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City of Grande Prairie

Final Report

Traffic Impact Assessment for 68 Avenue /
Community Knowledge Campus

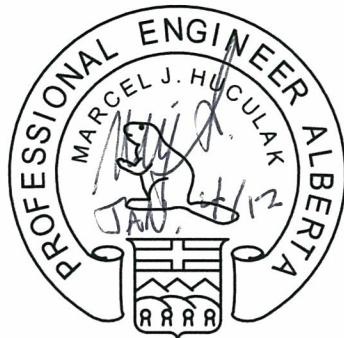
January, 2012





Corporate Authorization

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1.0 Introduction

The City of Grande Prairie is experiencing a significant amount of growth in the area of 68 Avenue at the Community Knowledge Campus (CKC) and the Stonebridge development sites. The CKC site will experience two new uses in the Multiplex and Wellness Center and a New Public High School in the short term while the Stonebridge development will complete its first two phases. In the medium and long term scenarios full build out of the Stonebridge development will occur. This growth will be coupled with other City background growth in areas like the O'Brien and Pinnacle subdivisions.

The City currently has a \$500,000 capital budget for improvements at the Kateri Drive/68 Avenue intersection. This intersection is to the East of the CKC/Stonebridge site and will be directly affected by the CKC/Stonebridge growth. However, the City requires certainty that this intersection is the critical intersection in the area before it invests funding. This certainty is also needed because Kateri Drive/68 Avenue will remain a T-intersection while the two CKC/Stonebridge accesses will become all directional, serving as the primary access points to the CKC site and secondary access points for the Stonebridge development.

Currently, the CKC site is made up of a Gymnastics Center, a Catholic High School and a twin arena. Later this year it is expected that the Multiplex and Wellness Center will open its doors as well. This new facility consists of an Olympic sized swimming pool, a 16,000 square foot work out area, a field house, a running track as well as some leasable retail area. Also, it is expected that a new 1000 student public high school will open up within the next three years. This high school will also include 400 student capacity portables for a total capacity of 1400. On the south side of 68 Avenue the first two phases of the Stonebridge development is expected to be completed within the short term; consisting of a mix of residential and commercial land uses.

Therefore, this study will determine the most critical intersection(s) and determine the best set of improvements to accommodate the growth of the two sites. The study area will include 5 intersections along 68 Avenue between 108 Street to 100 Street, including Kateri Drive, CKC W access and CKC E access. This will make it possible to account for gapping, created by the signalized intersections at 108 Street and 100 Street. The following diagram illustrates the study area and development areas. The Stonebridge accesses will be opposite the existing CKC accesses.



Figure 1.1: Study Area and Development Sites



To determine the critical intersection(s) and recommend the best set of improvements to accommodate the growth, the methodology will be:

- Establish future background traffic volumes at each of three population horizons using the current Transportation Master Plan travel demand model (65,000, 78,000, 90,000 population horizons).
- Apply traffic generated as a result of the growth of the two sites at each of the population horizons.
- Evaluate the traffic at each of these horizons using a range of traffic control options.
- Identify the best set of improvements to accommodate the traffic demand.

As shown in the list of objectives the City's Transportation Master Plan (TMP) model will be used to establish future background traffic. Therefore, growth which occurs outside the study area will be accounted for in the background traffic as the TMP accounts for City growth as a whole.

2.0 Traffic Generation

For each of the population horizons traffic will be generated as anticipated for the type of development being built. The amount of development for each of the population horizons was confirmed prior to commencing this study through discussions with the City. The following table shows the development assumptions at each of the population horizons. These assumptions are over and above those included in the Grande Prairie TMP travel demand model.

Table 2.1: Land Use Growth Assumptions

Population Horizon	Build
65,000	Multiplex, Stonebridge Phase 1 and 2, High School
78,000	Stonebridge Phase 3 and 4
90,000	Stonebridge Phase 5

Traffic generation for the Multiplex and High School was accounted for in the TMP model. In the model the Multiplex was assumed in the 65,000 horizon and the High School was assumed in the 78,000 horizon. Therefore, the traffic generated for the High School was moved to the 65,000 to represent the scenario assumed in this study.

Traffic generation for the Stonebridge development was based on the 2008 Stonebridge TIA completed by Focus and approved by the City. The land use of the development remained the same for this TIA as it is in this study with the exception that development will occur on a different timeline. Table 2.2 shows the site traffic for the Stonebridge development at each of the phases. The traffic generation chapter from the 2008 TIA can be found in the Appendix. Also, the zoning map from the outline plan can be found in the Appendix.

Table 2.2: Stonebridge Traffic Volumes

Phase 1	Trips	In	Out	In	Out
RM	115	65%	35%	75	40
RG	73.00	63%	37%	46	27
Phase 2	Trips	In	Out	In	Out
DC	42	50%	50%	21	21
RL	25	63%	37%	16	9
RM	115	65%	35%	75	40
CS	211	48%	52%	101	110
Phase 3 and 4	Trips	In	Out	In	Out
CA	358	48%	52%	172	186
RM	90	65%	35%	59	31
PS	427	58%	42%	248	179
Phase 5	Trips	In	Out	In	Out
RG	232	63%	37%	146	86
Total:					959
					729

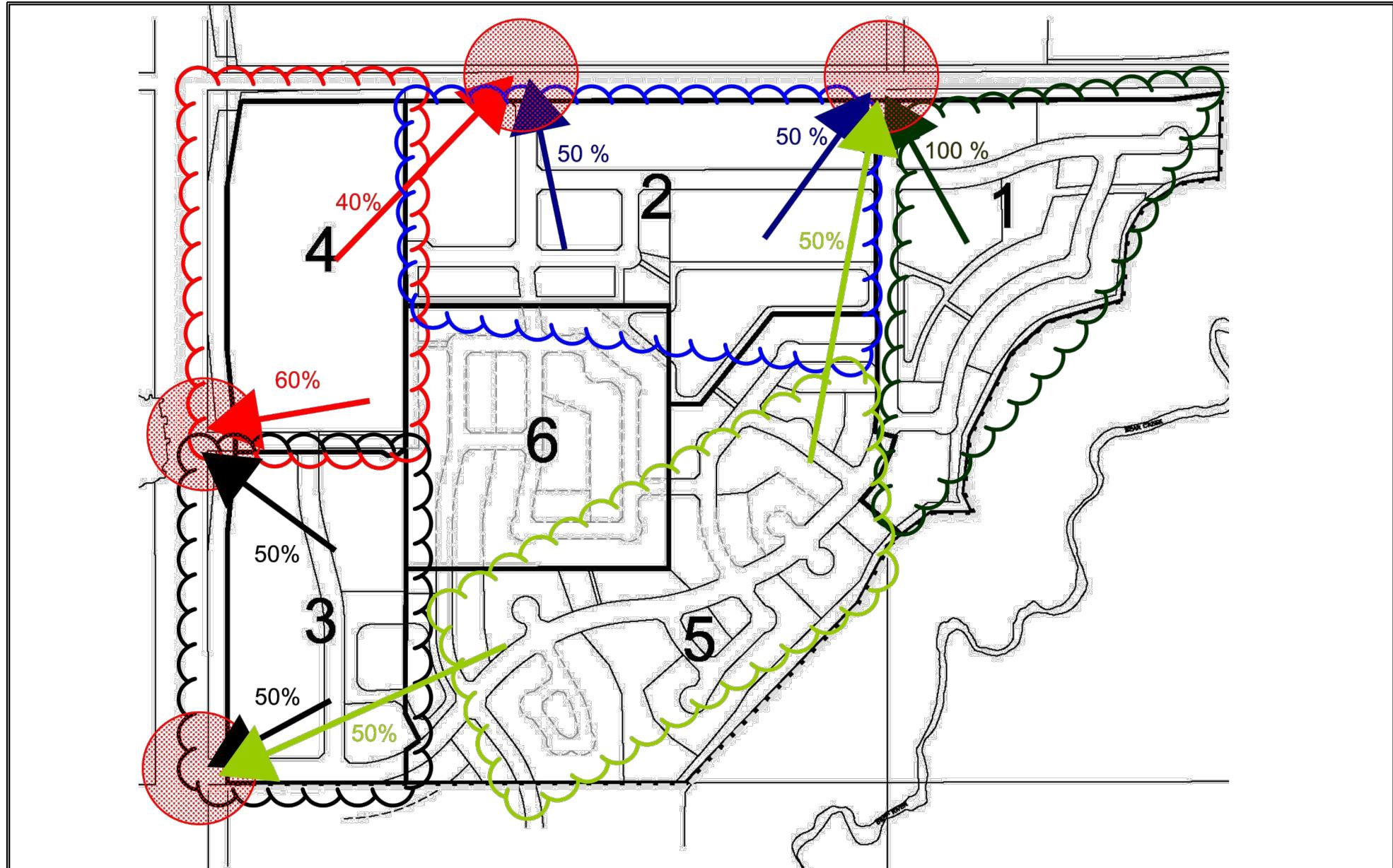


3.0 Traffic Distribution and Design Traffic

Traffic was distributed based on expected travel patterns. Refer to Exhibit 3.1, 3.2 and 3.3, showing the distribution assumptions for the CKC, Stonebridge sites as well arterial distribution.

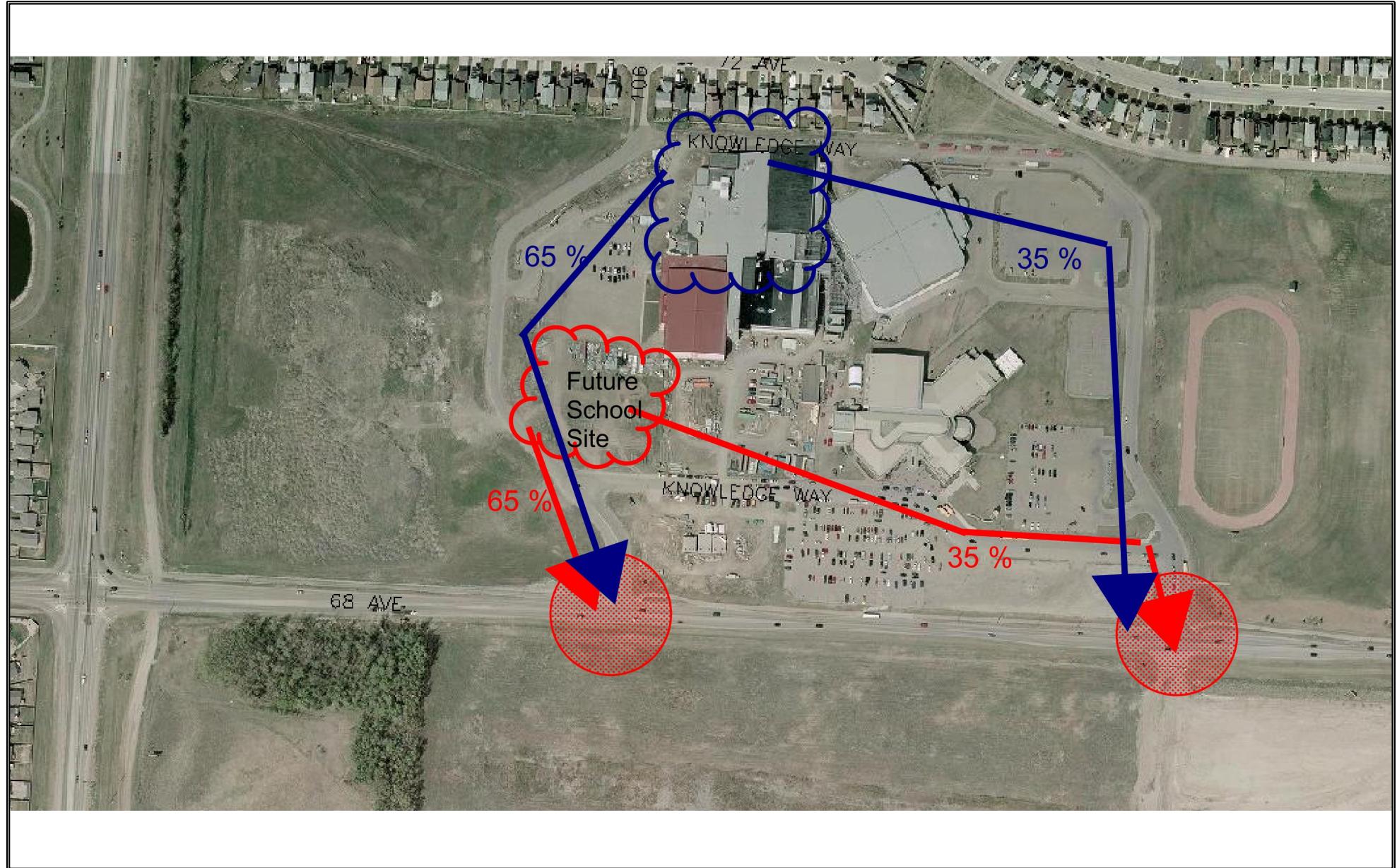
An adjustment to the CKC site traffic was made. The TMP model used the shortest travel time (shortest path in this case) algorithm which resulted in unrealistic traffic movements at each of the CKC intersections (zero volumes for “backtracking” movements). Therefore, all the traffic for the CKC site as shown in the model was removed from the background traffic and put back in as site traffic using the distribution assumptions in this study. This resulted in more realistic traffic movement predictions at each of the CKC intersections.

Detailed turning movements for site traffic and design traffic are shown in the following exhibits. Note that traffic shown entering/exiting the CKC site is total traffic as a result of it being removed from the background traffic and replaced using the distribution assumptions for site traffic.



68 Avenue / CKC TIA
Stonebridge Trip Distribution

Exhibit 3.1



68 Avenue / CKC TIA
CKC Trip Distribution

Exhibit 3.2



68 Avenue / CKC TIA
Study Area Trip Distribution

Exhibit 3.3

4.0 Traffic Analysis

Traffic at the three population horizons was analyzed using Synchro 7. This software is used to evaluate the performance of intersections on the roadway network using the Highway Capacity Manual (HCM) techniques; this is the accepted standard in North America.

Using the HCM methodology, intersection performance is categorized by its “Level of Service” (LOS). There are six levels of service as follows:

- LOS A represents the highest level of service, or generally “free flowing conditions”.
- LOS F generally represents a “breakdown” or “gridlock” condition in vehicular flow. At signalized intersections drivers will experience delays of two or more cycles.
- LOS's B, C, D and E reflect intermediate levels of operational performance between the two extremes.
- LOS D reflects “normal” peak hour congestion, and is generally the accepted performance criterion for design analysis.
- LOS E reflects an intersection or movement experiencing congestion and high delays. It may be acceptable for certain movements only (such as low volume or low v/c ratio movements). Typically, LOS D or better is the accepted standard for peak hour operations of all movements at an intersection.

Table 4.1 shows average delay per vehicle values that correspond with the six service levels.

Table 4.1: Average Delay per Vehicle

LOS	Delay
A	< 10
B	10 – 20
C	20 – 35
D	35 – 55
E	55 – 80
F	> 80

In this study LOS is reported for each intersection movement. This allows for an accurate assessment of each movement's delay, as opposed to averaging delays for approaches or the entire intersection, which can mask specific problem movements.

Synchro also calculates each movement's volume to capacity ratio (v/c). A v/c ratio of 1.0 represents an intersection or movement at full capacity with no ability to accommodate additional traffic. Typically, a v/c ratio of 0.85 or lower for all intersection movements is the accepted standard for peak hour operations. Finally, Synchro also calculates the 95th percentile vehicle queue length for each intersection movement. This allows the determination of left and right turn storage requirements. Use of the 95th percentile vehicle queue length criterion is accepted practice for normal peak hour operation; it means that the queue length is exceeded 5% of the time.

4.1 Traffic Signal Warrant Analysis

The Transportation Association of Canada Traffic Signal Warrant Matrix procedure was used to determine whether signals were warranted at each of the intersections. A value

of 100 or above suggests that signals are warranted. The warrant matrix requires six hours of traffic data, two for each the AM, Noon and PM peak hours. For this study, which didn't include an AM or Noon study hours, AM volumes were calculated by mirroring the PM peak volumes while Noon volumes were taken as an average of the AM and PM volumes. Typically AM volumes are lighter than PM but with the two school sites built on the CKC site the AM volumes may be heavier than typical. Therefore, mirroring the PM volumes to create AM volumes without any reduction will reasonably represent the expected AM volumes. However, this procedure will result in all six hours of data having the same amount of traffic entering the intersection, which is likely a conservative (high) estimate. The following table shows the warrant value at each of the intersections for the 65 K horizon, 78 K and 90 K Horizons as well as the maximum v/c ratio at the intersection (the highest v/c ratio reported of all intersection movements), found using HCM's unsignalized analysis procedures.

Table 4.2: Traffic Warrant and V/C Ratio for 65,000 Population Horizons

	Intersection	Warrant Priority Points	Max V/C
65 K	68 Ave/CKC W	282	3.46
	68 Ave/CKC E	234	1.75
	68 Ave/Kateri Dr.	171	1.38
	Intersection	Warrant Priority Points	Max V/C
78 K	68 Ave/CKC W	369	4.42
	68 Ave/CKC E	243	1.81
	68 Ave/Kateri Dr.	176	1.34

As shown in the above table all three intersections require signalization in the 65 K population horizon as the warrant value is well beyond the threshold of 100. This is due to heavy volumes generated by the CKC site and Stonebridge site as well as background volumes being quite heavy on 68 Avenue. The 90, 000 population horizon warrants were not done as it is assumed that these intersections will be signalized at this point. The 78K population horizon warrant accounts for the twinning of 68 Avenue as planned in the City's 10 year capital plan. The ultimate alignment, taken from the functional study, is in the Appendix.

To put this in context, the total volume entering/exiting the CKC site is 966 vehicles per hour during the PM peak, with full build out of the Multiplex and the High School; where it is currently approximately 465. The total volumes entering/exiting the Stonebridge site up to the 65 K population horizon is 581 per hour during the PM peak hour, with full build out of Phases 1 and 2 of the Stonebridge development; currently 0. Therefore, the total volume being added to the study area in the 65,000 population horizon is approximately 1,081 vehicles per hour or about 11,000 vehicles per day. With this volume being distributed over only two accesses and with 68 Avenue currently a two lane undivided arterial, as will be the case in the 65 K horizon, traffic congestion will increase substantially and traffic signals will be needed.

The Kateri Drive and 68 Avenue intersection is also directly affected by the growth in traffic volumes due to the development. This intersection will experience a growth in traffic volumes from approximately 14,000 to approximately 18,000 vehicles per day entering the intersection. Traffic signals at the 65 K population horizon will be warranted. Therefore, three sets of signals will be needed, one at each intersection.

4.1.1 Sensitivity Analysis

The City may be able to defer the second set of signals at the CKC site until a future date. This was demonstrated by completing a sensitivity analysis of the traffic distribution of the CKC traffic. Traffic volumes are heavier at the West access and therefore this should have the first signal. Adding traffic signals will increase capacity of the intersection and may make it possible for traffic to be re-routed from the other access. It may be able to accommodate much of the total traffic volumes exiting both the Stonebridge and CKC site. This signalized intersection will likely be the first choice for travelers turning right or left on to 68 Avenue where making the same movement at the unsignalized access will prove to be too difficult. To illustrate this 75% of traffic exiting the two sites were redistributed to the signalized access. The following table shows before and after results of the analysis. CKC W is assumed to be signalized with the addition of 75% of exiting volumes from the CKC E intersection. Detailed Synchro reports are shown in the Appendix.

Table 4.3: Before and After Capacity

Intersection	Before		After	
	Max v/c	LOS	Max v/c	LOS
CKC W	0.58	B	0.64	B
CKC E	2.01*	-	0.43*	-

*NBL and SBL movements LOS of F

As shown in the table, the CKC W access has sufficient capacity to accommodate at least 75% of the traffic exiting the two sites, Stonebridge and CKC in the 65,000 population horizon. The CKC E access, with these volumes, reduced will function within the acceptable limits in terms of v/c ratio but with excessive delay to the NBL and SBL lanes. However, it is expected that travellers will adjust their travel patterns once this is considered. The City may want to implement a sign which points out the location of the signals as is similar at the 105 Street/100 Avenue intersection. Therefore, if the City wishes, it is possible to defer the east access signal to a future date and monitor the intersection as traffic volumes increase.

With a signal installed at the CKC W access operations at the Kateri Drive intersection would only be minimally improved. With the warrant well beyond the threshold it was assumed that the West CKC signal would only have minimal effects in reducing the need for signalization.

It should be noted that both before and after analyses were done assuming that eastbound right and westbound left turn storage lanes will be constructed at each of the accesses. This is being recommended to accommodate heavy right and left turn movements as well as to ensure separate turning movements between through movements. Without separate turn bays these left and right turn movements are shared with through movements. This will affect the coordinate ability of the study area, increasing intersection delay, queue length and could increase overall rear end collisions. Therefore it is not recommended to build the two Stonebridge accesses without dedicated left and right turn lanes. The turnbays should be constructed according to the 68 Avenue Functional Study.

4.2 Intersection Analysis

The results of the intersection analysis are shown below for each of the population horizons along with the type of geometry and traffic control assumed. Detailed Synchro reports are given in the Appendix.

As shown in Tables 4.4 and 4.5 all intersections function within the acceptable limits except the unsignalized intersection, CKC E. The NBL and NBR movement experience LOS F. However, with the additional capacity available at the CKC W, with the construction of the signals, travellers will have a second option for turning onto 68 Avenue and can avoid this intersection. The volume is also quite low at around 20 vehicles per hour for each of these movements. Therefore, this will only affect a minimal amount of travellers.

Table 4.4: Intersection Analysis, 65 K

	Intersection	Geometry	Traffic Control	Max V/C	All Movements at LOS D or Better
65 K	108 Street	Existing	Signalized	0.82	Y
	CKC W	2 Lane w/L & R Turn Bays	Signalized*	0.64	Y
	CKC E	2 Lane w/L & R Turn Bays	2 Way Stop*	2.55	N
	Kateri Drive	2 Lane w/L & R Turn Bays	Signalized	0.57	Y
	100 Street	Existing	Signalized	0.63	Y

*Assumes Addition of 75 % of CKC E Traffic as previously discussed

Table 4.5: Intersection Analysis, 78 K

	Intersection	Geometry	Traffic Control	Max V/C	All Movements at LOS D or Better
78 K	108 Street	Existing plus 4 Lanes E/W	Signalized	0.98	Y
	CKC W	4 Lane w/L & R Turn Bays	Signalized	0.44	Y
	CKC E	4 Lane w/L & R Turn Bays	Signalized	0.55	Y
	Kateri Drive	4 Lane w/L & R Turn Bays	Signalized	0.84	Y
	100 Street	Existing	Signalized	0.55	Y

Table 4.6: Intersection Analysis, 78 K with Dual SBL Turning Lanes

	Intersection	Geometry	Traffic Control	Max V/C	All Movements at LOS D or Better
78 K	108 Street	Existing plus 4 Lanes E/W, Dual SB Left Turn Lanes	Signalized	0.78	Y

As shown in Table 4.6, adding an additional SB left turning lane reduced the v/c ratio to 0.78. It should also be noted that overall intersection delay and LOS for all movements were improved; the before and after intersection delay reduced from 30.5 seconds to 23.7 seconds. The current southbound left turning volume based on the City's 2010 count was found to be 322 vehicles per hour. Therefore, the City should consider adding a second left turn lane now as volumes are already above the 300 vehicles per hour threshold. However, based on the detailed analysis the movement may function up to the 78 K horizon as long as signal timing is optimized.

Table 4.7: Intersection Analysis, 90 K

	Intersection	Geometry	Traffic Control	Max V/C	All Movements at LOS D or Better
90 K	108 Street	Existing plus 4 Lanes E/W	Signalized	0.94	Y
	CKC W	4 Lane w/L & R Turn bays	Signalized	0.67	Y
	CKC E	4 Lane w/L & R Turn bays	Signalized	0.63	Y
	Kateri Drive	4 Lane w/L & R Turn bays	Signalized	0.58	Y
	100 St.	Existing	Signalized	0.67	Y

As shown in Table 4.7 all intersections function within the acceptable limits, with the exception of 108 Street and 68 Avenue southbound left turn (v/c ratio of 0.94). The southbound left turn was assumed to be a dual left turning movement and functions at a LOS D while all other movements also functioned at a LOS D, indicating this intersection is approaching capacity and will need further upgrades.



5.0 Twinning of 68 Avenue – Timing

In the City's current Transportation Master Plan (TMP), twinning of 68 Avenue between 108 Street and Poplar Drive is planned in the ten year capital plan (2014 to 2024). Two discrepancies between this study and the TMP were found, the first being that the Public High School was assumed to be constructed in the 78,000 population horizon. The second was the location of the accesses to the Stonebridge development. In the TMP model it was assumed that most of the traffic would use the 108 Street access, south of 68 Avenue, with no access to 68 Avenue until the 78,000 population horizon. Therefore, the Stonebridge traffic was not accounted for as it impacts 68 Avenue possibly meaning that the twinning may be required sooner than the 10 year capital plan recommends.

With current traffic along 68 Avenue in the 12,000 vehicle per day range, this roadway may already be experiencing some mild to moderate capacity issues. By adding the CKC and Stonebridge traffic this number increases to approximately 16,000 vehicles per day. Based on the volume alone the City may want to consider building the additional lanes prior to 2014, especially with the left and right turn lanes being recommended at each of the accesses, as these would be throw away costs.

6.0 Alternatives

A few alternatives were explored in concept only for this study. These options focused on reducing the need for signals by separating left turning movements and making the accesses right in/out only, with a solid median separator through the accesses. To provide access for left turning traffic four U-turn locations would be installed along 68 Avenue where drivers would essentially travel beyond their destined access and U-turn back towards. The approximate turning radius to accommodate large trucks is in around 15 – 20m. Therefore the shoulder would require widening as it would act as a turnaround surface. Depending on the results of a capacity analysis to confirm sufficient gaps exist; this would eliminate the need for a traffic signal. Examples of this type of intersection treatment are found in some areas of North America notably in Michigan USA (“Michigan U-turn”).

In terms of road widening, additional road right-of-way may be needed to construct the turnaround shoulder. For a 20m inner radius turnaround, the road surface measured from the edge of shoulder to the edge of the turning lane would be 40m. The entire future cross-section (ROW) of 68 Avenue provided in the 68 Avenue Functional Study is 72.0m. Therefore, constructing a turnaround for a 20m radius would require widening beyond the road right-of-way and is likely impractical. However, if it is assumed that large trucks will access the sites using the right in/out access then the turnaround would not need to be so large and could fit into the future cross section with only minor adjustments. These turnarounds would need to be built with the twinning of 68 Avenue.



7.0 Traffic Operations

Currently, the 68 Avenue/108 Street intersection uses a 120 second cycle length as it is tied into the City's Highway 43 corridor, which also uses a 120 second cycle length. When/If new signals are installed a coordination plan should be determined which connects the 108 Street signal to the new signals as well as the 100 Street signals while using a common cycle length. The coordination plan could be either inclusive or exclusive of the 108 Street systems and could use its own cycle length. Creating a corridor specific to 68 Avenue will help to reduce traffic delay and congestion in this area.



8.0 Pedestrian Movement

It is recommended that a pedestrian half signal be installed at the CKC E access, which would be converted to a full signal in the long term. It is anticipated that trail connection to the Bear Creek trail corridor will be installed on the south side of 68 Avenue. This will reduce pedestrian travel time to cross 68 Avenue as pedestrians are currently required to make the trek along the north trail of 68 Avenue which winds around the bottom of the 68 Avenue bridge abutments. A half signal is being recommended over other types of crossing controls as it will provide coordination capability with the other signals. This signal should be installed once sufficient development to the south side of 68 Avenue occurs and pedestrian volumes warrant installation.

9.0 Conclusions and Recommendations

The following conclusions are drawn from the information presented in this report:

- C1. The existing two lane 68 Avenue is moderately congested. This congestion will increase with the construction of Multiplex and Wellness center (2011), the new High School (2014) and the first two stages of the Stonebridge residential and commercial development (starting in 2012).
- C2. As volumes increase on 68 Avenue the delays to traffic approaching 68 Avenue from CKC W, CKC E and Kateri Drive will increase to unacceptable levels.
- C3. A traffic signal at CKC W will likely improve operations at CKC E, as some traffic can divert to the signal.
- C4. A traffic signal at CKC W will not improve operations at Kateri Drive
- C5. The widening of 68 Avenue to four lanes may need to occur sooner than 2014, depending on the pace of development. The widening will not significantly change the need for traffic signals.
- C6. U-turn facilities between access points on 68 Avenue could avoid the need for traffic signals. This would advance the timing for the twinning of 68 Avenue. If the U-turn facilities are to accommodate trucks more right-of-way is needed on 68 Avenue and this may not be a viable option.
- C7. A pedestrian signal at CKC E can be built in conjunction with the sidewalk connection at Bear Creek. The pedestrian signal can be built to be converted to a full signal in the future.

Based on the above conclusions the recommendations are shown in the table below:

	Intersection	Recommendations	Notes
65 K	108 Street		
	CKC W	Install Traffic Signals, construct EBR and WBL turning lanes	
	CKC E	Install Pedestrian Half Signal, construct EBR and WBL turning lanes	Install with sidewalk connection; ensure location is suitable for future conversion to full signal
	Kateri Drive	Install Traffic Signals	
	100 Street		
78 K	108 Street	Construct dual SB left turn lanes	
	CKC W		
	CKC E		Convert to full signal
	Kateri Drive		
	100 Street		
90 K	108 Street	Possible upgrades required	Intersection approaching capacity
	CKC W		
	CKC E		
	Kateri Drive		
	100 Street		

As shown in the above table, traffic signals are required at the 65 K horizon at two of three intersections studied. A pedestrian half signal at the CKC E intersection will acceptably accommodate pedestrian activity and will be capable of maintaining a signal coordination setting. At the 78 K horizon, 68 Avenue will be twinned. An additional southbound left turning lane will be required at 108 Street/68 Avenue to accommodate increased left turning traffic where in the 90 K horizon further upgrades are required. This intersection should be monitored beyond the 78 K horizon to determine required upgrades. The traffic signals should also be optimized with the installation of any new signal and into the future.

The City may, as an alternative, decide to apply an innovative approach to mitigating traffic congestion. This would be the construction of four U-turn facilities, one each between the intersections, while CKC E, W and Kateri Drive would function as right in/out only. However, it must be determined whether the facility should be designed for large trucks as they require a large turning radius meaning the U-turn facilities will not fit into the planned road ROW.



10.0 Closure

ISL Engineering and Land Services Ltd. has prepared this report entitled "68 Avenue/Community Knowledge Campus Traffic Impact Assessment" for the City of Grande Prairie. The material contained herein reflects ISL's best judgement in light of the information available at the time of the study and the level of detail normally expected at the preliminary planning stage.

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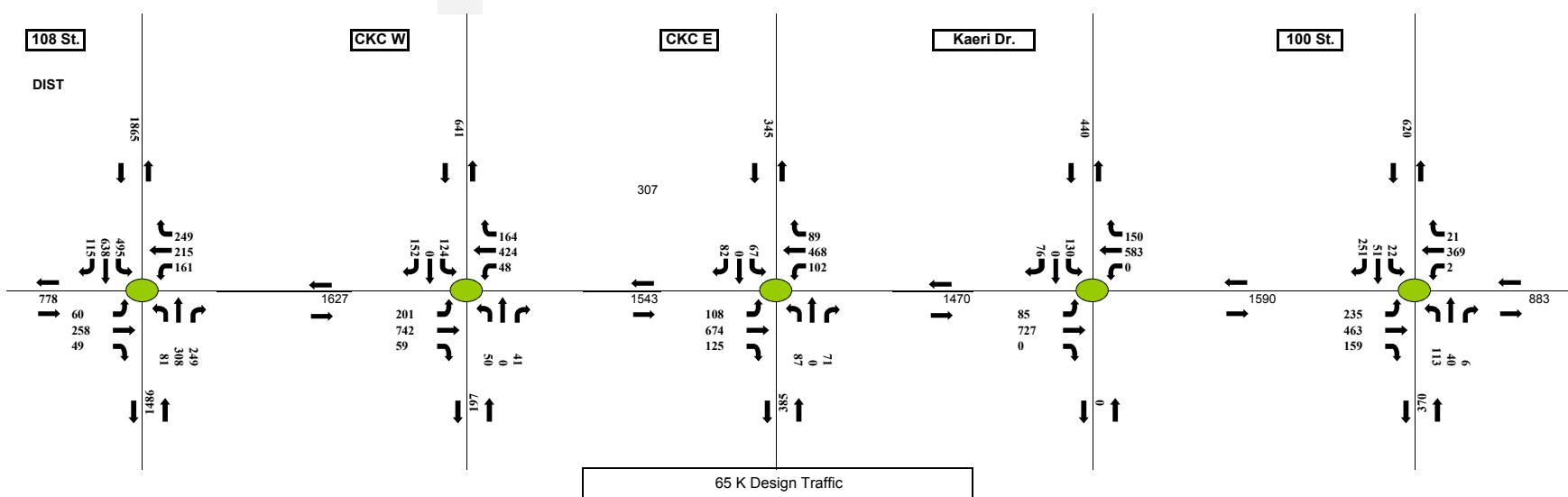
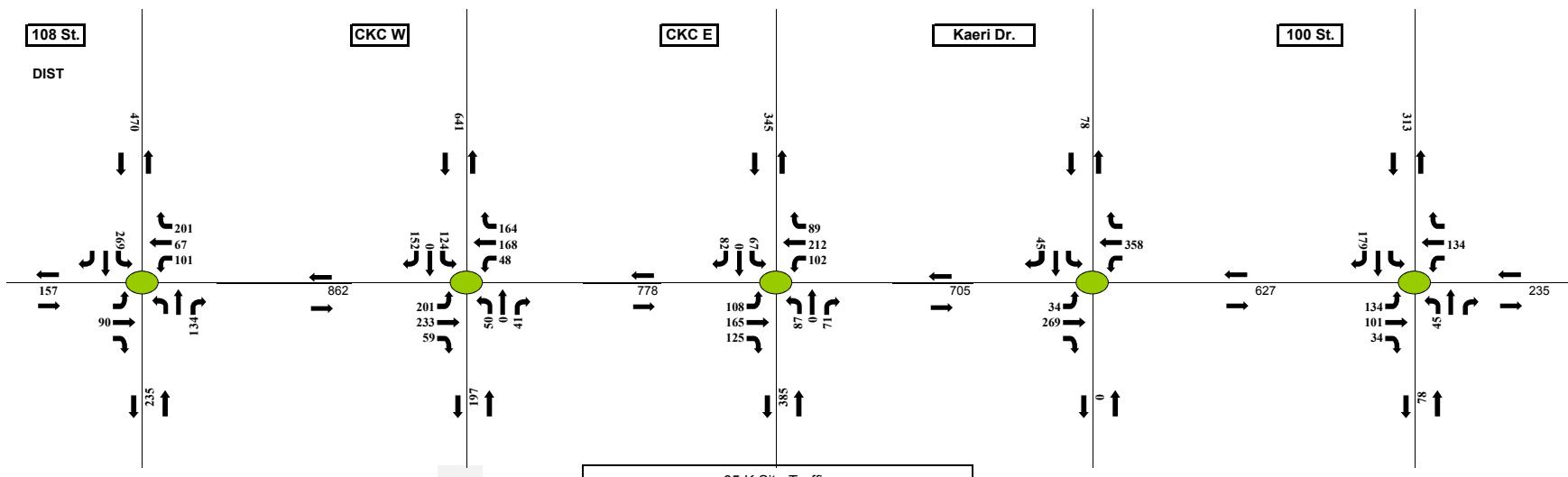


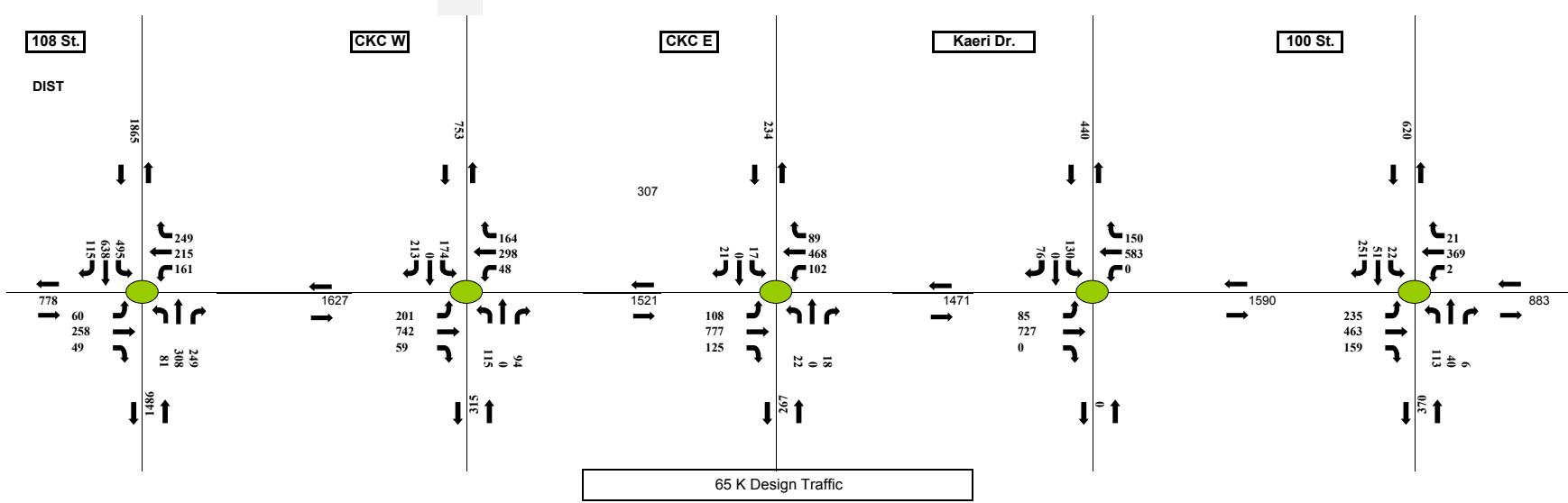
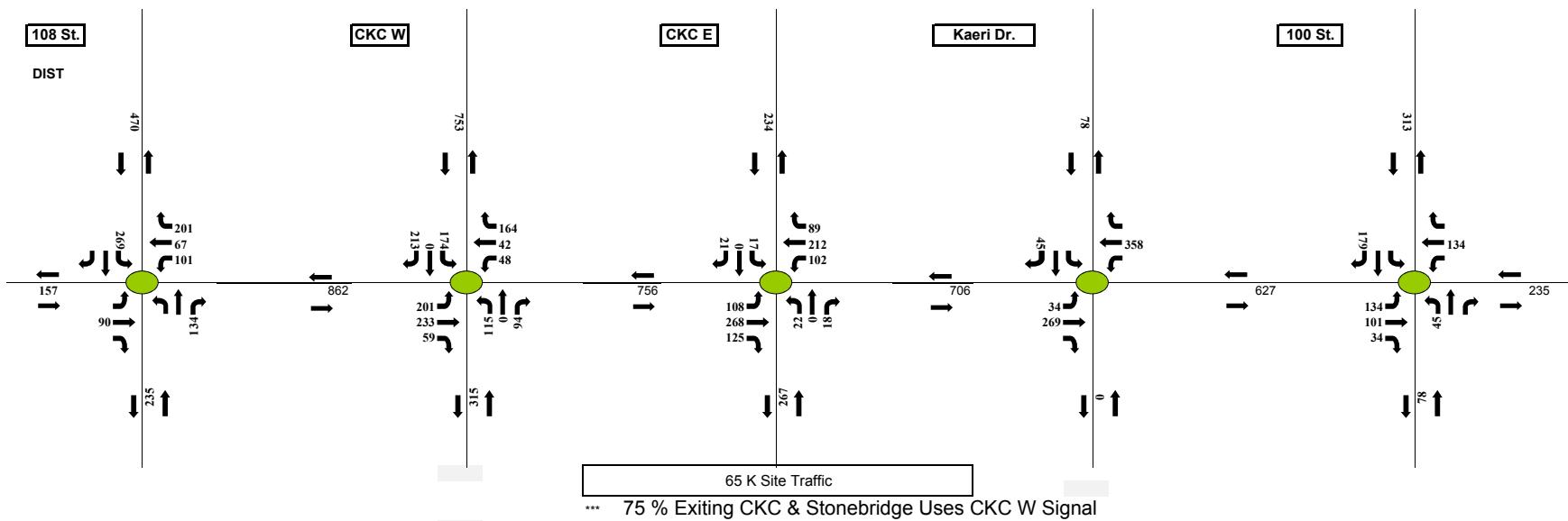
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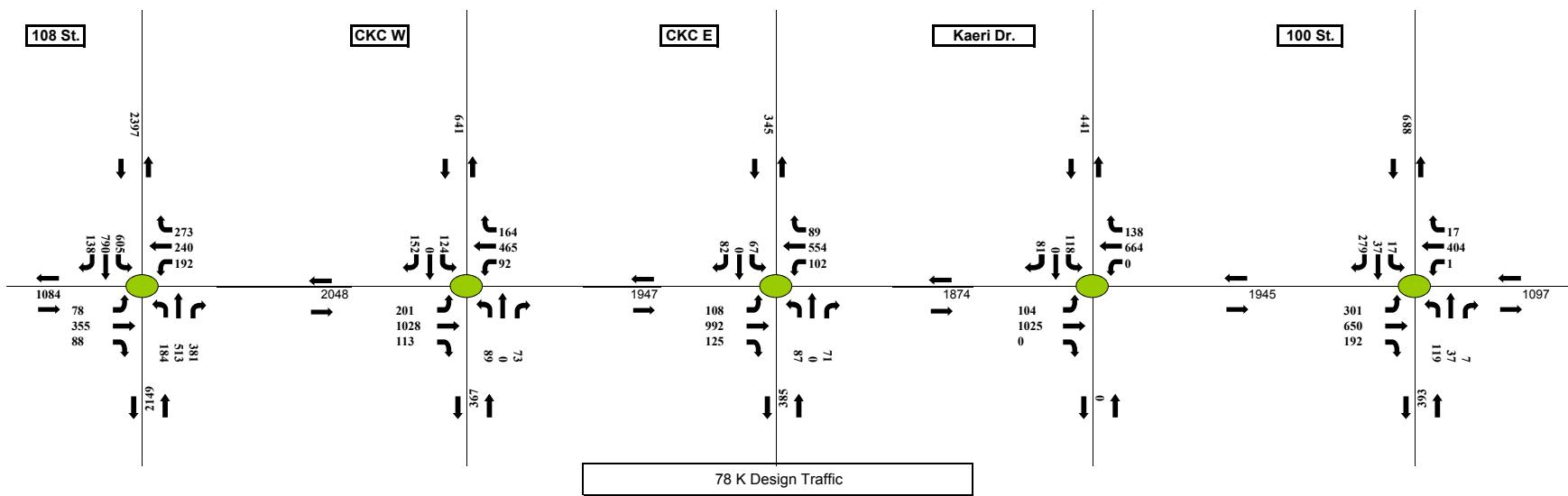
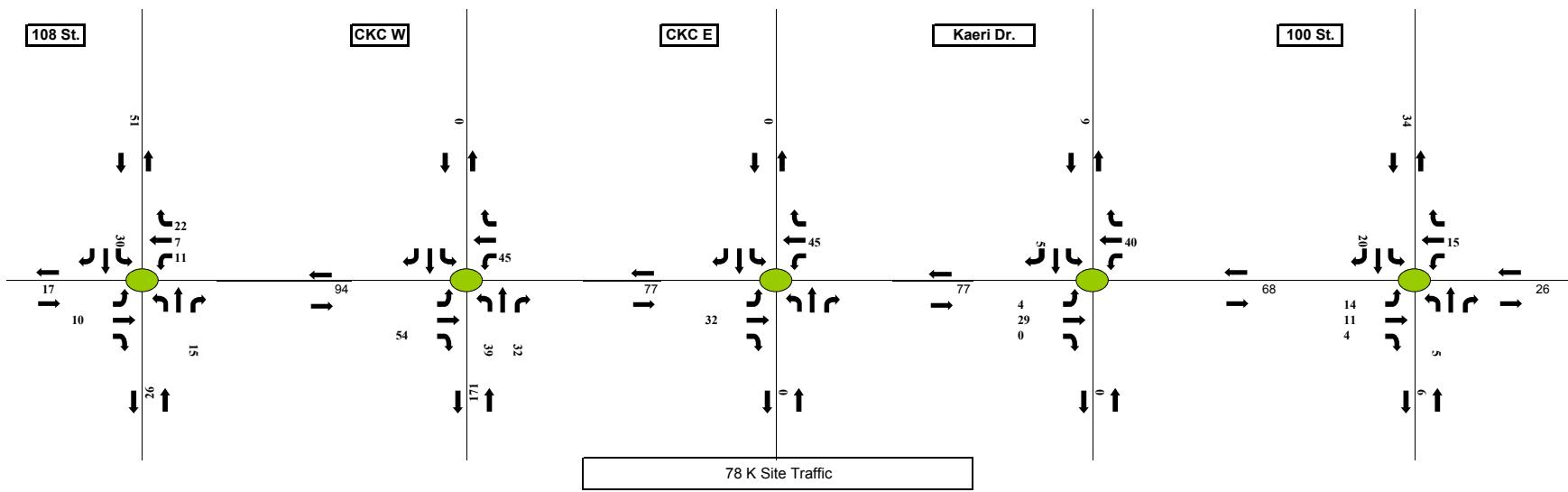
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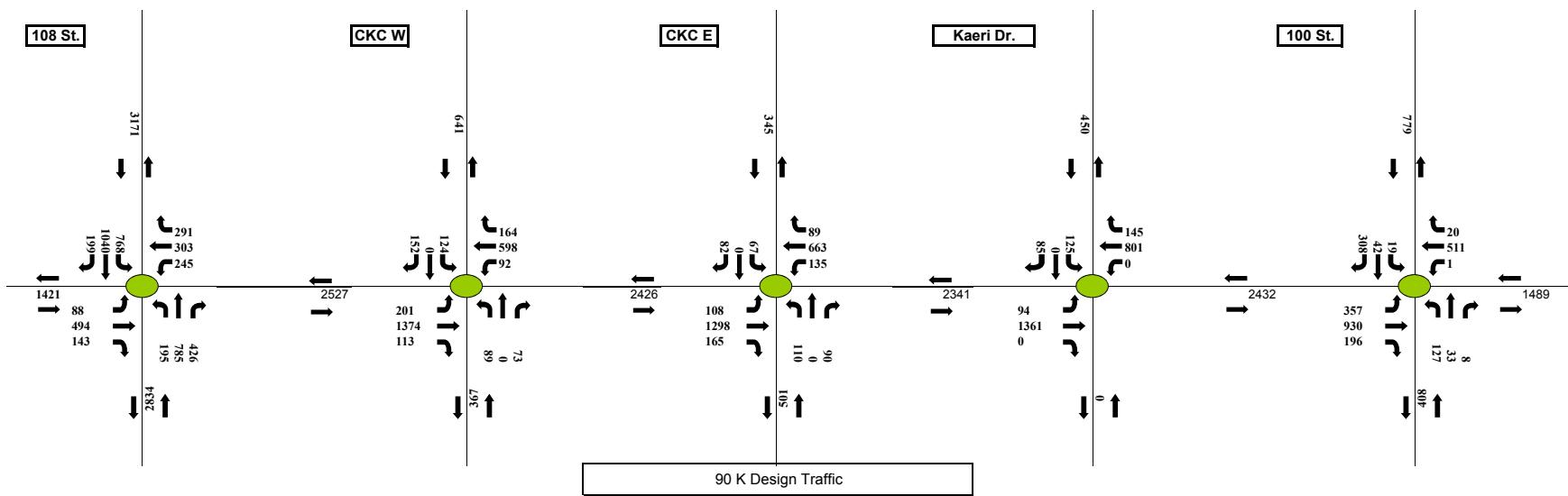
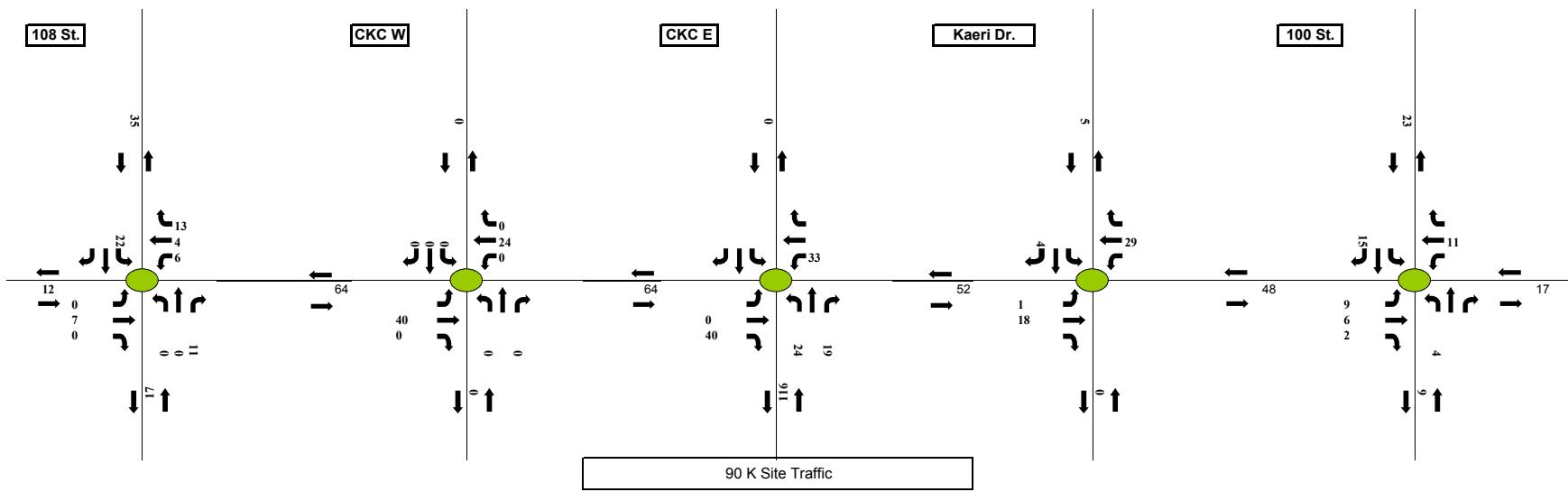
Appendix A

Site and Design Traffic











**Engineering
and Land Services**

**Traffic Impact Assessment for 68 Avenue/Community Knowledge Campus
Final Report**

City of Grande Prairie

Final Report

Appendix B

Synchro Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑ ↗	↑ ↘	↑ ↙	↑ ↖	↑ ↗	↑ ↙	↑ ↖	↑ ↗	↑ ↙	↑ ↖	↑ ↗	↑ ↙
Volume (vph)	60	258	49	161	215	249	81	308	249	495	638	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.61	1.00	1.00	0.32	1.00	1.00	0.39	1.00	1.00	0.41	1.00	1.00
Satd. Flow (perm)	1142	1863	1583	590	1863	1583	723	3539	1583	769	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	280	53	175	234	271	88	335	271	538	693	125
RTOR Reduction (vph)	0	0	39	0	0	67	0	0	195	0	0	56
Lane Group Flow (vph)	65	280	14	175	234	204	88	335	76	538	693	69
Turn Type	Perm		Perm	pm+pt		pm+ov		Perm		Perm	pm+pt	Perm
Protected Phases		2			1	6	7		8		7	4
Permitted Phases	2		2	6		6	8		8		4	4
Actuated Green, G (s)	31.4	31.4	31.4	46.0	46.0	74.4	33.6	33.6	33.6	66.0	66.0	66.0
Effective Green, g (s)	31.4	31.4	31.4	46.0	46.0	74.4	33.6	33.6	33.6	66.0	66.0	66.0
Actuated g/C Ratio	0.26	0.26	0.26	0.38	0.38	0.62	0.28	0.28	0.28	0.55	0.55	0.55
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	299	487	414	330	714	1034	202	991	443	660	1946	871
v/s Ratio Prot	c0.15		c0.05	0.13	0.05		0.09			c0.19	0.20	
v/s Ratio Perm	0.06		0.01	0.16		0.08	0.12		0.05	c0.26		0.04
v/c Ratio	0.22	0.57	0.03	0.53	0.33	0.20	0.44	0.34	0.17	0.82	0.36	0.08
Uniform Delay, d1	34.7	38.5	33.0	26.6	26.1	9.9	35.4	34.4	32.7	18.2	15.1	12.7
Progression Factor	1.00	1.00	1.00	0.81	0.82	2.94	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	4.9	0.2	1.5	1.2	0.1	6.7	0.9	0.8	7.7	0.5	0.2
Delay (s)	36.3	43.4	33.1	23.2	22.6	29.1	42.1	35.3	33.5	25.9	15.6	12.9
Level of Service	D	D	C	C	C	C	D	D	C	C	B	B
Approach Delay (s)		40.9			25.4			35.5			19.4	
Approach LOS		D			C			D			B	

Intersection Summary

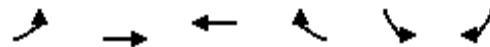
HCM Average Control Delay	27.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑ ↗	↑ ↘	↑ ↙	↑ ↖	↑ ↗	↑ ↘	↑ ↙	↑ ↖	↑ ↗	↑ ↘	↑ ↙	↑ ↖
Volume (vph)	201	742	59	48	424	164	50	0	41	124	0	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.40	1.00	1.00	0.32	1.00	1.00	0.56	1.00	0.72	1.00	0.72	1.00
Satd. Flow (perm)	753	1863	1583	598	1863	1583	1039	1583	1345	1583	1345	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	807	64	52	461	178	54	0	45	135	0	165
RTOR Reduction (vph)	0	0	17	0	0	65	0	0	36	0	0	133
Lane Group Flow (vph)	218	807	47	52	461	113	0	54	9	0	135	32
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	5	2			6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	89.0	89.0	89.0	76.3	76.3	76.3		23.0	23.0		23.0	23.0
Effective Green, g (s)	89.0	89.0	89.0	76.3	76.3	76.3		23.0	23.0		23.0	23.0
Actuated g/C Ratio	0.74	0.74	0.74	0.64	0.64	0.64		0.19	0.19		0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	632	1382	1174	380	1185	1007		199	303		258	303
v/s Ratio Prot	0.03	c0.43			0.25							
v/s Ratio Perm	0.23		0.03	0.09		0.07		0.05	0.01		c0.10	0.02
v/c Ratio	0.34	0.58	0.04	0.14	0.39	0.11		0.27	0.03		0.52	0.10
Uniform Delay, d1	5.8	7.1	4.1	8.7	10.6	8.6		41.4	39.4		43.6	40.0
Progression Factor	0.66	0.49	0.36	0.52	0.45	0.09		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	1.4	0.0	0.7	0.9	0.2		3.3	0.2		7.4	0.7
Delay (s)	4.1	4.8	1.5	5.2	5.6	1.0		44.7	39.6		51.0	40.7
Level of Service	A	A	A	A	A	A		D	D		D	D
Approach Delay (s)					4.4			42.4			45.3	
Approach LOS					A			D			D	

Intersection Summary

HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑ ↗	↑ ↘	↑ ↗	↑ ↘	↑ ↗	↑ ↘
Volume (vph)	85	727	583	150	130	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.31	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	572	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	790	634	163	141	83
RTOR Reduction (vph)	0	0	0	57	0	67
Lane Group Flow (vph)	92	790	634	106	141	16
Turn Type	pm+pt		Perm		Perm	
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	89.0	89.0	78.3	78.3	23.0	23.0
Effective Green, g (s)	89.0	89.0	78.3	78.3	23.0	23.0
Actuated g/C Ratio	0.74	0.74	0.65	0.65	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	491	1382	1216	1033	339	303
v/s Ratio Prot	0.01	c0.42	0.34		c0.08	
v/s Ratio Perm	0.13			0.07		0.01
v/c Ratio	0.19	0.57	0.52	0.10	0.42	0.05
Uniform Delay, d1	6.6	7.0	11.0	7.8	42.6	39.6
Progression Factor	0.98	1.08	0.81	1.14	1.00	1.00
Incremental Delay, d2	0.2	1.6	1.4	0.2	3.7	0.3
Delay (s)	6.7	9.0	10.3	9.0	46.3	39.9
Level of Service	A	A	B	A	D	D
Approach Delay (s)				8.8	10.1	44.0
Approach LOS				A	B	D
Intersection Summary						
HCM Average Control Delay		13.5		HCM Level of Service		B
HCM Volume to Capacity ratio		0.54				
Actuated Cycle Length (s)		120.0		Sum of lost time (s)		8.0
Intersection Capacity Utilization		52.6%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑ ↗	↑ ↘			↑ ↗	↑ ↘	↑ ↗	↑ ↘		↑ ↗	↑ ↘	
Volume (vph)	232	463	159	2	369	21	113	40	6	22	51	251
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Fr _t	1.00	0.96			1.00	0.85	1.00	0.98		1.00	0.88	
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1791			1862	1583	1770	1824		1770	1630	
Flt Permitted	0.37	1.00			1.00	1.00	0.38	1.00		0.72	1.00	
Satd. Flow (perm)	688	1791			1859	1583	700	1824		1349	1630	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	252	503	173	2	401	23	123	43	7	24	55	273
RTOR Reduction (vph)	0	10	0	0	0	12	0	5	0	0	149	0
Lane Group Flow (vph)	252	666	0	0	403	11	123	45	0	24	179	0
Turn Type	pm+pt			Perm		Perm		Perm		Perm		
Protected Phases	5	2			6				8			4
Permitted Phases	2			6		6		8			4	
Actuated Green, G (s)	71.0	71.0			57.1	57.1	41.0	41.0		41.0	41.0	
Effective Green, g (s)	71.0	71.0			57.1	57.1	41.0	41.0		41.0	41.0	
Actuated g/C Ratio	0.59	0.59			0.48	0.48	0.34	0.34		0.34	0.34	
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	496	1060			885	753	239	623		461	557	
v/s Ratio Prot	0.04	c0.37						0.02			0.11	
v/s Ratio Perm	0.26				0.22	0.01	c0.18			0.02		
v/c Ratio	0.51	0.63			0.46	0.01	0.51	0.07		0.05	0.32	
Uniform Delay, d1	13.5	15.9			21.0	16.6	31.6	26.7		26.5	29.2	
Progression Factor	0.74	0.88			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	2.4			1.7	0.0	7.7	0.2		0.2	1.5	
Delay (s)	10.8	16.4			22.7	16.6	39.3	26.9		26.7	30.7	
Level of Service	B	B			C	B	D	C		C	C	
Approach Delay (s)		14.8			22.4			35.7			30.5	
Approach LOS		B			C			D			C	

Intersection Summary

HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis

3: 68 Avenue & CKC E

31/10/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑ ↗	↑ ↘	↑ ↙	↑ ↖	↑ ↗	↑ ↘	↑ ↙	↑ ↖	↑ ↗	↑ ↘	↑ ↙	↑ ↖
Volume (veh/h)	108	674	125	102	468	89	87	0	71	67	0	82
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)	117	733	136	111	509	97	95	0	77	73	0	89
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					330							
pX, platoon unblocked	0.90					0.90	0.90		0.90	0.90	0.90	0.90
vC, conflicting volume	605			868			1787	1795	733	1775	1834	509
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	509			868			1818	1826	733	1805	1870	401
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 %	88			86			0	100	82	0	100	85
cM capacity (veh/h)	953			776			37	52	421	37	49	585
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2		
Volume Total	117	733	136	111	509	97	95	77	73	89		
Volume Left	117	0	0	111	0	0	95	0	73	0		
Volume Right	0	0	136	0	0	97	0	77	0	89		
cSH	953	1700	1700	776	1700	1700	37	421	37	585		
Volume to Capacity	0.12	0.43	0.08	0.14	0.30	0.06	2.55	0.18	1.99	0.15		
Queue Length 95th (m)	3.4	0.0	0.0	4.0	0.0	0.0	84.3	5.3	63.7	4.3		
Control Delay (s)	9.3	0.0	0.0	10.4	0.0	0.0	931.7	15.5	698.5	12.3		
Lane LOS	A			B			F	C	F	B		
Approach Delay (s)	1.1			1.6			520.0		320.8			
Approach LOS							F		F			
Intersection Summary												
Average Delay				70.5								
Intersection Capacity Utilization				62.6%			ICU Level of Service			B		
Analysis Period (min)				15								

HCM Signalized Intersection Capacity Analysis

1: 68 Avenue & 108 St.

31/10/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑	↑	↑	↑	↑	↑	↑↑	↑	↑	↑↑	↑
Volume (vph)	60	258	49	161	215	249	81	308	249	495	638	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.61	1.00	1.00	0.34	1.00	1.00	0.39	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	1142	1863	1583	628	1863	1583	723	3539	1583	746	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	280	53	175	234	271	88	335	271	538	693	125
RTOR Reduction (vph)	0	0	38	0	0	163	0	0	200	0	0	58
Lane Group Flow (vph)	65	280	15	175	234	108	88	335	71	538	693	67
Turn Type	Perm		Perm	pm+pt		Perm	Perm		Perm	pm+pt		Perm
Protected Phases		2			1	6			8		7	4
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	33.4	33.4	33.4	48.0	48.0	48.0	31.4	31.4	31.4	64.0	64.0	64.0
Effective Green, g (s)	33.4	33.4	33.4	48.0	48.0	48.0	31.4	31.4	31.4	64.0	64.0	64.0
Actuated g/C Ratio	0.28	0.28	0.28	0.40	0.40	0.40	0.26	0.26	0.26	0.53	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	318	519	441	352	745	633	189	926	414	642	1887	844
v/s Ratio Prot	c0.15		c0.04	0.13			0.09		c0.20	0.20		
v/s Ratio Perm	0.06		0.01	0.15		0.07	0.12		0.04	c0.25		0.04
v/c Ratio	0.20	0.54	0.03	0.50	0.31	0.17	0.47	0.36	0.17	0.84	0.37	0.08
Uniform Delay, d1	33.1	36.8	31.5	25.2	24.7	23.2	37.2	36.1	34.2	19.6	16.2	13.6
Progression Factor	1.00	1.00	1.00	0.92	0.92	1.75	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	4.0	0.1	1.0	1.0	0.6	8.0	1.1	0.9	9.4	0.6	0.2
Delay (s)	34.6	40.8	31.7	24.3	23.8	41.2	45.3	37.2	35.1	28.9	16.8	13.8
Level of Service	C	D	C	C	C	D	D	D	D	C	B	B
Approach Delay (s)		38.5			30.9			37.4			21.3	
Approach LOS		D			C			D			C	

Intersection Summary

HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

2: 68 Avenue & CKC W



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	201	742	59	48	298	164	115	0	94	175	0	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.48	1.00	1.00	0.21	1.00	1.00	0.50	1.00	0.62	1.00	0.62	1.00
Satd. Flow (perm)	886	1863	1583	397	1863	1583	939	1583	1153	1583	1153	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	807	64	52	324	178	125	0	102	190	0	233
RTOR Reduction (vph)	0	0	20	0	0	77	0	0	76	0	0	173
Lane Group Flow (vph)	218	807	44	52	324	101	0	125	26	0	190	60
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	81.0	73.8	73.8	71.4	68.2	68.2		31.0	31.0		31.0	31.0
Effective Green, g (s)	81.0	73.8	73.8	71.4	68.2	68.2		31.0	31.0		31.0	31.0
Actuated g/C Ratio	0.68	0.61	0.61	0.60	0.57	0.57		0.26	0.26		0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	663	1146	974	273	1059	900		243	409		298	409
v/s Ratio Prot	c0.02	c0.43		0.01	0.17							
v/s Ratio Perm	0.20		0.03	0.11		0.06		0.13	0.02		c0.16	0.04
v/c Ratio	0.33	0.70	0.05	0.19	0.31	0.11		0.51	0.06		0.64	0.15
Uniform Delay, d1	7.9	15.7	9.1	13.7	13.5	11.9		38.1	33.6		39.5	34.3
Progression Factor	0.58	0.61	0.29	0.54	0.43	0.06		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	2.8	0.1	0.3	0.7	0.2		7.6	0.3		10.0	0.8
Delay (s)	4.8	12.3	2.7	7.6	6.4	1.0		45.6	33.9		49.5	35.1
Level of Service	A	B	A	A	A	A		D	C		D	D
Approach Delay (s)		10.2			4.8			40.4			41.6	
Approach LOS		B			A			D			D	

Intersection Summary

HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: 68 Avenue & Kateri Dr.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑ ↗	↑ ↘	↑ ↗	↑ ↘	↑ ↗	↑ ↘
Volume (vph)	85	727	583	150	130	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.30	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	564	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	790	634	163	141	83
RTOR Reduction (vph)	0	0	0	58	0	66
Lane Group Flow (vph)	92	790	634	105	141	17
Turn Type	pm+pt		Perm		Perm	
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	88.0	88.0	77.3	77.3	24.0	24.0
Effective Green, g (s)	88.0	88.0	77.3	77.3	24.0	24.0
Actuated g/C Ratio	0.73	0.73	0.64	0.64	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	481	1366	1200	1020	354	317
v/s Ratio Prot	0.01	c0.42	0.34		c0.08	
v/s Ratio Perm	0.13			0.07		0.01
v/c Ratio	0.19	0.58	0.53	0.10	0.40	0.05
Uniform Delay, d1	7.0	7.4	11.5	8.1	41.7	38.8
Progression Factor	0.47	0.58	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	1.4	1.7	0.2	3.3	0.3
Delay (s)	3.4	5.7	13.2	8.3	45.0	39.1
Level of Service	A	A	B	A	D	D
Approach Delay (s)		5.5	12.2		42.9	
Approach LOS		A	B		D	
Intersection Summary						
HCM Average Control Delay		12.7	HCM Level of Service		B	
HCM Volume to Capacity ratio		0.54				
Actuated Cycle Length (s)		120.0	Sum of lost time (s)		8.0	
Intersection Capacity Utilization		52.6%	ICU Level of Service		A	
Analysis Period (min)		15				
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

5: 68 Avenue & 100 St.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑			↑	↑	↑	↑		↑	↑	
Volume (vph)	232	463	159	2	369	21	113	40	6	22	51	251
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Fr _t	1.00	0.96			1.00	0.85	1.00	0.98		1.00	0.88	
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1791			1862	1583	1770	1824		1770	1630	
Flt Permitted	0.40	1.00			1.00	1.00	0.37	1.00		0.72	1.00	
Satd. Flow (perm)	750	1791			1859	1583	684	1824		1349	1630	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	252	503	173	2	401	23	123	43	7	24	55	273
RTOR Reduction (vph)	0	10	0	0	0	11	0	5	0	0	139	0
Lane Group Flow (vph)	252	666	0	0	403	12	123	45	0	24	189	0
Turn Type	pm+pt			Perm		Perm		Perm		Perm		
Protected Phases	5	2			6				8			4
Permitted Phases	2			6		6		8			4	
Actuated Green, G (s)	77.0	77.0			69.0	69.0	43.0	43.0		43.0	43.0	
Effective Green, g (s)	77.0	77.0			69.0	69.0	43.0	43.0		43.0	43.0	
Actuated g/C Ratio	0.60	0.60			0.54	0.54	0.34	0.34		0.34	0.34	
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	483	1077			1002	853	230	613		453	548	
v/s Ratio Prot	0.02	c0.37						0.02			0.12	
v/s Ratio Perm	0.30				0.22	0.01	c0.18			0.02		
v/c Ratio	0.52	0.62			0.40	0.01	0.53	0.07		0.05	0.34	
Uniform Delay, d1	18.7	16.2			17.4	13.7	34.4	28.9		28.7	31.9	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	2.7			1.2	0.0	8.6	0.2		0.2	1.7	
Delay (s)	19.7	18.9			18.6	13.7	43.0	29.2		29.0	33.6	
Level of Service	B	B			B	B	D	C		C	C	
Approach Delay (s)		19.1			18.3			39.0			33.3	
Approach LOS		B			B			D			C	

Intersection Summary

HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	128.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis

3: 68 Avenue & CKC E

31/10/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Volume (veh/h)	108	777	125	102	468	89	22	0	18	17	0	20
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)	117	845	136	111	509	97	24	0	20	18	0	22
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh)												
Upstream signal (m)				330								
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	605			980			1832	1907	845	1829	1946	509
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	503			980			1869	1953	845	1867	1997	395
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 %	88			84			37	100	95	51	100	96
cM capacity (veh/h)	952			704			38	42	363	38	40	587
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2		
Volume Total	117	845	136	111	509	97	24	20	18	22		
Volume Left	117	0	0	111	0	0	24	0	18	0		
Volume Right	0	0	136	0	0	97	0	20	0	22		
cSH	952	1700	1700	704	1700	1700	38	363	38	587		
Volume to Capacity	0.12	0.50	0.08	0.16	0.30	0.06	0.63	0.05	0.49	0.04		
Queue Length 95th (m)	3.4	0.0	0.0	4.5	0.0	0.0	17.9	1.4	13.6	0.9		
Control Delay (s)	9.3	0.0	0.0	11.1	0.0	0.0	199.3	15.5	171.6	11.4		
Lane LOS	A			B			F	C	F	B		
Approach Delay (s)	1.0			1.7			116.6		85.0			
Approach LOS							F		F			
Intersection Summary												
Average Delay				5.7								
Intersection Capacity Utilization				64.4%			ICU Level of Service		C			
Analysis Period (min)				15								

HCM Signalized Intersection Capacity Analysis

1: 68 Avenue & 108 St.

78 K

31/10/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑		↑	↑↑	↑	↑	↑↑	↑
Volume (vph)	78	355	88	192	240	273	184	513	381	605	790	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3257		1769	3539	1583	1770	3539	1583
Flt Permitted	0.44	1.00	1.00	0.34	1.00		0.33	1.00	1.00	0.20	1.00	1.00
Satd. Flow (perm)	825	3539	1583	625	3257		614	3539	1583	373	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	386	96	209	261	297	200	558	414	658	859	150
RTOR Reduction (vph)	0	0	74	0	200	0	0	0	160	0	0	89
Lane Group Flow (vph)	85	386	22	209	358	0	200	558	254	658	859	61
Confl. Peds. (#/hr)									3			
Turn Type	Perm		Perm	pm+pt		pm+pt		Perm	pm+pt		Perm	
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6			8		8	4		4
Actuated Green, G (s)	18.0	18.0	18.0	26.0	26.0		25.5	16.0	16.0	46.0	32.5	32.5
Effective Green, g (s)	18.0	18.0	18.0	26.0	26.0		25.5	16.0	16.0	46.0	32.5	32.5
Actuated g/C Ratio	0.22	0.22	0.22	0.32	0.32		0.32	0.20	0.20	0.58	0.41	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	186	796	356	260	1059		333	708	317	669	1438	643
v/s Ratio Prot		0.11		c0.04	0.11		0.07	0.16		c0.32	0.24	
v/s Ratio Perm	0.10		0.01	c0.22			0.12		0.16	c0.25		0.04
v/c Ratio	0.46	0.48	0.06	0.80	0.34		0.60	0.79	0.80	0.98	0.60	0.09
Uniform Delay, d1	26.8	27.0	24.4	24.7	20.5		20.9	30.4	30.5	19.6	18.6	14.7
Progression Factor	1.00	1.00	1.00	0.76	0.30		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.9	2.1	0.3	15.8	0.8		3.0	8.7	18.9	30.5	1.8	0.3
Delay (s)	34.7	29.1	24.7	34.6	7.0		24.0	39.1	49.4	50.1	20.5	15.0
Level of Service	C	C	C	C	A		C	D	D	D	C	B
Approach Delay (s)		29.2			14.5			40.1			31.7	
Approach LOS		C			B			D			C	
Intersection Summary												
HCM Average Control Delay		30.5				HCM Level of Service			C			
HCM Volume to Capacity ratio		0.89										
Actuated Cycle Length (s)		80.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		81.5%			ICU Level of Service			D				
Analysis Period (min)		15										

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	201	1028	113	92	465	164	89	0	73	124	0	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.39	1.00	1.00	0.20	1.00	1.00	0.64	1.00	0.69	1.00	0.69	1.00
Satd. Flow (perm)	731	3539	1583	367	3539	1583	1187	1583	1293	1583	1293	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	1117	123	100	505	178	97	0	79	135	0	165
RTOR Reduction (vph)	0	0	55	0	0	89	0	0	60	0	0	126
Lane Group Flow (vph)	218	1117	68	100	505	89	0	97	19	0	135	39
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	53.0	44.2	44.2	44.7	39.9	39.9		19.0	19.0		19.0	19.0
Effective Green, g (s)	53.0	44.2	44.2	44.7	39.9	39.9		19.0	19.0		19.0	19.0
Actuated g/C Ratio	0.66	0.55	0.55	0.56	0.50	0.50		0.24	0.24		0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	602	1955	875	289	1765	790		282	376		307	376
v/s Ratio Prot	c0.04	c0.32		0.02	0.14							
v/s Ratio Perm	0.20		0.04	0.17		0.06		0.08	0.01		c0.10	0.02
v/c Ratio	0.36	0.57	0.08	0.35	0.29	0.11		0.34	0.05		0.44	0.10
Uniform Delay, d1	5.6	11.7	8.4	8.9	11.7	10.6		25.3	23.5		26.0	23.8
Progression Factor	0.73	0.76	1.08	1.06	0.76	1.68		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.7	0.1	0.7	0.4	0.3		3.3	0.3		4.5	0.6
Delay (s)	4.3	9.6	9.2	10.2	9.4	18.2		28.6	23.8		30.5	24.4
Level of Service	A	A	A	B	A	B		C	C		C	C
Approach Delay (s)		8.8			11.5			26.5			27.1	
Approach LOS		A			B			C			C	

Intersection Summary

HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	108	992	125	102	554	89	87	0	71	67	0	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.39	1.00	1.00	0.19	1.00	1.00	0.70	1.00	0.70	1.00	0.70	1.00
Satd. Flow (perm)	722	3539	1583	354	3539	1583	1303	1583	1295	1583	1295	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	1078	136	111	602	97	95	0	77	73	0	89
RTOR Reduction (vph)	0	0	61	0	0	44	0	0	60	0	69	0
Lane Group Flow (vph)	117	1078	75	111	602	53	0	95	17	73	20	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	50.1	44.1	44.1	49.9	44.0	44.0	18.0	18.0	18.0	18.0		
Effective Green, g (s)	50.1	44.1	44.1	49.9	44.0	44.0	18.0	18.0	18.0	18.0		
Actuated g/C Ratio	0.63	0.55	0.55	0.62	0.55	0.55	0.22	0.22	0.22	0.22		
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	531	1951	873	325	1946	871	293	356	291	356		
v/s Ratio Prot	0.02	c0.30		c0.03	0.17						0.01	
v/s Ratio Perm	0.12		0.05	0.19		0.03	c0.07	0.01	0.06			
v/c Ratio	0.22	0.55	0.09	0.34	0.31	0.06	0.32	0.05	0.25	0.06		
Uniform Delay, d1	6.1	11.6	8.5	7.3	9.8	8.4	25.9	24.3	25.5	24.3		
Progression Factor	0.33	0.68	0.84	0.43	0.64	1.43	1.00	1.00	1.00	1.00		
Incremental Delay, d2	0.2	1.0	0.2	0.6	0.4	0.1	2.9	0.3	2.1	0.3		
Delay (s)	2.2	8.8	7.3	3.7	6.7	12.1	28.8	24.5	27.5	24.6		
Level of Service	A	A	A	A	A	B	C	C	C	C		
Approach Delay (s)					6.9		26.9			25.9		
Approach LOS					A		C			C		
Intersection Summary												
HCM Average Control Delay			10.2		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.45									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				8.0			
Intersection Capacity Utilization			54.6%		ICU Level of Service				A			
Analysis Period (min)			15									
c Critical Lane Group												



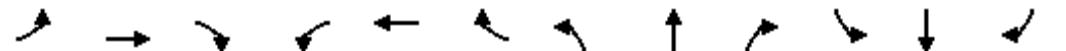
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑↑	↑↑	↑	↑	↑
Volume (vph)	104	1025	664	138	118	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Fr _t	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	3539	1583	1770	1583
Flt Permitted	0.28	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	528	3539	3539	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	113	1114	722	150	128	88
RTOR Reduction (vph)	0	0	0	76	0	64
Lane Group Flow (vph)	113	1114	722	74	128	24
Turn Type	pm+pt		Perm		Perm	
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	50.0	50.0	39.6	39.6	22.0	22.0
Effective Green, g (s)	50.0	50.0	39.6	39.6	22.0	22.0
Actuated g/C Ratio	0.62	0.62	0.50	0.50	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	429	2212	1752	784	487	435
v/s Ratio Prot	0.02	c0.31	0.20		c0.07	
v/s Ratio Perm	0.14			0.05		0.02
v/c Ratio	0.26	0.50	0.41	0.09	0.26	0.06
Uniform Delay, d1	6.9	8.2	12.8	10.7	22.7	21.4
Progression Factor	0.23	0.66	0.80	0.84	1.00	1.00
Incremental Delay, d2	0.3	0.7	0.6	0.2	1.3	0.2
Delay (s)	1.9	6.1	10.8	9.2	24.0	21.6
Level of Service	A	A	B	A	C	C
Approach Delay (s)			5.7	10.6		23.0
Approach LOS			A	B		C
Intersection Summary						
HCM Average Control Delay		9.2	HCM Level of Service		A	
HCM Volume to Capacity ratio		0.43				
Actuated Cycle Length (s)		80.0	Sum of lost time (s)		8.0	
Intersection Capacity Utilization		41.5%	ICU Level of Service		A	
Analysis Period (min)		15				
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

78 K

5: 68 Avenue & 100 St.

31/10/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑↑	
Volume (vph)	301	650	192	1	404	17	119	37	7	17	37	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	1.00	1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1816	1770	1616		
Flt Permitted	0.31	1.00	1.00	0.38	1.00	1.00	0.40	1.00	0.73	1.00		
Satd. Flow (perm)	585	3539	1583	713	3539	1583	748	1816	1352	1616		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	327	707	209	1	439	18	129	40	8	18	40	303
RTOR Reduction (vph)	0	0	97	0	0	14	0	5	0	0	193	0
Lane Group Flow (vph)	327	707	112	1	439	5	129	43	0	18	150	0
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm		Perm	
Protected Phases	5	2			6			8			4	
Permitted Phases	2		2	6		6	8				4	
Actuated Green, G (s)	43.0	43.0	43.0	20.0	20.0	20.0	29.0	29.0		29.0	29.0	
Effective Green, g (s)	43.0	43.0	43.0	20.0	20.0	20.0	29.0	29.0		29.0	29.0	
Actuated g/C Ratio	0.54	0.54	0.54	0.25	0.25	0.25	0.36	0.36		0.36	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	596	1902	851	178	885	396	271	658		490	586	
v/s Ratio Prot	c0.13	0.20			0.12			0.02			0.09	
v/s Ratio Perm	c0.16		0.07	0.00		0.00	c0.17			0.01		
v/c Ratio	0.55	0.37	0.13	0.01	0.50	0.01	0.48	0.07		0.04	0.26	
Uniform Delay, d1	11.2	10.7	9.2	22.5	25.7	22.6	19.6	16.6		16.5	17.9	
Progression Factor	0.34	0.33	0.09	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.5	0.3	0.1	2.0	0.1	5.9	0.2		0.1	1.1	
Delay (s)	7.1	4.0	1.1	22.6	27.7	22.6	25.5	16.8		16.6	19.0	
Level of Service	A	A	A	C	C	C	C	B		B	B	
Approach Delay (s)		4.3			27.5			23.2			18.9	
Approach LOS		A			C			C			B	
Intersection Summary												
HCM Average Control Delay			12.9		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				8.0			
Intersection Capacity Utilization			66.9%		ICU Level of Service				C			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

78 K, Dual SB L at 108 St

1: 68 Avenue & 108 St.

31/10/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑		↑	↑↑	↑	↑↑	↑↑	↑
Volume (vph)	78	355	88	192	240	273	184	513	381	605	790	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3257		1769	3539	1583	3433	3539	1583
Flt Permitted	0.44	1.00	1.00	0.37	1.00		0.18	1.00	1.00	0.26	1.00	1.00
Satd. Flow (perm)	825	3539	1583	698	3257		334	3539	1583	937	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	386	96	209	261	297	200	558	414	658	859	150
RTOR Reduction (vph)	0	0	70	0	174	0	0	0	217	0	0	102
Lane Group Flow (vph)	85	386	26	209	384	0	200	558	197	658	859	48
Confl. Peds. (#/hr)										3		
Turn Type	Perm		Perm	pm+pt		pm+pt		Perm	pm+pt		Perm	
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6			8		8	4		4
Actuated Green, G (s)	22.0	22.0	22.0	33.0	33.0		31.6	22.3	22.3	38.4	25.7	25.7
Effective Green, g (s)	22.0	22.0	22.0	33.0	33.0		31.6	22.3	22.3	38.4	25.7	25.7
Actuated g/C Ratio	0.28	0.28	0.28	0.41	0.41		0.40	0.28	0.28	0.48	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	227	973	435	382	1344		299	986	441	846	1137	509
v/s Ratio Prot		0.11		c0.05	0.12		0.08	0.16		c0.12	0.24	
v/s Ratio Perm	0.10		0.02	c0.18			0.19		0.12	c0.25	0.03	
v/c Ratio	0.37	0.40	0.06	0.55	0.29		0.67	0.57	0.45	0.78	0.76	0.09
Uniform Delay, d1	23.4	23.6	21.4	16.1	15.6		17.6	24.7	23.8	14.6	24.3	19.0
Progression Factor	1.00	1.00	1.00	1.02	1.08		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	1.2	0.3	1.6	0.5		5.6	2.4	3.3	4.5	4.7	0.4
Delay (s)	28.1	24.8	21.6	18.0	17.4		23.1	27.1	27.0	19.1	29.0	19.4
Level of Service	C	C	C	B	B		C	C	C	B	C	B
Approach Delay (s)		24.8			17.5			26.4			24.3	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM Average Control Delay		23.7			HCM Level of Service			C				
HCM Volume to Capacity ratio		0.69										
Actuated Cycle Length (s)		80.0			Sum of lost time (s)			12.0				
Intersection Capacity Utilization		65.8%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	201	1028	113	92	465	164	89	0	73	124	0	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.46	1.00	1.00	0.21	1.00	1.00	0.64	1.00	0.69	1.00	0.69	1.00
Satd. Flow (perm)	855	3539	1583	388	3539	1583	1195	1583	1293	1583	1293	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	1117	123	100	505	178	97	0	79	135	0	165
RTOR Reduction (vph)	0	0	43	0	0	62	0	0	59	0	0	124
Lane Group Flow (vph)	218	1117	80	100	505	116	0	97	20	0	135	41
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	52.0	52.0	52.0	52.0	52.0	52.0	20.0	20.0		20.0	20.0	
Effective Green, g (s)	52.0	52.0	52.0	52.0	52.0	52.0	20.0	20.0		20.0	20.0	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.65	0.65	0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	556	2300	1029	252	2300	1029	299	396		323	396	
v/s Ratio Prot	c0.32			0.14								
v/s Ratio Perm	0.26		0.05	0.26		0.07	0.08	0.01		c0.10	0.03	
v/c Ratio	0.39	0.49	0.08	0.40	0.22	0.11	0.32	0.05		0.42	0.10	
Uniform Delay, d1	6.6	7.2	5.2	6.6	5.7	5.3	24.5	22.8		25.1	23.1	
Progression Factor	0.70	0.67	0.82	0.69	0.72	0.32	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.6	0.1	4.5	0.2	0.2	2.9	0.2		3.9	0.5	
Delay (s)	6.2	5.3	4.4	9.1	4.3	1.9	27.3	23.0		29.1	23.6	
Level of Service	A	A	A	A	A	A	C	C		C	C	
Approach Delay (s)		5.4			4.4		25.4			26.1		
Approach LOS		A			A		C			C		

Intersection Summary

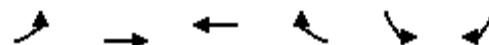
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

3: 68 Avenue & CKC E

31/10/2011

Movement	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	108	992	125	102	554	89	87	0	71	67	0	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.41	1.00	1.00	0.22	1.00	1.00	0.70	1.00	0.70	1.00	0.70	1.00
Satd. Flow (perm)	764	3539	1583	415	3539	1583	1303	1583	1295	1583	1295	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	1078	136	111	602	97	95	0	77	73	0	89
RTOR Reduction (vph)	0	0	46	0	0	33	0	0	59	0	68	0
Lane Group Flow (vph)	117	1078	90	111	602	64	0	95	18	73	21	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	53.0	53.0	53.0	53.0	53.0	53.0	19.0	19.0	19.0	19.0		
Effective Green, g (s)	53.0	53.0	53.0	53.0	53.0	53.0	19.0	19.0	19.0	19.0		
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.66	0.66	0.24	0.24	0.24	0.24		
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	506	2345	1049	275	2345	1049	309	376	308	376		
v/s Ratio Prot	c0.30			0.17						0.01		
v/s Ratio Perm	0.15		0.06	0.27		0.04	c0.07	0.01	0.06			
v/c Ratio	0.23	0.46	0.09	0.40	0.26	0.06	0.31	0.05	0.24	0.06		
Uniform Delay, d1	5.4	6.6	4.8	6.2	5.5	4.7	25.1	23.5	24.6	23.6		
Progression Factor	0.83	0.84	1.13	0.41	0.36	0.04	1.00	1.00	1.00	1.00		
Incremental Delay, d2	1.0	0.6	0.1	4.2	0.3	0.1	2.6	0.2	1.8	0.3		
Delay (s)	5.4	6.1	5.6	6.8	2.2	0.3	27.7	23.8	26.4	23.9		
Level of Service	A	A	A	A	A	A	C	C	C	C		
Approach Delay (s)		6.0			2.6		25.9			25.0		
Approach LOS		A			A		C		C		C	
Intersection Summary												
HCM Average Control Delay		7.5					HCM Level of Service			A		
HCM Volume to Capacity ratio		0.42										
Actuated Cycle Length (s)		80.0					Sum of lost time (s)			8.0		
Intersection Capacity Utilization		54.6%					ICU Level of Service			A		
Analysis Period (min)		15										
c Critical Lane Group												



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑↑	↑↑	↑	↑	↑
Volume (vph)	104	1025	664	138	118	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Fr _t	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	3539	1583	1770	1583
Flt Permitted	0.35	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	651	3539	3539	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	113	1114	722	150	128	88
RTOR Reduction (vph)	0	0	0	54	0	65
Lane Group Flow (vph)	113	1114	722	96	128	23
Turn Type	Perm		Perm		Perm	
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	51.0	51.0	51.0	51.0	21.0	21.0
Effective Green, g (s)	51.0	51.0	51.0	51.0	21.0	21.0
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	415	2256	2256	1009	465	416
v/s Ratio Prot	c0.31	0.20		c0.07		
v/s Ratio Perm	0.17		0.06		0.01	
v/c Ratio	0.27	0.49	0.32	0.09	0.28	0.06
Uniform Delay, d1	6.4	7.7	6.6	5.6	23.5	22.1
Progression Factor	0.74	0.70	0.85	0.68	1.00	1.00
Incremental Delay, d2	1.5	0.7	0.4	0.2	1.5	0.3
Delay (s)	6.2	6.1	6.0	4.0	24.9	22.3
Level of Service	A	A	A	A	C	C
Approach Delay (s)		6.1	5.6		23.9	
Approach LOS		A	A		C	
Intersection Summary						
HCM Average Control Delay		7.6	HCM Level of Service		A	
HCM Volume to Capacity ratio		0.43				
Actuated Cycle Length (s)		80.0	Sum of lost time (s)		8.0	
Intersection Capacity Utilization		41.5%	ICU Level of Service		A	
Analysis Period (min)		15				
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

78 K, Dual SB L at 108 St

5: 68 Avenue & 100 St.

31/10/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑↑	↑
Volume (vph)	301	650	192	1	404	17	119	37	7	17	37	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	1.00	1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1816	1770	1616		
Flt Permitted	0.48	1.00	1.00	0.34	1.00	1.00	0.38	1.00	0.73	1.00		
Satd. Flow (perm)	902	3539	1583	632	3539	1583	709	1816	1352	1616		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	327	707	209	1	439	18	129	40	8	18	40	303
RTOR Reduction (vph)	0	0	91	0	0	8	0	5	0	0	201	0
Lane Group Flow (vph)	327	707	118	1	439	10	129	43	0	18	142	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	45.0	45.0	45.0	45.0	45.0	45.0	27.0	27.0	27.0	27.0	27.0	
Effective Green, g (s)	45.0	45.0	45.0	45.0	45.0	45.0	27.0	27.0	27.0	27.0	27.0	
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.56	0.56	0.34	0.34	0.34	0.34	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	507	1991	890	356	1991	890	239	613	456	545		
v/s Ratio Prot		0.20			0.12			0.02			0.09	
v/s Ratio Perm	c0.36		0.07	0.00		0.01	c0.18			0.01		
v/c Ratio	0.64	0.36	0.13	0.00	0.22	0.01	0.54	0.07	0.04	0.26		
Uniform Delay, d1	12.0	9.6	8.3	7.7	8.7	7.7	21.5	18.0	17.8	19.3		
Progression Factor	0.69	0.53	0.45	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.6	0.4	0.3	0.0	0.3	0.0	8.5	0.2	0.2	1.2		
Delay (s)	13.8	5.5	4.0	7.7	9.0	7.7	30.0	18.2	18.0	20.4		
Level of Service	B	A	A	A	A	A	C	B	B	C		
Approach Delay (s)		7.5			8.9			26.8		20.3		
Approach LOS		A			A			C		C		
Intersection Summary												
HCM Average Control Delay		11.4			HCM Level of Service				B			
HCM Volume to Capacity ratio		0.60										
Actuated Cycle Length (s)		80.0			Sum of lost time (s)				8.0			
Intersection Capacity Utilization		66.9%			ICU Level of Service				C			
Analysis Period (min)		15										
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

1: 68 Avenue & 108 St.

31/10/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑		↑	↑↑	↑	↑↑	↑↑	↑
Volume (vph)	88	494	143	245	303	291	195	785	426	768	1040	199
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3279		1770	3539	1583	3433	3539	1583
Flt Permitted	0.41	1.00	1.00	0.21	1.00		0.12	1.00	1.00	0.11	1.00	1.00
Satd. Flow (perm)	758	3539	1583	383	3279		227	3539	1583	380	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	537	155	266	329	316	212	853	463	835	1130	216
RTOR Reduction (vph)	0	0	119	0	146	0	0	0	204	0	0	100
Lane Group Flow (vph)	96	537	36	266	499	0	212	853	259	835	1130	116
Confl. Peds. (#/hr)									3			
Turn Type	Perm		Perm	pm+pt		pm+pt		Perm	pm+pt		Perm	
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6			8		8	4		4
Actuated Green, G (s)	27.6	27.6	27.6	47.0	47.0		47.0	34.0	34.0	65.0	48.0	48.0
Effective Green, g (s)	27.6	27.6	27.6	47.0	47.0		47.0	34.0	34.0	65.0	48.0	48.0
Actuated g/C Ratio	0.23	0.23	0.23	0.39	0.39		0.39	0.28	0.28	0.54	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	174	814	364	328	1284		256	1003	449	893	1416	633
v/s Ratio Prot		0.15		c0.10	0.15		0.09	0.24		c0.21	0.32	
v/s Ratio Perm	0.13		0.02	c0.21			0.23		0.16	c0.30		0.07
v/c Ratio	0.55	0.66	0.10	0.81	0.39		0.83	0.85	0.58	0.94	0.80	0.18
Uniform Delay, d1	40.7	41.9	36.4	27.9	26.2		27.6	40.6	36.9	35.1	31.7	23.3
Progression Factor	1.00	1.00	1.00	1.44	1.67		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.0	4.2	0.5	13.6	0.9		19.3	9.0	5.3	16.5	4.8	0.6
Delay (s)	52.8	46.1	36.9	53.7	44.5		46.9	49.6	42.2	51.6	36.5	24.0
Level of Service	D	D	D	D	D		D	D	D	D	D	C
Approach Delay (s)		45.1			47.2			47.0			41.0	
Approach LOS		D			D			D			D	
Intersection Summary												
HCM Average Control Delay		44.3			HCM Level of Service			D				
HCM Volume to Capacity ratio		0.86										
Actuated Cycle Length (s)		120.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		84.2%			ICU Level of Service			E				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2: 68 Avenue & CKC W

31/10/2011

Movement	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	201	1374	113	92	598	164	89	0	73	124	0	152
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.36	1.00	1.00	0.11	1.00	1.00	0.57	1.00	0.66	1.00	0.66	1.00
Satd. Flow (perm)	665	3539	1583	200	3539	1583	1064	1583	1220	1583	1220	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	1493	123	100	650	178	97	0	79	135	0	165
RTOR Reduction (vph)	0	0	46	0	0	69	0	0	63	0	0	131
Lane Group Flow (vph)	218	1493	77	100	650	109	0	97	16	0	135	34
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	85.0	75.6	75.6	81.0	73.6	73.6		25.0	25.0		25.0	25.0
Effective Green, g (s)	85.0	75.6	75.6	81.0	73.6	73.6		25.0	25.0		25.0	25.0
Actuated g/C Ratio	0.71	0.63	0.63	0.68	0.61	0.61		0.21	0.21		0.21	0.21
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	558	2230	997	232	2171	971		222	330		254	330
v/s Ratio Prot	c0.03	c0.42		0.03	0.18							
v/s Ratio Perm	0.25		0.05	0.26		0.07		0.09	0.01		c0.11	0.02
v/c Ratio	0.39	0.67	0.08	0.43	0.30	0.11		0.44	0.05		0.53	0.10
Uniform Delay, d1	6.3	14.2	8.6	11.6	11.0	9.6		41.4	38.0		42.3	38.4
Progression Factor	1.23	0.87	1.95	1.87	0.95	1.93		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	1.0	0.1	1.2	0.3	0.2		6.1	0.3		7.8	0.6
Delay (s)	8.0	13.3	16.9	22.9	10.8	18.8		47.5	38.3		50.0	39.1
Level of Service	A	B	B	C	B	B		D	D		D	D
Approach Delay (s)					12.9	13.6		43.4			44.0	
Approach LOS					B			D			D	
Intersection Summary												
HCM Average Control Delay				17.6	HCM Level of Service				B			
HCM Volume to Capacity ratio				0.63								
Actuated Cycle Length (s)				120.0	Sum of lost time (s)				12.0			
Intersection Capacity Utilization				66.6%	ICU Level of Service				C			
Analysis Period (min)				15								
c Critical Lane Group												

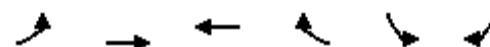
HCM Signalized Intersection Capacity Analysis

3: 68 Avenue & CKC E

90 K, Dual SB L at 108 St

31/10/2011

Movement	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑↑	↑
Volume (vph)	108	1298	165	135	663	89	110	0	90	67	0	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	1.00	0.85	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1583	1770	1583	1770	1583
Flt Permitted	0.36	1.00	1.00	0.12	1.00	1.00	0.67	1.00	0.59	1.00	0.59	1.00
Satd. Flow (perm)	676	3539	1583	219	3539	1583	1243	1583	1105	1583	1105	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	1411	179	147	721	97	120	0	98	73	0	89
RTOR Reduction (vph)	0	0	65	0	0	32	0	0	79	0	72	0
Lane Group Flow (vph)	117	1411	114	147	721	65	0	120	19	73	17	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		4
Protected Phases	5	2		1	6			8				
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	81.3	76.3	76.3	88.7	80.0	80.0	23.0	23.0	23.0	23.0		
Effective Green, g (s)	81.3	76.3	76.3	88.7	80.0	80.0	23.0	23.0	23.0	23.0		
Actuated g/C Ratio	0.68	0.64	0.64	0.74	0.67	0.67	0.19	0.19	0.19	0.19		
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	504	2250	1007	274	2359	1055	238	303	212	303		
v/s Ratio Prot	0.01	c0.40		c0.04	0.20						0.01	
v/s Ratio Perm	0.15		0.07	0.36		0.04	c0.10	0.01	0.07			
v/c Ratio	0.23	0.63	0.11	0.54	0.31	0.06	0.50	0.06	0.34	0.06		
Uniform Delay, d1	6.7	13.2	8.6	11.0	8.4	7.0	43.4	39.7	42.0	39.6		
Progression Factor	0.95	0.88	1.71	3.72	0.84	1.61	1.00	1.00	1.00	1.00		
Incremental Delay, d2	0.2	1.0	0.2	1.9	0.3	0.1	7.4	0.4	4.4	0.4		
Delay (s)	6.6	12.7	14.9	43.0	7.4	11.3	50.8	40.1	46.4	40.0		
Level of Service	A	B	B	D	A	B	D	D	D	D		
Approach Delay (s)		12.5			13.2		46.0			42.9		
Approach LOS		B			B		D			D		
Intersection Summary												
HCM Average Control Delay		16.7			HCM Level of Service			B				
HCM Volume to Capacity ratio		0.62										
Actuated Cycle Length (s)		120.0			Sum of lost time (s)			16.0				
Intersection Capacity Utilization		66.1%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑↑	↑↑	↑	↑	↑
Volume (vph)	94	1361	801	145	125	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Fr _t	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	3539	1583	1770	1583
Flt Permitted	0.26	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	491	3539	3539	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	1479	871	158	136	92
RTOR Reduction (vph)	0	0	0	59	0	73
Lane Group Flow (vph)	102	1479	871	99	136	19
Turn Type	pm+pt		Perm		Perm	
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Actuated Green, G (s)	87.0	87.0	75.5	75.5	25.0	25.0
Effective Green, g (s)	87.0	87.0	75.5	75.5	25.0	25.0
Actuated g/C Ratio	0.72	0.72	0.63	0.63	0.21	0.21
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	436	2566	2227	996	369	330
v/s Ratio Prot	0.01	c0.42	0.25		c0.08	
v/s Ratio Perm	0.16			0.06		0.01
v/c Ratio	0.23	0.58	0.39	0.10	0.37	0.06
Uniform Delay, d1	6.0	7.8	10.9	8.8	40.7	38.1
Progression Factor	1.14	0.96	0.90	1.28	1.00	1.00
Incremental Delay, d2	0.2	0.8	0.5	0.2	2.8	0.3
Delay (s)	7.0	8.3	10.3	11.5	43.6	38.4
Level of Service	A	A	B	B	D	D
Approach Delay (s)			8.2	10.5		41.5
Approach LOS			A	B		D
Intersection Summary						
HCM Average Control Delay		11.7	HCM Level of Service		B	
HCM Volume to Capacity ratio		0.53				
Actuated Cycle Length (s)		120.0	Sum of lost time (s)		8.0	
Intersection Capacity Utilization		51.2%	ICU Level of Service		A	
Analysis Period (min)		15				
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

90 K, Dual SB L at 108 St

5: 68 Avenue & 100 St.

31/10/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	357	930	196	1	511	20	127	33	8	19	42	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	1.00	1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1807	1770	1617		
Flt Permitted	0.37	1.00	1.00	0.28	1.00	1.00	0.22	1.00	0.73	1.00		
Satd. Flow (perm)	692	3539	1583	528	3539	1583	416	1807	1356	1617		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	388	1011	213	1	555	22	138	36	9	21	46	335
RTOR Reduction (vph)	0	0	63	0	0	10	0	7	0	0	263	0
Lane Group Flow (vph)	388	1011	150	1	555	12	138	38	0	21	118	0
Turn Type	pm+pt		Perm	Perm		Perm	pm+pt		Perm			
Protected Phases	5	2			6		3	8			4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	84.3	84.3	84.3	63.2	63.2	63.2	27.7	27.7	13.9	13.9		
Effective Green, g (s)	84.3	84.3	84.3	63.2	63.2	63.2	27.7	27.7	13.9	13.9		
Actuated g/C Ratio	0.70	0.70	0.70	0.53	0.53	0.53	0.23	0.23	0.12	0.12		
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	640	2486	1112	278	1864	834	207	417	157	187		
v/s Ratio Prot	c0.09	0.29			0.16		c0.05	0.02		0.07		
v/s Ratio Perm	c0.34		0.09	0.00		0.01	c0.10		0.02			
v/c Ratio	0.61	0.41	0.13	0.00	0.30	0.01	0.67	0.09	0.13	0.63		
Uniform Delay, d1	7.8	7.4	5.9	13.5	15.9	13.5	39.4	36.3	47.6	50.6		
Progression Factor	1.45	1.49	2.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Incremental Delay, d2	1.4	0.4	0.2	0.0	0.4	0.0	7.9	0.1	0.4	6.5		
Delay (s)	12.6	11.5	17.3	13.5	16.4	13.6	47.2	36.4	48.0	57.0		
Level of Service	B	B	B	B	B	B	D	D	D	E		
Approach Delay (s)		12.5			16.2			44.6		56.6		
Approach LOS		B			B			D		E		
Intersection Summary												
HCM Average Control Delay		21.8			HCM Level of Service			C				
HCM Volume to Capacity ratio		0.61										
Actuated Cycle Length (s)		120.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		75.5%			ICU Level of Service			D				
Analysis Period (min)		15										
c Critical Lane Group												



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Appendix C

68 Avenue Function Study, Exhibits 01 and 02



S.W.1/4 SEC.14-71-6-6

COMMUNITY KNOWLEDGE CAMPUS

COMMUNITY KNOWLEDGE CAMPUS

S.E.1/4 SEC.14-71-6-

KATERI

N.W.1/4 SEC.11-71-6-6

N.E.1/4 SEC.11-71-6-6

A scale bar with markings at 0, 20, 40, 60, and 80. Below the scale bar, the text "1:2000" indicates the scale.

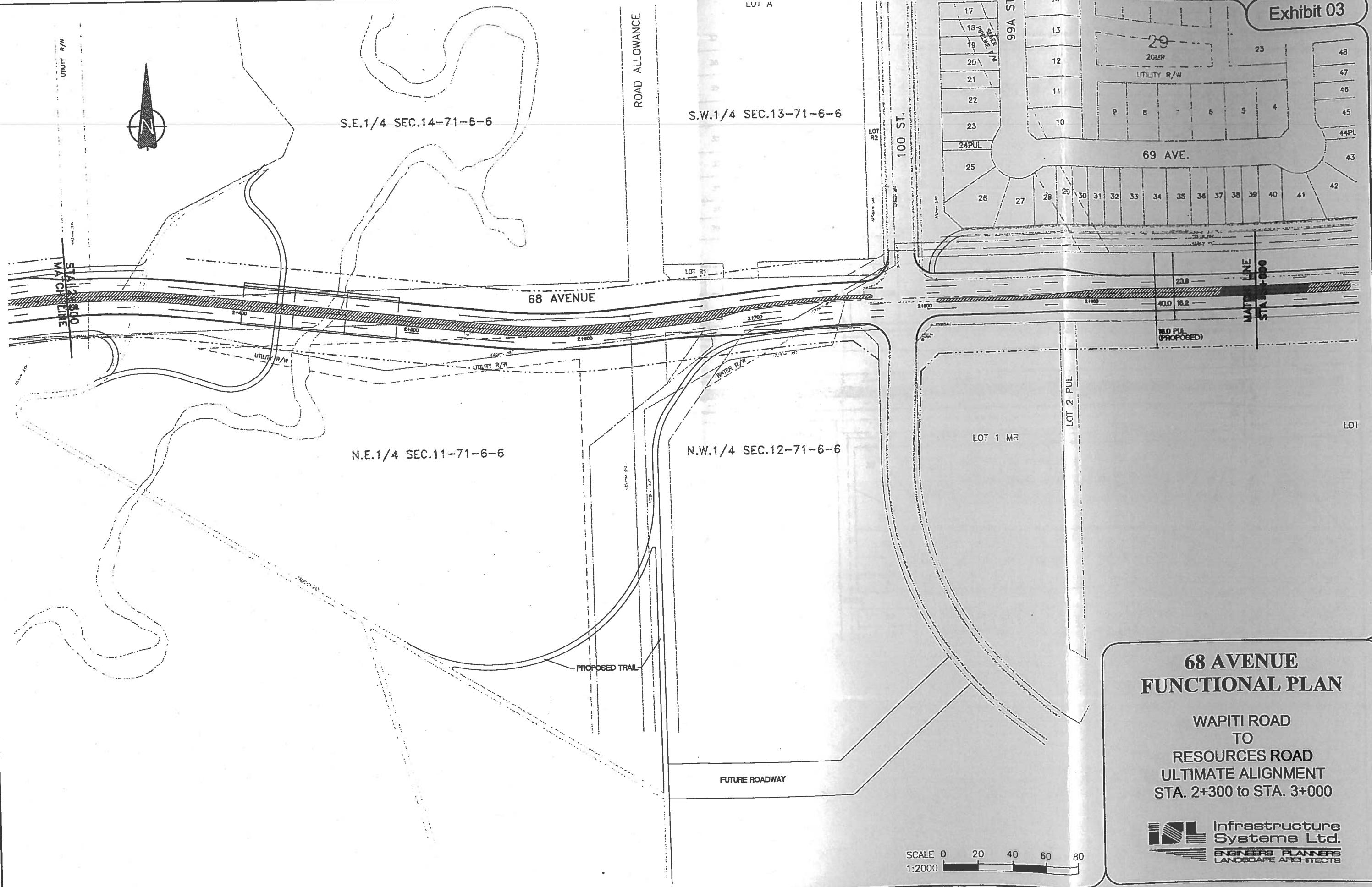
68 AVENUE FUNCTIONAL PLAN

WAPITI ROAD

50

**RESOURCES ROAD
ULTIMATE ALIGNMENT
STA. 1+600 to STA. 2+300**







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Appendix D

Stonebridge Development TIA

4.0 SITE GENERATED TRAFFIC

4.1 Proposed Land Uses

Proposed for the Stonebridge site are single-family, multi-family, commercial and institutional developments. **Figure 4.0a** illustrates the proposed land use from the “Stonebridge Outline Plan” and the tentative lot plan is illustrated in **Figure 4.0b**. For the purposes of this report, we have broken down the proposed site developments by type and size based on four traffic analysis zones. These four zones were defined by the likely driveway access for the various developments. The breakdown is shown in **Table 4.1**.

Table 4.1 – Land Use and Intensity by Traffic Analysis Zone

Traffic Zone	Single-Family	Multi-Family	Commercial	Institutional
1	1.05 ha	0.80 ha	5.25 ha	7.79 ha
2	6.21 ha	5.04 ha	Nil	Nil
3	6.78 ha	2.05 ha	3.56 ha	Nil
4	8.91 ha	Nil	Nil	Nil
sub-total	22.95 ha	7.89 ha	8.81 ha	7.79 ha
Total	$22.95 + 7.89 + 8.81 + 7.79 = 56.25 \text{ ha}$			

Figure 4.0c shows the boundary for each traffic analysis zone.

4.2 Trip Generation

In order to assess the volume of traffic the proposed site is likely to generate during the Weekday AM and PM peak hours, we used the average trip generation rates provided in the *Institute of Transportation Engineer's Trip Generation Manual, 7th Edition* for the land uses proposed, with the exception of that for multi-family dwelling units where the trip regression equations were applied.

Descriptions of the proposed land uses from the Trip Generation Manual are:

Land Use: 210

Single-Family Detached Housing

Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.

Land Use: 220

Apartment (Multi-Family)

Apartments are rental dwelling units that are located within the same building with at least three other dwelling units, for example quadraplexes are all types of apartment buildings. The studies included in this land use did not identify whether the apartments were low-rise, mid-rise, or high-rise.

Low-rise apartments (Land Use 221), high-rise apartments (Land Use 222), and mid-rise apartments (Land Use 223) are related uses.

Figure 4.0a – Land Use Map

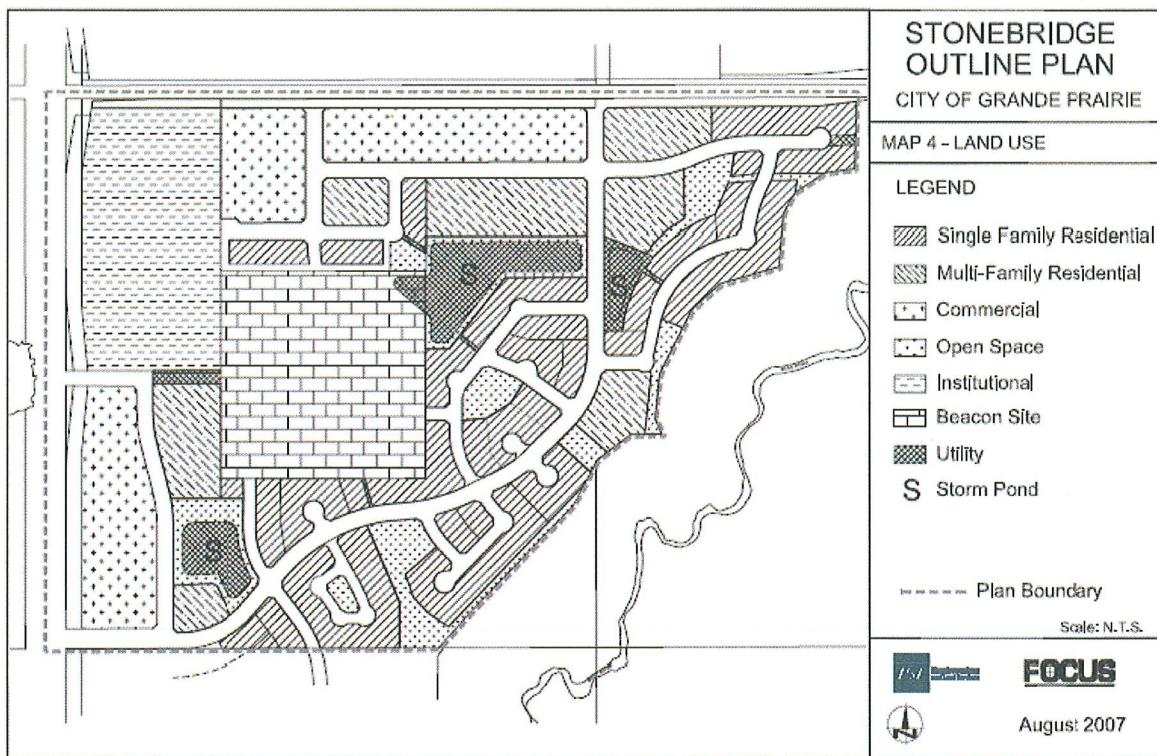


Figure 4.0b – Tentative Lot Plan

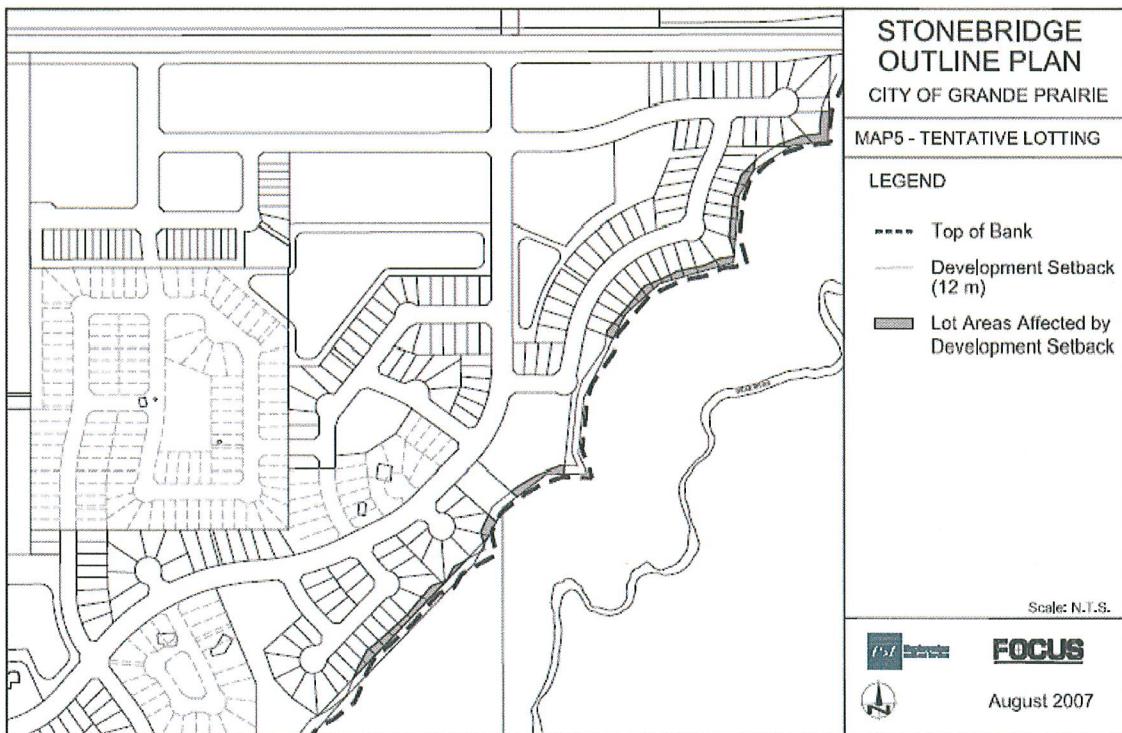
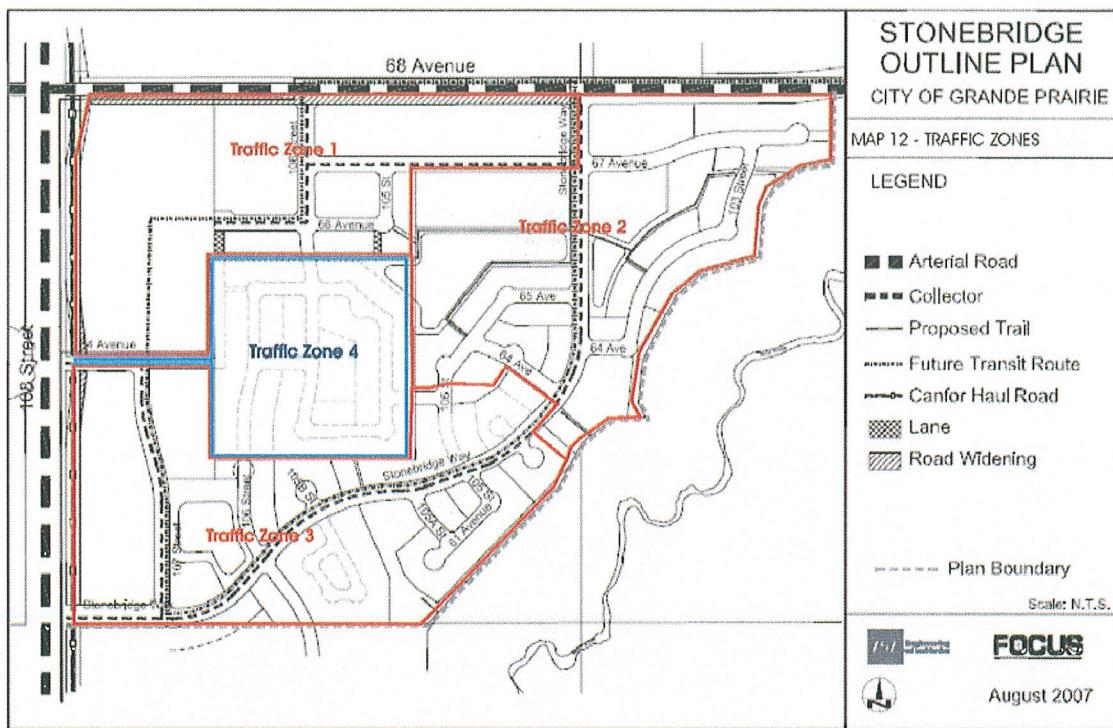


Figure 4.0c – Traffic Analysis Zone Map



Land Use: 946

Gasoline/Service Station and Convenience Market and Car Wash

This land use includes gasoline/service stations with convenience markets and car washes where the primary business is the fueling of motor vehicles. They may also have ancillary facilities for servicing and repairing motor vehicles. These service stations are generally located at intersections or interchanges. 24 hour convenience markets (Land Use 851), convenience market with gasoline pumps (Land Use 853), gasoline/service station (Land Use 944) and gasoline/service station with convenience market (Land Use 945) are related uses.

Land Use: 820

Shopping Center

A shopping center is an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. A shopping center's composition is related to its market area in terms of size, location and type of stores. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. Specialty retail center (Land Use 814) and factory outlet center (Land Use 823) are related uses.

Trip Generation Tables

The number of entering/exiting trips during the weekday AM and PM peak hour for each site development was calculated and is summarized in **Tables 4.2 and 4.3**. We note that within the Stonebridge site there is a parcel of federally-owned land leased by NAV Canada for the operation of an airport beacon. This land parcel is located within our traffic analysis zone 4. When this piece of land becomes available for development, the Stonebridge Outline Plan identifies it as being zoned for single-family detached housing.

Currently, the Stonebridge Outline Plan accounts for the land area only. In order to assess the full impact of the Stonebridge site, traffic zone 4 has been included in the trip generation and distribution.

Tables 4.2 and 4.3 also provide the breakdown of in/out trips generated by the proposed site. Assumptions used in calculating in/out trips shown in the tables are:

- 1) College:** Buildings have a Gross Floor Area (GFA) of approximately 20% of Developable Site Area ($20\% \times 7.81\text{ha}$) = $169,000\text{ ft}^2$.
- 2) Commercial:** AM peak hour trip rate = $1.03\text{ trips}/1,000\text{ft}^2 \times 107,639\text{ ft}^2/\text{ha} \times 25\% = 27.7\text{ trips}/\text{ha}/\text{hour}$
PM peak hour trip rate = $3.74\text{ trips}/1,000\text{ft}^2 \times 107,639\text{ ft}^2/\text{ha} \times 25\% = 100.6\text{ trips}/\text{ha}/\text{hour}$
- 3) Single-Family Detached Homes for two-way trips:**
 $9.57\text{ trips for single-family detached home/weekday}$
- 4) Multi-Family Dwelling Units (ITE Regression Equation):**

	AM Peak	PM Peak
Traffic Zone 1	$\ln(T)=0.80\ln(64)+0.26$	$\ln(T)=0.82\ln(64)+0.32$
	T=36 trips	T=41 trips
Traffic Zone 2	$\ln(T)=0.80\ln(403)+0.26$	$\ln(T)=0.82\ln(403)+0.32$
	T=157 trips	T=188 trips
Traffic Zone 3	$\ln(T)=0.80\ln(164)+0.26$	$\ln(T)=0.82\ln(164)+0.32$
	T=76 trips	T=90 trips
Total Trips	269	319

Table 4.2 – Trip Generation Weekday AM Peak Hour

Trip Generation - Weekday														
AM Peak Hour	Traffic Zone	Landuse	ITE Code	Rate	Units	No. of Units	Avg. 2-way Trip	% External	2-way Trips	In %	# of In	Out %	# of Out	
1	1	Single Family Detached	210	0.75	Dwelling	25	19	100%	19	25%	5	75%	14	
1	1	Multi Family Unit	230	Eq.	Dwelling	64	36	100%	36	20%	7	80%	29	
1	1	Gasbar/Conv/Car Wash	946	10.64	GFA	3.16	34	80%	27	51%	14	49%	13	
1	1	Commercial	820	27.7	GFA	2.1	58	80%	47	61%	28	39%	18	
1	1	College	540	2.99	GFA	168	502	95%	477	74%	353	26%	124	
2	2	Single Family Detached	210	0.75	Dwelling	144	108	100%	108	25%	27	75%	81	
2	2	Multi Family Unit	220	Eq.	Dwelling	403	157	100%	157	20%	31	80%	126	
3	3	Single Family Detached	210	0.75	Dwelling	157	118	100%	118	25%	29	75%	88	
3	3	Multi Family Unit	220	Eq.	Dwelling	164	76	100%	76	20%	15	80%	61	
3	3	Commercial	820	27.7	GFA	3.56	99	80%	79	61%	48	39%	31	
4	4	Single Family Detached	210	0.75	Dwelling	206	155	100%	155	25%	39	75%	116	
		Total				1361			596		701			

Table 4.3 – Trip Generation Weekday PM Peak Hour

Trip Generation - Weekday														
PM Peak Hour	Traffic Zone	Landuse	ITE Code	Rate	Units	No. of Units	Avg. 2-way Trip	% External	2-way Trips	In %	# of In	Out %	# of Out	
1	1	Single Family Detached	210	1.01	Dwelling	25	25	100%	25	63%	16	37%	9	
1	1	Multi Family Unit	230	Eq.	Dwelling	64	41	100%	41	65%	27	35%	14	
1	1	Gasbar/Conv/Car Wash	946	13.33	GFA	3.16	42	80%	34	50%	17	50%	17	
1	1	Commercial	820	100.6	GFA	2.1	211	80%	169	48%	81	52%	88	
1	1	College	540	2.54	GFA	168	427	95%	405	58%	235	42%	170	
2	2	Single Family Detached	210	1.01	Dwelling	144	145	100%	145	63%	92	37%	54	
2	2	Multi Family Unit	220	Eq.	Dwelling	403	188	100%	188	65%	122	35%	66	
3	3	Single Family Detached	210	1.01	Dwelling	157	159	100%	159	63%	100	37%	59	
3	3	Multi Family Unit	220	Eq.	Dwelling	164	90	100%	90	65%	59	35%	32	
3	3	Commercial	820	100.6	GFA	3.56	358	80%	287	48%	138	52%	149	
4	4	Single Family Detached	210	1.01	Dwelling	206	208	100%	208	63%	131	37%	77	
		Total				1895			596		701			

4.3 Trip Distribution

The trip distribution used in this study is in keeping with the trip distribution assumed for traffic studies for other developments in the surrounding area. Based on this distribution, the site-generated traffic was assigned throughout the road network.

The trip distributions for the weekday AM and PM peak hours are presented in **Tables 4.4a** and **4.4b**, respectively. **Figures 4.1** and **4.2** present the weekday AM and PM peak hour site generated trips, respectively.

Table 4.4a – Trip Distribution Weekday AM Peak Hour

Trip Distribution	106 Street	104 Street	64 Avenue	60 Avenue	Total Dis.
Zone 1	75%	25%	0%	0%	100%
Total	605				
In	407	305	102		407
Out	198	149	50		198
Zone 2	0%	90%	0%	10%	100%
Total	265				
In	58		52	6	58
Out	207		186	21	207
Zone 3	0%	0%	10%	90%	100%
Total	273				
In	92			9	92
Out	180			18	180
Zone 4	40%	20%	0%	40%	100%
Total	155				
In	39	16	8		39
Out	116	46	23		116

Table 4.4b – Trip Distribution Weekday PM Peak Hour

Trip Distribution	106 Street	104 Street	64 Avenue	60 Avenue	Total Dis.
Zone 1	75%	25%	0%	0%	100%
Total	674				
In	376	282	94		376
Out	298	224	75		298
Zone 2	0%	90%	0%	10%	100%
Total	333				
In	214		193	21	214
Out	120		108	12	120
Zone 3	0%	0%	10%	90%	100%
Total	535				
In	297		30	267	297
Out	240		24	216	240
Zone 4	40%	20%	0%	40%	100%
Total	208				
In	131	52	26		131
Out	77	31	15		77



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Appendix E

Stonebridge Outline Plan Zoning Map

STONEBRIDGE OUTLINE PLAN

CITY OF GRANDE PRAIRIE

MAP 12 - ZONING

LEGEND

- RG Residential General
- RL Low Density Residential
- RM Medium Density Resid.
- PS Public Service
- CA Arterial Commercial
- CS Service Commercial
- UR Urban Reserve
- DC Direct Control

Scale: N.T.S.

