

MMM Group Limited



Community Knowledge Campus Traffic, Parking and Pedestrian Study

Prepared for:
City of Grande Prairie

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE



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STANDARD LIMITATIONS

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TABLE OF CONTENTS

1.0	INTRODUCTION AND OVERVIEW.....	1
1.1	Introduction.....	1
1.2	Study Objectives	2
1.3	Study Methodology	2
1.4	Background Information.....	4
2.0	SITE CHARACTERISTICS AND EXISTING CONDITION	6
2.1	Site Development	6
2.1.1	St. Joseph's Catholic High School	6
2.1.2	New Public High School	7
2.1.3	Coca-Cola Centre.....	7
2.1.4	Eastlink Aquatics Centre	8
2.1.5	Gymniks Gymnastics Club	8
2.2	Road Network	9
2.3	Traffic Areas.....	9
3.0	PARKING	11
3.1	Parking Needs Characteristics	11
3.2	Parking Counts and Survey	12
3.3	Parking Generation	14
3.4	Observations and Discussion.....	16
3.5	Recommendations	18
4.0	INTERNAL TRAFFIC CIRCULATION	21
4.1	Traffic Generation	21
4.2	Trip Distribution and Assignment	22
4.3	Internal Traffic Circulation Analysis.....	24
4.3.1	Afternoon Peak Hour Scenario.....	24
4.3.2	Roundabout Afternoon Peak Hour Scenario	25

4.3.3	One Way Scenario	27
4.3.4	Special Events Peak Hour Scenario	27
4.4	Recommendations	28
5.0	TRANSIT AND SCHOOL BUS SERVICES	32
5.1	Recommendations	34
6.0	PEDESTRIAN AND BIKE MOVEMENTS	35
6.1	Existing Circulation Patterns	35
6.2	Recommendations	37
7.0	CONCLUSIONS AND RECOMMENDATIONS	40
7.1	Parking at the CKC	40
7.2	Internal Traffic Circulation.....	42
7.3	Transit and School Bus Services	46
7.4	Pedestrian and Bike Movements	46

APPENDIX A – Background Information

APPENDIX B – Parking Data

APPENDIX C – Trip Generation

APPENDIX D – Trip Distribution & Assignment

APPENDIX E – Synchro Reports

LIST OF TABLES

Table 3.1: Parking Requirements (Full Built-out).....	14
Table 4.1: Weekday PM Peak Hour Trip Generation (Full Built-Out).....	22
Table 4.2: PM Peak Hour Internal Traffic Operations.....	25
Table 4.3: Roundabout PM Peak Hour Internal Traffic Operations.....	26

LIST OF FIGURES

Figure 1.1: Site Location (Source: City of Grande Prairie, GPMMap, 2012).....	1
Figure 2.1: Site Buildings (Source: City of Grande Prairie, 2012).....	6
Figure 2.2: CKC Internal Road Network (Source: City of Grande Prairie).....	10
Figure 3.1: Site Parking Plan (Source: City of Grande Prairie).....	13
Figure 3.2: Site Parking Lot Loading Survey (Source: City of Grande Prairie).....	15
Figure 4.1: Site Weekday Afternoon Peak Hour Traffic.....	23
Figure 5.1: Transit and Drop-off/Pick-up Zones (Source: City of Grande Prairie).....	33
Figure 6.1: Existing and Recommended Pedestrian/Cyclist Network (Source: City of Grande Prairie).....	36
Figure 6.2: Pedestrian/Cyclist Network Recommendations (Source: City of Grande Prairie).....	39

1.0 INTRODUCTION AND OVERVIEW

1.1 Introduction

In August 2012, The City of Grande Prairie (the City) retained MMM Group Limited (MMM) to undertake a site analysis of parking, internal traffic circulation and pedestrians for the Community Knowledge Campus (CKC). CKC is located in the southern part of the City, on the north side of 68 Avenue between Wapiti Road (108 Street) to the west and Kateri Drive to the east. The site houses recreational and institutional facilities. A layout of the plan in the neighborhood is shown in **Figure 1.1**. The area is experiencing significant growth as developments are expected in the short and long terms. In the near future the CKC site will include the St Joseph's Catholic High School (including 6 modules expansion), a new Public High School, the Coca-Cola Centre, the Eastlink Aquatics Centre, and the Gymniks Gymnastic Club.

Figure 1.1 Site Location (Source: City of Grande Prairie, GPMMap, 2012)



Recently, the Eastlink Centre was opened to the public and as a result some parking and traffic issues were observed. With the future completion of the new public high school and expansion of the St Joseph's Catholic High School, it is expected that there will be impacts on parking availability, internal traffic circulation, and pedestrian/cyclist movements.

The City has recently completed a traffic impact assessment (TIA) for the 68 Avenue in the vicinity of the site, which assumed full build out of the CKC site with a 65,000 population horizon. This study specifically addresses traffic impacts on 68 Avenue including accesses to the CKC site.

1.2 Study Objectives

The purpose of this study is to review the adequacy and identify any deficiencies in the CKC's existing internal transportation network and provide recommendations regarding internal traffic circulation, parking and pedestrian movements. Furthermore, this study does not address land use planning, which is a prerogative of the City and beyond the scope of work. Specific objectives are:

- ▶ To complete an on-site parking inventory and survey, comparing this to the figures according to the City by-laws and the Institute of Transportation Engineers (ITE) parking generation manual.
- ▶ To provide parking recommendations regarding the capacity and location of parking lots relative to the facilities they are intended to serve.
- ▶ To complete an internal traffic circulation analysis identifying deficiencies and improvement measures in terms of traffic capacity, queue length, and circulation.
- ▶ To provide recommendations regarding drop-off/pick-up zones, public transit stop areas, and school/private transit stop areas.
- ▶ To provide recommendations regarding the provision and connectivity of the various pedestrian and cyclist facilities within the CKC site, and to the external roadway network.

1.3 Study Methodology

For the study, MMM developed and agreed a study methodology with the City and its stakeholders. Regular teleconference meetings were held to ensure smoothly project control and to receive input from all parties. To achieve the study goals and objectives the following tasks were completed:

Background Information:

- ▶ Assembled available data and reports.
- ▶ Identified issues from interviews with stakeholders.
- ▶ Identified the need for additional data (if necessary).

Parking:

- ▶ Divided the site into parking/traffic generator areas a.k.a. traffic areas (by development).

- ▶ Estimated parking demand according to the ITE parking generation report (by land use), and to the City's by-laws.
- ▶ Completed parking interviews with CKC's tenants, on-site parking observations, and parking survey.
- ▶ Compared parking demand with parking supply (by parking areas).
- ▶ Revised input from stakeholders regarding utilization.
- ▶ Identified viable options to balance parking demand/supply tailored for each area within the CKC site.
- ▶ Determined optimal parking layout (parking lot location, circulation, and availability) for each area as related to the entire CKC site.
- ▶ Provided final recommendations.

Traffic Circulation:

- ▶ Identified the internal transportation network's key features such as key intersections, traffic volumes, transit availability, parking zones, and pedestrian/cyclist pathways.
- ▶ Estimated traffic volumes generated by traffic areas, their distribution and assignment to the internal road network and key internal intersections.
- ▶ Identified deficiencies and required improvements (if applicable) at key internal intersections in terms of their queue/capacity, circulation, intersection layout, safety (high level), traffic control and signage needs.
- ▶ Identified the need for changing the internal circulation pattern (i.e. two-way vs. one-way traffic) and direction of one-way if recommended.
- ▶ Identified the need of a roundabout based on internal circulation, queue and capacity.
- ▶ Conducted a high level access management analysis to improve circulation.
- ▶ Provided final recommendations.

Transit and Drop-off/Pick-up Zones:

- ▶ Identified suitable stop zone locations for public transit.
- ▶ Identified suitable stop zone locations for school buses and private transit.
- ▶ Identified suitable locations for drop-off/pick-up zones.
- ▶ Provided recommendations.

Pedestrian/Cyclist Movement:

- ▶ Identified existing and planned pedestrian/cyclist pathways.
- ▶ Identified other pedestrian needs (high volumes traffic, use of strollers, safety).
- ▶ Provided recommendations to ensure connectivity and accessibility of pedestrians/cyclists.
- ▶ Identified suitable location of pedestrian crosswalks.
- ▶ Reviewed signage and road markings.
- ▶ Provided recommendations.

Report:

- ▶ Produced a draft report including methodology, assumptions, options, alternatives, and recommendations.
- ▶ Submitted the draft report.
- ▶ Received and addressed comments from the Steering Committee, the City, and stakeholders.
- ▶ Produced and submitted the final report including methodology, assumptions, options, alternatives, and proposed recommendations.
- ▶ Presented results to the City's Public Works Committee.

1.4 Background Information

For this study, the City has provided/recommended the following planning and reporting documents as references. In order to align this project with the policy and objectives of the City, various other planning, policy, and supplementary documents were also reviewed and considered. **Table A.1** in **Appendix A** lists the background information and referenced documents.

Key planning and technical documents for this study are presented as follows:

Transportation Master Plan 2009, (August 2011)

The Transportation Master Plan (TMP) is a high-level assessment of the City's changing transportation needs based on its future size and population. It developed a comprehensive transportation network for the City which reflects the community's needs and objectives. It also identified roadways for future investigation and development as the population grows, using employment and population forecasts at the 65,000; 78,000 and 90,000 population levels.

City of Grande Prairie Land Use By-Law

Land Use Bylaw C-1100 guides development within Grande Prairie. The purpose of this bylaw is to guide and regulate the uses and development of land and buildings with the purpose of achieving order and economic development within Grande Prairie. Land Use By-Law Section 63 provides parking standard requirements.

Traffic Impact Assessment for 68 Avenue / Community Knowledge Campus (2012)

The Traffic Impact Assessment (TIA) for 68 Avenue was completed by ISL Engineering, assuming full build-out of the CKC site and partial build-out of the Stonebridge development by the 65,000 population horizon, as well as major improvements for the 68 Avenue by the 78,000 population horizon. In the study, the CKC site was estimated to generate 987 vehicles entering and exiting the site during the PM peak hour. The TIA also identified critical intersections and improvements for future traffic accommodation. Both intersections accessing the CKC site on 68 Avenue (east and west access) will require signalization by the 65,000 population horizon. As an alternative, the study proposed not to signalize the CKC east access and

redirect most of traffic to the west signalized access. It also recommended to consider the twinning of 68 Avenue before 2014.

68 Avenue Functional Planning Study (2000)

Functional planning study for 68 Avenue was completed by ISL Engineering, and provided the horizontal alignment of 68 Avenue between 108 Street and Resources Road (to the east). The study recommended to designate 68 Avenue as a four-lane divided highway with a posted speed of 60 kph. It also recommended to provide a pedestrian and cycle pathway along the north side of the highway.

Institute of Transportation Engineers Parking Generation, 4th Edition

The Parking Generation, Informational Report of the Institute of Transportation Engineers, is intended as an informational report providing collected data on parking demand and supply by land use. The report does not provide authoritative findings, recommendation, or standards in parking demand; however, it provides a data resource for planners and designers.

Institute of Transportation Engineers Trip Generation, 8th Edition

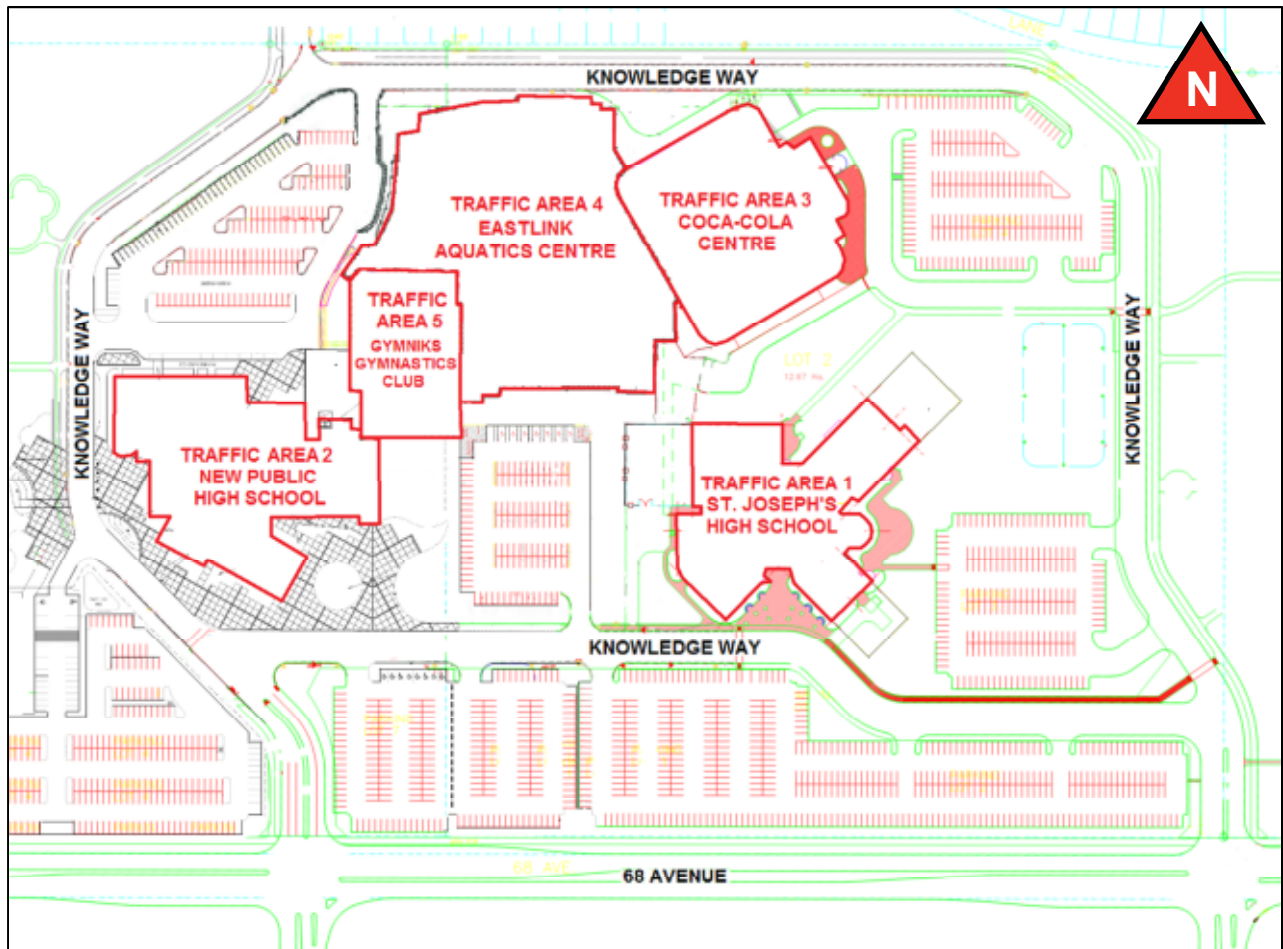
The Trip Generation report provides a summary of trip generation data for different land uses. The data was voluntarily collected and submitted to ITE. The report is used to estimate trips that may be generated by an specific land use. It also provides trip generation equation for different time periods.

2.0 SITE CHARACTERISTICS AND EXISTING CONDITION

2.1 Site Development

The Community Knowledge Campus (CKC) will house the St Joseph's Catholic High School (existing and expansion), a new public high school, the Coca-Cola Centre (existing), the Eastlink Aquatics Centre (existing), and the Gymniks Gymnastic Club (existing). **Figure 2.1** illustrates the CKC site buildings.

Figure 2.1 Site Buildings (Source: City of Grande Prairie, 2012)



2.1.1 St. Joseph's Catholic High School

St Joseph's Catholic High School is located on the northwest corner of the intersection of the South and East legs of Knowledge Way, south of the Coca-Cola Centre. Currently, the school has 71 staff members and 783 students; however an expansion of 6 additional modules will bring its maximum capacity to 146 staff members (40 new and 35 relocated from the downtown office) and 1,228 students. The expansion is planned inside a new building on either the current staff parking lot, or the gravel parking lot, or attached to

the existing south east wing of the school. For the purposes of this study it was assumed the expansion will not reduce the number of existing parking stalls.

When initially constructed the school was required to provide a total of 367 parking stalls on the southeast corner of the CKC site, which allows for approximately 627 parking stalls according to plans (surplus of 260 parking stalls). The entrance to the staff's parking is along the East Leg of Knowledge Way. Parking is also provided southeast of the South Leg of Knowledge Way. Currently students are dropped-off/picked-up along the South Leg of Knowledge Way; however the area in front of the school's entrance is designated for schools buses only. About 280 students are currently transported by 10 school buses.

2.1.2 New Public High School

The proposed new high school building will be located on the northeast corner of the intersection of the South and West Legs of Knowledge Way, west of St. Joseph's Catholic High School. The main entrance will be facing south. The school is planned for an ultimate capacity of 1,400 students, and 82 staff members. The total site area is 53,100m² with a total building footprint area of 8,000m² and total modular classroom area of 815m². It is understood that fences are recommended between the proposed high school and the Gymnastics building for security reasons.

According to the development permit the new school requires 390 new parking stalls. Approximately 280 stalls are proposed on the CKC's southwest corner for students and public, while 110 stalls are proposed on the south side of Knowledge Way (South Leg) for teachers and staff. The school plans also show 20 additional parking stalls for pick-up/drop-off and disable parking. However, the construction of the new school will take over the gravel parking lot of Gymnastics Centre (which currently allows for approximately 107 parking stalls).

2.1.3 Coca-Cola Centre

The Coca-Cola Centre has several amenities including two ice rink surfaces on the main floor with a capacity for 1,600 spectators (north rink) and 350 spectators (south rink). Three meeting banquet rooms are available on the second floor with a capacity for 140 people; while the third floor has a lounge with a capacity for 112 people. The facility hosts old-timer and recreational hockey leagues and it is available for private bookings and public events. There is also staff of maximum 10 persons at any time.

200 parking stalls are required based on the by-laws; however, according to site map only 192 stalls are provided (deficit of 8 stalls). The parking peak seems to occur during evening peaks with overlapping (people getting in/out). Special events include hockey games (one to two nights per week during winter) with about 800 spectators. The private transit parking zone is located on the northwest curb of Knowledge Way, although it seems most transit drivers do not stay in the facility after dropping-off of their passengers.

2.1.4 Eastlink Aquatics Centre

The Eastlink Centre is a recreational facility for the practice of aquatic and field sports. It was opened in December 2011. The aquatics area includes an Olympic size 54m competition pool, diving towers, a surfing simulator, water slides and play areas. The athletics area includes indoor basketball, volleyball, badminton and squash courts, a fitness centre, and an indoor track. The Eastlink Centre hosts several groups, shops and a tenant area.

557 parking stalls are required based on the by-laws. Approximately 108 stalls are provided by the south site parking lot. Also, 165 paved parking stalls are available on the northwest site parking lot. However, this parking supply is shared with the Gymnastics Club as both buildings share common areas including the entrance. The Gymnastics Club is required to provide 272 stalls based on the by-laws, which leaves a shortage of 556 stalls for both facilities.

2.1.5 Gymniks Gymnastics Club

The Gymnastics Club is located in the centre of the CKC site. The main door faces west and is shared with the Eastlink Aquatics Centre. The building has approximately 4,650 m² (floor area) of which 2,415 m² are an open gymnasium.

The Gymnastics Club's capacity is estimated for 1,300 students, 20-30 staff, 50-60 physiotherapy patients, and 50-60 pre-school parents (1,450 total) who arrive during operational hours to attend morning, afternoon and evening classes. Drop-off/Pick-up is estimated 50% of total parent's trips. The building has capacity for 450 spectators.

Special events include gymnastics competitions (once or twice per year usually between March and May), Christmas performances, and cheerleading public performances (annually in May). All events are standing room only and the peak capacity is estimated at 600 spectators, 200 participants, and 85 staff/volunteers. During registration the peak reached 200 people at the same time (entering and exiting the facility).

The facility is required to provide 272 parking stalls based on the City's by-law. However, only 118 paved stalls are provided on the northwest parking lot. Recently, with the opening of the Eastlink Centre, an additional 47 paved stalls were provided on the northwest lot (for a total of 165 stalls); and 108 paved stalls are provided on the south lot adjacent to the facility and between the St. Joseph's and the public school sites. In addition there is an approximately potential for 107 temporarily stalls in a gravel lot south of the northwest lot, which will be lost with the construction of the new public school. Currently this lot is used when demand exceeds capacity on the northwest paved lot. Although currently 273 parking stalls are provided, these are shared between the Eastlink Centre and the Gymnastics Club. Therefore, 556 stalls are still needed to comply with the parking by-law requirements.

2.2 Road Network

68 Avenue is designated as an arterial and planned as a four-lane roadway with a posted speed of 60 kph. In addition, 68 Avenue is designated as a truck route. For the purposes of this study, it was assumed upgrades on 68 Avenue will be completed before full development of the CKC site.

Two accesses off of 68 Avenue are provided at the east and west intersections of Knowledge Way and 68 Avenue. Both intersections are planned as four-leg intersections and will warrant signalization. An additional right-in/right-out access to a proposed parking lot for students has been proposed between the west intersection of Knowledge West and 68 Avenue, and the signalized intersection of Wapiti Road (108 Street) and 68 Avenue. The feasibility of the access will be revised in **Section 4**. No other accesses to the site are planned.

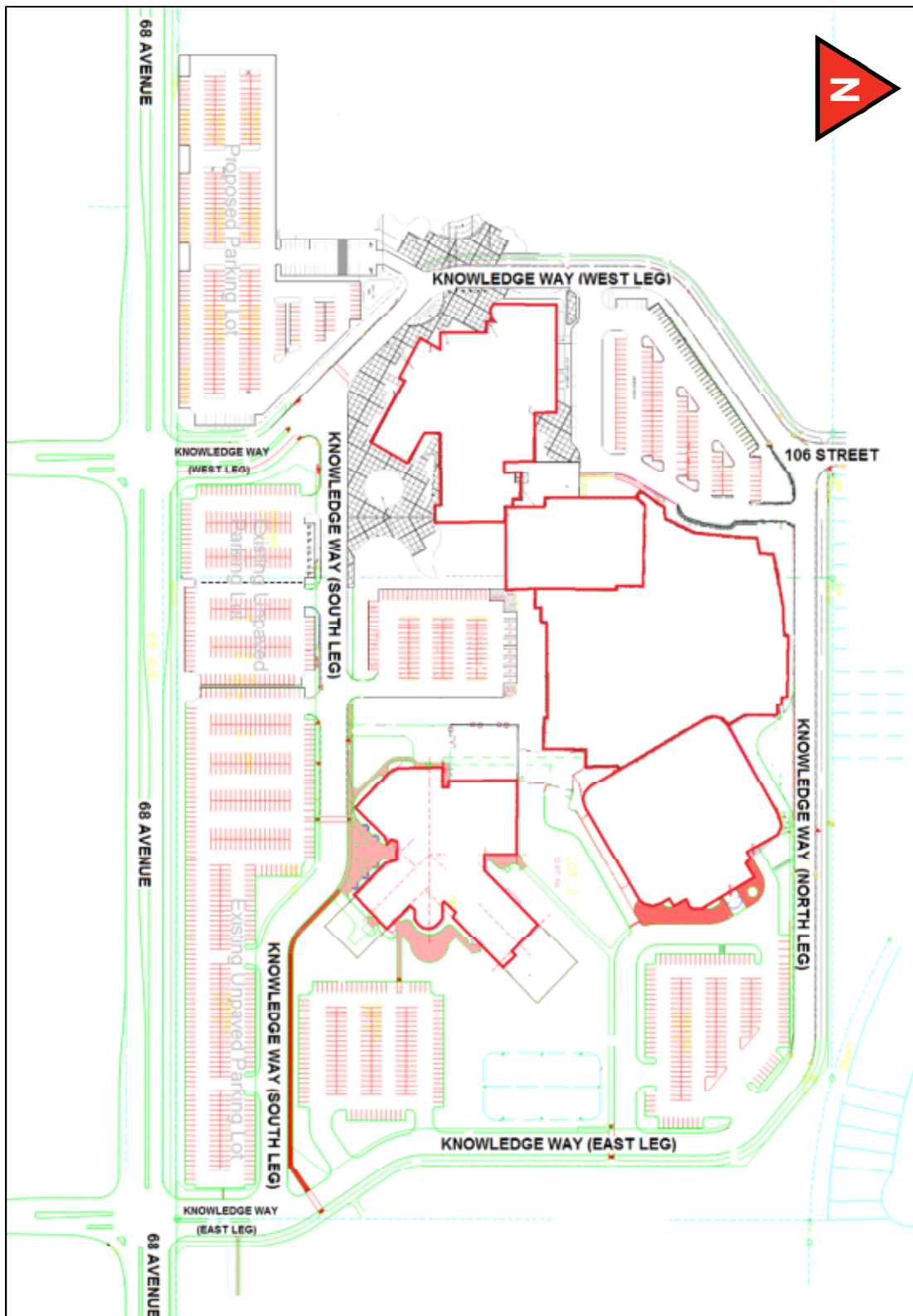
Within the CKC site, Knowledge Way loops around the building complex, inscribing an internal ring-road. For the purposes of describing the internal road system in this report, Knowledge Way will be divided into four sections: North Leg, East Leg, South Leg, and West Leg. **Figure 2.2** illustrates the internal road network.

Knowledge Way is a two-lane two-way undivided roadway for most of its length. Both segments between 68 Avenue and the South Leg of Knowledge Way are four-lane including the auxiliary lanes for turning movements. The South Leg of Knowledge Way is a two-lane undivided roadway with a width of approximately 15m, which can accommodate 4 lanes of 3.75m each. Moreover, it is our understanding that at least during peak hours this segment operates as a four-lane undivided roadway with one lane in each direction dedicated to drop-off/pick-up parking or school buses stop zone. Knowledge Way north of the South Leg of Knowledge Way is approximately 12m wide which could allow for three lanes of approximately 4m each (with one lane dedicated to left-turns, right-turns, on-street parking or transit stop zones). The posted speed of Knowledge Way is 30 kph.

2.3 Traffic Areas

For the purposes of parking and traffic circulation analysis, the CKC site was divided into Traffic Areas (TA) by facility location. Traffic Areas are not only convenient for analyzing the internal road network traffic circulation (including trip generation, distribution and assignment) but also for determining parking generation, demand and supply. **Figure 2.1** illustrates the Traffic Areas.

Figure 2.2 CKC Internal Road Network (Source: City of Grande Prairie)



3.0 PARKING

3.1 Parking Needs Characteristics

The Coca-Cola Centre requires suitable parking for a small number (estimated total 25) of daytime employees, attendees at its meeting room, and arena users; and accommodation for evening/weekend hockey and skating camps and competitions. Seating for both ice sheets total 1,950; experientially, event parkers (including players) tend to use space 4:1, and the estimated maximum requirement is 250 stalls. At present, the Centre is serviced by 192 stalls suggesting a potential deficit capacity of 58 stalls during a full capacity event. A full house at the Centre is extremely rare, and so the availability of evening/weekend parking, with emergency overflow opportunities in the adjacent St. Joseph's lots which are largely unused evenings and weekends, represents an effective sharing alternative.

St Joseph's Catholic School requires parking for 1,228 students and 146 staff; experientially, staff tend to use parking stalls 1:1, and students 4:1, and the estimated actual maximum requirement is 320 stalls. At present St Joseph's is serviced by 187 staff stalls and 440 student stalls (647 total) suggesting a surplus capacity of 327 stalls.

The Gymniks Gymnastics Club requires suitable parking for 1,300 students, 20-30 staff, 50-60 physiotherapy patients, and 50-60 preschool parents (1450 total) who arrive during operational hours to attend morning, afternoon and evening activities. These patrons tend to utilize parking 1:1 due to small children, short class or appointment periods, or injuries; however, the five scheduling periods of 1.5 hours each, coupled with significant pick-up and drop-off activities, distribute demand significantly and result in a consistent utilization of 6:1 or an estimated 246 stalls at any one time. At present, the Gymnastics is serviced by 165 stalls (northwest lot) and 117 stalls (south lot) for a total of 282 stalls, which is shared with the Eastlink Centre, suggesting an overuse scenario in the space adjacent to the facility. At present, overflow is serviced in the gravel section of the northwest lot, in the St. Joseph's student lot, and through poor parking practices (parking along curbs, sidewalks, loading and emergency areas).

Major concerns from the users of the Gymniks Gymnastics Club are related to insufficient parking spaces, long walking distances from parking lot to the entrance (especially during winter and for users with young children), lack of pavement/parking marking, lack of proper signing, speeding along Knowledge Way, and shortage of enforcement. Beside that the main entrance and the northwest parking lot is shared for the Eastlink Centre and the Gymnastics Club, the signage for the drop-off/pick-up parking zone is ignored, and vehicles stay between 30 to 40 minutes. There is also some concern related to City buses being blocked by traffic on this area. In addition illegal parking is impacting circulation and visibility.

The Eastlink Aquatics Centre requires parking for 2,500 members and 1,000 day use parkers, 100 of whom are preschool mothers with small children, and approximately 50 tenants and tenant customers, parking at 2.5 hour intervals over a 12 hour period. Capacities for the multiplex area, as well as information obtained from entry records, suggest 1,500 members and visitors over the course of a representative 12 hour day at 2 hour intervals, and a 6:1 user to parking stall ratio. At present, the Eastlink

Centre is serviced by 165 stalls (northwest lot) and 117 stalls (south lot) for a total of 282 stalls, which is shared with Gymniks Gymnastics Centre, suggesting an overuse scenario in the space adjacent to the facility. Currently, overflow is serviced in the gravel section of the northwest lot, in the curbside spaces around the west end of Knowledge Way.

A new public school is planned for the southwest corner of the Eastlink/Gymnastics site, and it was estimated that this facility will need 450 stalls for teachers and students, located as planned on the south and south west faces of Knowledge Way. However, only 390 stalls are required according to the development permit. For the purposes of this study a conservative value of 450 stalls will be used.

A site plan showing the numbers and locations of parking lots and stalls is presented in **Figure 3.1**.

3.2 Parking Counts and Survey

Stakeholders were interviewed to develop an understanding of problems and related issues; and to understand the general and experiential needs of each facility. Interviews were conducted with the following:

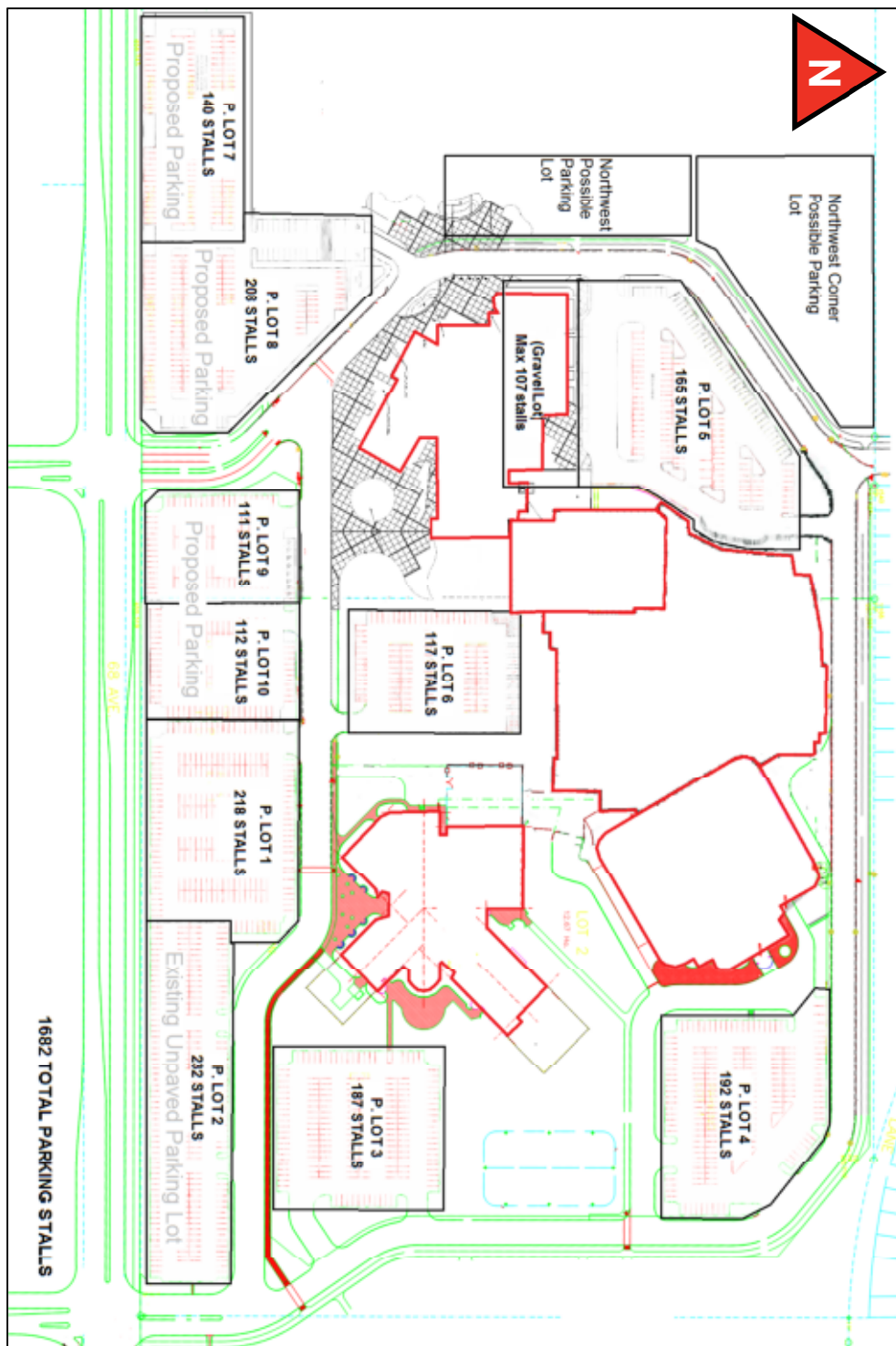
- ▶ Cocoa Cola Centre: Kylee Haining
- ▶ St Joseph's Catholic High School: Brian Sawchuk
- ▶ Gymniks Gymnastics Club: Katie Watson
- ▶ Eastlink Aquatics Centre: Carol Longmore

CKC's parking lot loading was observed from 8:30 AM to 8:00 PM on Thursday September 20, 2012. This day was described by stakeholders as representative of the usual weekday condition; higher loading levels are experienced during competitions and tournaments, and occasionally on weekends.

Parking lot occupancy counts were taken at 10:00 AM, 4:00 PM, and 7:00 PM. These timings were described by stakeholders as reasonably representative of loading/unloading periods over the course of a usual weekday. Again, in special event and weekend periods, loading reaches higher volumes. Experiential information indicates that – on busy days – loading can be almost doubled the September 20 representation.

Figure 3.2 summarizes the parking lot loading observations at the CKC site. **Appendix B** presents parking data observations at the CKC site.

Figure 3.1 Site Parking Plan (Source: City of Grande Prairie)



3.3 Parking Generation

MMM calculated parking demand and supply based on parking rates provided by the Institute of Transportation Engineers (ITE) Parking Generation, Informational Report, 4th Edition. The figures were compared to those from the City of Grande Prairie By-Laws, and to the site counts.

The available ITE parking rates, for similar land uses to those of the CKC site, are based on data collected in small samples which results in low correlation coefficients. This means that the available ITE parking rates might not be necessary representative of each land uses and should be used with precaution. The exception is the high school land use where the ITE database shows a higher level of correlation with field data. Notwithstanding, the ITE parking generation results are similar to those used in the by-laws. Moreover, these estimates have assumed that parking is not shared. Given that traffic peak hours from the schools do not overlap with the peak hour of the other facilities, opportunities for parking sharing are plentiful and parking can be managed efficiently. For the purposes of estimating the recommended parking supply, expertise knowledge was used in addition to the available data.

Table 3.1 presents the parking requirements based on the ITE parking generation manual, the City by-laws, and data collected on the field. **Appendix B** presents the by-law, on-site parking counts and the ITE parking generation results.

Table 3.1 Parking Requirements (Full Built-out)

Area	Land Use Description	ITE Parking Generation Informational Guide		Required By-Law	Inventory (# of stalls)	Recommended if Parking Is Shared
		Parking Demand	Parking Supply			
TA1	St Joseph's Catholic High School	305	615	410	627**	320
TA2	New Public High School	350	700	409*	-	450
TA3	Coca-Cola Centre	20	195	200	192	250
TA4	Eastlink Aquatics Centre	190	250	557	117	246
TA5	Gymniks Gymnastics Club	165	165	272	165	246
	Knowledge Curbside Southwest	-	-	-	12	-
	Knowledge Curbside St. Joseph High School	-	-	-	8	-
	Knowledge Curbside Northwest (Skate Park)	-	-	-	12	-
	Knowledge Curbside North (Rear of Eastlink)	-	-	-	45	-
TOTAL		1030	1925	1848	1178	1512
<p>* Calculated based on the available information. Only 390 stalls are required according to the development permit. However, 450 stalls are recommended and this figure is used for the purposes of this study.</p> <p>** Includes paved and unpaved parking stalls on the south side of Knowledge Way as well as staff parking on the east side of St. Joseph High School.</p>						

The site plan illustrates the Northwest Corner Possible Parking Lot, divided into several proposed and existing parking areas. A north arrow is located in the top right corner. The plan includes the following details:

- Northwest Corner Possible Parking Lot:** A large area at the top right, with a table showing usage statistics.
- P. LOT 6:** A proposed parking lot with 165 stalls, located in the upper middle section.
- (Gravel Lot) Max 107 stalls:** A designated area for gravel, located near P. LOT 6.
- P. LOT 9:** A proposed parking lot with 111 stalls, located in the middle left section.
- P. LOT 10:** A proposed parking lot with 112 stalls, located in the middle left section.
- P. LOT 1:** A proposed parking lot with 218 stalls, located in the middle left section.
- P. LOT 2:** A proposed parking lot with 232 stalls, located in the bottom left section.
- P. LOT 3:** A proposed parking lot with 187 stalls, located in the bottom middle section.
- P. LOT 4:** A proposed parking lot with 192 stalls, located in the bottom right section.
- LOT 2:** An existing paved parking lot, located in the bottom middle section.
- Existing Unpaved Parking Lot:** An area at the bottom right, adjacent to LOT 2.
- Usage Statistics Tables:** Five tables provide data on stall usage and availability for different time periods (10:00 AM, 4:00 PM, 6:30 PM).

Time:	10:00 AM	4:00 PM	6:30 PM
Used:	139 stalls	83 stalls	236 stalls
Available:	26 stalls	82 stalls	71 stalls

Time:	10:00 AM	4:00 PM	6:30 PM
Used:	29 stalls	18 stalls	55 stalls
Available:	88 stalls	99 stalls	62 stalls

Time:	10:00 AM	4:00 PM	6:30 PM
Used:	22 stalls	11 stalls	29 stalls
Available:	170 stalls	181 stalls	163 stalls

Time:	10:00 AM	4:00 PM	6:30 PM
Used:	64 stalls	14 stalls	1 stalls
Available:	133 stalls	173 stalls	188 stalls

Time:	10:00 AM	4:00 PM	6:30 PM
Used:	85 stalls	27 stalls	14 stalls
Available:	135 stalls	191 stalls	204 stalls

1682 TOTAL PARKING STALLS

3.4 Observations and Discussion

- ▶ On a representative day (Thursday) there was ample parking capacity for all uses: quite a lot of unused capacity in both of the St Joseph's lots, the Coca-Cola lot, the new south Eastlink/Gymnastics lot, and on the Knowledge Way curbside. There was a lot of activity in the northwest Eastlink/Gymnastics parking lot, but the spaces were being turned over, and there was always sufficient space for users.
- ▶ After 4 PM, use of the Eastlink and Gymnastics facilities increased considerably and appeared to be doubled that of daytime use – and the northwest lot was well over capacity. There was ample parking capacity in the other lots, especially the school lots, which were near empty. There was a football practice at the playing field at the east end of the property, and vehicles were parked along the curb, but not in the empty lots. It is believed that daytime Saturdays and Sundays reflect the evening use characteristics.
- ▶ On most evenings the Eastlink/Gymnastics buildings operate at half to 2/3 capacity fully loading the northwest parking lot areas. The Coca-Cola Centre operates at capacity only on an evening and weekend event cycle, loading only the parking lots on east side of the property. On the occasional day when the east lots are fully utilized, parkers overflow to the south side, St. Joseph's student lot (usually the gravel section).
- ▶ There seems to be effective sharing of space on most operating days, but there is a danger of a "perfect storm" situation if both St Joseph's and the new public school were to have major events, at the same time as the Coca-Cola Centre is loaded on both rinks, and the Eastlink Centre and the Gymnastics Club were operating at capacity. This can be avoided through management awareness, and it is suggested the facility managers should share their event dates and calendar in their quarterly operations meetings.
- ▶ The northwest lot services the main reception entrance to both the Eastlink Centre and Gymnastics Club, and it is traditionally viewed as the "front entrance" for customers of both facilities. As a consequence, most parkers accessing the centre gravitate to this door, even though there are ample stalls in other nearby lots. There is no apparent practical reason for this to happen, – except for, perhaps, mothers with strollers dropping off for day care, or the pick-up/drop-off of visitors to the therapy clinics or Eastlink tenants. It is believed that the availability of informal parking on the landscape in the northwest lot – coupled with the lack of site parking control – contributes to this phenomenon.
- ▶ The City has recently completed a new lot between St Joseph's high school and the Eastlink Centre, and has built an inviting entrance to the south side of the complex. As users become more aware of this lot, it is anticipated that they will take advantage of the new space in greater numbers and lesser the pressure on the northwest lot. However, in the evening/weekend time segments, even the addition of this new lot will not accommodate all parkers, and it is suggested that the City create awareness or an instruction to visitors to park in the St Joseph's student lot, when the "new" Eastlink/Gymnastics south lot is full. At present St Joseph's parking lot constitutes the best overflow for the multiplex during busy times. It is noted that this new lot is planned to be overbuilt by a field house or other structure in the

future, and may not exist permanently. Awareness can be created by: (1) providing information inside the Eastlink Centre (that additional parking is available and where); (2) educating the students; (3) providing signage to direct to the available parking lots; (4) improving the south entrance to make it look more like a main door.

- ▶ The new public school has proposed to build teacher and student stalls on the southwest and south side of the South Leg of Knowledge Way. These stalls will also be available to the Eastlink Centre and Gymnastics Club during evening and weekend time segments, and this will be a considerable benefit to the multiplex centre. Conversely, the presence of teacher and student vehicles during the day, and the reduction in size of the northwest lot, will be a very significant risk to maintaining stall availability in that lot. The lack of proximate available parking has been cited as a major threat to the continuing success and further growth of the Eastlink complex. It is suggested that the City develop a reserved permit system or a pay parking system to discourage overuse of this lot when construction of the new public school commences.
- ▶ Where local parking demand exceeds local parking supply, as it is the case, a regulatory system is necessary in order to manage the parking space resource. This is done to either regulate or charge a fee, and enforcement. Enforcement is a key issue and in the lack of enforcement parkers will ignore the regulation. Two options are suggested from the point of view of parking management in this case:
 - A reserved permit system that would allow frequent users of the multiplex to park in the northwest lot (and perhaps the Eastlink south lot) bundled with memberships, and supported by dedicated stalls for mothers with strollers, or patrons of the services in the building on a priority basis (i.e. seniors, parents with small children, etc.); or
 - A pay parking system for these high demand areas that suppresses demand by encouraging parkers to seek out free stalls. A pay parking scheme would generate a small revenue stream, but is problematic at several levels, and so it is suggested that the reserved permit system is the preferred first option.

Several other measures will aid in efficient management of parking at the complex:

- ▶ The City should erect an informational sign at the corner of Knowledge Way west entrance to direct traffic east on Knowledge Way and into the school parking lots; Parkers should be encouraged to move in that direction to ease pressure on the northwest lot. The wordy and complicated signs that are present now should be removed.
- ▶ The “new” south entrance to the multiplex complex should be further improved to make it look more like a main entrance. Much of this work has been completed, but more needs to be done to make it psychologically more appealing to people seeking a main entrance to the building, and a parking space close to it.
- ▶ The lots should be more consistently maintained in better condition (i.e. garbage pick up, asphalt topping, pot holes, weeds, stall paint, etc.); a higher standard of care will encourage more responsible use and less misuse or poor parking efforts, which will damage the landscape.

- ▶ The gap between the proposed public school parking lot on the south side and the St Joseph's student parking lot should be closed to maximize the sharing ability of the parking space. There is sufficient space for all the students from both schools to park in the same large area, between both West and East Legs of Knowledge Way. If this can be achieved, closing the gap will amplify parking capacity by an estimated 200 stalls through additional sharing opportunities.
- ▶ The "front exterior" of the new school should face southwest, rather than towards the northwest lot, and pedestrian access from the north face of the new school building to the multiplex complex should be restricted; this will reinforce the attraction of students and teachers to their new lots at the public school.
- ▶ Property management should install a fence along the island in front of St Joseph's main door; this will prevent students from straggling across the road; this is currently in place at the east sports field and has achieved some success. Similar treatments will be needed around the new school and along 68th Avenue when the south side development is complete.
- ▶ Speed humps in the lots and on the roads are an option to encourage buses and passenger traffic to slow down in key areas.
- ▶ Signage for special needs parkers (mothers with strollers, physiotherapy patients, etc.) would be an effective option in minimizing drop off uses and misuses in the northwest lot.
- ▶ Additional bus routes would be supportive.
- ▶ Generic signs that identify stalls as "Reserved" or "Public Parking" would be more successful than the current signage, in encouraging parkers to use overflow parking in evening and weekend event hours.

3.5 Recommendations

It is concluded that the Community Knowledge Campus has ample parking to sustain its operations at present; however the addition of the new public school and full development of the site will challenge the existing stock of space. It is expected that the planned 450 stalls additional to the new construction will be sufficient to accommodate new demand, and that the addition of a number of other site controls and amenities will significantly improve parking facilities and services, and optimize use of the lots by adjacent facilities. It is anticipated that these planned upgrades will be sufficient to permanently service the site within current planning horizons. The following recommendations are provided:

1. It is estimated that at full build-out of the site, approximately 1,848 parking stalls are required based on the City's By-law. Moreover, based on the ITE parking generation manual only about 1,030 parking stalls are required (parking demand), and about 1,925 parking stalls are provided for similar land uses in North America (parking supply). Based on field observations, the site has currently an inventory of approximately 1,101 parking stalls (including the unpaved parking south of the South Leg of Knowledge Way) at parking lots and about 77 on-street parking along Knowledge Way (a total of 1,178 parking stalls). However, field observations and information

provided by the stakeholders indicate that peaks of parking demand do not coincide for the schools developments and other site developments. This means, there are opportunities for sharing parking supply and efficiently manage the parking at the site, reducing the number of additional parking.

2. While the overall site affords sufficient capacity to accommodate operations at the present time, it is anticipated that the addition of the new public school will overload the west end of the site. It is recommended that 450 stalls be constructed to accommodate new demand. According to the current plan, provided to MMM, the additional parking is proposed on the southwest side of the CKC site. This plan will be enough to meet the site parking demand needs, in conjunction with (1) shared parking, (2) paved of all south parking lots, and (3) the parking recommendations provided in this report. However, several concerns regarding the distances from the proposed parking lots, south side parking lots and the Eastlink/Gymnastics facilities have been raised. Experience shows that if the parking lot is paved and well lit, to the same degree as the existing paved lots, the differentiation would be removed, and the lot would be acceptable for the users. However, if the City's wish is to provide more space, the west and northwest sides of the West Leg of Knowledge Way might be used to provide additional parking (likely used by the Eastlink/Gymnastics users) or to accommodate some of the parking on the southwest side (i.e. the proposed parking lot 7 in Figure 3.1). This alternative will impact how the land is used within the site. It is beyond the scope of this study to provide recommendations regarding land use.
3. The new public school stalls will be available to the Eastlink Centre and Gymnastics Club during evening and weekend timings, but parking demand in the northwest sector of the site will require containment. It is recommended that the City develop a reserved permit system bundled with Eastlink and Gymnastics memberships and lessons to discourage overuse of this lot.
4. It is recommended that facilities managers should share their event dates and calendars in their quarterly operations meetings to avoid special event increments.
5. It is recommended that the City create awareness or an instruction to campus visitors to park in the St Joseph's student lot, when the Eastlink/Gymnastics south lot is full. Awareness can be created by: (1) providing information inside the Eastlink Centre (that additional parking is available and where); (2) educating the students; (3) providing signage to direct to the available parking lots; (4) improving the south entrance to make it look more like a main entrance.
6. It is recommended that the City erect an informative sign at the corner of Knowledge Way west entrance to direct traffic eastbound onto the South Leg of Knowledge Way and into the old and new school parking lots. The existing signs should be removed.
7. It is recommended the south entrance to the multiplex complex be further improved with large display signage to make it look more like a main entrance.

8. It is recommended that all parking lots be regularly and better maintained to demonstrate a higher standard of care and discourage misuse and vandalism.
9. It is recommended that the parking on the southwest side be paved, well lit, to the same degree as the existing paved lots, as well as properly delineated. As such, the lot would be acceptable for the users.
10. It is recommended that an outside mobile security or peace officer patrol be implemented to patrol the grounds, ensure property and parking standards, discourage loiterers, and warn potential offenders.
11. It is recommended that the landscape gap between the proposed public school parking lot on the south side of the South Leg of Knowledge Way and the St Joseph's student parking lot should be closed to maximize the sharing ability of the parking space.
12. It is recommended that the front exterior of the new public high school faces southwest, or be reconfigured as much as possible to do so, rather than towards the northwest lot. In addition, pedestrian access from the north face of the new school building to the multiplex complex should be restricted.
13. It is recommended that the City consider installing traffic calming treatments (such as speed humps or others) within the parking lots as an option to encourage traffic to slow down.
14. It is recommended that signage be rationalized and made enforceable, and that special signage for special needs parkers be considered for installation in selected stalls in the northwest and south Eastlink/Gymnastics lots.
15. It is recommended that additional bus routes be considered to service the campus as available.
16. It is recommended that generic signs identifying stalls as "Reserved" and "Public Parking" replace the current signs identifying teachers and students only.

4.0 INTERNAL TRAFFIC CIRCULATION

Knowledge Way serves as the internal ring road of the site. It is a two-lane two-way undivided roadway for most of its length. Both segments between 68 Avenue and the South Leg of Knowledge Way are four-lane including the auxiliary lanes for turning movements. The South Leg of Knowledge Way is a 15m wide two-lane undivided roadway; although it could easily accommodate four lanes. Moreover, it is our understanding that at least during peak hours this segment operates as a four-lane undivided roadway with one lane in each direction dedicated to drop-off/pick-up parking or school buses stop zone.

4.1 Traffic Generation

Traffic generated by the full development was estimated using the Institute of Transportation Engineers (ITE) Trip Generation Informational Report, 8th Edition. The traffic generated during the weekday afternoon peak hour was estimated and compared to that of the 2012 Traffic Impact Assessment for the 68 Avenue / Community Knowledge Campus Report by ISL Engineering and Land Services (68 Avenue TIA), for the 78,000 population horizon. Both studies estimated similar figures although the main difference is in the in/out traffic split. For the purposes of this study, our estimated traffic figures will prevail. **Table 4.1** summarizes the trip generation for the CKC site. **Appendix C** presents details of the trip generation.

Trip generation reduction of 50 percent was applied to both high schools due to modal split. Currently, about 280 out of 783 students are using the school's transit system. This figure is equivalent to 36% of the existing trips generated by the school. In addition, it was assumed that 4% of the trips are made using public transit and active transportation (walking or bicycle). Furthermore, it was assumed that 10% of the trips are made using car-pool (about 20% of the students are assumed to drive to/from the school with a vehicle occupancy of 2 persons per car in average). No trip generation reductions were applied to other land uses or traffic areas.

By comparison, the 68 Avenue TIA estimated 987 trips were generated in the CKC site (562 in, and 425 out) during the peak hour at full built-out by the 78,000 population horizon. Their estimate is close to our findings although they differ on the In/Out split distribution. In the 68 Avenue TIA about 57% of the trips are entering and 43% exiting the site; while, findings based on the ITE trip generation rates and split distribution suggest 49% trips entering and 51% exiting the site. For the purposes of this analysis, we have increased the number trips entering the site to match the 68 Avenue TIA estimates (about 83 additional trips). This approach provides a more conservative traffic operation analysis.

Table 4.1 Weekday PM Peak Hour Trip Generation (Full Built-Out)

Land Use Description	ITE Code	Unit (x)	Trip Rate	Trip Generation			Trip Generation After Modal Split Reduction		
				In	Out	Total	In	Out	Total
TA1: St. Joseph's Catholic High School	530	1,228	$T = 0.29(x)$	117	238	355	59	119	178
TA2: New Public High School	530	1,400	$T = 0.29(x)$	134	271	405	67	136	203
TA3: Coca-Cola Centre	465	50	$T = 2.36(x)$	7	8	15	7	8	15
TA4: Eastlink Aquatics Centre	493	64	$T = 5.96(x)$	236	144	380	236	144	380
TA5: Gymniks Gymnastics Club	492	55	$T = 3.53(x)$	111	84	195	111	84	195
Total	-	-	-	604	746	1,350	479	491	970
Notes: <ul style="list-style-type: none"> ▶ Trips in vehicles per hour (vph) ▶ Unit (x) for High School (TA1 and TA2) in number of students ▶ Unit (x) for TA3, TA4, and TA5 in 1,000 square foot of gross floor area 									

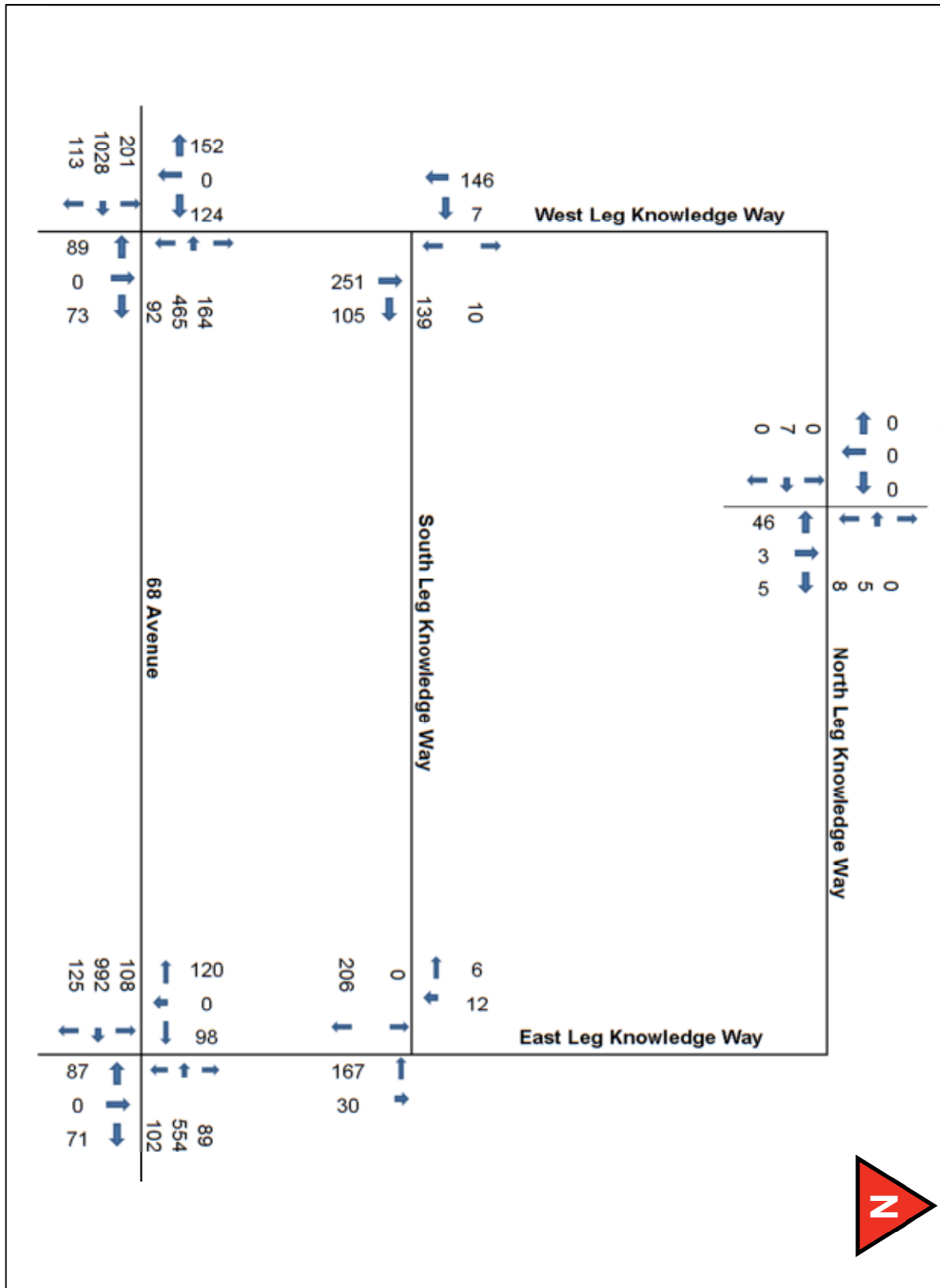
4.2 Trip Distribution and Assignment

Traffic was distributed within the CKC site based on the location of each traffic area (TA), as well as the parking lots available for each TA. For the purposes of trip distribution and assignment, it is assumed that the MMM's recommendations regarding parking are in place. This means that the schools' staffs are parked on the designated staff parking lots for each school; while students are parked on the public/visitor parking lots on the south side and southwest side of the CKC site. The low demand during the afternoon peak hour of the Coca-Cola Centre is parked on the northeast parking lot. Users of the Eastlink Aquatics Centre and the Gymniks Gymnastics Club are using the south parking lot and other public parking lots in the site (i.e. south side and southwest side of the CKC site), in addition to the northwest parking lot.

During MMM site visit it was observed that the peak hour for the Coca-Cola Centre, the Eastlink Aquatics Centre and the Gymniks Gymnastics Club is not necessary concurrent with the peak hour of the high school.

Appendix D shows the trip distribution and assignment assumed for the CKC site, by land use. **Figure 4.1** illustrates the estimated internal traffic volumes during the weekday afternoon peak hour.

Figure 4.1 Site Weekday Afternoon Peak Hour Traffic



4.3 Internal Traffic Circulation Analysis

Internal traffic circulation was analyzed for capacity at key intersections during the peak. The intersection capacity is based on Level of Service (LOS), control delay by intersection and traffic movement, and the expected 95th percentile queue at critical movements. LOS ranges from A (excellent) to F (beyond capacity). For this study, LOS D is considered the threshold for introducing improvements.

Intersection capacity utilization level of service (ICU LOS) provides additional insight into how an intersection is functioning and how much extra capacity is available to handle traffic fluctuations and incidents. ICU LOS ranges from A (excellent) to H (beyond capacity), with ICU LOS E generally considered being at practical capacity.

Three key intersections were analyzed: East Leg of Knowledge Way & South Leg of Knowledge Way; West Leg of Knowledge Way & South Leg of Knowledge Way; Knowledge Way (North Leg) & 106 Street.

The purpose of this analysis is to identify any improvement required to accommodate traffic demand during the peak hour, reducing traffic delays as much as possible, and keeping the expected queues under the storage capacity of the intersection approaches. The issue of queue lengths is particularly critical at the south approach of both intersections of the East/West Leg of Knowledge Way & the South Leg of Knowledge Way. At these approaches the distance between the intersection and the 68 Avenue is short (under 400m), and long queues may result in traffic blocks on the arterial road (68 Avenue). Analyzing capacity at intersections with 68 Avenue is out of the scope of this project as it has been studied previously. MMM included both CKC access intersections in the traffic model and ran a simulation model with the use of SimTraffic, to ensure expected queues will not create a problem, and to recommend the appropriate traffic control at the key intersections. **Appendix E** provides the Synchro reports.

4.3.1 Afternoon Peak Hour Scenario

The capacity analysis shows no major circulation issues after roadway improvements during the afternoon peak hour, based on the Synchro model results, as summarized in **Table 4.2**. The following roadway and intersection improvements are recommended:

- To avoid driver confusion and improve circulation and road safety of the site, lane widths should be reduced. The South Leg of Knowledge Way should be upgraded to two-way undivided roadway with four lanes each of approximately 3.75m. Two of these lanes must be exclusively for on-street parking (for pick-up and drop-off parking) and for the transit stop zone. The Knowledge Way loop north of the South Leg of Knowledge Way should be upgraded to a two-way roadway with three lanes each of approximately 4m. One lane must be exclusively for on-street parking. It is believed the current length width size (6 to 7.5m) may negatively impact road safety by giving the impression of a roadway for higher posted speed, and by allowing drivers to attempt risky maneuvers such as weaving and cut-traffic at intersections.

- For the intersection of the West Leg and South Leg of Knowledge Way it is recommended: (1) to channelize the northbound right-turn lane; (2) to introduce a curb extension or bulbout at the westbound approach so there is no an auxiliary right-turn lane on this approach.
- For the intersection of the East Leg and South Leg of Knowledge Way it is recommended to provide a median on the southbound approach to: (1) reduce the width of the southbound lane (share thru and right turn lane) to approximately 3.7m; (2) block traffic on the northbound left-turn lane that attempt to proceed through the intersection rather than turning; and (3) provide a clear use of each lane at the intersection. A curb extension is also recommended on the South Leg of Knowledge Way at the eastbound approach.

Table 4.2 PM Peak Hour Internal Traffic Operations

Intersection (Traffic Control)	Intersection LOS (Intersection Delay)	Max V/C Ratio	ICU (%)	Critical Movements at the Intersection		
				Movement	LOS (Delay)	Queue (m)
Knowledge Way & 106St (N-S TWSC)	A (7 sec)	0.06	A (17%)	NB L/T/R	A (9 sec)	2m
West Leg & South Leg of Knowledge Way (E-W TWSC)	A (7 sec)	0.44	A (42%)	WB L/T/R	C (23 sec)	17m
East Leg & South Leg of Knowledge Way (E-W TWSC)	A (8 sec)	0.22	A (35%)	EB L/R	A (9 sec)	6 m
Notes: <ul style="list-style-type: none"> ► All intersections are Two-Way Stop Controlled (TWSC) ► Delay is provided in seconds ► ICU (Intersection Capacity Utilization) ► 95th Percentile Queue Length provided in meters 						

4.3.2 Roundabout Afternoon Peak Hour Scenario

A roundabout was proposed at the West Leg and South Leg of Knowledge Way intersection. It is however noted that the capacity analysis of the existing configuration at this intersection shows that a two-way stop controlled intersection can handle the expected traffic volumes during the weekday afternoon peak hour; analysis of the roundabout treatment was requested at the beginning of this study.

The following network and intersection upgrades are recommended and assumed for the purposes of this analysis:

- ▶ To avoid driver confusion and improve circulation and road safety of the site, lane widths should be reduced. The South Leg of Knowledge Way should be upgraded to two-way undivided roadway with four lanes each of approximately 3.75m. Two of these lanes must be exclusively for on-street parking (for pick-up and drop-off parking) and for the transit stop zone. The Knowledge Way loop north of the South Leg of Knowledge Way should be upgraded to a two-way roadway with three lanes each of approximately 4m. One lane must be exclusively for on-street parking. It is believe the current length width size (6 to 7.5m) may negatively impact road safety by given the impression of a roadway for higher posted speed, and by allowing drivers to attempt risky maneuvers such as weaving and cut-traffic at intersections.
- ▶ For the intersection of the West Leg and South Leg of Knowledge Way it is recommended to introduce a curb extension or bulbout at the westbound approach so there is no an auxiliary right-turn lane on this approach.
- ▶ For the intersection of the East Leg and South Leg of Knowledge Way it is recommended to provide a median on the southbound approach to: (1) reduce the width of the southbound lane (share thru and right turn lane) to approximately 3.7m; (2) block traffic on the northbound left-turn lane that attempt to proceed through the intersection rather than turning; and (3) provide a clear use of each lane at the intersection. A curb extension is also recommended on the South Leg of Knowledge Way at the eastbound approach.

The capacity analysis shows that there are no major circulation issues for the afternoon peak hour of travel as showed in **Table 4.3**. However, the introduction of a roundabout is not deemed necessary at this point of time.

Table 4.3 Roundabout PM Peak Hour Internal Traffic Operations

Intersection (Traffic Control)	Intersection LOS (Intersection Delay)	Max V/C Ratio	ICU (%)	Critical Movements at the Intersection		
				Movement	LOS (Delay)	Queue (m)
Knowledge Way & 106St (N-S TWSC)	A (7 sec)	0.06	A (17%)	NB L/T/R	A (9 sec)	2m
West Leg & South Leg of Knowledge Way (Roundabout)	A (8 sec)	0.25	A (42%)	WB	A (6 sec)	1m
East Leg & South Leg of Knowledge Way (E-W TWSC)	A (8 sec)	0.22	A (35%)	EB L/R	A (9 sec)	6 m
Notes: <ul style="list-style-type: none"> ▶ Two-Way Stop Controlled (TWSC) ▶ Delay is provided in seconds ▶ ICU (Intersection Capacity Utilization) ▶ 95th Percentile Queue Length provided in meters 						

4.3.3 One Way Scenario

One way streets and one way couplets works well typically in high traffic volume congested downtown environments. Successful implementation examples are found in major North American cities such as Manhattan, New York in the US, or Calgary, Alberta in Canada. Despite its efficiency, such configuration does create inconvenience to recirculating traffic and to errand vehicles.

Within the CKC site, traffic volumes today and when fully development are not at a level high enough to justify such a consideration. Capacity analysis demonstrated that all roadways are operating at satisfactory LOS. In addition, roadway geometry of Knowledge is wide enough to accommodate two-way traffic, even with curbside parking.

One way traffic does promote and enhance pedestrian safety. Given the slow posted speed within the site, this is however not considered a significant improvement. In addition, one way traffic will negatively impact access to the site and will create long traffic queues blocking through traffic on 68 Avenue. The implementation of a one street system within the CKC site is therefore not recommended.

4.3.4 Special Events Peak Hour Scenario

Special events will create unique challenges to parking and to traffic circulation, both internally within the CKC site, and externally at access and exit points on 68 Avenue. While the present study indicated that the transportation infrastructure with improvements serving the proposed development at CKC is sufficient to support the normal needs of traffic, special planned athletic and cultural events with spiked attendance and participation will generate extraordinary level of traffic requiring additional parking and special traffic treatments.

The purpose of this report is not to address traffic and parking concerns associated with these activities directly. For completeness we have however identified some of the problems with some possible mitigation measures.

It is noted that the occurrence of concurrent events at the multiplex facility are likely to be on weekday evenings or during Saturday weekend afternoons. During these periods, however, traffic volumes generated by the schools are relatively low and less likely to create an additional burden to the loaded system. Given that the nature, size, and frequency of these special events are unknown at this point in time, it will not be possible to accurately quantify the amount of additional parking required, or to realistically calculate the effect of internal and external traffic circulation.

The following mitigation measures on parking and internal circulation may be considered:

- ▶ Provide spill over parking on the unpaved lots south side of the site, immediately north of 68 Avenue.
- ▶ Encourage use of public transit to ease the number of vehicles by providing special event transit shuttle service between downtown and other major residential centres, and the site.
- ▶ Encourage carpooling.

- ▶ Provide service of temporary traffic directors to channelize traffic on such occasions.
- ▶ Provide temporary signage to direct traffic to designated temporary parking lots.

To further ease traffic congestion, special events should be planned and scheduled on dates and times to avoid coinciding with normal peak hour traffic; and the City's transportation department needs to be involved with their planning

4.4 Recommendations

It is concluded that the CKC's internal roadway network will require some upgrades to accommodate the expected traffic volumes during the weekday peak hour at full build-out. During special events traffic volumes will be higher. For event traffic, the most likely destination will be the complexes in the north side, while most of the site's available parking supply is provided on the south side. If the recommendations provided for parking management are followed, it is expected that the negative impact in traffic circulation due to excessive traffic volumes during special events will be minimized. Given the size of the complex, the location of the buildings compared to the location of parking lots, and the internal ring roadway, the better the management of parking facilities, the better the internal traffic circulation, within the current planning horizon.

The recommended intersection layouts (including recommended safety treatments such as curb extensions or bulbouts) for the intersection of East & South Leg of Knowledge Way and the intersection of West & South Leg of Knowledge Way are able to accommodate turning movements of an inter-municipal bus while enhancing circulation and road safety; however, trucks (WB-21) will be unable to perform turning movements at these locations and will be only allowed to the thru movement on the north-south directions. Details of the geometric layout must be worked out at the design stage.

The following recommendations are provided:

1. It is recommended to reduce lane widths to avoid driver confusion and improve circulation and road safety of the site. The South Leg of Knowledge Way should be upgraded to two-way undivided roadway with four lanes each of approximately 3.75m. Two of these lanes must be exclusively for on-street parking (for pick-up and drop-off parking) and for the transit stop zone. The Knowledge Way loop north of the South Leg of Knowledge Way should be upgraded to a two-way roadway with three lanes each of approximately 4m. One lane must be exclusively for on-street parking. It is believe the current length width size (6 to 7.5m) may negatively impact road safety by given the impression of a roadway for higher posted speed, and by allowing drivers to attempt risky maneuvers such as weaving and cut-traffic at intersections.
2. It is recommended to delineate the internal roadway lanes (paving markings).
3. The following layout is recommended for the intersection of the East Leg and South Leg of Knowledge Way: one left-turn lane, and one thru lane on the northbound approach; one shared thru/right-turn lane on the southbound approach; and one shared left-turn/right-turn lane on the

eastbound approach. This intersection works as a two-way stop controlled intersection with the stop sign for the eastbound approach. It was found the northbound queue will not block 68 Avenue.

4. For the intersection of the East Leg and South Leg of Knowledge Way it is also recommended to provide a median on the southbound approach to: (1) reduce the width of the southbound lane (share thru and right turn lane) to approximately 3.7m; (2) block traffic on the northbound left-turn lane that attempt to proceed through the intersection rather than turning; and (3) provide a clear use of each lane at the intersection. A curb extension is also recommended on the South Leg of Knowledge Way at the eastbound approach.
5. The following layout is recommended for the intersection of the West Leg and South Leg of Knowledge Way: one thru lane, and one channelized right-turn auxiliary lane on the northbound approach; one shared left-turn/thru lane on the southbound approach; and one shared left-turn/right-turn lane on the westbound approach. This intersection works as a two-way stop controlled intersection with the stop sign on the westbound approach. It was found the northbound queue will not block 68 Avenue. Alternatively, the configuration of the southbound approach can be: one thru lane, and one auxiliary left-turn lane. This alternative southbound approach configuration is possible if desired by the City; although it is not required based on the traffic analysis.
6. For the intersection of the West Leg and South Leg of Knowledge Way it is also recommended: (1) to channelize the northbound right-turn lane to restrain northbound traffic from going thru when on the right lane; and (2) to introduce a curb extension or bulbout at the westbound approach so there is no an auxiliary right-turn lane on this approach. These measures will also reduce pedestrian crossing distances.
7. It is recommended a curb extension or bulbout be constructed on the westbound approach of the intersection of West Leg & South Leg of Knowledge Way; as well as on the eastbound approach of the intersection of East Leg & South Leg of Knowledge Way.
8. It is recommended to close the access to the proposed parking lot 9. Users of this parking lot can have access throughout the proposed parking lot 10.
9. It is recommended that the access to the proposed southwest parking lot be located north of the intersection of the West Leg and South Leg of Knowledge Way, at least 50m away, and should not be located on the curve. The roadway inside the parking lot must be perpendicular to Knowledge Way (West Leg) to avoid creating visibility problems at this location.
10. It is not recommended to provide an additional right-in/right-out access out of 68 Avenue and into the proposed southwest parking lot. The distances between this right-in/right-out access and the adjacent signalized intersections, 108 Street & 68 Avenue on the east and West Leg of Knowledge Way & 68 Avenue on the west, will be only approximately 200 meters. Also, traffic operations at the intersection of 108 Avenue & 68 Avenue are already challenged by the intersection of Canfor

Hauling Road & 68 Avenue (located approximately 50m away to its east side). The proposed additional access will likely negatively impact traffic operations along 68 Avenue on the westbound direction. In addition, the circulation analysis showed that the proposed southwest parking lot can be accessed along Knowledge Way without negatively impacting internal traffic circulation or traffic operations at 68 Avenue, which make unnecessary the right-in/right-out access on 68 Avenue.

11. The intersection of the West Leg and South Leg of Knowledge Way will operate at acceptable level of service LOS during the weekday afternoon peak hour if a roundabout treatment is considered for this intersection. However, the introduction of a roundabout is not necessary looking at the full build-out of the site. Therefore, the roundabout is not recommended.
12. The implementation of one way street system is not recommended. A one way street system will negatively impact traffic accessing the site, and through traffic on 68 Avenue, as well as will create inconvenience to recirculating traffic and to errant vehicles within the CKC site.
13. It is recommended that the City implements a two-way traffic circulation for the North Leg of Knowledge Way.
14. All access to parking lots must be two-way controlled intersections with the stop sign facing traffic volumes exiting the parking lot.
15. It is recommended two-way stop control for the following intersections: intersection of the South Leg and East Leg of Knowledge Way (stop control on the east-west direction); intersection of the South Leg and West Leg of Knowledge Way (stop control on the east-west direction); and intersection of 106 Street and Knowledge Way (stop control on the north-south direction);
16. It is recommended a posted speed of 30kph within the CKC site. Knowledge Way is a roadway providing direct access to several parking lots while there are several crosswalk for the pedestrian/cyclist pathway system. In addition, it is expected a considerable volume of users with strollers.
17. It is recommended the use of the following traffic signs within the CKC site:
 - Posted speed of 30 kph,
 - Pedestrian crosswalk sign at all crosswalks,
 - Public parking site (for student/visitor parking lots that are also intended to be available for users of other facilities beside the schools),
 - Staff parking site (for teacher parking lots),
 - Coca-Cola Users Only (for the northeast lot as currently is),
 - Transit Stop Zone signs with information of routes and schedule,
 - School Bus Stop Only signs for these zones,

- Drop-off/Pick-up Only sign with limit of time at the proper locations,
 - Loading Zones signs,
 - Truck route sign allowing only the thru movement on the north-south directions of Knowledge Way,
 - Truck prohibited sign along the South Leg of Knowledge Way,
 - Informative parking signs at internal intersection right after the entrance to the CKC site,
 - Prohibited parking site at accesses or where deemed necessary.
18. It is recommended to consider renaming the road segment of Knowledge Way that this report is calling South Leg of Knowledge Way. The existing road network configuration and the fact that all internal roads are called Knowledge Way make difficult to provide clear concise information to users as well as way finding for someone unfamiliar to the site (i.e. currently there are two intersections of Knowledge Way & Knowledge Way).
19. It is recommended to complete a revision of the intersection geometry of intersections within the CKC site. The study should revise as-constructed or detail design internal intersection geometry to ensure turning vehicle paths and visibility are adequate.
20. It is recommended that the City reviews accesses to loading zones, to ensure the design vehicle will be able to manoeuvre in and out of the loading zone without blocking the pathways to or through roadways and parking lots. It is also recommended that the City reviews all existing and planned building configurations to ensure loading zones are not compromised by the plans. As example, the proposed plans for the new public school leave little space for a design vehicle to access the loading zone of the Gymnastics Club. The access or internal roadway of the northwest parking lot should not be blocked by a parked vehicle in the loading zone or by the vehicle manoeuvring to access/exit the loading zone, which can negatively impact other users and modes including public transit.
21. If speeding becomes an issue within the CKC site in the future; it is recommended that the City introduces speed reduction treatments. The decision of what treatment to use depends on a safety review.

5.0 TRANSIT AND SCHOOL BUS SERVICES

The City currently operates one bus route service to the CKC site, Route #3, which accesses the site from 68 Avenue westbound, turning right into the West Leg of Knowledge Way with a bus stop in front of the current main entrance of the Eastlink/Gymnastic. The transit route exits the site on 106 Street northbound. Route #3 serves Mission Heights and also stops on the 68th Avenue (WB) between both intersections of Knowledge Way with 68 Avenue.

An additional public transit route has been planned along the South Leg of Knowledge Way with a possible bus stop close to both schools (Route A, in the 2008-2013 City of Grande Prairie Transit Master Plan). A concrete pad is placed on the North Leg of Knowledge Way adjacent to the Eastlink Aquatics Centre, to potentially serve as bus stop. The South Leg of Knowledge Way is also a candidate for an additional bus stop for any potential future transit route.

An additional transit stop zone is located on the North Leg of Knowledge Way, north of the Coca-Cola Centre, and it is intended for private transit for groups attending the arena or special events.

The Grande Prairie Public School District #2357 and the Grande Prairie and District Catholic School Board operate school bus services to the CKC site, offered to students living more than 2.4km from their local school. Information about bus frequency and capacity is as follows:

- ▶ 9 Rural Busses (AM): Arrival time 8:20 AM to 8:40 AM. Approximately 188 students.
- ▶ 2 Urban Busses (AM): Arrival time 8:30AM to 8:40 AM. Approximately 92 students.
- ▶ Same number of buses arrives and departs between 3:15 to 3:30 PM.
- ▶ St Joseph's "Special" Transit Bus (as per Transit Schedule). Approximately 200 students throughout school day.

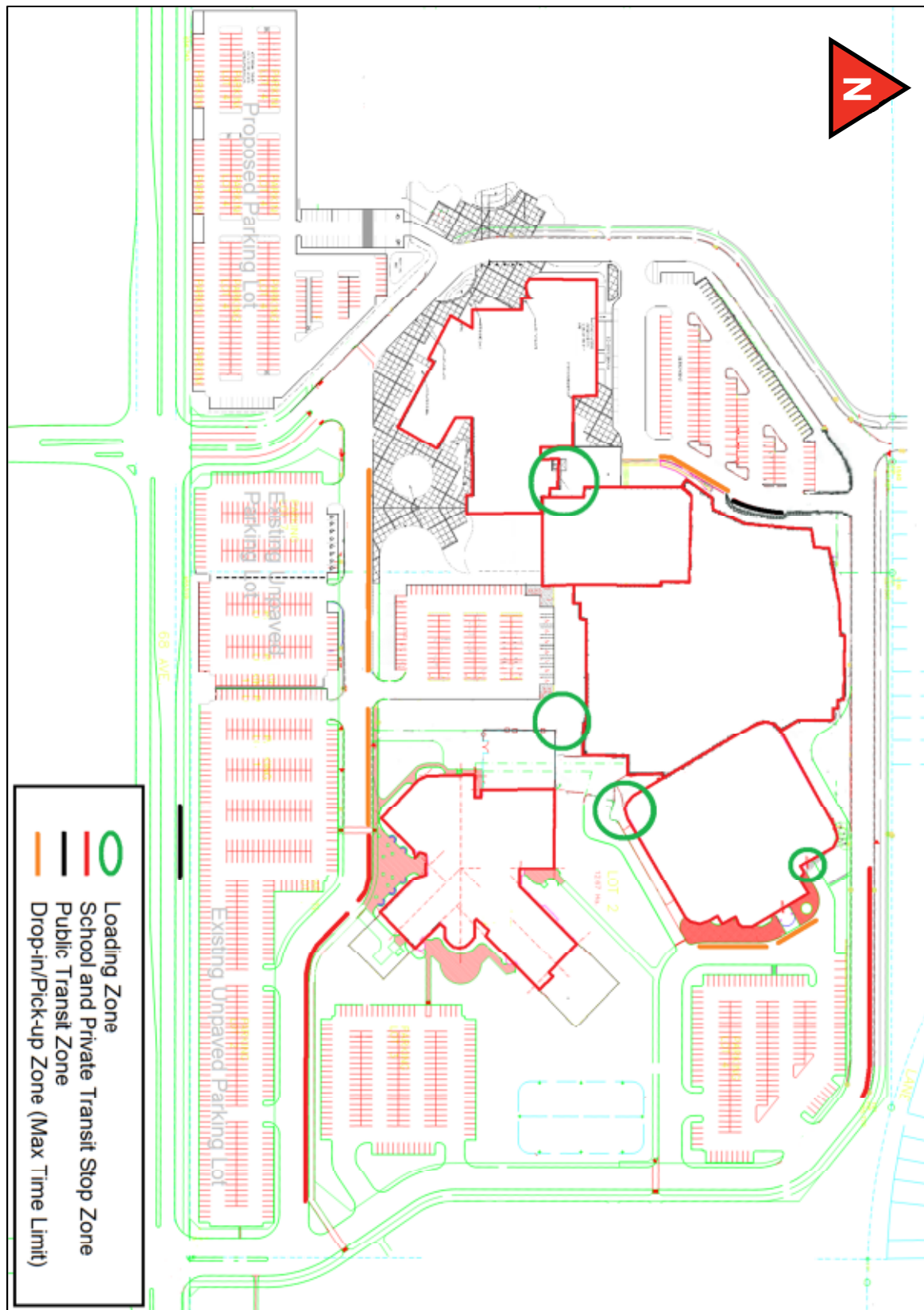
Currently school buses stop zone is located south of St Joseph Catholic School along the South Leg of Knowledge Way.

Currently, drop-off/pick-up parking zones are provided along the South Leg of Knowledge Way for the St. Joseph's Catholic High School; in front of the Eastlink/Gymnastics main entrance (within the northwest parking lot), and in front of the Coca-Cola Centre main entrance (within the northeast parking lot).

Previous studies have recommended the South Leg of Knowledge Way as a candidate for designated school bus stop zone, and primary parent/student drop-off zone, serving both high schools. School buses will transport students from both the catholic and public the school. In addition, 10 drop-off/pick-up parking stalls are proposed on the north side of the school, adjacent to the Gymnastics' parking lot.

Figure 5.1 illustrates the existing and recommended transit stop zones and drop-off/pick-up zones.

Figure 5.1 Transit and Drop-off/Pick-up Zones (Source: City of Grande Prairie)



5.1 Recommendations

The following recommendations are provided:

1. It is recommended to maintain one bus stop for public transit at the Easlink Centre. If this bus stop is relocated, the relocated bus stop should be close to the building access entrance.
2. It is recommended to provided one bus stop for the future Route A inside the CKC site. The location of this bus stop may be provided on the westbound direction of the South Leg of Knowledge Way, between both schools. However, depending of the transit users' destination and the final route layout, there are opportunities for a bus stop location on the North Leg of Knowledge Way.
3. It is recommended to provide the school transit stop zone in the westbound direction on the east side of the South Leg of Knowledge Way. Although a central location could be ideal, it is considered more efficient to maintain the drop-off/pick-up parking area separate from the transit stop zone (each one on one side of Knowledge Way). This will avoid potential conflicts between arriving/departing vehicles and the school buses. Walking distances from the bus stop to the schools are still reasonable, and sidewalks are provided.
4. It is recommended to provide a drop-off/pick-up parking zone in the westbound direction on the west side of the South Leg of Knowledge Way. It is recommended to provide time parking limit to this zone as well as signage.
5. It is recommended to provide a time parking limit to the drop-off/pick-up zone in front of the Gymnastics Club. An additional drop-off/pick-up zone north of the new high school and inside of the access roadway to the northwest parking lot is not desirable for the users of that parking lot, as expressed during the duration of this study. Access to the loading zone must not block the traffic circulation within this parking lot.
6. It is recommended to educate users of the drop-off/pick-up parking zones to respect parking time limits. If education does not improve behaviour, the City should consider enforcement.
7. If demand for drop-off/pick-up parking is considerable higher than the supply (for both schools), additional drop-off/pick-up parking stalls should be provided on the eastbound direction of South Leg of Knowledge Way. However, sidewalks should be provided on this side in such case and students should be educated to not jaywalk.

6.0 PEDESTRIAN AND BIKE MOVEMENTS

6.1 Existing Circulation Patterns

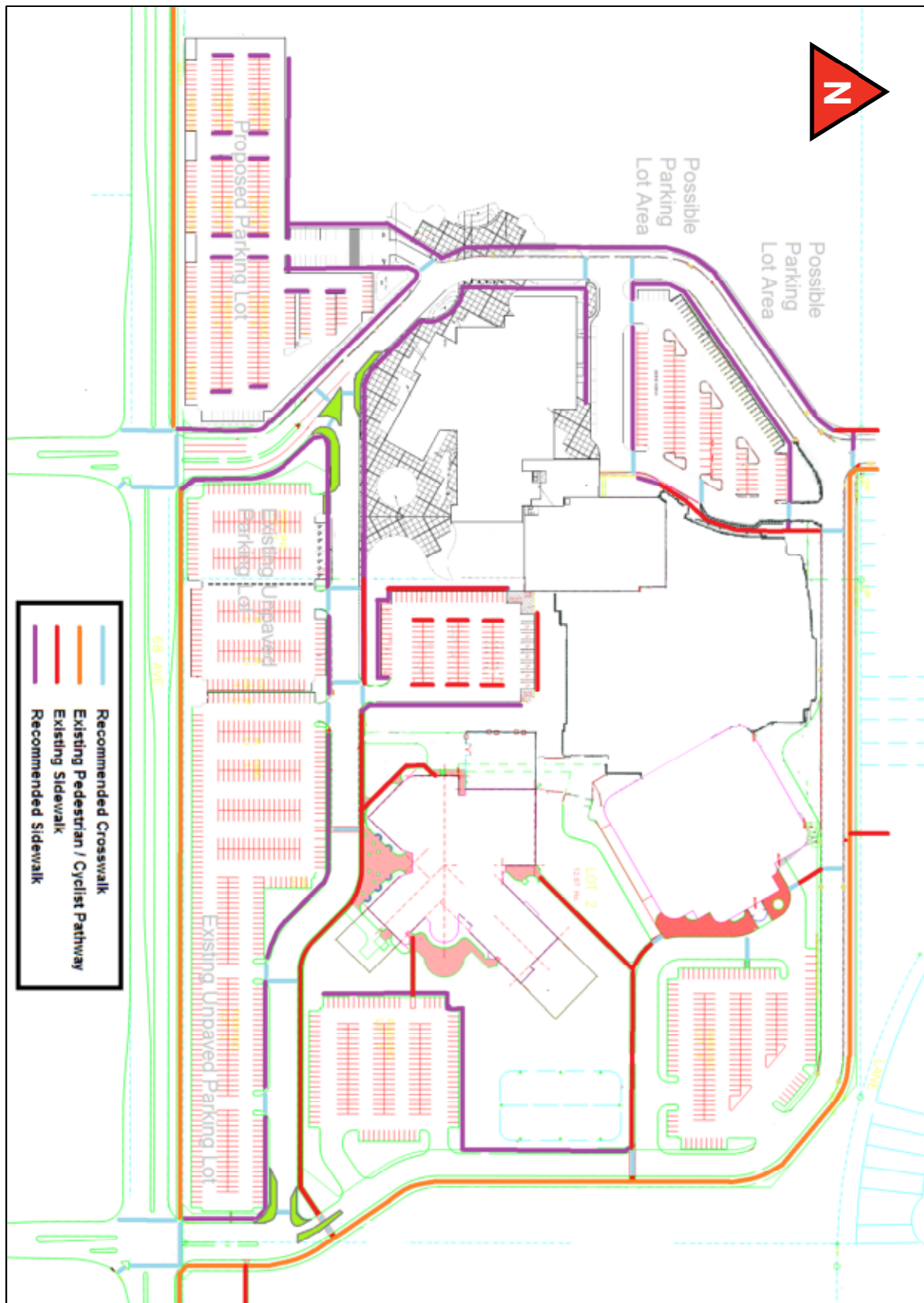
Pedestrian and Cyclists within the CKC site are served by two paved walking/cycling trails. One trail runs east-west, along the north side of 68 Avenue, and connects the CKC site with residential communities to the west and the trail network (at Bear River). A second trail starts on 106 Street; lying on the north side of Knowledge Way (North Leg) and east side of Knowledge Way (East Leg), and connecting to the north side trail along 68 Avenue.

The paved trail system within CKC site is complemented by sidewalks along the north side of the South Leg of Knowledge Way serving mainly St. Joseph's Catholic High School. There are also sidewalks connecting the Coca-Cola Centre with the high school and the Aquatics Centre.

With the opening of the new public school the pedestrian/cyclist network needs to be completed. There are other challenges to be resolved such as potential jaywalking across the South Leg of Knowledge Way and 68 Avenue, as well as the proper location of crosswalks.

Figure 6.1 illustrates the existing and recommended pedestrian/cyclist pathway network.

Figure 6.1 Existing and Recommended Pedestrian/Cyclist Network (Source: City of Grande Prairie)



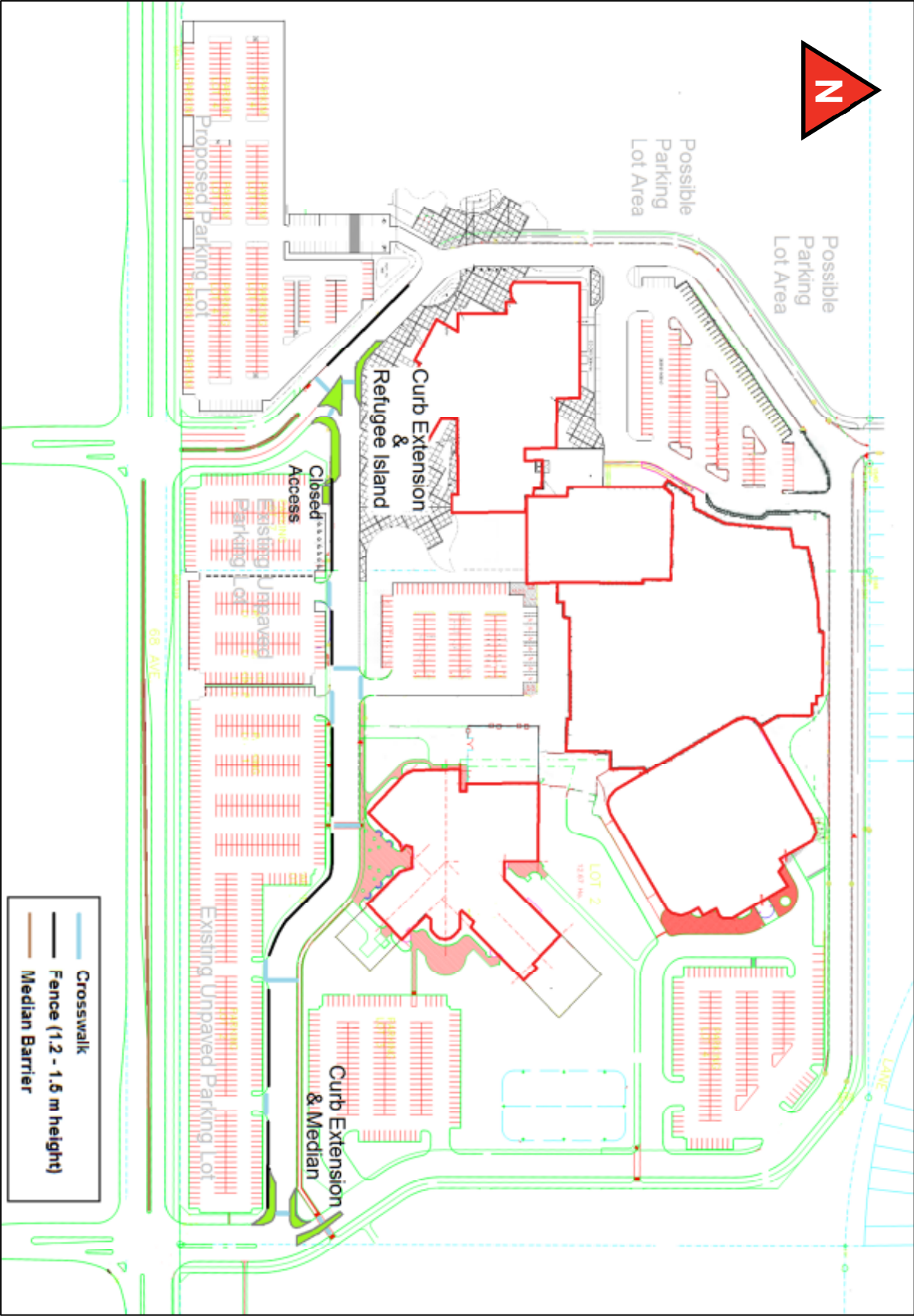
6.2 Recommendations

Recommendations for pedestrians/cyclist movements are provided with consideration to parking and internal traffic circulation. **Figure 6.2** illustrates the recommended treatments.

1. It is recommended to complete the sidewalk network to support parking development recommendations on the CKC south side and the share-parking initiatives. In order to encourage users of the Eastlink/Gymnastics facilities to utilize available parking on the south side, it is necessary to complete the sidewalk network in between the landscaping gaps. Additional sidewalks should be provided on: the north side of the South Leg of Knowledge Way; both sides of the West Leg of Knowledge Way between 106 Street and 68 Avenue; both sides of parking lot south of the Eastlink/Gymnastics facilities between both schools; and within the new southwest parking lot.
2. Provide sidewalks on the south side of the South Leg of Knowledge Way. This sidewalk might be necessary to provide a safe trail for users of the south parking lots to reach the designated crosswalks in the event that pedestrian barriers are installed along Knowledge Way (South Leg) to stop jaywalking.
3. It is recommended to provide sidewalks around the current St. Joseph's Catholic School in conjunction with sidewalks connecting the parking lot with the Coca-Cola Centre. This is necessary in the event that south parking lots are to be used as additional parking for special events in the Coca-Cola Centre or at Multiplex facilities.
4. All buildings within the CKC site should be accessible through sidewalks or pathways, as well as connected to parking lots to allow for shared parking and to support parking recommendations and initiatives. Sidewalks and pathways should be properly maintained throughout the year and cleared of snow during the winter time.
5. Wherever pedestrians walk through an area, they should be guided by way-finding signing and pavement markings. Sidewalks and pathways should be barrier-free, to allow for seniors, pedestrians with strollers, or pedestrians with mobility and visual impairments to navigate through the area. Sidewalks width should be enough to accommodate users with strollers.
6. Crosswalk selected location are provided in **Figure 6.1**. Crosswalks should be properly marked and perpendicular to vehicular traffic. Marked crosswalks identify pedestrians crossing points and reminds motorist to yield to pedestrians. The Manual of Uniform Traffic Control Devices for Canada presents the traditional crosswalk design of two parallel solid white lines approximately 2.5 m apart. Variations include ladder, zebra and diagonal patterns. Zebra markings at crosswalks are more visible to motorist; at high traffic/pedestrian intersection reduce the rate of vehicle-pedestrian conflicts; and they are easy to spot due to the increasing contrast. The City should consider the most appropriate.

7. It is recommended to provide curb ramps at all crosswalks. To assist people with visual or cognitive impairments, a distinct colour and texture should be used on the curb ramp. The surface should be slip resistant and free-draining.
8. Curb extensions or bulbouts should be provided on the westbound approach of the intersection of the South and the West Legs of Knowledge Way. A curb extension is an horizontal intrusion of the curb into the roadway. It reduces the roadway section, reducing the crossing distance for pedestrians. The sacrificed travel lane will be destined for drop-off/pick-up parking and transit stop zones.
9. It is recommended to channelize the northbound approach of the intersection of the South and West Legs of Knowledge Way. The island should be sufficiently large to provide safe refuge for pedestrians crossing at the intersection.
10. Both signalized intersections on 68 Avenue and Knowledge Way (East and West Legs) should be provided with pedestrians signal indications.
11. Bike parking stalls should be provided at all facilities in order to encourage biking to/from the CKC side.
12. To discourage jaywalking across 68 Avenue from the CKC site, barriers along the sidewalks or in the median are recommended. Similarly, barriers are recommended along the south side of the South Leg of Knowledge Way, and around the new school. One possible option is the use of 1.2m high chain-link fencing for consistency within the CKC site. However, other options are available in the market that serves the same purpose. In addition, it has been observed in the past that some individuals had climbed over a 1.2m fencing. If this is identified as an issue in the CKC site, the height of the fence should be increased. In addition to the barriers, properly marked crossing points should be provided.
13. If speeding within the CKC facility becomes an issue in the future, traffic calming treatments such as the following may be considered: raised crosswalks, speed humps, or others.

Figure 6.2 Pedestrian/Cyclist Network Recommendations (Source: City of Grande Prairie)



7.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study is to review the adequacy and identify any deficiencies in the Community Knowledge Campus existing internal transportation network and provide recommendations regarding internal traffic circulation, parking and pedestrian movements. The study does not address land use planning, which is a prerogative of the City of Grande Prairie. The following conclusions and recommendations are provided.

7.1 Parking at the CKC

It is concluded that the Community Knowledge Campus has ample parking to sustain its operations at present; however the addition of the new public school and full development of the site will challenge the existing stock of space. It is expected that the planned 450 stalls additional to the new construction will be sufficient to accommodate new demand, and that the addition of a number of other site controls and amenities will significantly improve parking facilities and services, and optimize use of the lots by adjacent facilities. It is anticipated that these planned upgrades will be sufficient to permanently service the site within current planning horizons. The following recommendations are provided:

1. It is estimated that at full build-out of the site, approximately 1,848 parking stalls are required based on the City's By-law. Moreover, based on the ITE parking generation manual only about 1,030 parking stalls are required (parking demand), and about 1,925 parking stalls are provided for similar land uses in North America (parking supply). Based on field observations, the site has currently an inventory of approximately 1,101 parking stalls (including the unpaved parking south of the South Leg of Knowledge Way) at parking lots and about 77 on-street parking along Knowledge Way (a total of 1,178 parking stalls). However, field observations and information provided by the stakeholders indicate that peaks of parking demand do not coincide for the schools developments and other site developments. This means, there are opportunities for sharing parking supply and efficiently manage the parking at the site, reducing the number of additional parking.
2. While the overall site affords sufficient capacity to accommodate operations at the present time, it is anticipated that the addition of the new public school will overload the west end of the site. It is recommended that 450 stalls be constructed to accommodate new demand. According to the current plan, provided to MMM, the additional parking is proposed on the southwest side of the CKC site. This plan will be enough to meet the site parking demand needs, in conjunction with (1) shared parking, (2) paved of all south parking lots, and (3) the parking recommendations provided in this report. However, several concerns regarding the distances from the proposed parking lots, south side parking lots and the Eastlink/Gymnastics facilities have been raised. Experience shows that if the parking lot is paved and well lit, to the same degree as the existing paved lots, the differentiation would be removed, and the lot would be acceptable for the users. However, if the City's wish is to provide more space, the west and northwest sides of the West Leg of Knowledge

Way might be used to provide additional parking (likely used by the Eastlink/Gymnastics users) or to accommodate some of the parking on the southwest side (i.e. the proposed parking lot 7 in Figure 3.1). This alternative will impact how the land is used within the site. It is beyond the scope of this study to provide recommendations regarding land use.

3. The new public school stalls will be available to the Eastlink Centre and Gymnastics Club during evening and weekend timings, but parking demand in the northwest sector of the site will require containment. It is recommended that the City develop a reserved permit system bundled with Eastlink and Gymnastics memberships and lessons to discourage overuse of this lot.
4. It is recommended that facilities managers should share their event dates and calendars in their quarterly operations meetings to avoid special event increments.
5. It is recommended that the City create awareness or an instruction to campus visitors to park in the St Joseph's student lot, when the Eastlink/Gymnastics south lot is full. Awareness can be created by: (1) providing information inside the Eastlink Centre (that additional parking is available and where); (2) educating the students; (3) providing signage to direct to the available parking lots; (4) improving the south entrance to make it look more like a main entrance.
6. It is recommended that the City erect an informative sign at the corner of Knowledge Way west entrance to direct traffic eastbound onto the South Leg of Knowledge Way and into the old and new school parking lots. The existing signs should be removed.
7. It is recommended the south entrance to the multiplex complex be further improved with large display signage to make it look more like a main entrance.
8. It is recommended that all parking lots be regularly and better maintained to demonstrate a higher standard of care and discourage misuse and vandalism.
9. It is recommended that the parking on the southwest side be paved, well lit, to the same degree as the existing paved lots, as well as properly delineated. As such, the lot would be acceptable for the users.
10. It is recommended that an outside mobile security or peace officer patrol be implemented to patrol the grounds, ensure property and parking standards, discourage loiterers, and warn potential offenders.
11. It is recommended that the landscape gap between the proposed public school parking lot on the south side of the South Leg of Knowledge Way and the St Joseph's student parking lot should be closed to maximize the sharing ability of the parking space.
12. It is recommended that the front exterior of the new public high school faces southwest, or be reconfigured as much as possible to do so, rather than towards the northwest lot. In addition,

pedestrian access from the north face of the new school building to the multiplex complex should be restricted.

13. It is recommended that the City consider installing traffic calming treatments (such as speed humps or others) within the parking lots as an option to encourage traffic to slow down.
14. It is recommended that signage be rationalized and made enforceable, and that special signage for special needs parkers be considered for installation in selected stalls in the northwest and south Eastlink/Gymnastics lots.
15. It is recommended that additional bus routes be considered to service the campus as available.
16. It is recommended that generic signs identifying stalls as “Reserved” and “Public Parking” replace the current signs identifying teachers and students only.

7.2 Internal Traffic Circulation

It is concluded that the CKC’s internal roadway network will require some upgrades to accommodate the expected traffic volumes during the weekday peak hour at full build-out. During special events traffic volumes will be higher. If the recommendations provided for parking management are followed, it is expected that the negative impact in traffic circulation due to excessive traffic volumes during special events will be minimized. Given the size of the complex, the location of the buildings compared to the location of parking lots, and the internal ring roadway, the better the management of parking facilities, the better the internal traffic circulation, within the current planning horizon.

The recommended intersection layouts (including recommended safety treatments such as curb extensions or bulbouts) for the intersection of East & South Leg of Knowledge Way and the intersection of West & South Leg of Knowledge Way are able to accommodate turning movements of an inter-municipal bus while enhancing circulation and road safety; however, trucks (WB-21) will be unable to perform turning movements at these locations and will be only allowed to the thru movement on the north-south directions. Details of the geometric layout must be worked out at the design stage.

The following recommendations are provided:

1. It is recommended to reduce lane widths to avoid driver confusion and improve circulation and road safety of the site. The South Leg of Knowledge Way should be upgraded to two-way undivided roadway with four lanes each of approximately 3.75m. Two of these lanes must be exclusively for on-street parking (for pick-up and drop-off parking) and for the transit stop zone. The Knowledge Way loop north of the South Leg of Knowledge Way should be upgraded to a two-way roadway with three lanes each of approximately 4m. One lane must be exclusively for on-street parking. It is believed the current length width size (6 to 7.5m) may negatively impact road

safety by given the impression of a roadway for higher posted speed, and by allowing drivers to attempt risky maneuvers such as weaving and cut-traffic at intersections.

2. It is recommended to delineate the internal roadway lanes (paving markings).
3. The following layout is recommended for the intersection of the East Leg and South Leg of Knowledge Way: one left-turn lane, and one thru lane on the northbound approach; one shared thru/right-turn lane on the southbound approach; and one shared left-turn/right-turn lane on the eastbound approach. This intersection works as a two-way stop controlled intersection with the stop sign for the eastbound approach. It was found the northbound queue will not block 68 Avenue.
4. For the intersection of the East Leg and South Leg of Knowledge Way it is also recommended to provide a median on the southbound approach to: (1) reduce the width of the southbound lane (share thru and right turn lane) to approximately 3.7m; (2) block traffic on the northbound left-turn lane that attempt to proceed through the intersection rather than turning; and (3) provide a clear use of each lane at the intersection. A curb extension is also recommended on the South Leg of Knowledge Way at the eastbound approach.
5. The following layout is recommended for the intersection of the West Leg and South Leg of Knowledge Way: one thru lane, and one channelized right-turn auxiliary lane on the northbound approach; one shared left-turn/thru lane on the southbound approach; and one shared left-turn/right-turn lane on the westbound approach. This intersection works as a two-way stop controlled intersection with the stop sign on the westbound approach. . It was found the northbound queue will not block 68 Avenue. Alternatively, the configuration of the southbound approach can be: one thru lane, and one auxiliary left-turn lane. This alternative southbound approach configuration is possible if desired by the City; although it is not required based on the traffic analysis.
6. For the intersection of the West Leg and South Leg of Knowledge Way it is also recommended: (1) to channelize the northbound right-turn lane to restrain northbound traffic from going thru when on the right lane; and (2) to introduce a curb extension or bulbout at the westbound approach so there is no an auxiliary right-turn lane on this approach. These measures will also reduce pedestrian crossing distances.
7. It is recommended a curb extension or bulbout be constructed on the westbound approach of the intersection of West Leg & South Leg of Knowledge Way; as well as on the eastbound approach of the intersection of East Leg & South Leg of Knowledge Way.
8. It is recommended to close the access to the proposed parking lot 9. Users of this parking lot can have access throughout the proposed parking lot 10.
9. It is recommended that the access to the proposed southwest parking lot be located north of the intersection of the West Leg and South Leg of Knowledge Way, at least 50m away, and should not

be located on the curve. The roadway inside the parking lot must be perpendicular to Knowledge Way (West Leg) to avoid creating visibility problems at this location.

10. It is not recommended to provide an additional right-in/right-out access out of 68 Avenue and into the proposed southwest parking lot. The distances between this right-in/right-out access and the adjacent signalized intersections, 108 Street & 68 Avenue on the east and West Leg of Knowledge Way & 68 Avenue on the west, will be only approximately 200 meters. Also, traffic operations at the intersection of 108 Avenue & 68 Avenue are already challenged by the intersection of Canfor Hauling Road & 68 Avenue (located approximately 50m away to its east side). The proposed additional access will likely negatively impact traffic operations along 68 Avenue on the westbound direction. In addition, the circulation analysis showed that the proposed southwest parking lot can be accessed along Knowledge Way without negatively impacting internal traffic circulation or traffic operations at 68 Avenue, which make unnecessary the right-in/right-out access on 68 Avenue.
11. The intersection of the West Leg and South Leg of Knowledge Way will operate at acceptable level of service LOS during the weekday afternoon peak hour if a roundabout treatment is considered for this intersection. However, the introduction of a roundabout is not necessary looking at the full build-out of the site. Therefore, the roundabout is not recommended.
12. The implementation of one way street system is not recommended. A one way street system will negatively impact traffic accessing the site, and through traffic on 68 Avenue, as well as will create inconvenience to recirculating traffic and to errant vehicles within the CKC site.
13. It is recommended that the City implements a two-way traffic circulation for the North Leg of Knowledge Way.
14. All access to parking lots must be two-way controlled intersections with the stop sign facing traffic volumes exiting the parking lot.
15. It is recommended two-way stop control for the following intersections: intersection of the South Leg and East Leg of Knowledge Way (stop control on the east-west direction); intersection of the South Leg and West Leg of Knowledge Way (stop control on the east-west direction); and intersection of 106 Street and Knowledge Way (stop control on the north-south direction);
16. It is recommended a posted speed of 30kph within the CKC site. Knowledge Way is a roadway providing direct access to several parking lots while there are several crosswalk for the pedestrian/cyclist pathway system. In addition, it is expected a considerable volume of users with strollers.
17. It is recommended the use of the following traffic signs within the CKC site:
 - Posted speed of 30 kph,
 - Pedestrian crosswalk sign at all crosswalks,

- Public parking site (for student/visitor parking lots that are also intended to be available for users of other facilities beside the schools),
 - Staff parking site (for teacher parking lots),
 - Coca-Cola Users Only (for the northeast lot as currently is),
 - Transit Stop Zone signs with information of routes and schedule,
 - School Bus Stop Only signs for these zones,
 - Drop-off/Pick-up Only sign with limit of time at the proper locations,
 - Loading Zones signs,
 - Truck route sign allowing only the thru movement on the north-south directions of Knowledge Way,
 - Truck prohibited sign along the South Leg of Knowledge Way,
 - Informative parking signs at internal intersection right after the entrance to the CKC site,
 - Prohibited parking site at accesses or where deemed necessary.
18. It is recommended to consider renaming the road segment of Knowledge Way that this report is calling South Leg of Knowledge Way. The existing road network configuration and the fact that all internal roads are called Knowledge Way make difficult to provide clear concise information to users as well as way finding for someone unfamiliar to the site (i.e. currently there are two intersections of Knowledge Way & Knowledge Way).
19. It is recommended to complete a revision of the intersection geometry of intersections within the CKC site. The study should revise as-constructed or detail design internal intersection geometry to ensure turning vehicle paths and visibility are adequate.
20. It is recommended that the City reviews accesses to loading zones, to ensure the design vehicle will be able to manoeuvre in and out of the loading zone without blocking the pathways to or through roadways and parking lots. It is also recommended that the City reviews all existing and planned building configurations to ensure loading zones are not compromised by the plans. As example, the proposed plans for the new public school leave little space for a design vehicle to access the loading zone of the Gymnastics Club. The access or internal roadway of the northwest parking lot should not be blocked by a parked vehicle in the loading zone or by the vehicle manoeuvring to access/exit the loading zone, which can negatively impact other users and modes including public transit.
21. If speeding becomes an issue within the CKC site in the future; it is recommended that the City introduces speed reduction treatments. The decision of what treatment to use depends on a safety review.

7.3 Transit and School Bus Services

The following recommendations are provided regarding transit and school bus services for the CKC site:

1. It is recommended to maintain one bus stop for public transit at the Gymnastics Club. If this bus stop is relocated, the relocated bus stop should be close to the building access entrance.
2. It is recommended to provide one bus stop for the future Route A inside the CKC site. The location of this bus stop may be provided on the westbound direction of the South Leg of Knowledge Way, between both schools. However, depending on the transit users' destination and the final route layout, there are opportunities for a bus stop location on the North Leg of Knowledge Way.
3. It is recommended to provide the school transit stop zone in the westbound direction on the east side of the South Leg of Knowledge Way. Although a central location could be ideal, it is considered more efficient to maintain the drop-off/pick-up parking area separate from the transit stop zone (each one on one side of Knowledge Way). This will avoid potential conflicts between arriving/departing vehicles and the school buses. Walking distances from the bus stop to the schools are still reasonable, and sidewalks are provided.
4. It is recommended to provide a drop-off/pick-up parking zone in the westbound direction on the west side of the South Leg of Knowledge Way. It is recommended to provide time parking limit to this zone as well as signage.
5. It is recommended to provide a time parking limit to the drop-off/pick-up zone in front of the Gymnastics Club. An additional drop-off/pick-up zone north of the new high school and inside of the access roadway to the northwest parking lot is not desirable for the users of that parking lot, as expressed during the duration of this study. Access to the loading zone must not block the traffic circulation within this parking lot.
6. It is recommended to educate users of the drop-off/pick-up parking zones to respect parking time limits. If education does not improve behaviour, the City should consider enforcement.
7. If demand for drop-off/pick-up parking is considerably higher than the supply (for both schools), additional drop-off/pick-up parking stalls should be provided on the eastbound direction of South Leg of Knowledge Way. However, sidewalks should be provided on this side in such case and students should be educated to not jaywalk.

7.4 Pedestrian and Bike Movements

The following recommendations are provided regarding pedestrians/cyclist movements at the CKC site:

1. It is recommended to complete the sidewalk network to support parking development recommendations on the CKC south side and the share-parking initiatives. In order to encourage

users of the Eastlink/Gymnastics facilities to utilize available parking on the south side, it is necessary to complete the sidewalk network in between the landscaping gaps. Additional sidewalks should be provided on: the north side of the South Leg of Knowledge Way; both sides of the West Leg of Knowledge Way between 106 Street and 68 Avenue; both sides of parking lot south of the Eastlink/Gymnastics facilities between both schools; and within the new southwest parking lot.

2. Provide sidewalks on the south side of the South Leg of Knowledge Way. This sidewalk might be necessary to provide a safe trail for users of the south parking lots to reach the designated crosswalks in the event that pedestrian barriers are installed along Knowledge Way (South Leg) to stop jaywalking.
3. It is recommended to provide sidewalks around the current St. Joseph's Catholic School in conjunction with sidewalks connecting the parking lot with the Coca-Cola Centre. This is necessary in the event that south parking lots are to be used as additional parking for special events in the Coca-Cola Centre or at Multiplex facilities.
4. All buildings within the CKC site should be accessible through sidewalks or pathways, as well as connected to parking lots to allow for shared parking and to support parking recommendations and initiatives. Sidewalks and pathways should be properly maintained throughout the year and cleared of snow during the winter time.
5. Wherever pedestrians walk through an area, they should be guided by way-finding signing and pavement markings. Sidewalks and pathways should be barrier-free, to allow for seniors, pedestrians with strollers, or pedestrians with mobility and visual impairments to navigate through the area. Sidewalks width should be enough to accommodate users with strollers.
6. Crosswalk selected location are provided in **Figure 6.1**. Crosswalks should be properly marked and perpendicular to vehicular traffic. Marked crosswalks identify pedestrians crossing points and reminds motorist to yield to pedestrians. The Manual of Uniform Traffic Control Devices for Canada presents the traditional crosswalk design of two parallel solid white lines approximately 2.5 m apart. Variations include ladder, zebra and diagonal patterns. Zebra markings at crosswalks are more visible to motorist; at high traffic/pedestrian intersection reduce the rate of vehicle-pedestrian conflicts; and they are easy to spot due to the increasing contrast. The City should consider the most appropriate.
7. It is recommended to provide curb ramps at all crosswalks. To assist people with visual or cognitive impairments, a distinct colour and texture should be used on the curb ramp. The surface should be slip resistant and free-draining.
8. Curb extensions or bulbouts should be provided on the westbound approach of the intersection of the South and the West Legs of Knowledge Way. A curb extension is an horizontal intrusion of the curb into the roadway. It reduces the roadway section, reducing the crossing distance for

pedestrians. The sacrificed travel lane will be destined for drop-off/pick-up parking and transit stop zones.

9. It is recommended to channelize the northbound approach of the intersection of the South and West Legs of Knowledge Way. The island should be sufficiently large to provide safe refuge for pedestrians crossing at the intersection.
10. Both signalized intersections on 68 Avenue and Knowledge Way (East and West Legs) should be provided with pedestrians signal indications.
11. Bike parking stalls should be provided at all facilities in order to encourage biking to/from the CKC side.
12. To discourage jaywalking across 68 Avenue from the CKC site, barriers along the sidewalks or in the median are recommended. Similarly, barriers are recommended along the south side of the South Leg of Knowledge Way, and around the new school. One possible option is the use of 1.2m high chain-link fencing for consistency within the CKC site. However, other options are available in the market that serves the same purpose. In addition, it has been observed in the past that some individuals had climbed over a 1.2m fencing. If this is identified as an issue in the CKC site, the height of the fence should be increased. In addition to the barriers, properly marked crossing points should be provided.
13. If speeding within the CKC facility becomes an issue in the future, traffic calming treatments such as the following may be considered: raised crosswalks, speed humps, or others.

Table A.1 Background Information and Reference Documents

Information/Reference Document Name	Description	Traffic Area	Reference Source
G.P Transportation.doc	ASAP III School Site Investigations (page11-22) 2012	Public High School	Morrison Hershfield
Circulation Notice Development Permit.doc	Circulation Notice Development Permit	Public High School	Stantec Architecture Ltd.
Site Map.doc	Site picture	Public High School	City of Grande Prairie
GP CKC high school_DP submission 2012-06-13	Plan of the public schools	Public High School	Stantec Architecture Ltd.
99-07 Public High School Parking Requirements 2011-10-17	Email explaining short-cuts in parking	Public High School	City of Grande Prairie
99-07 Public High School Parking Requirements 2011-10-17	Plan of the CKC with parking counts	All	City of Grande Prairie
012366-B6958S-A100b	Roundabout option plan and parking	Public High School	Stantec Architecture Ltd.
012366-B6958S-A101b	Roundabout option plan and parking (aesthetics)	Public High School	Stantec Architecture Ltd.
Letter to GP (2).doc	Letter of AT regarding the roundabout	Public High School	Alberta Transportation
Scan001.pdf	Report describing planning design of the public school	Public High School	Stantec Architecture Ltd.
Staff	email explaining capacity at full build-out	Public High School	City of Grande Prairie
St Joseph Parking	email explaining capacity at full build-out	Catholic School	City of Grande Prairie
DOC082212 Bus Stops	Plan showing bus stops	Catholic School	City of Grande Prairie
St Joseph Buses	email info about bus routes	Catholic School	City of Grande Prairie
A000 - Cover Sheet	Eastlink's issues of construction	Eastlink Centre	Barr Ryder Architects and Interior Designers
C-002 - Site Service Plan - Rev. H - 100726	Underground utilities plan	Eastlink Centre	Barr Ryder Architects and Interior Designers
2170 Site Pages from 2011.12.21	Electrical plan	Eastlink Centre	Barr Ryder Architects and Interior Designers / AECOM
South parking Eastlink Centre	South parking lot plan - Eastlink Centre	Eastlink Centre	City of Grande Prairie
Floor2final.pdf	Easlink's site plans	Eastlink Centre	City of Grande Prairie
Floor3track.pdf	Easlink's site plans	Eastlink Centre	City of Grande Prairie
Mainfloorfinal.pdf	Easlink's site plans	Eastlink Centre	City of Grande Prairie
9733	Site Plan	Coca-Cola Centre	City of Grande Prairie
9738	Main floor reflected ceiling plan	Coca-Cola Centre	City of Grande Prairie
9782	Main floor plan	Coca-Cola Centre	City of Grande Prairie
9795	Overall main floor plan	Coca-Cola Centre	City of Grande Prairie
9803	Overall second floor plan	Coca-Cola Centre	City of Grande Prairie
Gymniks ASBUILT 2005 DWG	Site plan and parking lots (2005)	Gymnastics Club	Field Field & Field Architecture Engineering Ltd.
EXH asbuilt october 19 2007	Gymnastics plan and parking lots (2007)	Gymnastics Club	City of Grande Prairie
Parking Information	Parking/Traffic Key Information	Gymnastics Club	City of Grande Prairie
68 Ave Functional Study	Functional Planning Study of 68 Avenue	-	ISL Infrastructure Systems Ltd.
13385_Final_Report_Entire[1]	68 Avenue Traffic Impact Assessment	-	ISL Infrastructure Systems Ltd.
CKC site Areas	2003 Conceptual site layout	-	City of Grande Prairie

Information/ReferenceDocument Name	Description	Traffic Area	Reference Source
CKC WEST Master Plan (v7)	Southwest conceptual parking layout	Public High School	City of Grande Prairie
Transportation Master Plan (TMP)	TMP 2009	-	ISL Infrastructure Systems Ltd.
LUB_Part8_Section 63-66	Land Use By-Law (Parking)	-	City of Grande Prairie
2012 Rider's Guide	Transit maps and guide	-	City of Grande Prairie
C93029-11x17 Sidewalks	Pedestrian/Cyclist pathway map	-	City of Grande Prairie
Recreation/Trail Map	Recreation/Trail Map	-	City of Grande Prairie
Collision complaints stats CKC	Collision complaints	All	City of Grande Prairie
ITE Parking Generation, 4 th Edition	Parking generation informational report	-	Institute of Transportation Engineers (ITE)
ITE Trip Generation, 8 th Edition	Trip generation informational report	-	Institute of Transportation Engineers (ITE)

BY-LAWS PARKING GENERATION

Zone	Land Use Description	X	X units	Parking Generation	
				Parking Demand Rate	Generated
TZ1	St Joseph's Catholic High School				
	Originally (783 Students, 71 Staff)			Required	367
	Assumed - Students	1,325	m^2 Classroom	P= 0.2 stalls / 10 m^2 classroom	27
	Assumed - Teachers	14	# of Classrooms	P= 0.75 stalls / classroom	11
	Assumed - Visitor Parking	193	m^2 Office/Adm Area	P= 2.8 stalls / 100 m^2 office/adm area	5
				Sub-Total	410
TZ2	New Public High School				
	Student Parking	4,167	m^2 Classroom	P= 0.2 stalls / 10 m^2 classroom	83
	Teacher Parking	45	# of Classrooms	P= 0.75 stalls / classroom	34
	Visitor Parking	606	m^2 Office/Adm Area	P= 2.8 stalls / 100 m^2 office/adm area	17
	Event Parking	1,275	m^2 Gym Area	P= 1.0 stall / 5 m^2 Gym area	255
	Pick-up/Drop-off (No Required)				10
	Disable Parking Stalls Provided				10
				Sub-Total	409
TZ3	Coca-Cola Centre				
	Required			Determined by Public Authority	200
TZ4	Eastlink Aquatics Centre				
	Required			Determined by Public Authority	557
TZ5	Gymniks Gymnastics Club				
	Required			Determined by Public Authority	272
				TOTAL	1,848

PARKING GENERATION AVAILABLE RATES (BASED ON ITE INFORMATIONAL REPORT)

Zone	Land Use	Land Use Description	X	X units	Parking Generation				Comments
					Parking Demand Rate	Generated	Parking Supply Rate	Generated	
TZ1		St Joseph's Catholic High School							
	530	High School	1,228	Students	T= 0.25*X	305	T= 0.50*X	615	Transit within 3 blocks; Peak 10-11AM; 160 ft^2 (GFA)/Student
TZ2		New Public High School							
	530	High School	1,400	Students	T= 0.25*X	350	T= 0.50*X	700	Transit within 3 blocks; Peak 10-11AM; 160 ft^2 (GFA)/Student
TZ3		Coca-Cola Centre							
	465	Ice Skating Rink	50	1000 ft^2	T= 0.42*X	20	T= 3.9*X	195	Friday; Peak 5-6PM and 8-9PM; Only one sample in October (size 26,000 ft^2)
	464	Roller Skating Rink	50	1000 ft^2	T= 5.80*X	290			Peak 11PM-12AM Friday Evenings; ONE SAMPLE (28,800 ft^2)
TZ4		Eastlink Aquatics Centre							
	414	Water Slide Park		Acres	T= 49.70*X	0	T= 84.5*X	0	Peak 12-4PM (Average size 32.5 Acres). Only two samples.
	493	Athletic Club	64	1000 ft^2	T= 2.97*X	190	T= 3.90*X	250	0.34 Employees/1000ft^2 (GFA). Small sample.
	493	Athletic Club		Members	T= 0.08*X	0	T= 0.08*X	0	Only one sample.
	495	Recreational Community Centre	64	1000 ft^2	T= 2.69*X	170	T= 2.69*X	170	Small sample.
TZ5		Gymniks Gymnastics Club							
	493	Athletic Club	55	1000 ft^2	T= 2.97*X	165	T= 2.97*X	165	Small sample.
	493	Athletic Club	3,000	Members	T= 0.08*X	240	T= 0.08*X	240	Only one sample.
	495	Recreational Community Centre	55	1000 ft^2	T= 2.69*X	150	T= 2.69*X	150	Small sample.
	492	Health/Fitness Club	55	1000 ft^2	T= 1.38*X	75	T= 1.38*X	75	

RECOMMENDED PARKING GENERATION (BASED ON ITE INFORMATIONAL REPORT)

Zone	Land Use	Land Use Description	X	X units	Parking Generation				Comments
					Parking Demand Rate	Generated	Parking Supply Rate	Generated	
TZ1		St Joseph's Catholic High School							
	530	High School	1,228	Students	T= 0.25*X	305	T= 0.50*X	615	Transit within 3 blocks; Peak 10-11AM; 160 ft^2 (GFA)/Student
TZ2		New Public High School							
	530	High School	1,400	Students	T= 0.25*X	350	T= 0.50*X	700	Transit within 3 blocks; Peak 10-11AM; 160 ft^2 (GFA)/Student
TZ3		Coca-Cola Centre							
	465	Ice Skating Rink	50	1000 ft^2	T= 0.42*X	20	T= 3.9*X	195	Friday; Peak 5-6PM and 8-9PM; Only one sample in October (size 26,000 ft^2)
TZ4		Eastlink Aquatics Centre							
	493	Athletic Club	64	1000 ft^2	T= 2.97*X	190	T= 3.90*X	250	0.34 Employees/1000ft^2 (GFA). Small sample.
TZ5		Gymniks Gymnastics Club							
	493	Athletic Club	55	1000 ft^2	T= 2.97*X	165	T= 2.97*X	165	Small sample.
					TOTAL	1,030	TOTAL	1,925	

PARKING INVENTORY AND CAPACITY REQUIREMENTS

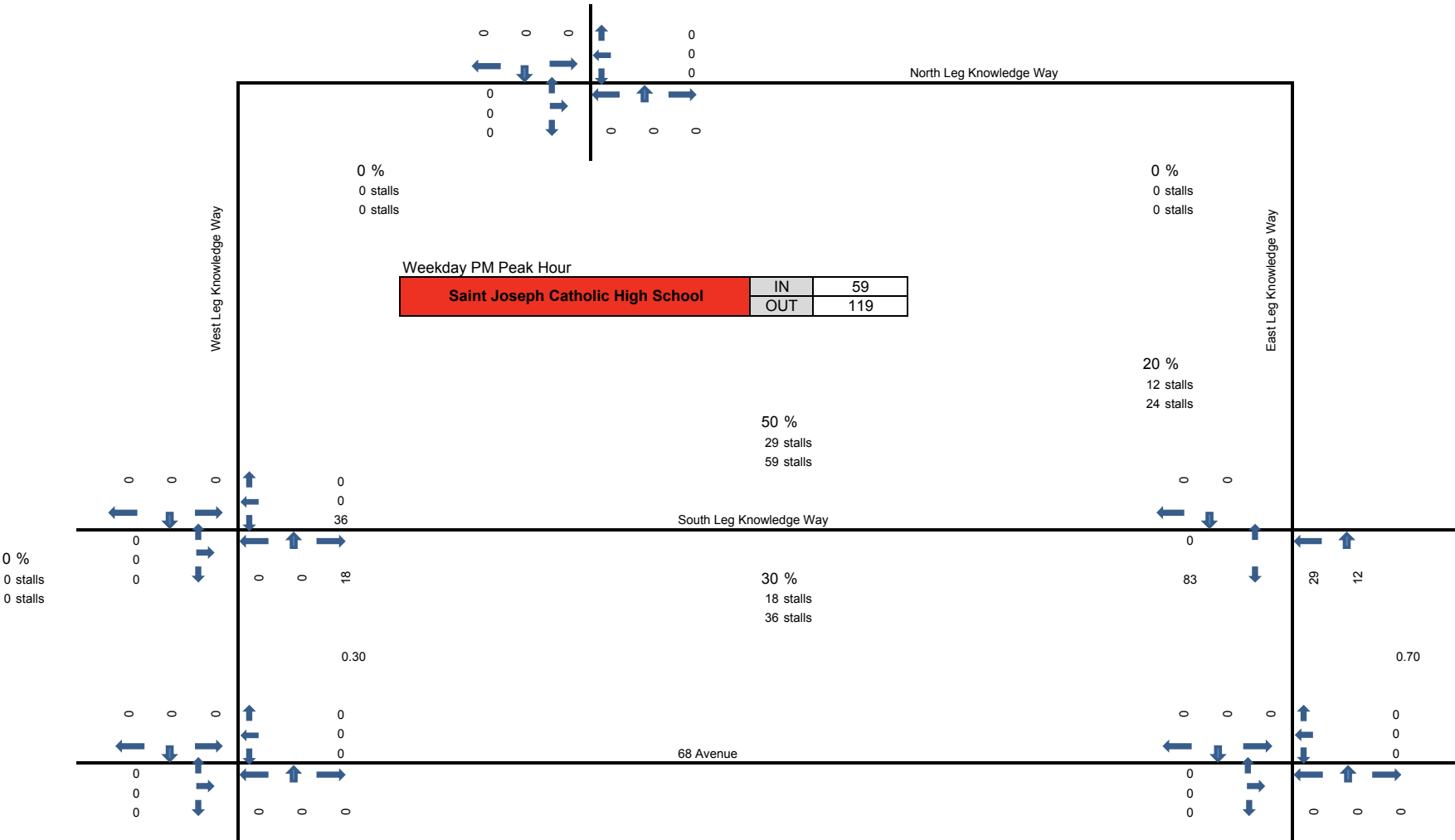
Zone	Land Use Description	ITE Parking Generation Informational Guide			Required By-Law	Associated Parking Areas (Includes Parking Lots and On-Street Parking)	Inventory (# of stalls)	Parking Counts (September 20, 2012)									Comments
		Independent Variable	Parking Demand	Parking Supply				Time: 10:00 AM			Time: 4:00 PM			Time: 6:30 PM			
								Used	Avail	%	Used	Avail	%	Used	Avail	%	
TZ1	St Joseph's Catholic High School	Students	305	615	410	St Joseph's Student Lot	440	85	355	81%	27	413	94%	14	426	97%	
TZ2	New Public High School	Students	350	700	409	St Joseph's Staff Lot	187	54	133	71%	14	173	93%	1	186	99%	
TZ3	Coca-Cola Centre	GFA (ft^2)	20	195	200	Coca Cola Centre Lot	192	22	170	89%	11	181	94%	29	163	85%	
TZ4	Eastlink Aquatics Centre	GFA (ft^2)	190	250	557	Gymnastics/Eastlink South Lot	117	29	88	75%	18	99	85%	55	62	53%	
TZ5	Gymniks Gymnastics Club	GFA (ft^2)	165	165	272	Gymnastics/EastLink Northwest Lot	165	139	26	16%	83	82	50%	236	-71	-43%	Extra vehicles parked in adjacent gravel lot
						Knowledge Curbside Southwest	12	4	8	67%	2	10	83%	8	4	33%	
						Knowledge Curbside St. Joseph High School	8	7	1	13%	0	8	100%	1	7	88%	
						Knowledge Curbside Northwest (Skate Park)	12	10	2	17%	8	4	33%	12	0	0%	
						Knowledge Curbside North (Rear of Eastlink)	45	15	30	67%	12	33	73%	28	17	38%	More stalls available after construction complete
TOTAL			1030	1925	1848	TOTAL	1178	365	813	69%	175	1003	85%	384	794	67%	

GENERAL TOTAL TRIP GENERATION (BASE ON ITE GUIDELINES)

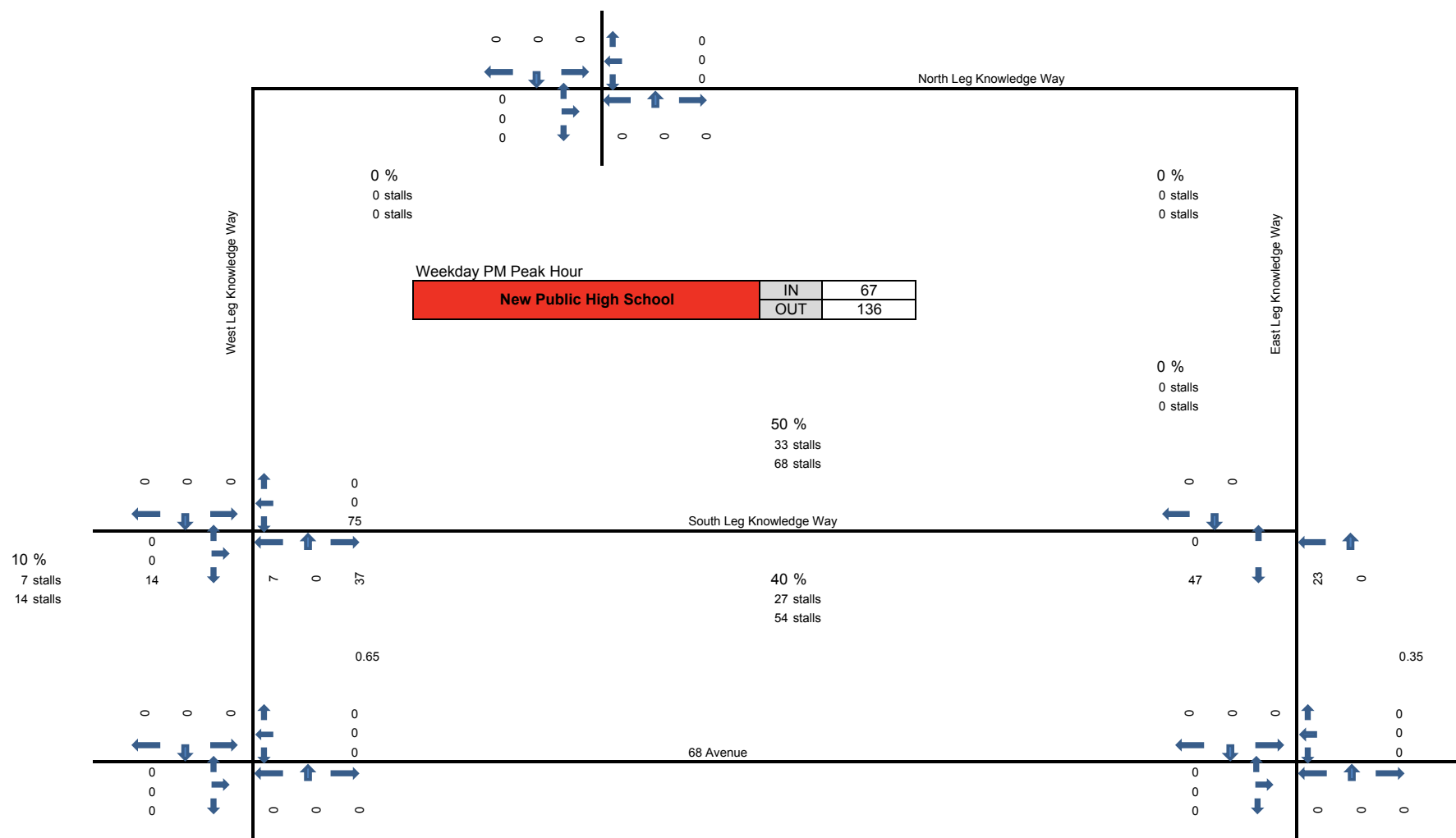
Area	ITE Code	Land Use Description	X	X units	Trip Rate Equation	Trips Generated	Trip Split %		Trip Generated PM Peak Hour			After Modal Split Reduction		
							In	Out	In	Out	Total	In	Out	Total
TA1	530	St Joseph's Catholic High School High School	1,228	Students	$T = 0.29 \times X$	355	33	67	117	238	355	59	119	178
TA2	530	Public High School High School	1,400	Students	$T = 0.29 \times X$	405	33	67	134	271	405	67	136	203
TA3	465	Coca-Cola Centre Ice Skating Rink	50	1000 ft^2	$T = 2.36 \times X$ (small sample)	15	45	55	7	8	15	7	8	15
TA4	493	Eastlink Aquatics Centre Athletic Club	64	1000 ft^2	$T = 5.96 \times X$ (small sample)	380	62	38	236	144	380	236	144	380
TA5	492	Gymniks Gymnastics Club Health/Fitness Club	55	1000 ft^2	$T = 3.53 \times X$	195	57	43	111	84	195	111	84	195
					TOTAL	1,350	46	54	604	746	1,350	479	491	970

APPENDIX D – Trip Distribution & Assignment

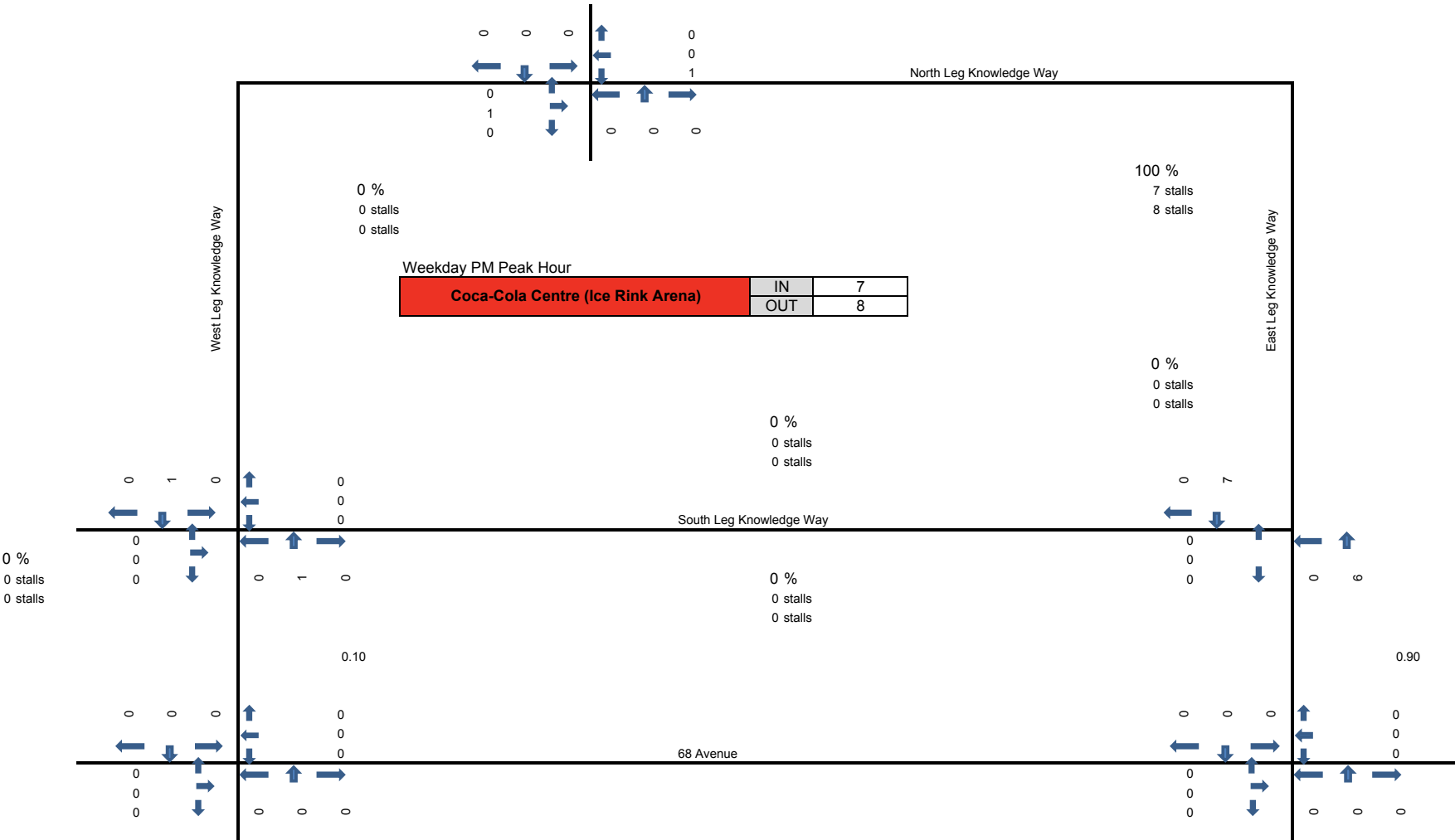
SITE TRAFFIC - ST JOSEPH'S CATHOLIC HIGH SCHOOL (TA1)



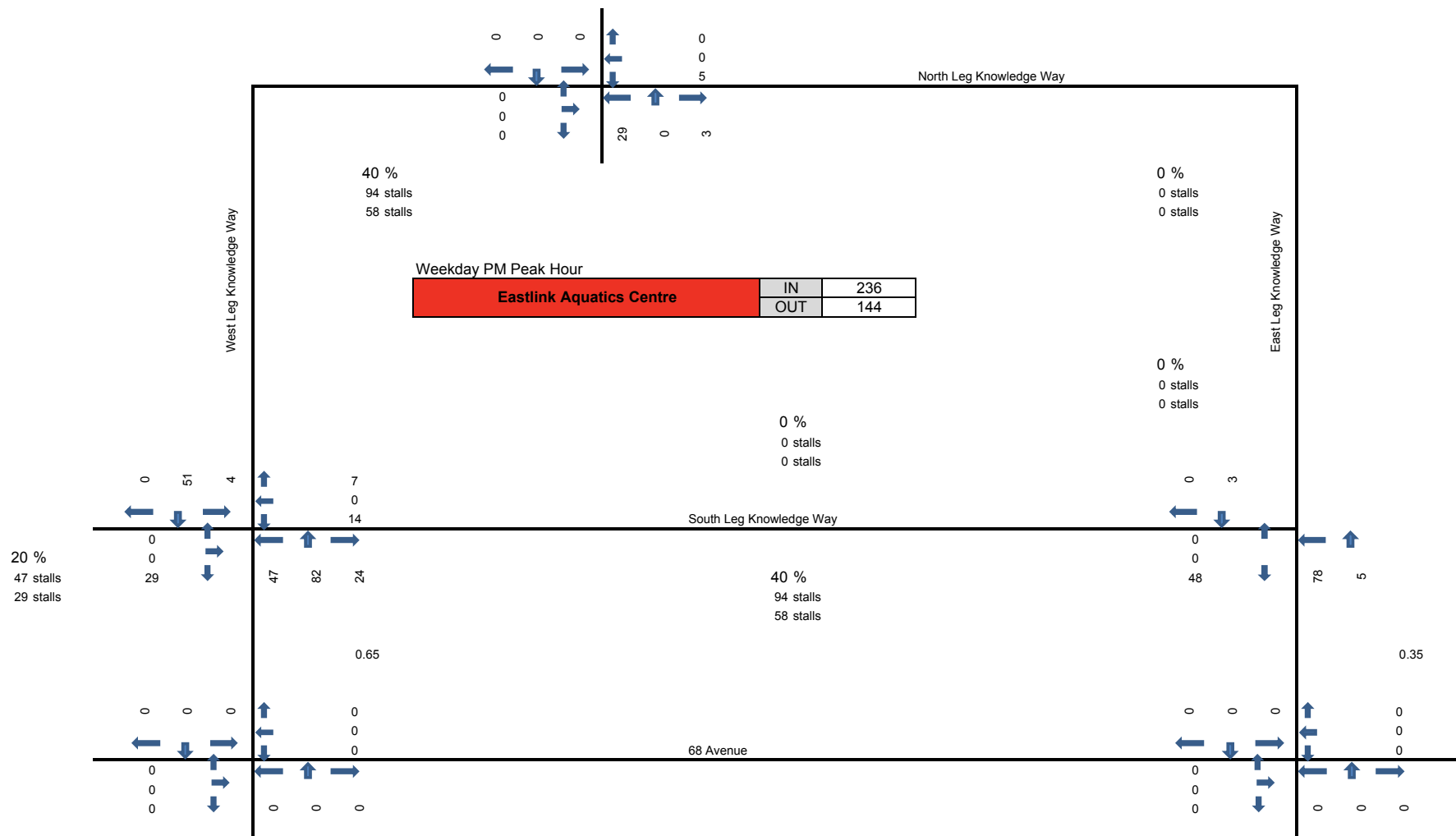
SITE TRAFFIC - NEW PUBLIC HIGH SCHOOL (TA2)



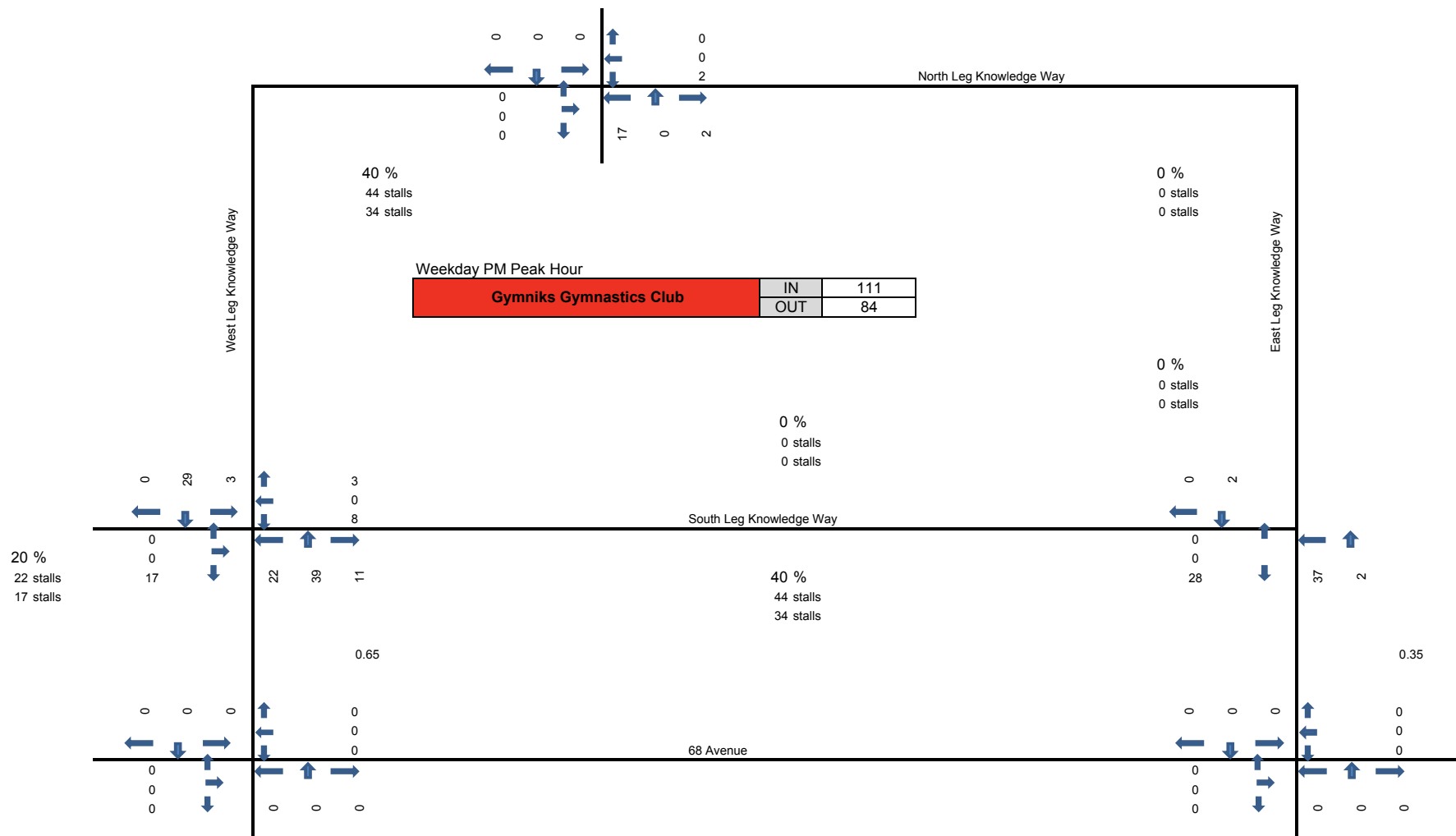
SITE TRAFFIC - COCA-COLA CENTRE (TA3)



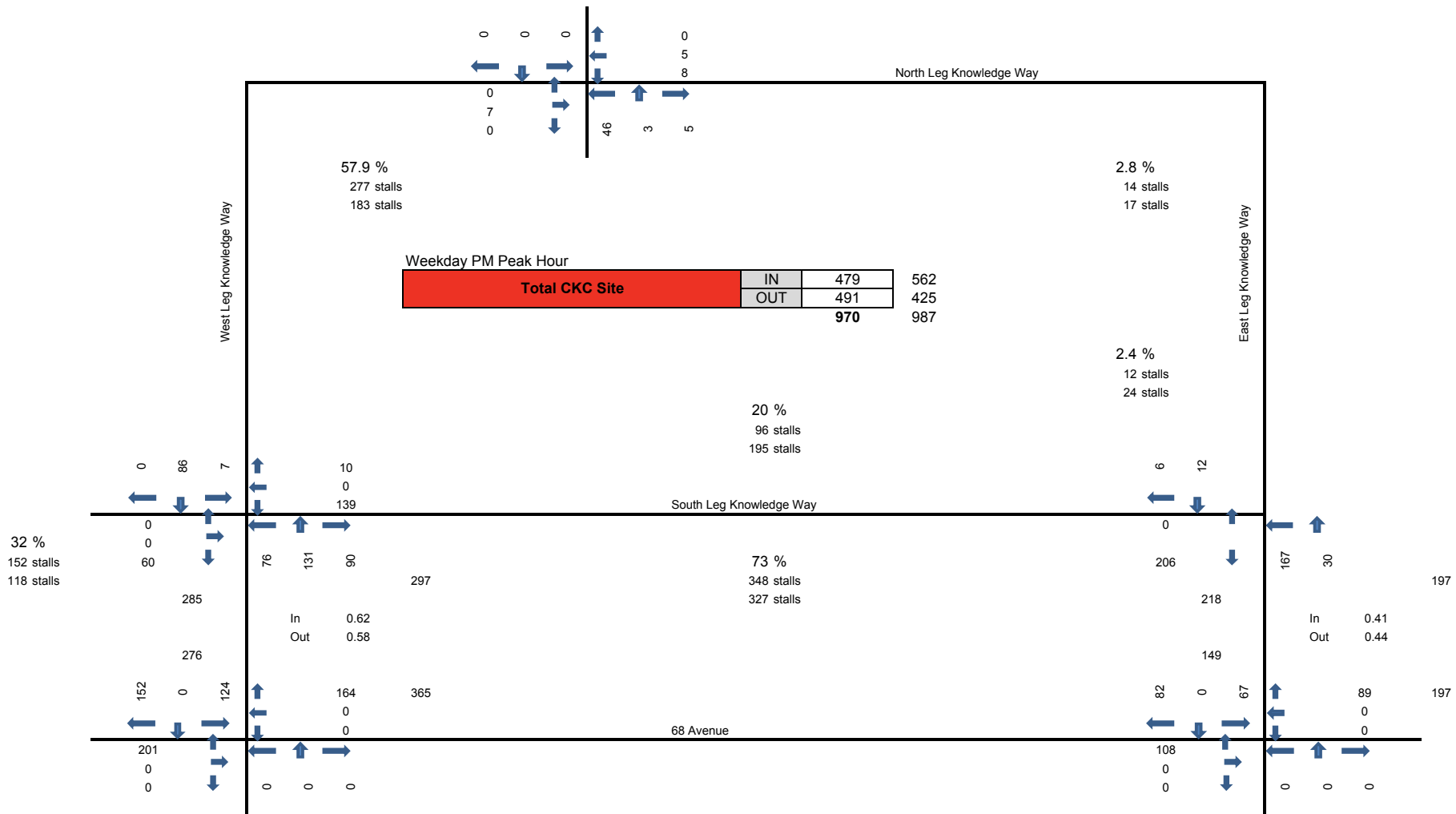
SITE TRAFFIC - EASTLINK AQUATICS CENTRE (TA4)



SITE TRAFFIC - GYMNIKS GYMNASTICS CLUB (TA5)













SITE TRAFFIC - COMMUNITY KNOWLEDGE CAMPUS (ALL SITE TRAFFIC) BALANCED



HCM Unsignalized Intersection Capacity Analysis

1: East Leg Knowledge Way & South Leg Knowledge Way


















HCM Unsignalized Report

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	206	167	30	12	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	224	182	33	13	7
Pedestrians	10					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)				66		
pX, platoon unblocked						
vC, conflicting volume	422	26	30			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	422	26	30			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	78	88			
cM capacity (veh/h)	516	1040	1570			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	224	182	33	20		
Volume Left	0	182	0	0		
Volume Right	224	0	0	7		
cSH	1040	1570	1700	1700		
Volume to Capacity	0.22	0.12	0.02	0.01		
Queue Length 95th (m)	6.2	3.0	0.0	0.0		
Control Delay (s)	9.4	7.6	0.0	0.0		
Lane LOS	A	A				
Approach Delay (s)	9.4	6.4		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay		7.6				
Intersection Capacity Utilization		35.3%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

4: West Leg Knowledge Way & South Leg Knowledge Way

















HCM Unsignalized Report

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	60	139	0	10	7	86	0	91	160	105
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	65	151	0	11	8	93	0	99	174	114
Pedestrians		30			30							
Lane Width (m)		3.7			3.7							
Walking Speed (m/s)		1.2			1.2							
Percent Blockage		3			3							
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (m)											113	
pX, platoon unblocked												
vC, conflicting volume	521	540	123	576	540	204	204			123		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	521	540	123	576	540	204	204			123		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	93	57	100	99	99			93		
cM capacity (veh/h)	406	394	904	351	394	815	1333			1426		
Direction, Lane #	EB 1	WB 1	SE 1	NW 1	NW 2							
Volume Total	65	162	101	273	114							
Volume Left	0	151	8	99	0							
Volume Right	65	11	0	0	114							
cSH	904	365	1333	1426	1700							
Volume to Capacity	0.07	0.44	0.01	0.07	0.07							
Queue Length 95th (m)	1.8	16.7	0.1	1.7	0.0							
Control Delay (s)	9.3	22.5	0.6	3.2	0.0							
Lane LOS	A	C	A	A								
Approach Delay (s)	9.3	22.5	0.6	2.2								
Approach LOS	A	C										
Intersection Summary												
Average Delay			7.2									
Intersection Capacity Utilization			41.8%			ICU Level of Service			A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis











10: Access/106 Street & North Leg Knowledge Way

HCM Unsignalized Report

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	7	0	8	5	0	46	3	5	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	8	0	9	5	0	50	3	5	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	5			8			30	30	8	38	30	5
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	5			8			30	30	8	38	30	5
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			95	100	99	100	100	100
cM capacity (veh/h)	1616			1613			974	858	1075	956	858	1078
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	8	14	59	0								
Volume Left	0	9	50	0								
Volume Right	0	0	5	0								
cSH	1700	1613	975	1700								
Volume to Capacity	0.00	0.01	0.06	0.00								
Queue Length 95th (m)	0.0	0.1	1.5	0.0								
Control Delay (s)	0.0	4.5	8.9	0.0								
Lane LOS		A	A	A								
Approach Delay (s)	0.0	4.5	8.9	0.0								
Approach LOS			A	A								
Intersection Summary												
Average Delay			7.3									
Intersection Capacity Utilization			17.4%		ICU Level of Service				A			
Analysis Period (min)			15									


















HCM Unsignalized Intersection Capacity Analysis

1: East Leg Knowledge Way & South Leg Knowledge Way

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	206	167	30	12	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	224	182	33	13	7
Pedestrians	10					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)				66		
pX, platoon unblocked						
vC, conflicting volume	422	26	30			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	422	26	30			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	78	88			
cM capacity (veh/h)	516	1040	1570			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1		
Volume Total	224	182	33	20		
Volume Left	0	182	0	0		
Volume Right	224	0	0	7		
cSH	1040	1570	1700	1700		
Volume to Capacity	0.22	0.12	0.02	0.01		
Queue Length 95th (m)	6.2	3.0	0.0	0.0		
Control Delay (s)	9.4	7.6	0.0	0.0		
Lane LOS	A	A				
Approach Delay (s)	9.4	6.4		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay		7.6				
Intersection Capacity Utilization		35.3%		ICU Level of Service		A
Analysis Period (min)		15				

















HCM Unsignalized Intersection Capacity Analysis

4: West Leg Knowledge Way & South Leg Knowledge Way

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	139	0	10	7	146	0	0	251	105
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	151	0	11	8	159	0	0	273	114
Pedestrians		30			30							
Lane Width (m)		3.7			3.7							
Walking Speed (m/s)		1.2			1.2							
Percent Blockage		3			3							
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											113	
pX, platoon unblocked												
vC, conflicting volume	488	507	189	477	507	303	303			189		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	488	507	189	477	507	303	303			189		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	67	100	98	99			100		
cM capacity (veh/h)	450	442	831	465	442	718	1226			1350		
Direction, Lane #	EB 1	WB 1	SE 1	NW 1	NW 2							
Volume Total	0	162	166	273	114							
Volume Left	0	151	8	0	0							
Volume Right	0	11	0	0	114							
cSH	1700	476	1226	1700	1700							
Volume to Capacity	0.00	0.34	0.01	0.16	0.07							
Queue Length 95th (m)	0.0	11.3	0.1	0.0	0.0							
Control Delay (s)	0.0	16.4	0.4	0.0	0.0							
Lane LOS	A	C	A									
Approach Delay (s)	0.0	16.4	0.4	0.0								
Approach LOS	A	C										
Intersection Summary												
Average Delay			3.8									
Intersection Capacity Utilization			28.4%			ICU Level of Service			A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

10: Access/106 Street & North Leg Knowledge Way

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	7	0	8	5	0	46	3	5	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	8	0	9	5	0	50	3	5	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	5			8			30	30	8	38	30	5
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	5			8			30	30	8	38	30	5
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			95	100	99	100	100	100
cM capacity (veh/h)	1616			1613			974	858	1075	956	858	1078
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	8	14	59	0								
Volume Left	0	9	50	0								
Volume Right	0	0	5	0								
cSH	1700	1613	975	1700								
Volume to Capacity	0.00	0.01	0.06	0.00								
Queue Length 95th (m)	0.0	0.1	1.5	0.0								
Control Delay (s)	0.0	4.5	8.9	0.0								
Lane LOS		A	A	A								
Approach Delay (s)	0.0	4.5	8.9	0.0								
Approach LOS			A	A								
Intersection Summary												
Average Delay			7.3									
Intersection Capacity Utilization			17.4%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM 2010 Roundabout
4: West Leg Knowledge Way & South Leg Knowledge Way

HCM 2010 Roundabout Report

Intersection					
Intersection Delay (sec/veh)	4.8				
Intersection LOS	A				
Approach	EB	WB	SE	NW	
Entry Lanes	1	1	1	1	
Conflicting Circle Lanes	1	1	1	1	
Adjusted Approach Flow (vph)	65	162	101	387	
Demand Flow Rate (pc/h)	66	165	103	394	
Vehicles Circulating (pc/h)	257	278	255	8	
Vehicles Exiting (pc/h)	101	8	188	315	
Follow-Up Headway (s)	3.186	3.186	3.186	3.186	
Ped Vol. Crossing Leg (#/hr)	30	30	0	0	
Ped Capacity Adjustment	0.996	0.996	1.000	1.000	
Approach Delay (sec/veh)	4.9	6.3	5.3	3.9	
Approach LOS	A	A	A	A	
Lane	Left	Left	Left	Left	Bypass
Designated moves	LR	LR	LT	LT	R
Assumed Moves	LR	LR	LT	LT	R
Right Turn Channelized					Free
Lane Utilization	1.000	1.000	1.000	1.000	
Critical Headway (s)	5.193	5.193	5.193	5.193	
Entry Flow Rate (pc/h)	66	165	103	278	116
Capacity, Entry Lane (pc/h)	874	856	876	1121	1938
Entry HV Adjustment Factor	0.985	0.982	0.982	0.980	0.980
Flow Rate, Entry (vph)	65	162	101	273	114
Capacity, Entry (vph)	857	837	860	1099	1900
Volume to Capacity Ratio	0.076	0.194	0.118	0.248	0.060
Control Delay (sec/veh)	4.9	6.3	5.3	5.6	0.0
Level of Service	A	A	A	A	A
95th-Percentile Queue (veh)	0	1	0	1	0