestrian crossing locations will have to be identified as the adjacent lands along the corridor are redeveloped. To encourage use of the controlled crossings at the signalized intersections, the pedestrian phases should be set to recall on every cycle, the flashing 'Don't Walk' intervals should be set for the actual crossings distances (using reasonable pedestrian walking speeds), and accessibility features should be installed at all intersections (per AODA).

7.2 Access Management

There are a significant number of properties, both private residential and commercial, fronting onto Grand River Street North with multiple access points on both sides of the road. These accesses create numerous conflict points between users, which increases the likelihood of a collision occurring. Widening the road to include four through lanes plus TWLTL and ultimate median further increases the number of conflict points and the associated potential for collisions. The number of conflict points can be reduced in three ways:

1. Closing or consolidating accesses;
2. Restricting the movements at accesses (e.g., prohibiting left-turns); and/or
3. Staggering the location of the accesses relative to other entrances.

7.2.1 Restricting Accesses and Movements

All-access (or full-moves) driveways have the highest number of conflict points, with left-turn movements, in particular, having the highest collision potential. The ultimate preferred solution has a raised median along the entire corridor, restricting all driveways along Grand River Street North to right-in/right-out (RIRO) operations except where strategic median breaks are provided. This is ideal from a safety perspective, as converting a two-way left-turn lane (TWLTL) to a raised median has been shown to significantly improve safety performance, with an associated collision modification factor (CMF) of 0.77 (i.e., a 23% expected reduction in collisions).

In the interim period, with a TWLTL throughout the entire corridor, consideration should be given to installing medians at select locations along Grand River Street North to restrict problematic access points, specifically, those located within the functional areas of intersections. Consolidating the number of driveways, and, where possible, relocating driveways to the side streets should be an ongoing initiative as redevelopment occurs.

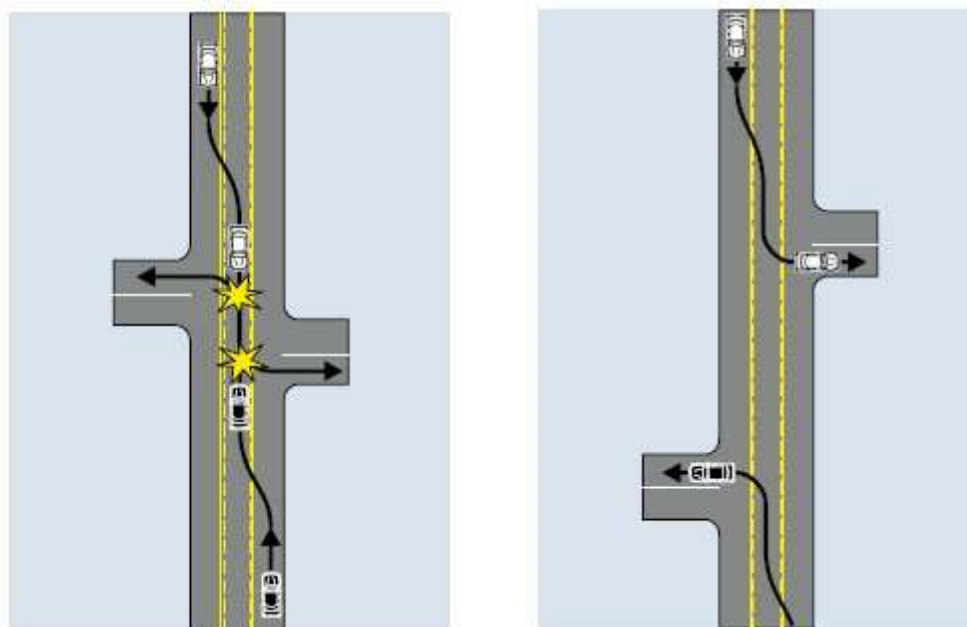
For example, there is a gas station on the northeast corner of the intersection of Grand River Street North and Trillium Way / Bradbury Crescent. The entire frontage along Grand River Street North is open, with two marked entrances, one of which is actually located within the signalized intersection. There is also a marked entrance on Bradbury Crescent. To improve safety at this location in the short-term, access to the gas station should be reconfigured. Temporary measures could be used to restrict access to the north end of the property. Ultimately, a barrier curb and median could be installed at the intersection to ensure left-turns into/out of the establishment do not take place, limiting access via Grand River Street North to RIRO.

Additionally, pre-emptively installing the raised median at locations that do not currently accommodate left-turns should be considered to avoid issues that might arise if redevelopment occurred, and those movements would have to be restricted at a later date (i.e., when the ultimate preferred option is implemented).

7.2.2 Relative Access Location

With the TWLTL, it is also desirable to limit overlaps between left-turn movements accessing opposite sides of the street. For example, there are two significant trip generators south of Scott Avenue, namely a Tim Hortons on the west side of the street, and a McDonalds on the east side of the street. The locations of their entrances are such that inbound left-turn movements overlap within the TWLTL (i.e., driveway on the east side is located further south than the driveway on the west side). As both establishments are located within larger plazas with multiple access points, it is recommended that access be reconfigured or limited to avoid the overlap as illustrated in the figure below.

Exhibit 7-2: Preferred Alignment of Driveways on Opposite Sides of a Roadway to Prevent Overlap for Left



Turning Vehicles²

7.2.3 Speed Management

Despite posted speed limits, drivers naturally drive at the speed that feels appropriate for the surrounding operating environment. There are many factors that can influence the comfortable operating speed within a given corridor, but most relate back to the perceived risk of a collision. When the perceived risk of a collision is low, drivers tend to drive faster, which increases the chances of a collision occurring. At higher speeds, drivers are able to process less information in their field of view and they have less time to react to unexpected events. The severity of collisions also increases at higher speeds.

The northern part of the corridor, between Watt's Pond Road and Scott Avenue, is currently not densely developed, with wide open areas on either side of the roadway. Straight, homogenous, rights-of-way with wide lanes and no visual obstructions create a comfortable and seemingly forgiving environment for drivers, which reinforces the perception that it is safe to drive at higher speeds. This is suitable for the rural environment north of the study area, where the posted speed is 80 km/h, but these high speeds become problematic when drivers enter the urban environment where the posted speed limit is 50 km/h. Currently, the transition between the two operating environments may be too subtle to alert drivers to the increased risks associated with the urban area (e.g., slowing and turning vehicles, pedestrians, etc.). As a result, operating speeds through the study area have the potential to be high, adding to collision risk.

7.2.4 Gateway Treatment

The intersection of Grand River Street North and Scott Avenue currently marks the transition between the rural area to the north, and the urban area to the south, with the posted speed changing from 80 km/h to 50 km/h just north of this intersection. Aside from the regulatory signs indicating the change in speed limit, there are few cues to drivers that they are entering an urban environment, which requires a shift in their driving behaviour. This is further

² *Access Management in the Vicinity of Intersections*, Report FHWA-SA-10-002, U.S. Department of Transportation, February 2010.

compounded by the tendency of drivers to underestimate their travel speeds after having driven at higher speeds for an extended period of time.

A gateway treatment (e.g., prominent signage, landscaping, coloured pavement, etc.) north of the intersection of Grand River Street North and Scott Avenue would signal to drivers that the nature of the roadway is changing, and they are entering an environment where they should reduce their speed and be more aware of potential conflicts in their surroundings. The elongated roundabout under consideration on Grand River Street North at the Paris Links Road / Silver Street intersection (see Section 6.1.4) is a very good example of a gateway treatment that can influence driving behaviour. Roundabouts that were considered as part of Option 2 would have also served as a convenient gateway feature but are not considered feasible.

7.2.5 Lane Widths

Lane widths have a direct relationship with travel speed, with wider lanes encouraging higher speeds. On high-speed rural roads, such as those to the north of the study area, drivers are in a consistent environment with traffic generally flowing in the same direction, and at the same speed. These environments are conducive to higher speeds, and wider lanes of 3.5 m afford extra space for drivers to react and recover, especially where there is no separation from oncoming traffic. However, the benefits of wider lanes do not carry over into urban areas, where there is higher “friction” between users, as higher speeds significantly increase driver/vehicle reaction time, increasing the potential for collisions. In an urban environment, there is also an increased chance that a collision involving a vulnerable user (e.g. pedestrian or cyclists) will occur. The risk for a vulnerable user to be seriously injured or killed as a result of a collision increases dramatically with increases in speed. Therefore, designs that encourage reduced operating speeds, such as narrower lane widths, should be considered.

The proposed options have an inside lane width of 3.35 m, and a curbside lane width of 3.50 m, not including curb and gutter. These widths are significantly wider than required, as narrower lane widths of 3.0 m – 3.2 m provide sufficient space for drivers to feel comfortable at the desired speed of 50 km/h. Conversely, it is recognized that wider lane widths in the context of Grand River Street North can be needed on occasion to accommodate large heavy vehicles.

Beyond reducing operating speeds, narrower lanes reduce crossing distances. Shorter crossing distances help improve pedestrian safety, by reducing exposure, and improve intersection operations, as shorter cycle lengths become feasible. Similar speed management and pedestrian accommodations could be achieved through the use of smaller corner and access radii along the corridor.

7.2.6 Road Capacity/Cross-section

Under the preferred option, road widening is proposed to accommodate predicted growth in peak period traffic volumes, as a result of the new developments occurring in north Paris. However, until those developments are built (and outside of the peak hours, thereafter), the road widening will reduce vehicle “friction”, encouraging higher operating speeds. Often, in urban environments, on-street parking is permitted on multi-lane roads during the off-peak periods to provide this friction. In addition to adding to the available parking supply, on-street parking serves to narrow the effective roadway cross-sections, thereby serving as traffic calming. However, few if any of the current land uses along the Grand River Street North corridor are conducive to being serviced by on-street parking. Therefore, there are likely to be challenges associated with speed management with the preferred five-lane cross-section owing to this lack of side friction.

In the interim, until traffic volumes warrant the additional capacity, there exists the option of revising lane markings and configurations to encourage lower speeds. For example, cross-hatching can be added to the curb lane to effectively remove a travel lane and visually reduce the lane width, encouraging lower speeds (as appears to have been done in the south end of

the corridor). However, such treatments do little to increase the perceived risk of collisions/conflicts, so their impact on operating speeds is often slight. Friction imposed by the introduction of the raised median may provide some relief in the long-term.

7.3 Accommodating Large Vehicles

Given the rural surrounding area, and the proximity to Highway 403, heavy vehicles and slow moving vehicles are expected to be present along the corridor. The safety impacts of these larger vehicles are discussed below.

7.3.1 Heavy Vehicles

Currently, heavy vehicles travel along Grand River Street North to either access local businesses, or to access Highway 403 to the south. The Alternate 24 truck by-pass operates west of Paris. The County's Transportation Master Plan recommends moving the south connection to this bypass north from Silver Street to Watt's Pond Road. This will significantly reduce cut-through truck traffic on Grand River Street North, potentially reducing the total number of heavy vehicles to only those making deliveries within Paris.

The proposed cross-section has ample space to accommodate larger vehicles. Further lane narrowing under 3.35 m might result in some encroachment issues, but would also force large vehicles to make slower more cautious turning movements. The RIRO operations imposed by the ultimate raised median along Grand River Street North might also pose some routing challenges for heavy vehicles. However, the majority of the adjacent land uses have entrances off of the side streets that permit access to signalized intersections. Only the plaza with the Tim Hortons, southwest of the intersection of Grand River Street North and Scott Avenue, will have their only access restricted to RIRO, once a median is installed. In that case, U-turns could be feasible if the elongated roundabout concept is constructed at the Silver Street/ Paris Links Road intersection. Specific consideration for heavy vehicles will be required at the detailed design stage.

7.3.2 Slow Moving Vehicles/ Farm Vehicles

The proximity of surrounding agricultural land is such that slow moving vehicles/ farm vehicles may be present on the urban roadway. These vehicles typically travel at slower speeds, and occupy more space. Generally, on rural roads, farm vehicles will partially travel on the shoulder to ensure they are not in the oncoming lane and provide general traffic an opportunity to pass. South of Watt's Pond Road, the recommended option maintains curb and gutter, and active transportation facilities on both sides of the street. As such, larger farm vehicles may be required to occupy both lanes, reducing the average speed and limiting opportunities for general traffic to pass.

As the urban area expands further north, the number of farm vehicles travelling into the urban area along Grand River Street North is expected to decrease. Furthermore, farm vehicles are likely to be travelling during the off-peak periods, when traffic volumes are lower and the roadway has excess capacity to accommodate them. Special considerations for slow moving vehicles/ farm vehicles, such as wider lane widths, are not recommended. Drivers will need to comply with the Highway Traffic Act, and reduce their speeds to accommodate the slow moving vehicles until a safe opportunity to pass them arises.

7.4 Streetscaping

There are two main streetscaping opportunities along the Grand River Street North corridor. The first is the potential elongated roundabout feature at the Silver Street/Paris Links Road intersection shown previously on Exhibit 6.5 and 6.6. The central island in this feature can be landscaped and still maintain all required lines-of-sight for moving through the roundabout. Other island features ranging from signage to art can be considered for this roundabout.

The other streetscape opportunity is in the centre median as it transitions from the interim TWLTL to ultimate design that could include the option for zero-maintenance landscaping shown below from an example on King Street in Kitchener.



7.5 Phasing and Constructability

Given the coordination with other construction works along the corridor in the near future, there may be a need to evaluate the phasing of the preferred alternative. The property required to ultimately construct Option 1 will take time to acquire, so construction of the interim solution with the TWLTL is needed to address growing traffic demands within the existing Grand River Street North right-of-way generated by planned north Paris subdivision and other development. Further evaluation is needed to determine the best phasing strategy which minimizes redundant construction works and costs.

7.6 Property Requirement

The conceptual layout of the Option 1 four travel lane study corridor with the elongated roundabout option at the Paris Links Road/Silver Street intersection would require acquisition of approximately 0.2 hectares of abutting property.

Property for the Paris Links Road realignment option is about double this amount at 0.4 hectares, and may increase depending on whether two or three residential lots would need to be acquired.

Appendix A – Synchro Outputs

Appendix B – Vissim 7 Elongated Roundabout Analysis
