



Ref. No. DA10538

September 26, 2014

Mr. Hugh Morrison, P. Eng.
Development Engineer
Halifax Community Development - Alderney Gate
PO Box 1749
HALIFAX NS B3J 3A5

RE: Traffic Impact Analysis, Proposed Apartment Building with Ground Floor Commercial Space, Glenwood Avenue, Dartmouth

Dear Mr. Morrison:

Monaco Investments Partnership is preparing plans for construction of an apartment building with ground floor commercial space at the southeast corner of the Prince Albert Road / Glenwood Avenue intersection in Dartmouth (Figure 1). The site is currently occupied by Walkers Funeral Home (307 Prince Albert Road) and a single family residence (5 Glenwood Avenue). The project includes a 14 storey building plus penthouse with approximately 110 apartments. This is the Traffic Impact Analysis (TIA) required to accompany the development application.

Description of Site Accesses-

Glenwood Avenue is a two lane 9.2 meter wide local street. While there is a section of sidewalk on the east side of the street adjacent to the Funeral Home site (Figure 1), there is no sidewalk on the street south of the site. The proposed development will have a driveway on Glenwood Avenue at the southeast end of the building to access an underground parking facility with approximately 147 spaces. Since the parking garage entrance is set back approximately 7.5 m (24.75 ft.) from the edge of the right-of-way, there should be adequate visibility between drivers exiting the garage and pedestrians on any future sidewalk. Sight distances are adequate for both Glenwood Avenue approaches to the parking garage driveway (Photos 1 and 2).



Photo 1 - Looking south on Glenwood Avenue from the proposed parking garage driveway at the southeast end of the building.

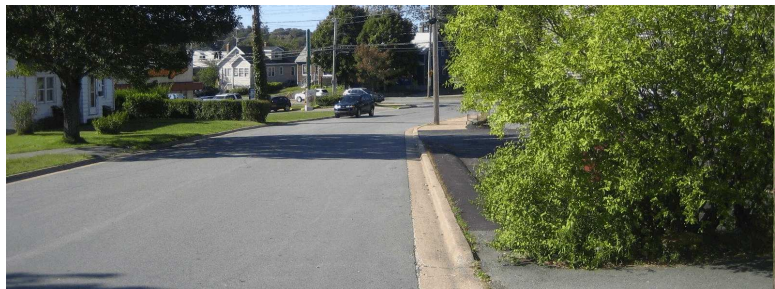


Photo 2 - Looking north on Glenwood Avenue towards Prince Albert Road from the proposed parking garage driveway at the southeast end of the building. The bush to the right of the photo will be removed during construction.



Description of Prince Albert Road - Prince Albert Road is a four-lane major collector street with sidewalks on both sides at the Glenwood Avenue intersection (Photos 3 and 4). Intersection traffic control includes a STOP sign on the Glenwood Avenue approach.



Photo 3 - Looking west on Prince Albert Road from the Glenwood Avenue intersection.

Description of Transit Service - Metro Transit Route 62 (Wildwood) which serves Prince Albert Road with a bus stop near Glenwood Avenue provides connections to the Penhorn and Bridge Halifax Transit Terminals, as well as to the Alderney Ferry Terminal.



Photo 4 - Looking east on Prince Albert Road from the Glenwood Avenue intersection.

Manual Traffic Counts - A manual turning movement count was obtained at the Prince Albert Road / Glenwood Avenue intersection during AM, noon and PM peak travel periods during September 2014. Tabulated counts with AM, noon and PM peak hours shown as shaded areas are recorded in Table A-1, Appendix A. Existing two-way volumes on Prince Albert Road west of the intersection include 1,400 vehicles per hour (vph) during the AM peak hour and 1,605 vph during the PM peak hour.

The 2014 AM and PM peak hour volumes are shown diagrammatically in Figure A-1, Boxes A and B, Appendix A. They have been increased with an annual traffic volume growth rate of 1.0%, which is considered typical of many major collector streets in Halifax, to provide projected 2016 AM and PM peak hour volumes which are shown diagrammatically in Figure A-1, Boxes C and D.

Critical Gap Analysis - Because of high peak hour traffic volumes on Prince Albert Road, the critical traffic movement at this intersection is the left turn from Glenwood Avenue to Prince Albert Road westbound. Synchro 8.0, the intersection performance software used to evaluate level of service during peak hours, considers 6.8 seconds as the critical two-way gap for a single vehicle to left turn to a four lane street, and also uses a 3.5 second follow-up gap for a second vehicle to turn left immediately after the first vehicle. A total gap longer than 10.3 seconds allows two or more vehicles to turn left utilizing the same gap.

Evaluation of gap data obtained during the manual count indicated the following gaps were available in Prince Albert Road peak hour traffic during the count periods in September 2014:

- **AM peak hour** - 112 gaps longer than the 6.8 second critical gap and 37 gaps longer than the minimum required 10.3 seconds with follow-up gap. This indicates that 149 vehicles could have turned left from Glenwood Avenue during the AM peak hour.
- **PM peak hour** - 64 gaps longer than the 6.8 second critical gap and 25 gaps longer than the minimum required 10.3 seconds with follow-up gap. This indicates that 89 vehicles could have turned left from Glenwood Avenue during the PM peak hour.

Trip Generation - Trip generation estimates for the 110 apartment units and 5,719 square feet of ground floor commercial space, prepared using published trip generation rates from *Trip Generation, 9th Edition*, are included in Table 1. The commercial space is expected to include businesses of a neighborhood nature. It is estimated that the proposed development will generate 40 two-way vehicle trips (12 vph entering and 28 vph exiting) during the AM peak hour and 55 two-way vehicle trips (31 vph entering and 24 vph exiting) during the PM peak hour.

Table 1 - Trip Generation Estimates for the Proposed Development									
Land Use ¹	Number Units ²	Trip Generation Rates ³				Trips Generated ⁴			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
High-Rise Apt (Land Use 222)	110	0.075	0.225	0.21	0.14	8	25	24	15
Specialty Retail (Use Code 826) ⁵	5,719 KGLA	0.76	0.60	1.19	1.52	4	3	7	9
Total Trip Estimates for the Site						12	28	31	24
NOTES: 1. Land Use Codes are from <i>Trip Generation, 9th Edition</i> , Institute of Transportation Engineers, Washington, 2012. 2. 'Number of residential units' for Apartments; 'Gross Leasable Area x 1000 square feet' for Specialty Retail. 3. Trip generation rates are 'vehicles per hour per unit' for Apartments and 'vehicles per hour per 1000 sq. ft.' for Retail space. 4. Trips generated are 'vehicles per hour' for AM and PM peak hours. 5. Specialty Retail (Land Use 826) rates have been used. Since there are no published rates for the AM peak hour for this Land Use, and since AM peak hour trips to Specialty Retail are generally lower than PM rates, AM trip rates have been assumed to be 50% of the PM rate with reversal of the directional split.									

Trip Distribution and Assignment - AM and PM peak hour site generated trips have been distributed and assigned to the Prince Albert Road / Glenwood Avenue intersection generally in accordance with existing Glenwood Avenue turning volumes obtained from the turning movement count. Site generated trips are shown diagrammatically in Figure A-2, Boxes A and B. Site generated trips have been added to the projected 2016 peak hour volumes to provide projected 2016 AM and PM peak hour volumes that include site generated trips, which are shown diagrammatically in Figure A-2, Boxes C and D.

Traffic Signal Warrant Principles - A signal warrant analysis is completed to determine if the installation of traffic signals at an intersection will provide a positive impact on total intersection operation. That is, the benefits in time saved and improved safety that will accrue to vehicles entering from a side street will exceed the impact that signals will have in time lost and potential additional collisions for vehicles approaching the intersection on the main street. The *Canadian Traffic Signal Warrant Matrix Analysis (Transportation Association of Canada (TAC), 2005)* considers 100 warrant points, and higher than 75 vph average approach volume on the side street, as an indication that traffic signals will provide a positive impact. Signal warrant analysis uses vehicular and pedestrian volumes, and intersection, roadway and study area characteristics to calculate a warrant point value.

Summary Signal Warrant Analysis - Traffic signal warrant analyses, completed for projected 2016 volumes without and with site generated trips, are included in Tables A-2 and A-3, Appendix A. Traffic signals are not warranted at the intersection since calculated priority points, 24 without the site and 36 with the site, are significantly less than the 100 points required to warrant installation of traffic signals.

Level of Service Analysis - The level or quality of performance of an intersection in terms of traffic movement is determined by a level of service (LOS) analysis. LOS criteria (Table 2) are stated in terms of average control delay per vehicle which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. While drivers judge the quality of intersection performance by how long they must wait at a red light or a STOP sign, traffic engineers also use volume / capacity (v/c) ratio and 95th % queue to evaluate performance of an intersection approach.

A **v/c ratio** is a measure of how the peak hour volume on an approach to an intersection compares to the capacity of that intersection approach. While the capacity of an intersection approach at a signalized intersection depends on the number of lanes and the amount of green time, the capacity of a Stop sign approach is determined by the volume on the through street. Approaches with volumes less than 50% of capacity (v/c ratios less than 0.50) usually have low or no congestion, and a v/c ratio up to 0.75 is usually associated with moderate congestion. While a v/c ratio of less than 0.85 suggests that the approach has residual capacity available, it is also an indication that mitigative measures must be considered if higher volumes are to be accommodated in future years.

The **95th % queue** is the estimated length in meters of a line of vehicles stopped on an intersection approach that is only exceeded 5% of the time. Since a stopped vehicle occupies about six meters of queue length, 95th % queue lengths of two or three meters indicate that there will rarely be a vehicle stopped on an approach, and a 95th % queue of 12 meters indicates that 5 times out of 100 only two vehicles would be expected to be stopped on the approach.

Synchro 8.0 software has been used for performance evaluation of projected 2016 AM and PM peak hourly volumes both without and with added site generated trips. Analysis results are included on Pages A-6 to A-9 and results are summarized in Table 3.

Table 2 - Level of Service (LOS) Criteria for Intersections		
LOS	LOS Description	Two Way Stop Controlled (TWSC) Intersections Control Delay (seconds per vehicle)
A	Very low delay at the STOP sign (Excellent)	less than 10.0
B	Slightly higher delay at the STOP sign (Very Good)	between 10.0 and 15.0
C	Higher level of congestion; queue at the STOP sign may be two vehicles; main street may experience slight delays caused by left turning vehicles (Good)	between 15.0 and 25.0
D	Congestion becomes noticeable; vehicles must wait longer periods of time at the STOP sign; queues get longer (Satisfactory)	between 25.0 and 35.0
E	Delays at the STOP sign increase; queues at the STOP sign are often five or six vehicles; considered by many agencies to be the limit of acceptable delay	between 35.0 and 50.0
F	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates at the STOP sign exceed the capacity of the intersection (Unacceptable)	greater than 50.0

Critical Limits for Intersection Evaluation - Halifax Guidelines for Preparation of Transportation Impact Studies indicate the following critical limits for intersection evaluation:

- the v/c ratio of an intersection exceeds 0.85;
- the v/c ratio of an individual through movement or shared through/ turning movement exceeds 0.85;
- the v/c ratio of an exclusive turning movement exceeds 1.0;
- an exclusive turning movement generates queues which exceed the available turning lane storage space.

Summary Level of Service Analysis - The intersection now operates with very low delays on Prince Albert Road, low to moderate delays on Glenwood Avenue, and with v/c ratios that are considerably lower than Halifax critical limits. Site generated trips are not expected to have any significant impact to the level of performance of the intersection. Also, the projected 2016 number of left turning vehicles from Glenwood Avenue that include site generated trips (AM peak hour 33 vph; PM peak hour 17 vph; Figure A-2, Boxes C and D) are significantly lower than the calculated available gaps for left turning vehicles (149 vph AM peak hour and 89 vph PM peak hour) discussed in the *Critical Gap Analysis* section on Page 3.

Table 3 - LOS for Prince Albert Road / Glenwood Avenue Intersection						
LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95 th % Queue (m) by Intersection Movement					Intersection Average Delay
	EB-T	EB-TR	WB-LT	WB-T	NB-LR	
AM Peak Hour - Projected 2016 Volumes without Site (Page A-6)						
Delay	0.0	0.0	0.9	0.0	16.7	1.0
v/c	0.22	0.11	0.35	0.38	0.21	-
Queue	0.0	0.0	0.6	0.0	5.9	-
AM Peak Hour - Projected 2016 Volumes with Site (Page A-8)						
Delay	0.0	0.0	1.3	0.0	18.1	1.5
v/c	0.22	0.11	0.36	0.38	0.29	-
Queue	0.0	0.0	0.9	0.0	9.0	-
PM Peak Hour - Projected 2016 Volumes without Site (Page A-7)						
Delay	0.0	0.0	3.5	0.0	23.3	1.1
v/c	0.42	0.21	0.46	0.27	0.18	-
Queue	0.0	0.0	2.5	0	4.9	-
PM Peak Hour - Projected 2016 Volumes with Site (Page A-9)						
Delay	0.0	0.0	4.7	0.0	30.2	1.9
v/c	0.42	0.22	0.50	0.27	0.33	-
Queue	0.0	0.0	3.8	0.0	10.4	-

Other Approved Developments in the Study Area - Contact with Halifax planning and development officials revealed that Twin Lakes Condominium, an 83 unit building proposed on Bartlin Road during 2005, is the only previously approved and not yet constructed project near the Prince Albert Road / Glenwood Avenue intersection. A traffic impact statement prepared in September, 2005, estimated that the proposed 83 unit development would generate about 28 two-way vehicles trips (5 vph entering and 23 vph exiting) during the AM peak hour and 32 two-way vehicle trips (20 vph entering and 12 vph exiting) during the PM peak hour. The conclusion that the low number of site generated trips would not have any significant impact on the performance of Prince Albert Road is still considered to be applicable.

Summary -

1. The proposed project at the southeast corner of the Prince Albert Road / Glenwood Avenue intersection in Dartmouth will include a 14 storey building plus penthouse with approximately 110 apartment units and 5,719 square feet of ground floor commercial space.
2. A driveway on Glenwood Avenue at the south end of the building will serve an underground parking facility with approximately 147 spaces. Since the parking garage entrance is set back approximately 7.5 m (24.75 ft.) from the edge of the right-of-way, there should be adequate visibility between drivers exiting the garage and pedestrians on any future sidewalk.

3. Trip generation estimates for the proposed development include 40 two-way vehicles trips (12 vph entering and 28 vph exiting) during the AM peak hour and 55 two-way vehicle trips (31 vph entering and 24 vph exiting) during the PM peak hour.
4. Metro Transit Route 62 (Wildwood) which serves Prince Albert Road with a bus stop near Glenwood Avenue provides connections to the Penhorn and Bridge Halifax Transit Terminals, as well as to the Alderney Ferry Terminal.
5. Existing 2014 two-way volumes on Prince Albert Road west of the intersection include 1,400 vehicles per hour (vph) during the AM peak hour and 1,605 vph during the PM peak hour. Existing left turning traffic from Glenwood Avenue to Prince Albert Road westbound includes 25 vph during the AM peak hour and 10 vph during the PM peak hour.
6. Projected 2016 left turning vehicles from Glenwood Avenue that include site generated trips (AM peak hour 33 and PM peak hour 17) are significantly lower than the available gaps in Prince Albert Road traffic for left turning vehicles (149 vph AM peak hour and 89 vph PM peak hour).
7. Traffic signals are not warranted at the intersection since calculated priority points, 24 without the site and 36 with the site, are significantly less than the 100 points required to warrant installation of traffic signals.
8. The Prince Albert Road / Glenwood Avenue intersection will continue to operate with very low average delays on Prince Albert Road, low to moderate delays on Glenwood Avenue, and with v/c ratios that are considerably lower than Halifax critical limits, with the addition of site generated trips.
9. An 83 unit building proposed on Bartlin Road during 2005 is the only known previously approved and not yet constructed project near the Prince Albert Road / Glenwood Avenue intersection. A previously completed study estimated that the development would generate about 28 two-way vehicle trips during the AM peak hour and 32 trips during the PM peak hour.

Conclusions

10. The low number of estimated site trips for the 83 unit building on Bartlin Road proposed in 2005 is not expected to have any significant impact on the performance of Prince Albert Road.
11. Site generated trips from the proposed *Monaco Investments Partnership* building are not expected to have any significant impact on the performance of Prince Albert Road, Glenwood Avenue, or the regional street network.

If you have any questions or comments, please contact me by Email to ken.obrien@wspgroup.com or telephone 902-443-7747.

Sincerely:



Ken O'Brien, P. Eng.
Senior Traffic Engineer
WSP Canada Inc.



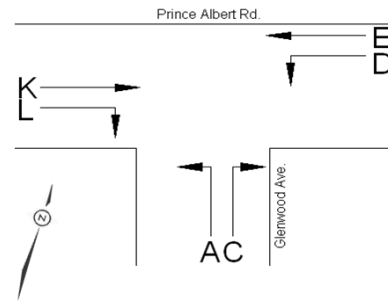
Table A-1
Prince Albert Road
@
Glenwood Avenue

Dartmouth, Nova Scotia

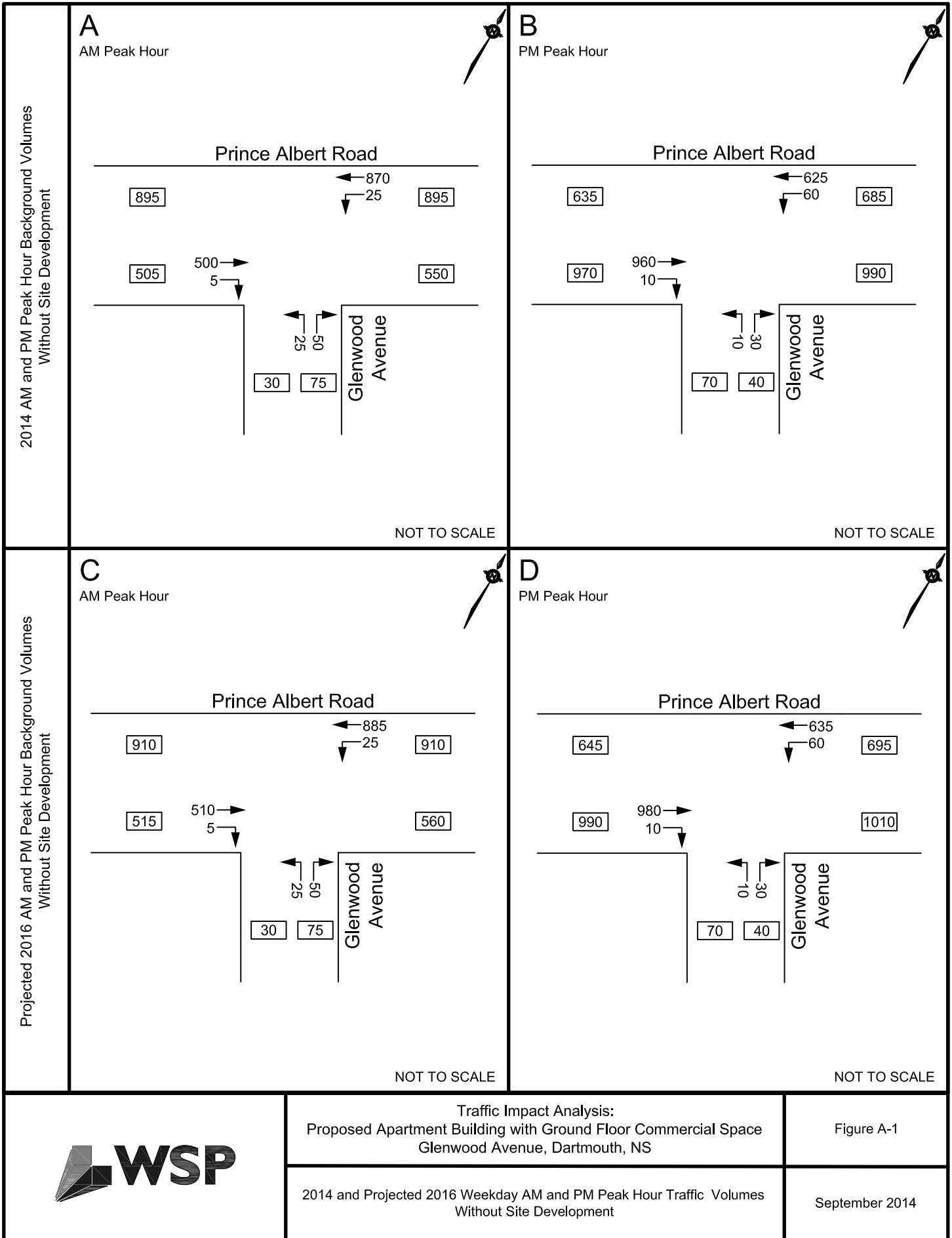
AM: Thursday, September 24, 2014

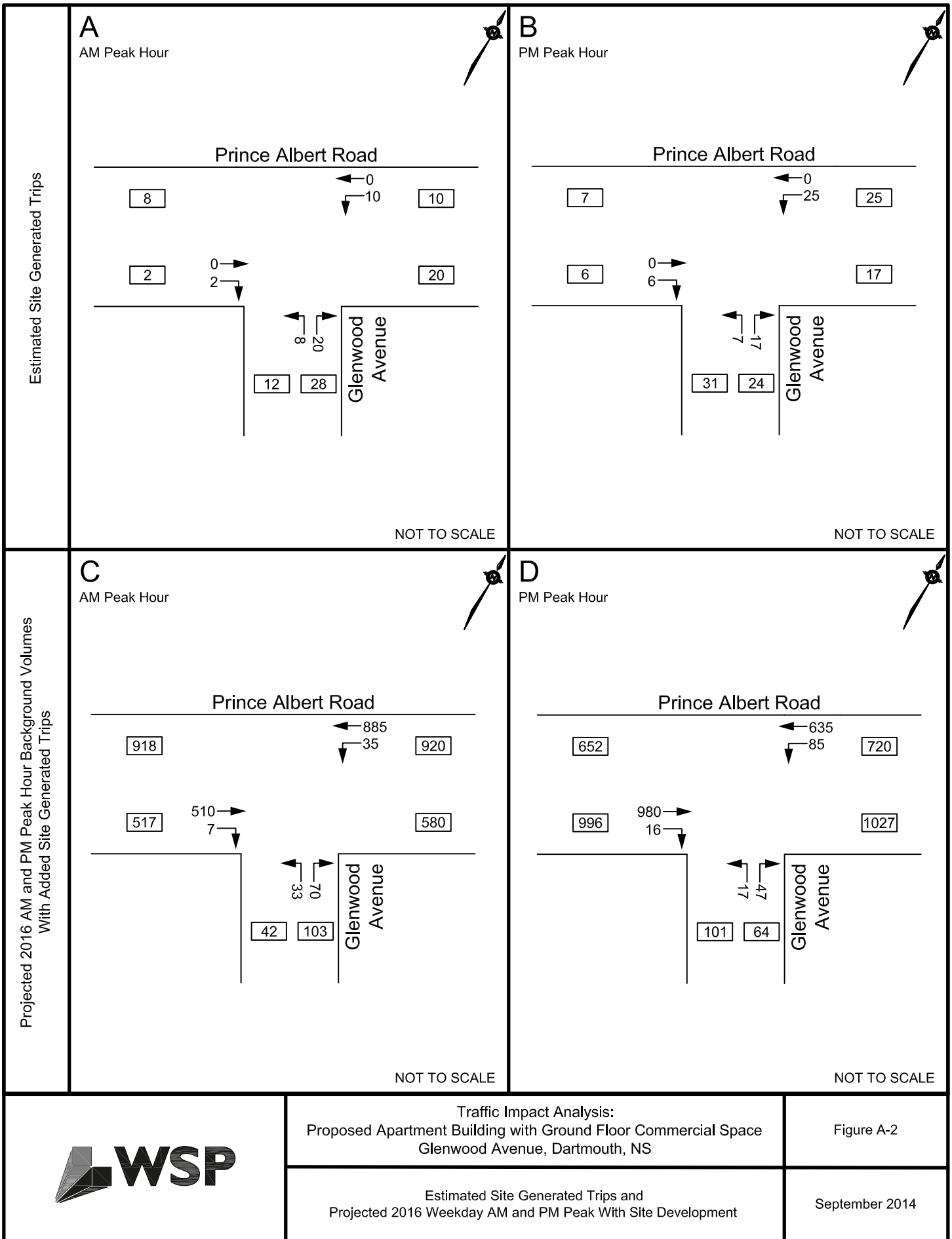
Noon: Wednesday, September 17, 2014

PM: Wednesday, September 23, 2014



Time	Glenwood Ave. Northbound Approach		Prince Albert Rd. Westbound Approach		Prince Albert Rd. Eastbound Approach		Total Vehicles
	A	C	D	E	K	L	
07:00 07:15	5	7	8	163	66	1	250
07:15 07:30	3	7	4	210	91	2	317
07:30 07:45	8	11	6	170	99	2	296
07:45 08:00	5	18	8	173	138	1	343
08:00 08:15	9	16	4	207	108	1	345
08:15 08:30	4	13	6	235	145	2	405
08:30 08:45	6	9	5	211	111	2	344
08:45 09:00	5	10	8	215	138	1	377
07:00 08:00	21	43	26	716	394	6	1206
08:00 09:00	24	48	23	868	502	6	1471
AM Peak Hour	24	48	23	868	502	6	1471
11:30 11:45	5	4	10	76	67	4	166
11:45 12:00	0	3	11	124	151	3	292
12:00 12:15	2	2	12	110	150	2	278
12:15 12:30	2	4	9	109	144	4	272
12:30 12:45	1	6	11	134	138	6	296
12:45 13:00	3	2	11	162	123	2	303
13:00 13:15	1	4	12	124	152	4	297
13:15 13:30	2	1	5	111	151	1	271
11:30 12:30	9	13	42	419	512	13	1008
12:30 13:30	7	13	39	531	564	13	1167
Noon Peak Hour	7	16	43	529	557	16	1168
15:30 15:45	0	12	12	119	221	4	368
15:45 16:00	0	13	11	141	217	5	387
16:00 16:15	4	5	13	139	242	3	406
16:15 16:30	4	16	12	141	229	5	407
16:30 16:45	1	2	11	158	271	3	446
16:45 17:00	4	3	15	144	215	1	382
17:00 17:15	3	7	21	181	247	3	462
17:15 17:30	4	9	10	158	210	7	398
15:30 16:30	8	46	48	540	909	17	1568
16:30 17:30	12	21	57	641	943	14	1688
PM Peak Hour	12	28	59	624	962	12	1697





2005 Canadian Traffic Signal Warrant Matrix Analysis

Table A-2 Prince Albert Road @ Glenwood Avenue - 2016 volumes without Site

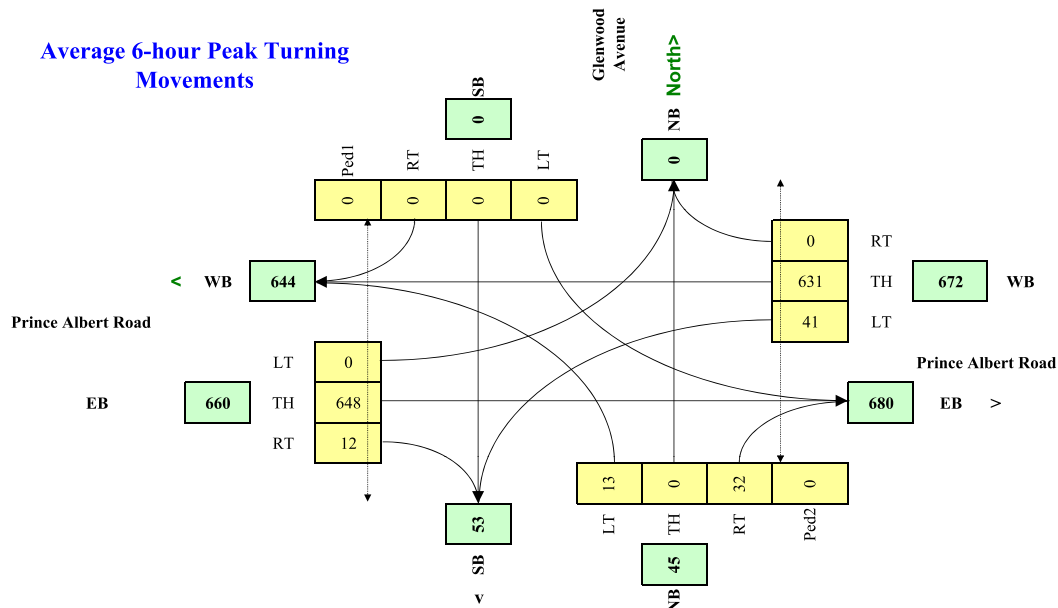
Main Street (name)	Prince Albert Road		Direction (EW or NS)		EW	Date:		September 2014	
Side Street (name)	Glenwood Avenue		Direction (EW or NS)		NS	City:		Halifax	
Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Prince Albert Road	WB		1	1			350	2	
Prince Albert Road	EB			1	1			2	
Glenwood Avenue	NB			1					
Glenwood Avenue	SB								

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Prince Albert Road	EW	50	2.0%	y	0.0
Glenwood Avenue	NS		2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:00 - 8:00	0	0	0	0
8:00 - 9:00	0	0	0	0
11:00 - 12:00	0	0	0	0
12:00 - 13:00	0	0	0	0
15:30 - 16:30	0	0	0	0
16:30 - 17:30	0	0	0	0
Total (6-hour peak)	0	0	0	0
Average (6-hour peak)	0	0	0	0

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	370,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	20	0	45	0	0	0	25	730	0	0	400	5
8:00 - 9:00	25	0	50	0	0	0	25	885	0	0	510	5
11:00 - 12:00	10	0	15	0	0	0	45	425	0	0	520	15
12:00 - 13:00	5	0	15	0	0	0	40	540	0	0	575	15
15:30 - 16:30	10	0	45	0	0	0	50	550	0	0	925	15
16:30 - 17:30	10	0	20	0	0	0	60	655	0	0	960	15
Total (6-hour peak)	80	0	190	0	0	0	245	3,785	0	0	3,890	70
Average (6-hour peak)	13	0	32	0	0	0	41	631	0	0	648	12



$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p}) L) / K_2] \times C_i$$

$$W = \begin{matrix} 24 & 24 & 0 \\ & Veh & Ped \end{matrix}$$

Not Warranted - Vs<75

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table A-3 Prince Albert Road @ Glenwood Avenue - 2016 volumes with Site

Main Street (name)	Prince Albert Road		Direction (EW or NS)		EW	Date:	September 2014	
Side Street (name)	Glenwood Avenue		Direction (EW or NS)		NS	City:	Halifax	

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Prince Albert Road	WB		1	1			350	2	
Prince Albert Road	EB			1	1			2	
Glenwood Avenue	NB			1					
Glenwood Avenue	SB								

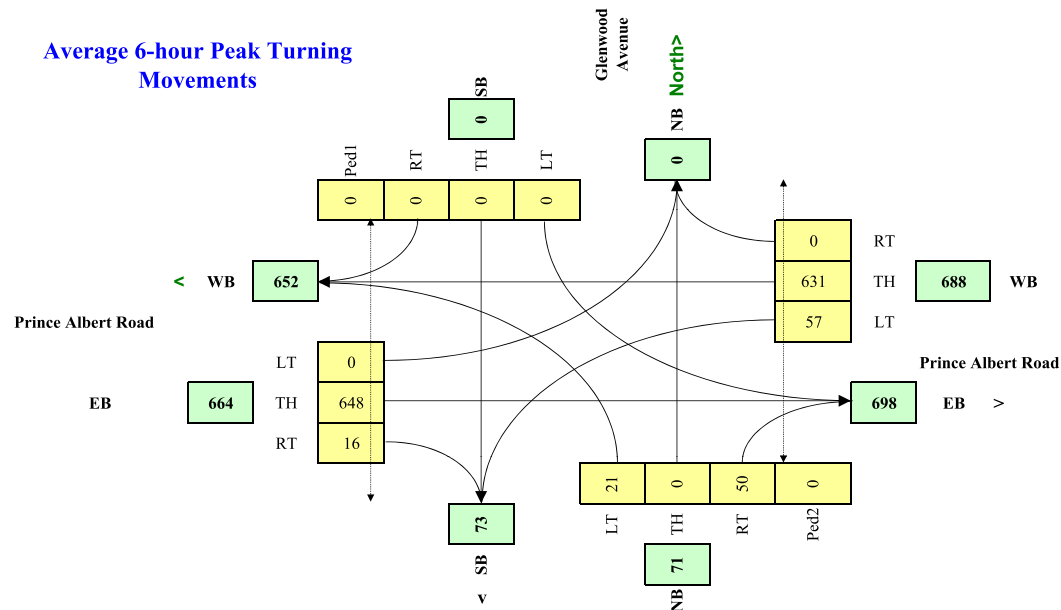
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Prince Albert Road	EW	50	2.0%	y	0.0
Glenwood Avenue	NS		2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:00 - 8:00	0	0	0	0
8:00 - 9:00	0	0	0	0
11:00 - 12:00	0	0	0	0
12:00 - 13:00	0	0	0	0
15:30 - 16:30	0	0	0	0
16:30 - 17:30	0	0	0	0
Total (6-hour peak)	0	0	0	0
Average (6-hour peak)	0	0	0	0

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	370,000
Central Business District	(y/n)	n

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	370,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	30	0	65	0	0	0	35	730	0	0	400	10
8:00 - 9:00	30	0	70	0	0	0	35	885	0	0	510	10
11:00 - 12:00	15	0	30	0	0	0	55	425	0	0	520	15
12:00 - 13:00	15	0	30	0	0	0	55	540	0	0	575	15
15:30 - 16:30	15	0	65	0	0	0	75	550	0	0	925	25
16:30 - 17:30	20	0	40	0	0	0	85	655	0	0	960	20
Total (6-hour peak)	125	0	300	0	0	0	340	3,785	0	0	3,890	95
Average (6-hour peak)	21	0	50	0	0	0	57	631	0	0	648	16



$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p}) L) / K_2] \times C_i$$

$$W = \begin{matrix} 36 & 36 & 0 \\ & Veh & Ped \end{matrix}$$

Not Warranted - $V_s < 75$

1: Glenwood Avenue & Prince Albert Road

2016 AM Peak Hour without Site Development (FIG A1-C)

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	510	5	25	885	25	50
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	554	5	27	962	27	54
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			560		1092	280
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			560		1092	280
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		87	92
cM capacity (veh/h)			1007		203	717
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	370	190	348	641	82	
Volume Left	0	0	27	0	27	
Volume Right	0	5	0	0	54	
cSH	1700	1700	1007	1700	389	
Volume to Capacity	0.22	0.11	0.03	0.38	0.21	
Queue Length 95th (m)	0.0	0.0	0.6	0.0	5.9	
Control Delay (s)	0.0	0.0	0.9	0.0	16.7	
Lane LOS			A		C	
Approach Delay (s)	0.0		0.3		16.7	
Approach LOS					C	
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			53.6%		ICU Level of Service	A
Analysis Period (min)			15			

1: Glenwood Avenue & Prince Albert Road

2016 PM Peak Hour without Site Development (FIG A1-D)

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	980	5	60	635	10	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1065	5	65	690	11	33
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			1071		1543	535
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1071		1543	535
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		89	93
cM capacity (veh/h)			647		95	490
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	710	361	295	460	43	
Volume Left	0	0	65	0	11	
Volume Right	0	5	0	0	33	
cSH	1700	1700	647	1700	240	
Volume to Capacity	0.42	0.21	0.10	0.27	0.18	
Queue Length 95th (m)	0.0	0.0	2.5	0.0	4.9	
Control Delay (s)	0.0	0.0	3.5	0.0	23.3	
Lane LOS			A		C	
Approach Delay (s)	0.0		1.4		23.3	
Approach LOS					C	
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			59.9%		ICU Level of Service	B
Analysis Period (min)			15			

1: Glenwood Avenue & Prince Albert Road

2016 AM Peak Hour with Site Development (FIG A2-C)

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	510	7	35	885	33	70
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	554	8	38	962	36	76
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			562		1115	281
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			562		1115	281
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		82	89
cM capacity (veh/h)			1005		194	716
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	370	192	359	641	112	
Volume Left	0	0	38	0	36	
Volume Right	0	8	0	0	76	
cSH	1700	1700	1005	1700	385	
Volume to Capacity	0.22	0.11	0.04	0.38	0.29	
Queue Length 95th (m)	0.0	0.0	0.9	0.0	9.0	
Control Delay (s)	0.0	0.0	1.3	0.0	18.1	
Lane LOS			A		C	
Approach Delay (s)	0.0		0.5		18.1	
Approach LOS					C	
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization			55.9%		ICU Level of Service	B
Analysis Period (min)			15			

1: Glenwood Avenue & Prince Albert Road

2016 PM Peak Hour with Site Development (FIG A2-D)

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	980	16	85	635	17	47
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1065	17	92	690	18	51
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			1083		1604	541
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1083		1604	541
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			86		78	89
cM capacity (veh/h)			640		82	485
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	710	372	322	460	70	
Volume Left	0	0	92	0	18	
Volume Right	0	17	0	0	51	
cSH	1700	1700	640	1700	211	
Volume to Capacity	0.42	0.22	0.14	0.27	0.33	
Queue Length 95th (m)	0.0	0.0	3.8	0.0	10.4	
Control Delay (s)	0.0	0.0	4.7	0.0	30.2	
Lane LOS			A		D	
Approach Delay (s)	0.0		1.9		30.2	
Approach LOS					D	
Intersection Summary						
Average Delay			1.9			
Intersection Capacity Utilization			61.5%		ICU Level of Service	B
Analysis Period (min)			15			