

**City of Kingston**

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**RECONSTRUCTION AND  
REALIGNMENT OF  
ALMA AND BALACLAVA STREETS**

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**TRAFFIC IMPACT STUDY**

September 2006



**CITY OF KINGSTON**

**RECONSTRUCTION AND REALIGNMENT OF  
ALMA AND BALACLAVA STREETS**

**FINAL REPORT**

**TSH Project No. 14-150060**

**Prepared by:**

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**Stephen Sargeant, P.Eng., PTOE  
Project Manager**

**Totten Sims Hubicki Associates  
654 Norris Court  
Kingston, Ontario  
K7P 2R9**



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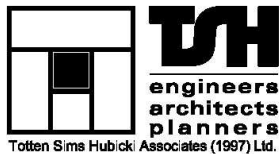
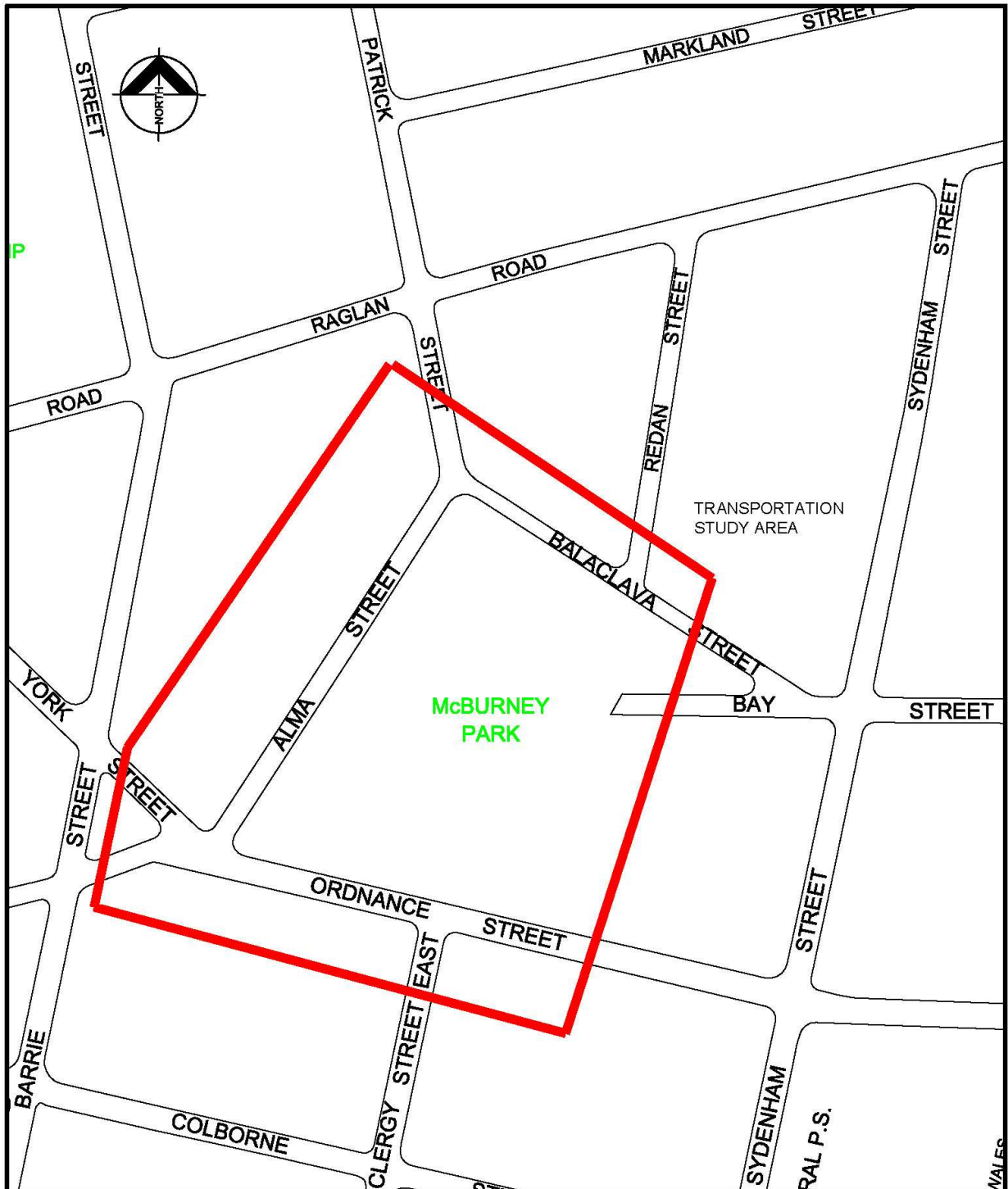
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## 1. INTRODUCTION

TSH (Totten Sims Hubicki Associates) has been retained by the City of Kingston to prepare a transportation impact study for the Reconstruction and Realignment of Alma and Balaclava Streets Environmental Assessment in the City of Kingston, Ontario. The objective of the Study is to quantify the transportation impact of each of the proposed reconstruction alternatives and to recommend improvements to mitigate the impact. Vehicle movement, parking and pedestrian movement are the primary transportation concerns for this area.

The Study Area is generally defined as Alma Street and the immediately adjacent intersections. It includes portions of Balaclava Street (Alma Street to Redan Street), Patrick Street, York Street, and Ordnance Street. This area is predominantly residential and includes historic McBurney Park (aka Skeleton Park). The Study Area is illustrated in **Figure 1**.



**FIGURE 1 - AREA MAP**

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## 2. EXISTING CONDITIONS

### 2.1 PHYSICAL

The proposed reconstruction would occur on Alma Street and include the intersections with Balacava Street/Patrick Street and Ordnance Street/York Street. The area is generally level with slight grades on York Street west of Alma Street and on Patrick Street northwest of Alma Street. The area consists of primarily two-storey residential houses, McBurney Park and a small, doctor's office on the southwest corner of Alma/Ordnance.

**Alma Street** is a narrow two-lane street extending generally north/south within the study area. The street is the west boundary of McBurney Park. Residences line the west side of the street. Parking is permitted on the west curb of the street with weekday morning (10-11 am) and weekday afternoon (2-3 pm) restrictions. Overnight parking is restricted (1-7 am) on Wednesday. No parking is permitted on the east side of the street adjacent to the park. There are curb cuts on the west side of the street to provide access to private driveways. The sidewalk is located on the west side of the street. The intersections at each end of Alma Street are Stop-sign controlled.

**Balaclava Street** is a very narrow two-lane street extending east from the intersection of Alma Street and Patrick Street. Balaclava Street terminates at Bay Street very close to Sydenham Street. Parking is permitted on the north side of Balaclava Street with morning (10-11 am) and afternoon (2-3 pm) restrictions. Overnight parking is restricted (1-7 am) on Monday. No parking is permitted on the south side of the street adjacent to the McBurney Park. The Balaclava Street approach at the Alma Street intersection is Stop-sign controlled.

**Ordnance Street** is a two-lane street extending east/west through the study area. It provides good connectivity between Wellington Street and Division Street resulting in vehicles using it as a way to avoid downtown traffic. East of Alma Street, it is wide enough to accommodate two travel lanes and on-street parking in both directions. However, parking is restricted adjacent to McBurney Park. No overnight parking is permitted on the south side of Ordnance Street on Wednesday.

**York Street** is a two-lane street running northwest/southeast through the study area. At the intersection of Alma/Ordnance, York Street turns slightly eastward and becomes Ordnance Street. Along with Ordnance Street it forms a good east/west connection in the area.

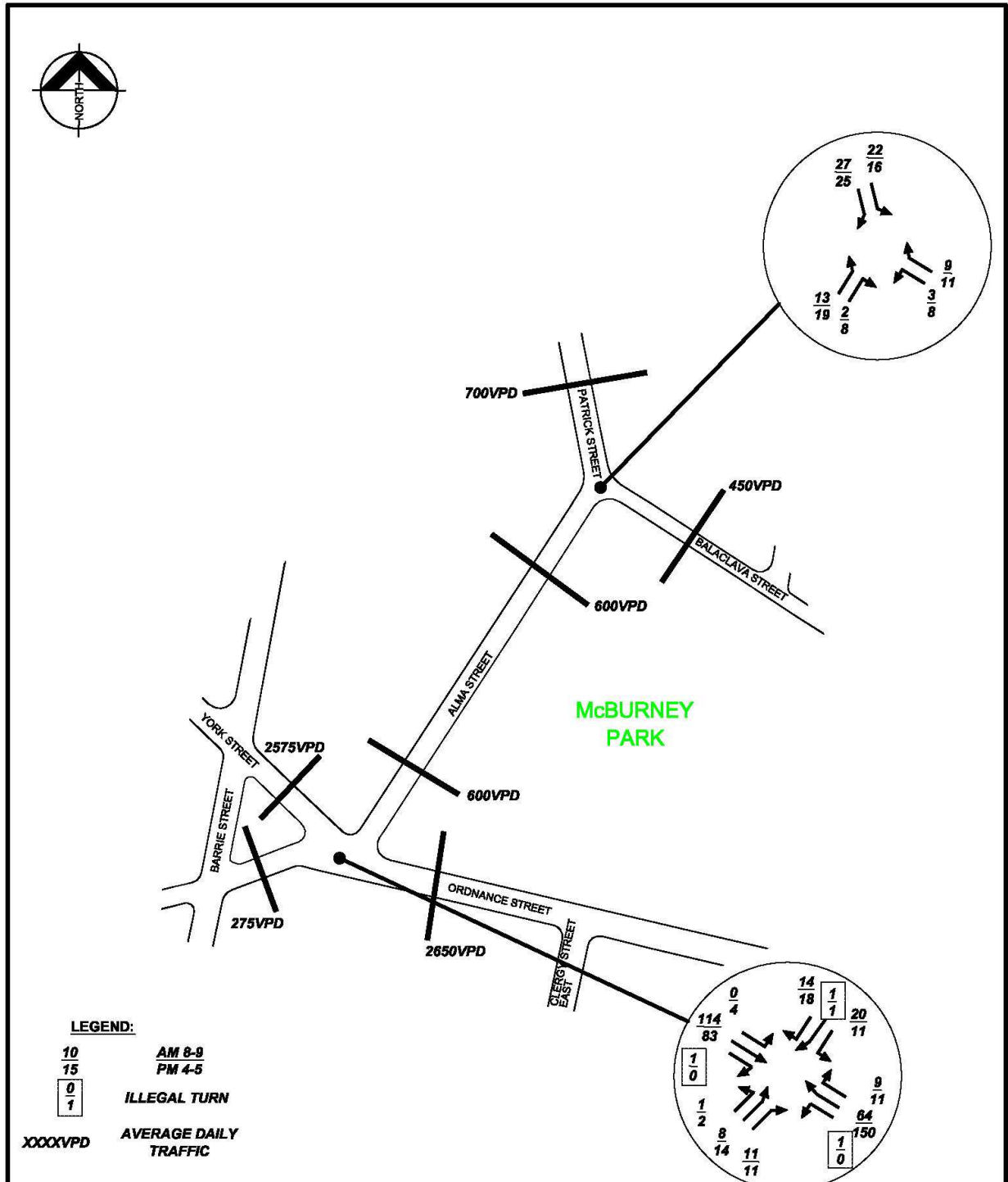
**Patrick Street** is a two-lane street extending north from the intersection of Alma Street/Balaclava Street. There is parking permitted on both sides of the street.

Except for the pathways within McBurney Park, all of the sidewalks are not separated from the curb with a boulevard.

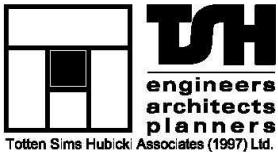
### 2.2 TRAFFIC COUNTS

Existing vehicle and pedestrian traffic volumes were collected on July 18, 2006 by TSH. Peak hour turning movement counts were conducted at the intersections of Alma Street/Balaclava Street/Patrick Street and Alma Street/Ordnance Street/York Street. For this study, we will refer to these intersections as Alma/Balaclava and Alma/Ordnance. The counts provided information on the quantity of pedestrian and vehicle traffic during two time windows. Morning counts were conducted from 7:00-9:00 a.m, and evening counts from 4:00-6:00 p.m. During each of the two-hour windows, the peak hour was identified and used for analyses. **Figure 2** shows the peak hour volumes that resulted from these counts. Summaries of these counts are provided in Appendix A.

Additional counts at adjacent intersections were obtained from the City of Kingston.



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**FIGURE 2 - EXISTING VOLUMES**

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The peak hour volumes from the counts were used to project daily traffic volumes on the subject streets. Typically, the PM peak hour represents approximately 10% of the daily traffic. The July 18, 2006 peak hour counts were used to estimate the daily volumes and then compared to similar calculations performed with the peak hour counts obtained from the City. **Table 2.1** shows the average daily traffic (ADT) volume for each street based on this methodology. All of the daily volumes are rounded to the nearest 25 vehicles.

**Table 2.1 – Existing Average Daily Traffic**

Average Daily Traffic Volumes (Vehicles)			
Street	PM Peak	ADT	Daily Directional Split
	Hour		
Alma Street	60	600	60% southbound
Balaclava Street	43	450	60% eastbound
Ordnance Street (east of Alma)	266	2650	52% eastbound
Ordnance Street (west of Alma)	27	275	N/A One-way
Patrick Street	71	700	63 % southbound
York Street	257	2575	55% westbound

### 2.3 OPERATIONS

The traffic counts revealed typical daily traffic patterns. During the morning peak hour, there is an influx of traffic destined to the east. Commuters are destined to downtown Kingston, and major employers such as CFB Kingston. The traffic patterns reverse during the afternoon peak hour when employees return home. The observed peaks in traffic were short in duration with the increase only lasting about 10 minutes.

The intersections of Alma/Balaclava and Alma/Ordnance were analyzed with Synchro version 6 (build 614), using the Highway Capacity Manual parameters. The existing intersection configuration and were used, with traffic volumes, truck percentages and peak hour factors from the July 2006 traffic counts. Synchro outputs include multiple measures of effectiveness, including level of service (LOS) and volume to capacity ratio (v/c) for each approach and the overall intersection. LOS is defined in terms of average control delay per vehicle, according to the criteria of the Highway Capacity Manual. The LOS criteria are summarized in **Table 2.2**.

**Table 2.2  
 Intersection Level of Service Criteria**

Level of Service	Average Control Delay (Seconds per Vehicle)	
	Traffic Signals and Roundabouts	Stop Signs
A	≤ 10	≤ 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

Detailed Synchro analysis printouts are provided in **Appendix B. Table 2.3** summarizes the analysis results in terms of a LOS and v/c for each intersection. No overall intersection LOS is assigned since the through movements on Ordnance/York do not experience any delay at Alma Street. Therefore, the average delay and LOS for the intersection as a whole would not reflect the delays experienced by the Stop-sign controlled side road movements. The intersection of Alma/Balaclava/Patrick has Stop signs on Alma Street and Balaclava

Street. It is unclear why right of way preference is given to Patrick Street traffic. Due to this configuration it cannot be analyzed without making the assumption that the Patrick Street approach is also Stop-sign controlled. This will overestimate the delay for Patrick Street but will provide a consistent base for comparison of alternatives.

**Table 2.3**  
**Summary of Existing Intersection Operations**

Intersection	Control Type	Approach	Peak Hour			
			A.M.		P.M.	
			LOS	v/c	LOS	v/c
Alma Street/ Balaclava Street/ Patrick Street	Stop Signs	Alma Street	A	0.02	A	0.03
		Balaclava Street	A	0.01	A	0.02
	Free	Patrick Street	A	0.06	A	0.05
Alma Street/ Ordnance Street/ York Street	Stop Signs	Alma Street	B	0.05	B	0.05
		Ordnance West	A	0.03	B	0.04

The intersection operations analysis showed that all through and turning movements at this intersection are operating at acceptable levels of service (LOS B or better) and well below capacity. Based on the daily volumes, none of the streets are close to capacity during peak hours.

During the counts, there were no notable queuing or delay problems at either of the intersections. There were five illegal movements that occurred at the intersection of Alma/Ordnance during the count periods. All of them involved wrong way movements on the one-way section of Ordnance Street. Three of the movements were clearly intentional, one appeared accidental and the fifth occurrence had no obvious intent. Also, during the morning peak hour, a recycling truck performed a three point turn within the intersection to avoid driving around the block.

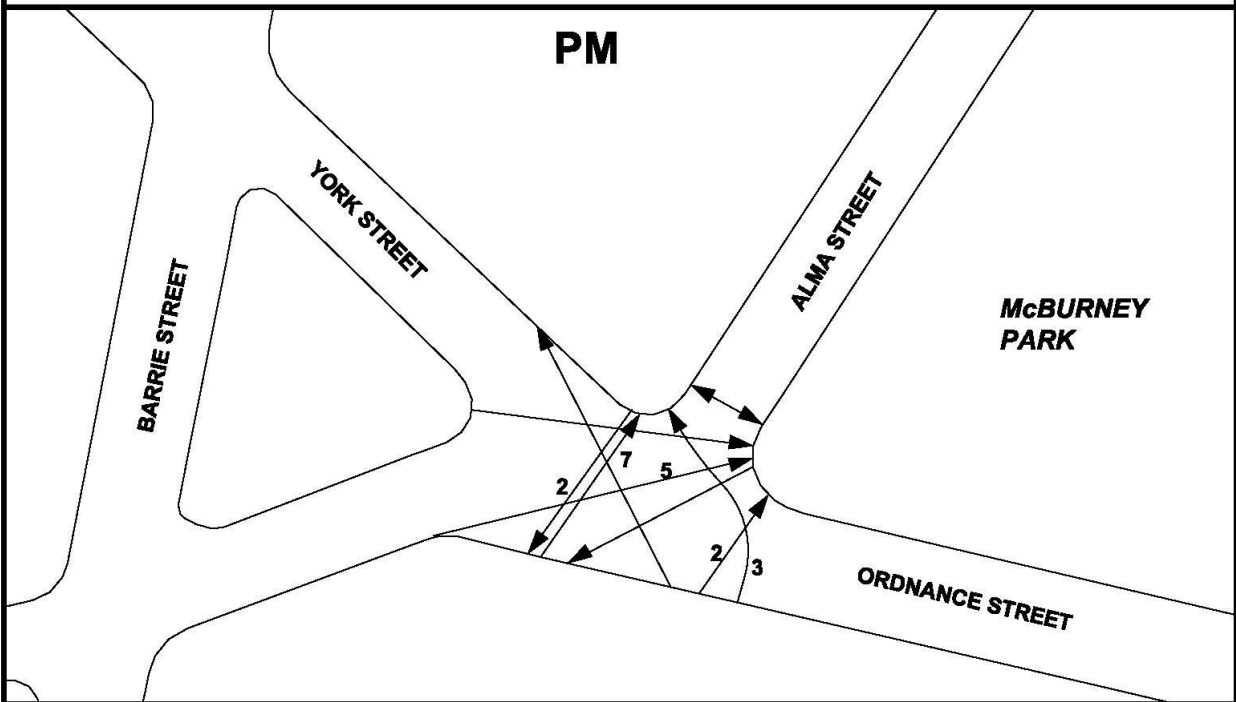
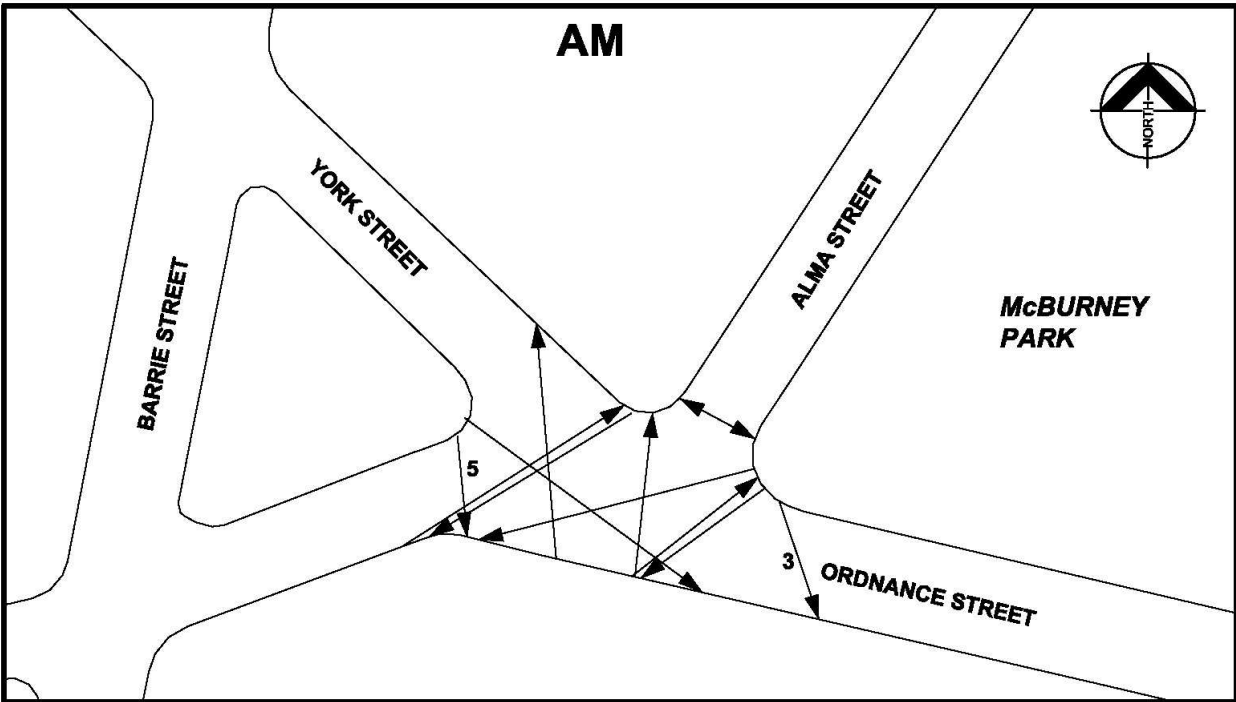
Throughout the count at Alma/Ordnance the Stop sign on the west leg (Ordnance) was not obeyed once by the 79 vehicles that used that leg of the intersection. The combination of a wide intersection and an oblique angle of approach allows vehicles to roll into the intersection well past the Stop sign. A rolling stop was the typical operation with a few vehicles hardly slowing their speed before entering the intersection.

Ordnance Street was observed to have some vehicles speeding but there is not an overall high operating speed on the street. Alma Street and Balaclava Street have no obvious ongoing speeding issues. Narrow cross sections, short block lengths and presence of on-street parking help discourage speeding on these streets.

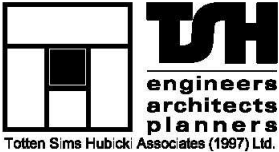
**2.4 PEDESTRIANS AND CYCLISTS**

There was a significant amount of pedestrian and cyclist activity in the study area during the count periods. The park attracts people throughout the day and has a series of pathways that connect to the studied intersections. Traversing the park by foot or bicycle is easy and comfortable. This residential area is located close to downtown and the Princess Street commercial corridor. Therefore, residents are walking to/from work and shopping rather than taking cars. Details of the pedestrian and cyclist volumes are part of the intersection counts included in Appendix A.

The intersection of Alma/Ordnance has obvious issues with pedestrian crossings. **Figure 3** illustrates the observed pedestrian crossing paths during the AM and PM peak hours. The existing layout of the intersection creates long crossing distances, indirect routes and places pedestrians in situations where a high level of judgment is necessary.



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**FIGURE 3 - PEDESTRIAN CROSSINGS**

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### 3. FUTURE CONDITIONS

The study area is not planned to have any changes in land use nor any planned redevelopment within the foreseeable future. However, the continuing redevelopment of properties in downtown Kingston can be expected to increase the overall traffic volumes that are in the study area. An increase in volumes of 20% over the next ten years has been assumed as a conservative estimate. That amount of growth roughly equates to a 1.8% increase per year.

**Figure 4** shows the 2016 volumes based on a 20% increase in volumes. These volumes will be the basis of the comparisons of alternatives.

#### 3.1 ALTERNATIVE EVALUATIONS

##### 3.1.1 Do Nothing

The 2016 volumes from Figure 4 were evaluated to determine the future level of service with no improvements. No other variables have changed. The results are shown in **Table 3.1**

**Table 3.1**  
**Summary of 2016 Intersection Operations – Do Nothing**

Intersection	Control Type	Approach	Peak Hour			
			A.M.		P.M.	
			LOS	v/c	LOS	v/c
Alma Street/ Balaclava Street/ Patrick Street	Stop Signs	Alma Street	A	0.03	A	0.04
		Balaclava Street	A	0.02	A	0.03
	Free	Patrick Street	A	0.07	A	0.06
Alma Street/ Ordnance Street/ York Street	Stop Signs	Alma Street	B	0.06	B	0.06
		Ordnance West	B	0.04	B	0.05

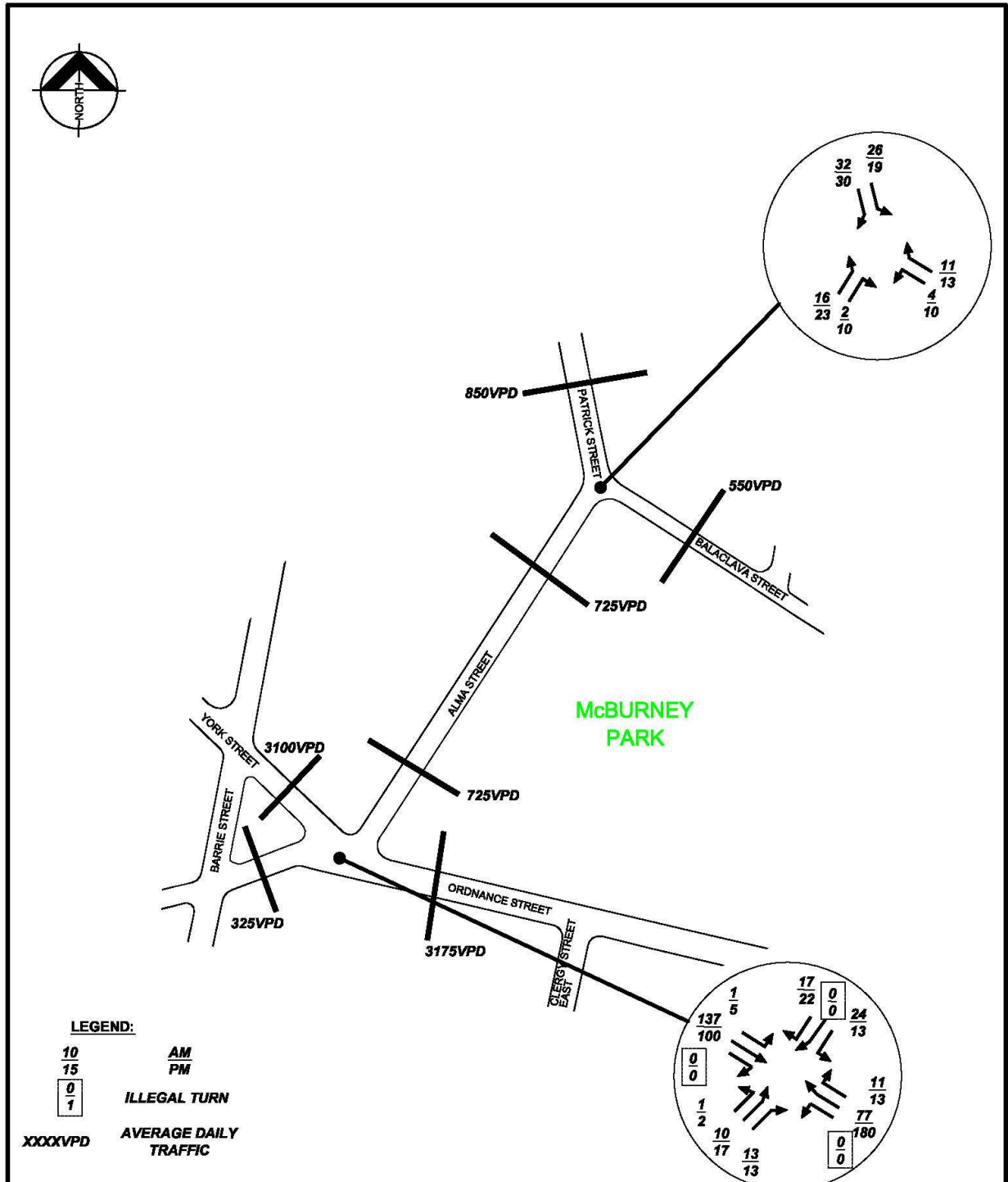
With this alternative the intersections will operate at an acceptable level of service and will not be near capacity. Volumes on adjacent streets will remain the same and there will be no change in traffic patterns in the area.

##### 3.1.2 Replace Infrastructure & Reconstruct Alma – as a narrow two-way street with no parking

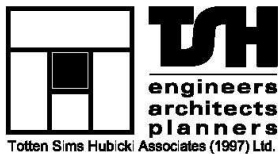
The volumes and level of service analysis for this alternative are the same as the Do Nothing alternative. With this alternative the intersections will operate at an acceptable level of service and will not be near capacity. Volumes on adjacent streets will remain the same and there will be no change in traffic patterns in the area.

##### 3.1.3 Replace Infrastructure & Reconstruct Alma – as a northerly one-way street with parking

The 2016 volumes from Figure 4 were updated to reflect the elimination of southbound traffic on Alma Street. **Figure 5** shows the volumes for this alternative. These volumes were then evaluated to identify the impacts to intersection operation. The results are shown in **Table 3.2**.



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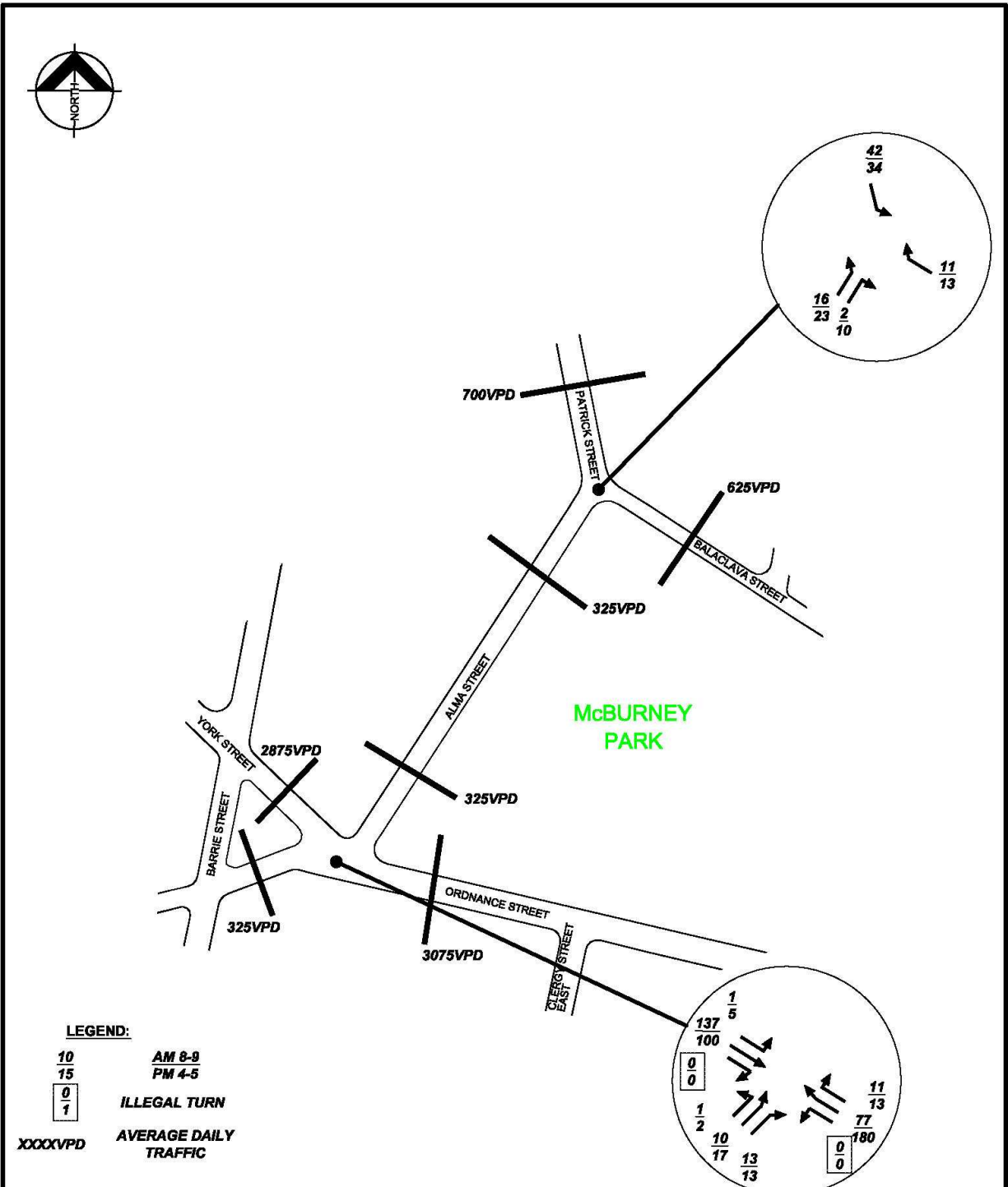


**FIGURE 4 - 2016 VOLUMES**

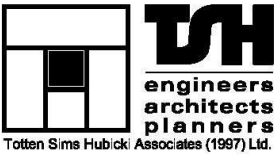
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**FIGURE 5 - 2016 VOLUMES  
 - ALMA ST. ONE WAY NORTHBOUND**

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**Table 3.2**  
**Summary of 2016 Intersection Operations – Alma Street as a Northerly One-Way Street**

Intersection	Control Type	Approach	Peak Hour			
			A.M.		P.M.	
			LOS	v/c	LOS	v/c
Alma Street/ Balaclava Street/ Patrick Street	Stop Signs	Alma Street	A	0.03	A	0.04
		Balaclava Street	A	0.01	A	0.01
	Free	Patrick Street	A	0.03	A	0.02
Alma Street/ Ordnance Street/ York Street	Stop Signs	Alma Street	N/A – movement eliminated			
		Ordnance West	B	0.04	B	0.05

With this alternative the intersections will operate at an acceptable level of service and will not be near capacity. There will be a change in traffic patterns in the area due to the elimination of southbound traffic on Alma Street. The majority of traffic that currently turns right from Patrick Street onto Alma Street will take one of two routes: A) traffic destined to the south or west will take Barrie Street via Raglan Road or Pine Street, or B) traffic destined to the east or southeast will take Balaclava Street to Sydenham Street or Montreal Street. Assuming an even split between east and west traffic, that will result in an additional 75 vpd on Balaclava Street and 100 vpd on Raglan Road and Pine Street. Alma Street will have a reduction in daily traffic to approximately 325 vehicles.

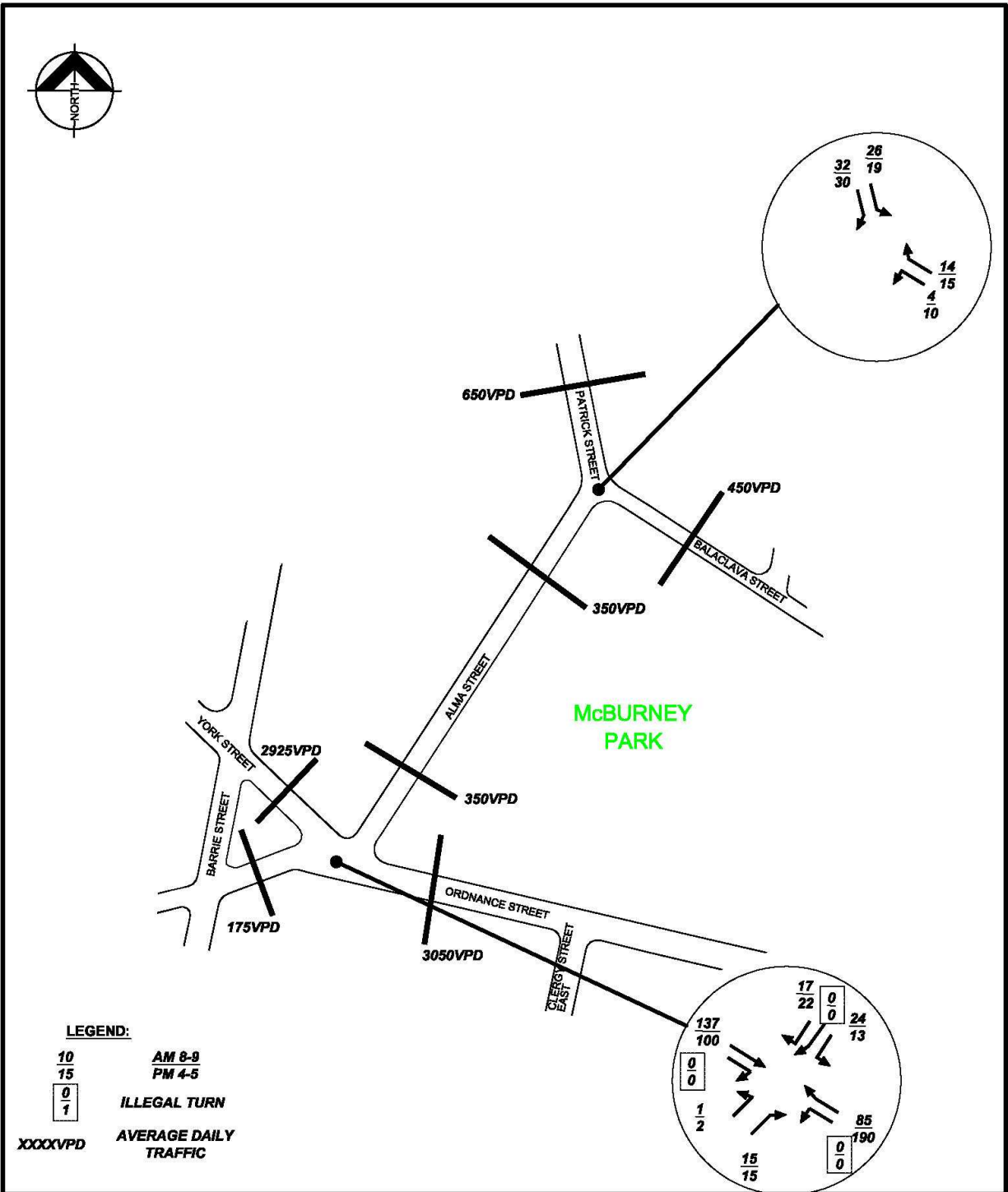
**3.1.4 Replace Infrastructure & Reconstruct Alma – as a southerly one-way street with parking**

The 2016 volumes from Figure 4 were updated to reflect the elimination of northbound traffic on Alma Street. **Figure 6** shows the volumes for this alternative. These volumes were then evaluated to identify the impacts to intersection operation. The results are shown in **Table 3.3**.

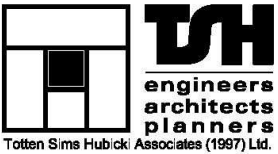
**Table 3.3**  
**Summary of 2016 Intersection Operations – Alma Street as a Southerly One-Way Street**

Intersection	Control Type	Approach	Peak Hour			
			A.M.		P.M.	
			LOS	v/c	LOS	v/c
Alma Street/ Balaclava Street/ Patrick Street	Stop Signs	Alma Street	N/A – movement eliminated			
		Balaclava Street	A	0.02	A	0.03
	Free	Patrick Street	A	0.07	A	0.06
Alma Street/ Ordnance Street/ York Street	Stop Signs	Alma Street	B	0.06	B	0.06
		Ordnance West	A	0.02	A	0.02

With this alternative the intersections will operate at an acceptable level of service and will not be near capacity. There will be a change in traffic patterns in the area due to the elimination of northbound traffic on Alma Street. The majority of traffic that currently turns right from Ordnance Street onto Alma Street will likely take York Street to Barrie Street, or Sydenham Street to Balaclava Street, or Montreal Street to an east/west street north of the area. The net result of the changes is a daily volume of 450 vpd on Balaclava Street and 3050 vpd on Ordnance Street. Alma Street will have a reduction in daily traffic to approximately 350 vehicles.



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**FIGURE 6 - 2016 VOLUMES  
 - ALMA ST. ONE WAY SOUTHBOUND**

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## **4. DISCUSSION**

### **4.1 VEHICLE OPERATIONS**

All four alternatives will have acceptable levels of service at intersections and the daily volumes appropriate for the streets in the area. There are negligible differences between the intersection levels of service of each alternative. Field observations and the analysis of future scenarios did not indicate delays or queues that will be problematic for any of the alternatives. Apart from the occurrence of rolling stops at the Stop signs, there were no obvious recurring violations.

Speeding did not appear to be an issue on Alma Street or Balaclava Street. Some speeding is present on Ordnance Street east of Alma Street but did not appear excessive. The removal of on-street parking in the alternative with two-way traffic and no parking will result in an increase in mid-block speeds on Alma Street. The short block length and Stop control at each end of the street reduces the opportunity to reach high speeds.

If either of the alternatives that change Alma Street to one-way operations are selected, a number of considerations need to be included in the design of the intersections of Alma/Balaclava and Alma/Ordnance. Both intersections should be designed to clearly indicate that Alma Street is one-way. Preferably the design should rely on physical indicators such as curb extensions and changes to the curb line. Regulatory signs (Do Not Enter, One-Way) are required and will augment the physical changes.

The intersection of Alma/Balaclava currently has atypical traffic control. Stop signs control the Alma Street and Balaclava Street approaches but the Patrick Street approach is uncontrolled. The “Y” shape of the intersection does not indicate a clear through path nor do the counts indicate a dominant movement that necessitates designating priority to any particular movement. The sight lines for the Balaclava Street approach are limited by the building and the utility pole on the north corner. Compounding the issue is the hill on Patrick Street which is relatively level (1 or 2% grade) but increases away from the intersection. Technically the sight distance is adequate for the design speed but the optics of the intersection do not give vehicles on Alma Street and Balaclava Street a traditional view of approaching vehicles. For these reasons, we believe that for most alternatives the intersection should be all-way Stop controlled by adding a Stop sign to the Patrick Street approach. The only exception is the alternative with the one-way southbound configuration. The elimination of northbound traffic on Alma Street reduces the number of conflicting turning movements at the intersection.

### **4.2 PEDESTRIAN AND BICYCLE OPERATIONS**

Pedestrians and cyclists use this area for recreation and commuting. The counts showed people traveling between their residences and McBurney Park and through the area in all directions. Pedestrians tended to travel on the pathways of McBurney Park and the sidewalks. The only area of concern is the intersection of Alma/Ordnance which has expansive areas of pavement due to the angles at which the approaches intersect each other. Pedestrians cross very long distances and the crossing locations are not direct.

Shortening the pedestrian crossing distance while providing adequate room for the design vehicle to negotiate the corner will improve pedestrian safety without compromising vehicle mobility. Where feasible, the pedestrian crossings in the study area should be shortened through the introduction of curb extensions and blisters. These features can be incorporated into the design of the one way street entrance and exit. The south side of the intersection of Alma/Ordnance should be reconstructed to narrow Ordnance Street and to reduce the oblique angle which contributes to the violation of the Stop sign. The travel lanes should remain at their current width and the narrowing could occur to reduce the distance across Ordnance Street. Narrowing the intersection would also increase the number of vehicles obeying the Stop sign at the end of the Ordnance Street one way segment. Depending on how the narrowing is designed, it will result in the loss of a few parking spaces particularly the spaces that are effective in the intersection of Alma/Ordnance.

No additional treatments are necessary to accommodate the on-street cyclists. In general, all four alternatives are viable with respect to pedestrian and bicycle operations but the reconstruction alternatives are preferable with the reduction of pedestrian crossing distances.

#### **4.3 PARKING**

Alma Street currently has parking on the west side of the street with no parking on the east side. The do nothing alternative and the alternative with Alma Street as a one-way street southbound require no changes to the current parking configuration. Parking will occur on the right side of the travel lane.

The alternative that eliminates parking on Alma Street will force residents to find other locations to park their vehicles. Many of the properties on the block have room in their driveways for at least one more car but it may create a situation where cars are blocked in the driveway. Visitors to the residences and the park will have to find parking on one of the other adjacent streets. Mid-block speeds on Alma Street would likely increase with the elimination of on-street parking because the presence of parked cars helps calm traffic.

With Alma Street as a one-way street northbound, the parking would either have to switch to the east side of the street adjacent to the park or would have to occur on the left side of the travel lane. It is our understanding that the City of Kingston prefers to not have parking occurring adjacent to City parks thereby eliminating that option.

It would be preferable to have the parking on the right hand side of the travel lane. Therefore the one-way southbound alternative and the do nothing alternative are preferable to the one-way northbound option with respect to parking. With respect to the placement of curb extensions, they should be designed to be on the same side as the on-street parking. This eliminates two unnecessary weaving movements and makes for more natural vehicle turning radii.

## **5. CONCLUSIONS AND RECOMMENDATIONS**

This report documents a detailed transportation assessment of the proposed Alma and Balaclava alternatives.

The following is a summary of the major findings:

- Regardless of which alternative is selected, the traffic volumes in the immediate and surrounding area will be appropriate and will operate at acceptable levels of service in ten years.
- None of the evaluated alternatives have negative transportation impacts that would eliminate them from consideration in the Environmental Assessment.
- The alternative that eliminates northbound traffic on Alma Street (i.e. one-way southbound) has the most transportation benefits and does not have any significant negative impacts to the immediate or surrounding area. With respect to transportation issues, it is the recommended alternative.
- The alternative to do nothing is the worst of the four alternatives because it does nothing to improve pedestrian operations at Alma/Ordnance.

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**APPENDIX A**  
**Traffic Count Summaries**

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**APPENDIX B**  
**HCS Intersection Analysis**

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