



Ref. No. 151-00564 Task 5

June 23, 2016

Ms. Ashley Blissett, P. Eng.  
Senior Development Engineer  
Halifax Regional Municipality  
PO Box 1749  
HALIFAX NS B3J 3A5

**RE: Revised Addendum to the Traffic Impact Study - Proposed Mixed Use Development,  
Northeast Corner Young Street / Windsor Street Intersection  
(WSP Canada Inc., September 2013 and June 2015)**

Dear Ms. Blissett:

We are responding to comments in your Memorandum of June 6, 2016, to Andrew Bone, HRM Planner, with regards to a Traffic Impact Study (September 2013) and an Addendum to the Study (June 2015) that were prepared by WSP Canada Inc. Item 2 of the Memorandum includes six 'bullets' and the following includes a discussion of each comment.

1. *"A 25% reduction for pedestrian / cycling / transit / on-site synergies appears high for this area. The consultant is required to provide justification for HRM's consideration."*

A 25% reduction is appropriate, in our opinion, for the following reasons:

- *Pedestrian access* - The site is near a major employment center, is within one block of the Superstore shopping area as well a development under construction on the south side of Young Street to the east, and is within walking distance to Halifax Shopping Center.
- *Cycling* - HRM has provided bicycle lanes on Windsor Street adjacent to the site which provides a reasonably flat cycling route between north end Halifax and Quinpool Road area.
- *Transit* - Many Halifax Transit routes which service Windsor Street, Bayers Road, and Young Street adjacent to, or near, the site will allow transfer and connections to other Metro Transit and Ferry services.
- *On-Site Synergies* - Since the proposed deployment considered in the June 2015 Addendum includes 351 apartment units, 48,717 SF of office space and 28,490 SF of retail space, it is probable that there will be many on-site trips between the mix of land uses.

2. *The average trip generation rates appear to have been used rather than the equations which result in a higher number of trips generated. The equations are recommended for use when possible. Explanation / rational is required to be provided to HRM as to the reason the equations were not used. Every additional trip counts at this location due to the existing capacity issues.*

When using the published trip generation rates in *Trip Generation, 9<sup>th</sup> Edition* (Institute of Transportation Engineers, 2012) the traffic engineer's objective should be to provide a realistic estimate of the number of trips that will be generated. Since the 'fitted curve' and 'average rate curve' for High Rise Apartment (Land Use 222, Pages 376 and 377) and those for Specialty Retail (Land Use 826, Page 1580) are similar, we have generally used the average rates. For General Office Building (Land Use 710), *Trip Generation, 9<sup>th</sup> Edition*, includes the following cautionary note on Page 1250:

“Some of the regression curves plotted for this land use may produce illogical trip-end estimates for small office buildings. When the proposed site size is significantly smaller than the average-sized facility published in this report, caution should be used when applying these statistics.”

Since the proposed office area of 48,717 SF is significantly less than the average sized facilities of 222,000 SF (AM peak hour, Page 1260) and 215,000 SF (PM peak hour, Page 1261), engineering judgement would dictate that the average trip generations rates for Land Use 710 are appropriate for this site.

3. *Trip distributions differ between AM & PM peaks. As this information is available, separate trip distributions are to be used.*

WSP has usually based trip distribution estimates on local knowledge of the area, as a result of members of our team living and working in Halifax for many decades, and a review of available traffic volumes in the area. While AM and PM peak hours will have different directional splits, trip distribution does not necessarily differ for the two time periods. Trip distributions for the Bayers Road / Young Street @ Windsor Street intersection assumed in our September 2013 Report and from a turning movement count obtained by HRM Traffic Management on September 2014 are compared in Table RA-1. The adjusted trip distribution percentages included in Table RA-1 have been used for both AM and PM peak hour traffic assignment of site generated trips for analysis in this Revised Addendum.

Table RA-1 - Trip Distribution at Bayers Road / Young Street @ Windsor Street Intersection				
Direction	Percent Trip Distribution (Two-Way Traffic)			
	Assumed September 2013 <sup>1</sup>	AM Count September 2014 <sup>2</sup>	PM Count September 2014 <sup>2</sup>	Adjusted Values June 2016 <sup>3</sup>
North	20	23	23	22.5
East	30	28	28	27.5
South	25	25	25	25.0
West	25	24	24	25.0
NOTES: 1. <i>Traffic Impact Study - Proposed Mixed Use Development, Northeast Corner Young Street / Windsor Street Intersection, WSP Canada Inc., September 2013, Page 5</i> 2. <i>Turning movement count, HRM Traffic Management, September 23, 2014 (Appendix A, Pages A-1 and A-2, this Revised Addendum).</i> 3. <i>Trip distribution percentages have been adjusted for use in traffic assignment of site generated trips for analysis in this Revised Addendum.</i>				

4. *Although the existing volume / capacity ratio is above the HRM recommended guidelines, it is the responsibility of the developer to mitigate further effects to the intersection capacity by the added traffic of the development. Proposed solutions shall be provided by the traffic consultant.*

Although we question how far the developer's consultant should be required to find solutions to an intersection that is already operating outside the performance criteria used by HRM, we have reviewed signal phasing and timing to determine if changes are possible to enhance performance.

5. As there are already capacity issues at this intersection, the additional volumes represented in the addendum (dated June 2015) are to be included to provide updated LOS and v/c ratios. See response under Item 6.
6. The driveway on Young Street is required to be right-out only, with both right and left turns into the site permitted.

The following tasks have been completed to provide updated LOS and v/c ratio analyses for the Bayers Road / Young Street @ Windsor Street intersection in response to Items 5 and 6:

**Background 2014 Volumes** - AM peak hourly volumes (8:00 AM to 9:00 AM) and PM peak hourly volumes (4:00 PM to 5:00 PM) from a turning movement count obtained by HRM on September 23, 2014 (Appendix A, Pages A-1 and A-2) are shown diagrammatically on Figure A-3, Boxes A and B.

**Projected 2021 Background Volumes** - While September 2014 volumes are lower than the December 2012 volumes used in the September 2013 Report, an annual volume growth rate of 0.5% has been to provide projected 2021 volumes which are shown diagrammatically on Figure A-3, Boxes C and D.

**Trip Generation** - Trip generation estimates for the development, prepared using published trip generation rates from *Trip Generation, 9<sup>th</sup> Edition*, are included in Table RA-2. Since there is expected to be high pedestrian / cycling / transit usage, as well as some on-site synergies on the mixed use site, a 25% reduction has been applied to site generated vehicle trip estimates. After adjustments for on-site synergies and non-vehicle trips by site occupants, it is estimated that the site will generate 165 two-way vehicle trips (86 entering and 79 exiting) during the AM peak hour and 204 two-way trips (91 entering and 113 exiting) during the PM peak hour.

Table RA-2 - Trip Generation Estimates for Proposed Development									
Land Use <sup>1</sup>	Units <sup>2</sup>	Trip Generation Rates <sup>3</sup>				Trips Generated <sup>3</sup>			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
High-Rise Apt (Land Use 222)	351	0.075	0.225	0.21	0.14	26	79	75	48
Specialty Retail (Land Use 826) <sup>4</sup>	28.49 KGLA	0.76	0.60	1.19	1.52	22	17	34	43
General Office (Land Use 710)	48.717 KGFA	1.37	0.19	0.25	1.24	67	9	12	60
Trip Generation Estimates for the Proposed Development						115	105	121	151
25% Reduction in Trip Generation Estimates - High Pedestrian / Transit Usage <sup>5</sup>						29	26	30	38
<b>Adjusted Trip Generation Estimates for Proposed Development</b>						<b>86</b>	<b>79</b>	<b>91</b>	<b>113</b>
NOTES: 1. Rates are for the indicated Land Use Codes, <i>Trip Generation, 9th Edition</i> , Institute of Transportation Engineers, 2012. 2. KGFA is 'Gross Floor Area x 1000 square feet'; KGLA is 'Gross Leasable Area x 1000 square feet'. 3. Rates are 'vehicles per hour per unit'; Trips generated are 'vehicles per hour for peak hours'. 4. Since there are no published rates for the AM peak hour for Specialty Retail (Land Use 826), 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. 5. Since high pedestrian / cycling / transit usage is expected in the Study Area, and there will be on-site synergies between the residential, office and retail and uses, a 25% reduction has been applied to site generated trip estimates to account for non-vehicle trips generated by the site..									

***Trip Distribution and Assignment*** - Trips have been distributed in accordance with the percentages shown in the last column of Table RA-1. Assignment has been completed with the following considerations and site generated trips are shown diagrammatically on Figure A-4, Boxes A and B:

- Right in, right-out, and left-in movements only are permitted at the Young Street driveway.
- Entering vehicles from the east have been assigned to the Young Street driveway. Exiting vehicles that would have been distributed to the east (left) at the Young Street driveway, have been assigned with 25% right turns at the Young Street driveway and 75% to the Windsor Street driveway, and then have been directed south on Windsor Street.
- Entering trips from the north and south have been assigned to the Windsor Street driveway.
- Exiting vehicle to the north have been assigned to the Windsor Street driveway. Exiting vehicles to the south have been assigned with 75% to the Windsor Street driveway and 25% to the Young Street driveway.
- Entering and exiting vehicles to and from the west have been assigned with 50% of trips to each of the Windsor Street and Young Street driveways.

***Projected 2021 Volumes with Site Trips*** - Site generated trips have been added to projected 2021 background volumes (Figure A-3, Boxes C and D) to provide projected 2021 volumes that include site generated trips which are shown diagrammatically in Figure A-4, Boxes C and D.

***Level of Service Analyses*** - The level or quality of performance of an intersection in terms of traffic movement is determined by a level of service (LOS) analysis. LOS for intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and increased travel time. LOS criteria 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.

*Synchro 9.0* software has been used for evaluation of AM and PM peak hours at the Windsor Street @ Bayers Road / Young Street intersection for projected 2021 AM and PM peak hour volumes without and with site generated trips. Existing signal phasing and timing obtained from HRM on June 21, 2016, were used for the 2021 analyses without the site. The cycle length and signal timing were modified for the 2021 analyses with site traffic to mitigate effects of background and added site traffic. LOS analysis sheets are included in Appendix A, Page A-5 to A-8 and results are summarized in the Table RA-3.

***HRM Critical Limits for Intersection Performance Evaluation*** - The HRM *Guidelines for Preparation of Transportation Impact Studies* indicates the following critical limits for intersection evaluation:

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

***Summary Level of Service Analysis*** - LOS results summarized in Table RA-3 indicate:

1. While the NB-TR movement has a v/c ratio of 0.90 for projected 2021 PM peak hourly background volumes which is greater than the HRM limit of 0.85 for a shared through/ turning movement, all other movements operate within HRM performance criteria for projected 2021 AM and PM peak hourly background volumes without site trips.

- With changes to signal timing, all intersection approaches are expected to operate within HRM performance criteria for projected 2021 AM and PM peak hourly volumes with added site generated trips.

Table RA-3 - LOS for Windsor Street @ Bayers Road / Young Street Intersection									
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement								Overall Intersection LOS
	EB-L	EB-TR	WB-L	WB-TR	NB-L	NB-TR	SB-L	SB-TR	
AM Peak Hour - Projected 2021 Background Volumes without Site (Page A-5)									
Delay	21.7	30.7	13.5	11.3	83.1	51.4	30.7	46.9	36.1
v/c	0.13	0.69	0.17	0.19	0.79	0.83	0.50	0.85	-
Queue	17.4	167.4	12.7	27.2	38.2	92.2	26.8	131.4	-
AM Peak Hour - Projected 2021 Volumes with Site (Page A-7)									
Delay	24.7	35.2	16.3	13.6	87.7	47.2	28.6	46.1	37.1
v/c	0.16	0.73	0.23	0.21	0.82	0.79	0.48	0.85	-
Queue	21.8	194.8	16.4	32.7	38.9	96.7	25.7	139.8	-
PM Peak Hour - Projected 2021 Background Volumes without Site (Page A-6)									
Delay	30.2	31.5	16.9	18.1	24.3	43.8	119.8	34.6	33.2
v/c	0.33	0.60	0.28	0.43	0.55	0.90	0.96	0.61	-
Queue	27.8	102.3	20.9	60.8	36.5	169.7	45.4	77.2	-
PM Peak Hour - Projected 2021 Volumes with Site (Page A-8)									
Delay	39.6	41.4	23.0	23.3	24.8	39.0	74.1	34.4	34.0
v/c	0.42	0.69	0.37	0.46	0.57	0.85	0.78	0.62	-
Queue	37.5	138.8	30.0	80.5	35.4	160.2	41.6	90.5	-

### Recommendations -

- HRM should monitor traffic volumes at the Windsor Street @ Bayers Road / Young Street intersection to determine when signal timing changes are required during the next five years to mitigate traffic volume changes.
- While it is understood that left turns from the Young Street site driveway will not be permitted, the existing proposed driveway width should be retained and marked with four meter wide entrance and exits lanes with a painted center median.

### Conclusion -

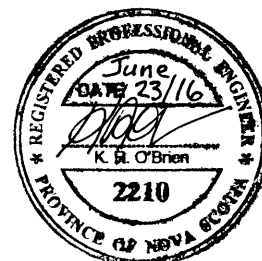
With changes to traffic signal timing, site generated trips are not expected to have any significant impact to the operational performance of the Windsor Street @ Bayers Road / Young Street intersection.

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

Sincerely:



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



# VEHICULAR GRAPHIC SUMMARY SHEET

Page A-1

INTERSECTION :

BAYERS ROAD AT YOUNG STREET AND WINDSOR STREET

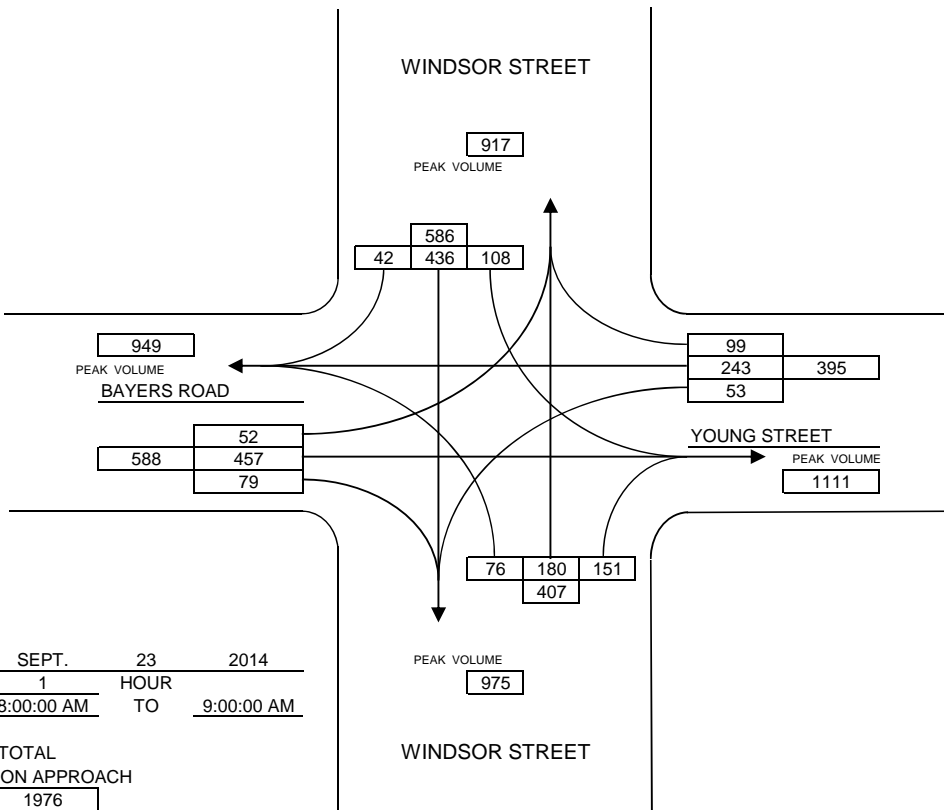
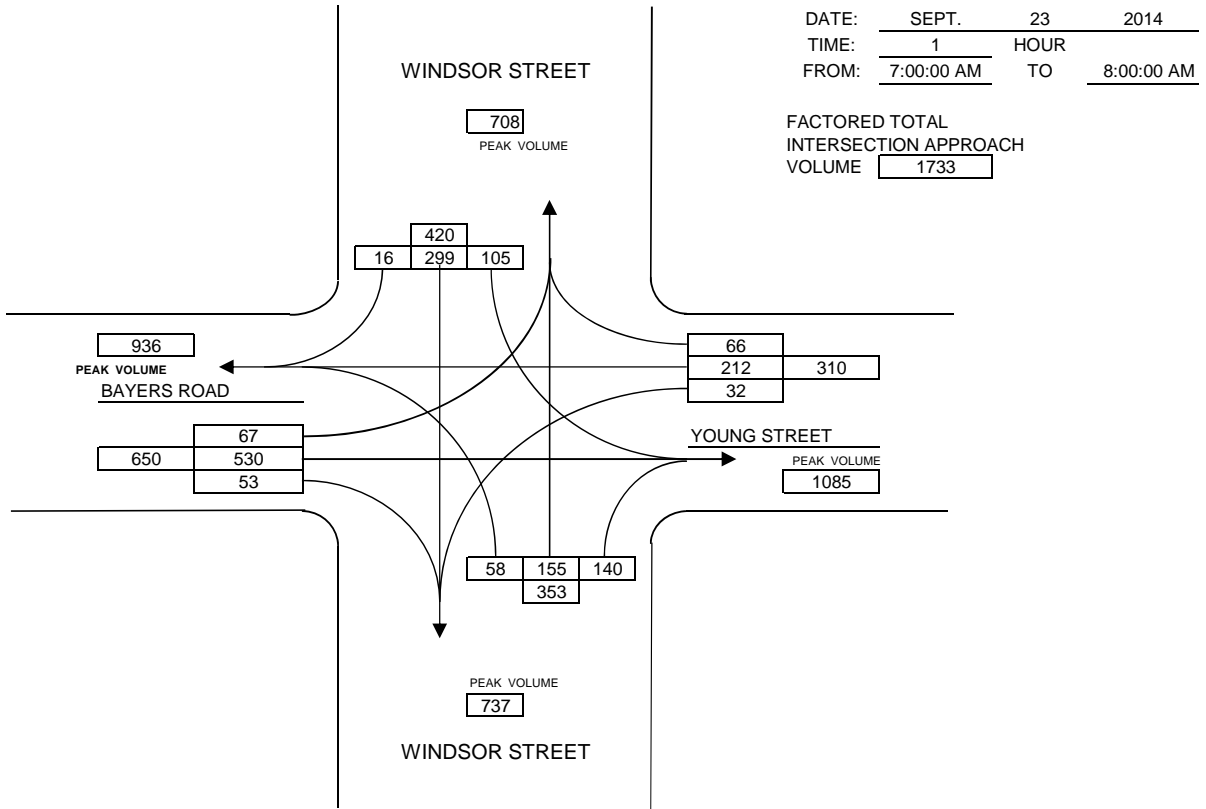


Figure A-1

# VEHICULAR GRAPHIC SUMMARY SHEET

Page A-2

INTERSECTION :

BAYERS ROAD AT YOUNG STREET AND WINDSOR STREET

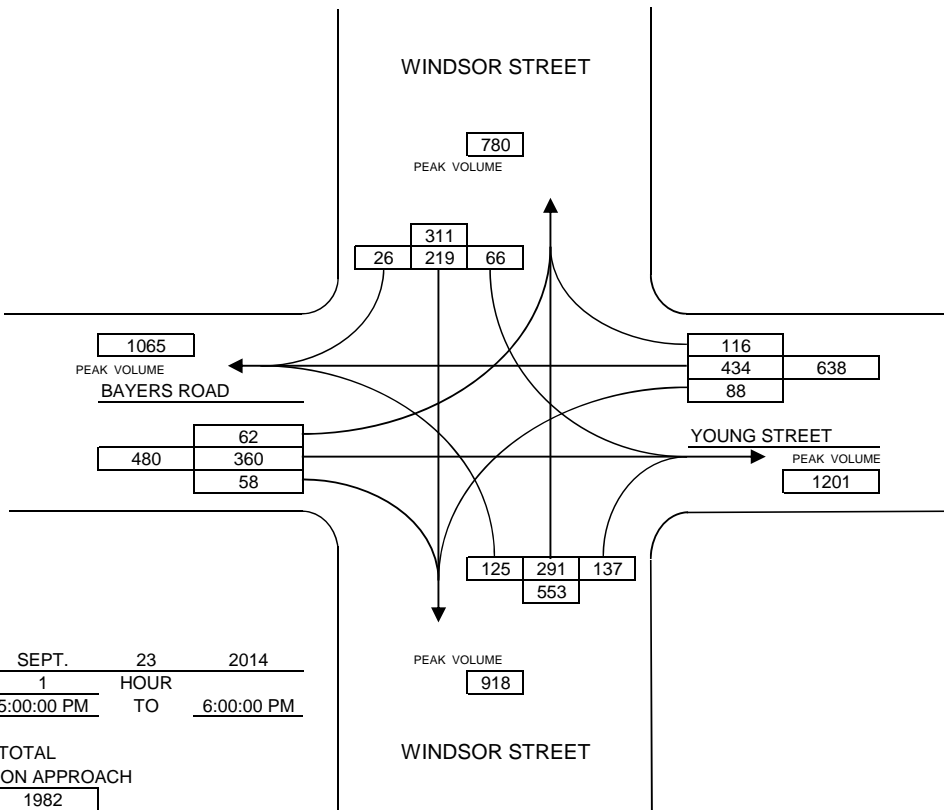
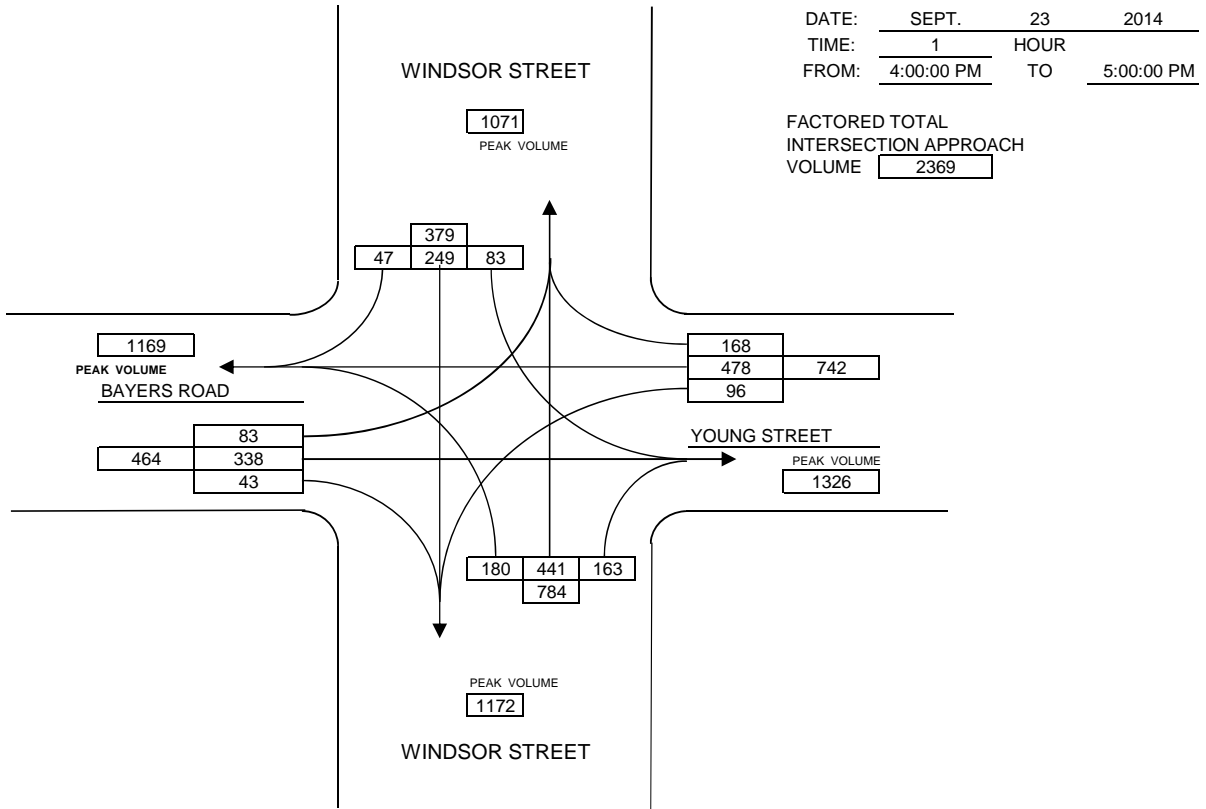
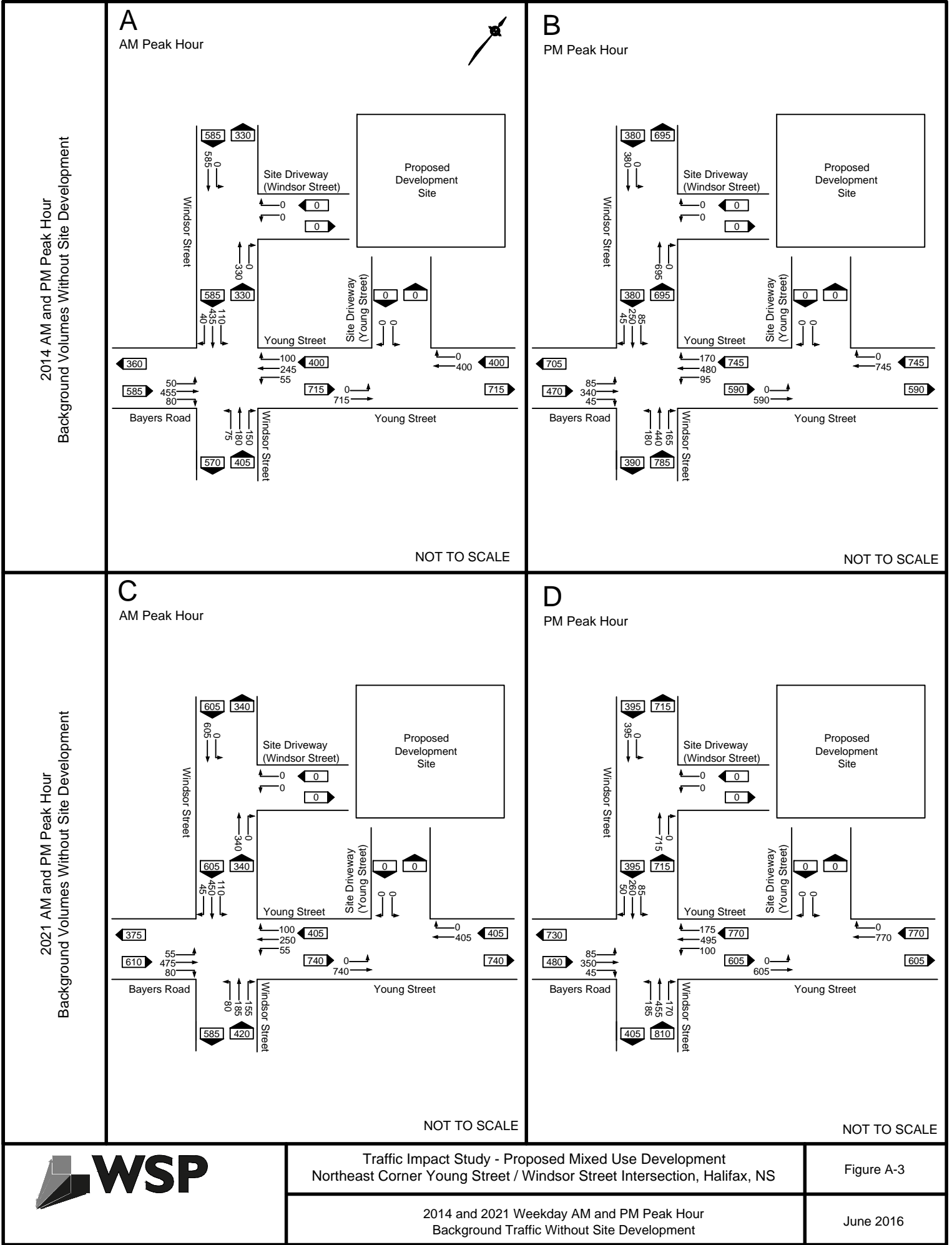
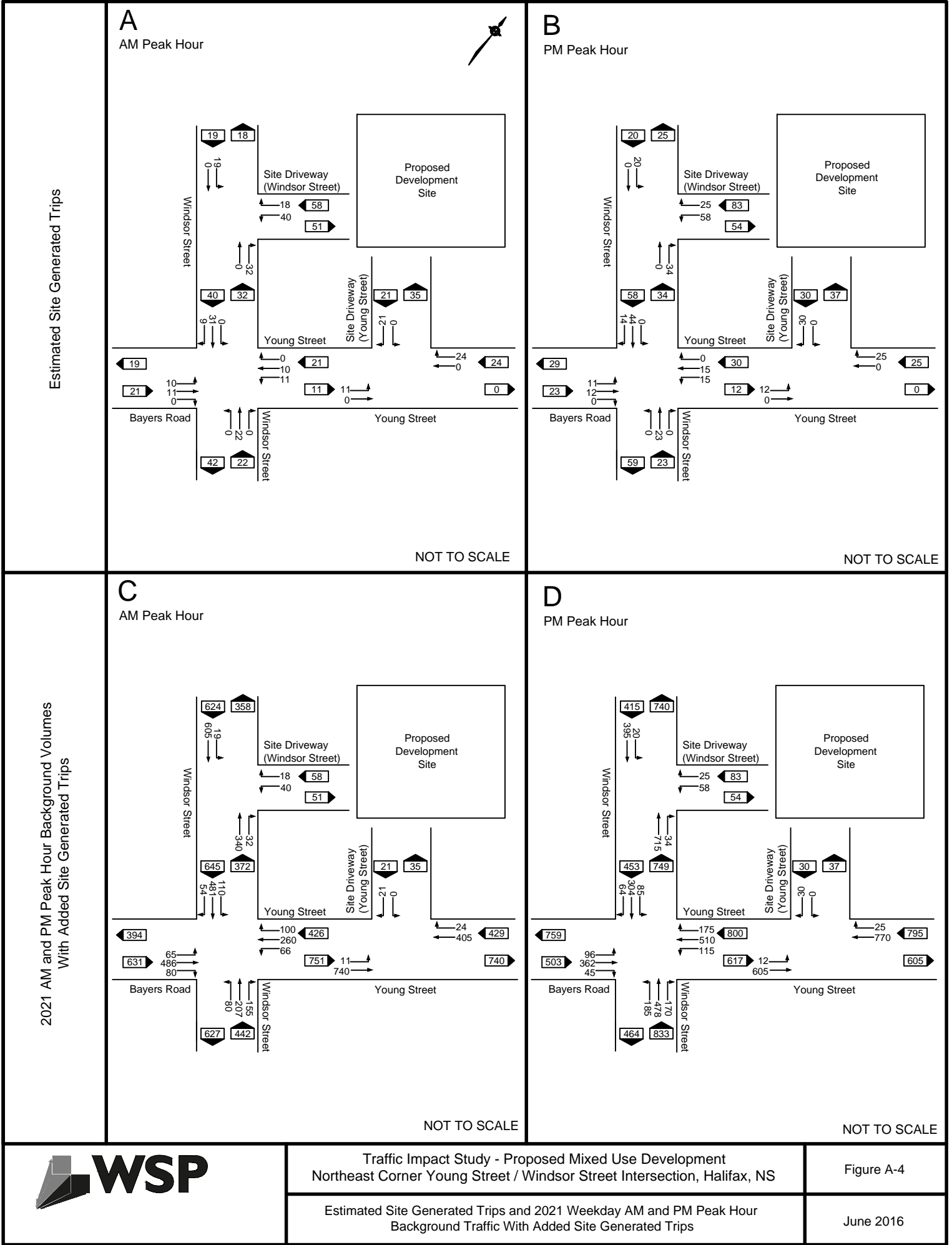


Figure A-2



























**Northeast Corner Young Street / Windsor Street TIS**  
**1: Windsor Street & Bayers Road/Young Street**

**Page A-5**  
2021 AM Peak Hour Without Site Development










												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	475	80	55	250	100	80	185	155	110	450	45
Future Volume (vph)	55	475	80	55	250	100	80	185	155	110	450	45
Satd. Flow (prot)	1789	1842	0	1789	3425	0	1789	1755	0	1789	1857	0
Flt Permitted	0.533			0.231			0.247			0.211		
Satd. Flow (perm)	1004	1842	0	435	3425	0	465	1755	0	397	1857	0
Satd. Flow (RTOR)		9			74			39			5	
Lane Group Flow (vph)	58	584	0	58	368	0	84	358	0	116	521	0
Turn Type	Perm	NA		pm+pt	NA		Perm	NA		pm+pt	NA	
Protected Phases		2		1	6			8		7	4	
Permitted Phases	2			6			8			4		
Total Split (s)	49.0	49.0		11.0	60.0		39.0	39.0		11.0	50.0	
Total Lost Time (s)	7.1	7.1		4.0	7.1		7.0	7.0		4.0	7.0	
Act Effect Green (s)	50.6	50.6		62.7	59.6		25.3	25.3		39.3	36.3	
Actuated g/C Ratio	0.46	0.46		0.57	0.54		0.23	0.23		0.36	0.33	
v/c Ratio	0.13	0.69		0.17	0.19		0.79	0.83		0.50	0.85	
Control Delay	21.7	30.7		13.5	11.3		83.1	51.4		30.7	46.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	21.7	30.7		13.5	11.3		83.1	51.4		30.7	46.9	
LOS	C	C		B	B		F	D		C	D	
Approach Delay		29.9			11.6			57.4			43.9	
Approach LOS		C			B			E			D	
Queue Length 50th (m)	7.3	99.0		5.3	16.0		17.0	65.7		16.8	101.9	
Queue Length 95th (m)	17.4	#167.4		12.7	27.2		#38.2	92.2		26.8	131.4	
Internal Link Dist (m)		143.2			183.9			222.1			204.8	
Turn Bay Length (m)	50.0			35.0			50.0			35.0		
Base Capacity (vph)	461	852		336	1889		135	538		230	728	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.13	0.69		0.17	0.19		0.62	0.67		0.50	0.72	

**Intersection Summary**

Cycle Length: 110  
Actuated Cycle Length: 110  
Offset: 11 (10%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
Control Type: Actuated-Coordinated  
Maximum v/c Ratio: 0.85  
Intersection Signal Delay: 36.1  
Intersection Capacity Utilization 88.9%  
Analysis Period (min) 15  
# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.





















Intersection LOS: D  
ICU Level of Service E

**Splits and Phases: 1: Windsor Street & Bayers Road/Young Street**

			
Ø1	Ø2 (R)		Ø4
11 s	49 s		50 s
			
Ø6 (R)			Ø7
60 s			11 s
			39 s
			
			Ø8

**Northeast Corner Young Street / Windsor Street TIS**  
**1: Windsor Street & Bayers Road/Young Street**

**Page A-6**  
 2021 PM Peak Hour Without Site Development









												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	85	350	45	100	495	175	185	455	170	85	260	50
Future Volume (vph)	85	350	45	100	495	175	185	455	170	85	260	50
Satd. Flow (prot)	1789	1851	0	1789	3439	0	1789	1806	0	1789	1838	0
Flt Permitted	0.384			0.314			0.342			0.173		
Satd. Flow (perm)	723	1851	0	591	3439	0	644	1806	0	326	1838	0
Satd. Flow (RTOR)		7			62			24			10	
Lane Group Flow (vph)	89	415	0	105	705	0	195	658	0	89	327	0
Turn Type	Perm	NA		pm+pt	NA		pm+pt	NA		Perm	NA	
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2			6			8			4		
Total Split (s)	39.0	39.0		11.0	50.0		11.0	50.0		39.0	39.0	
Total Lost Time (s)	7.1	7.1		4.0	7.1		4.0	7.0		7.0	7.0	
Act Effect Green (s)	37.2	37.2		49.3	46.2		42.7	39.7		28.7	28.7	
Actuated g/C Ratio	0.37	0.37		0.49	0.46		0.43	0.40		0.29	0.29	
v/c Ratio	0.33	0.60		0.28	0.43		0.55	0.90		0.96	0.61	
Control Delay	30.2	31.5		16.9	18.1		24.3	43.8		119.8	34.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	30.2	31.5		16.9	18.1		24.3	43.8		119.8	34.6	
LOS	C	C		B	B		C	D		F	C	
Approach Delay		31.3			17.9			39.3			52.9	
Approach LOS		C			B			D			D	
Queue Length 50th (m)	13.3	68.9		11.2	44.8		22.5	108.3		16.2	50.8	
Queue Length 95th (m)	27.8	102.3		20.9	60.8		36.5	#169.7		#45.4	77.2	
Internal Link Dist (m)		143.2			151.8			222.1			204.8	
Turn Bay Length (m)	50.0			35.0			50.0			35.0		
Base Capacity (vph)	268	693		378	1623		354	790		104	594	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.33	0.60		0.28	0.43		0.55	0.83		0.86	0.55	

**Intersection Summary**

Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 11 (11%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.96  
 Intersection Signal Delay: 33.2  
 Intersection Capacity Utilization 88.7%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.





















Intersection LOS: C  
 ICU Level of Service E

**Splits and Phases: 1: Windsor Street & Bayers Road/Young Street**

			
Ø1	Ø2 (R)	Ø3	Ø4
11 s	39 s	11 s	39 s
			
Ø6 (R)		Ø8	
50 s		50 s	

**Northeast Corner Young Street / Windsor Street TIS**  
**1: Windsor Street & Bayers Road/Young Street**

**Page A-7**  
 2021 AM Peak Hour with Site Development









												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	486	80	66	260	100	80	207	155	110	481	54
Future Volume (vph)	65	486	80	66	260	100	80	207	155	110	481	54
Satd. Flow (prot)	1789	1844	0	1789	3428	0	1789	1763	0	1789	1855	0
Flt Permitted	0.527			0.204			0.213			0.221		
Satd. Flow (perm)	993	1844	0	384	3428	0	401	1763	0	416	1855	0
Satd. Flow (RTOR)		8			63			35			6	
Lane Group Flow (vph)	68	596	0	69	379	0	84	381	0	116	563	0
Turn Type	Perm	NA		pm+pt	NA		Perm	NA		pm+pt	NA	
Protected Phases		2		1	6			8		7	4	
Permitted Phases	2			6			8			4		
Total Split (s)	47.0	47.0		11.0	58.0		46.0	46.0		11.0	57.0	
Total Lost Time (s)	7.1	7.1		4.0	7.1		7.0	7.0		4.0	7.0	
Act Effct Green (s)	50.8	50.8		63.2	60.1		29.8	29.8		43.8	40.8	
Actuated g/C Ratio	0.44	0.44		0.55	0.52		0.26	0.26		0.38	0.35	
v/c Ratio	0.16	0.73		0.23	0.21		0.82	0.79		0.48	0.85	
Control Delay	24.7	35.2		16.3	13.6		87.7	47.2		28.6	46.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	24.7	35.2		16.3	13.6		87.7	47.2		28.6	46.1	
LOS	C	D		B	B		F	D		C	D	
Approach Delay		34.2			14.0			54.5			43.1	
Approach LOS		C			B			D			D	
Queue Length 50th (m)	9.4	112.2		7.1	19.2		17.6	72.6		16.9	113.8	
Queue Length 95th (m)	21.8	#194.8		16.4	32.7		#38.9	96.7		25.7	139.8	
Internal Link Dist (m)		143.2			183.9			222.1			204.8	
Turn Bay Length (m)	50.0			35.0			50.0			35.0		
Base Capacity (vph)	438	819		301	1820		135	621		242	809	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.16	0.73		0.23	0.21		0.62	0.61		0.48	0.70	

**Intersection Summary**

Cycle Length: 115  
 Actuated Cycle Length: 115  
 Offset: 11 (10%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.85  
 Intersection Signal Delay: 37.1  
 Intersection Capacity Utilization 91.6%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.





















Intersection LOS: D  
 ICU Level of Service F

**Splits and Phases: 1: Windsor Street & Bayers Road/Young Street**

			
Ø1	Ø2 (R)		Ø4
11 s	47 s		57 s
			
Ø6 (R)			Ø7
58 s			11 s
			Ø8
			46 s

**Northeast Corner Young Street / Windsor Street TIS**  
**1: Windsor Street & Bayers Road/Young Street**

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 2021 PM Peak Hour with Site Development











												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	362	45	115	510	175	185	478	170	85	304	64
Future Volume (vph)	96	362	45	115	510	175	185	478	170	85	304	64
Satd. Flow (prot)	1789	1853	0	1789	3443	0	1789	1810	0	1789	1834	0
Flt Permitted	0.378			0.262			0.312			0.180		
Satd. Flow (perm)	712	1853	0	493	3443	0	588	1810	0	339	1834	0
Satd. Flow (RTOR)		5			47			22			11	
Lane Group Flow (vph)	101	428	0	121	721	0	195	682	0	89	387	0
Turn Type	Perm	NA		pm+pt	NA		pm+pt	NA		Perm	NA	
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2			6			8			4		
Total Split (s)	39.0	39.0		11.0	50.0		11.0	65.0		54.0	54.0	
Total Lost Time (s)	7.1	7.1		4.0	7.1		4.0	7.0		7.0	7.0	
Act Effect Green (s)	38.5	38.5		54.0	50.9		53.0	50.0		39.0	39.0	
Actuated g/C Ratio	0.33	0.33		0.47	0.44		0.46	0.43		0.34	0.34	
v/c Ratio	0.42	0.69		0.37	0.46		0.57	0.85		0.78	0.62	
Control Delay	39.6	41.4		23.0	23.3		24.8	39.0		74.1	34.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	39.6	41.4		23.0	23.3		24.8	39.0		74.1	34.4	
LOS	D	D		C	C		C	D		E	C	
Approach Delay		41.1			23.3			35.9			41.8	
Approach LOS		D			C			D			D	
Queue Length 50th (m)	18.3	85.4		15.5	56.0		25.2	128.1		17.5	68.7	
Queue Length 95th (m)	37.5	#138.8		30.0	80.5		35.4	160.2		#41.6	90.5	
Internal Link Dist (m)		143.2			151.8			222.1			204.8	
Turn Bay Length (m)	50.0			35.0			50.0			35.0		
Base Capacity (vph)	238	623		326	1551		344	923		138	756	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.42	0.69		0.37	0.46		0.57	0.74		0.64	0.51	

**Intersection Summary**

Cycle Length: 115  
 Actuated Cycle Length: 115  
 Offset: 11 (10%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.85  
 Intersection Signal Delay: 34.0  
 Intersection Capacity Utilization 90.4%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Intersection LOS: C  
 ICU Level of Service E

**Splits and Phases: 1: Windsor Street & Bayers Road/Young Street**

				
Ø1	Ø2 (R)		Ø3	Ø4
11 s	39 s		11 s	54 s
				
Ø6 (R)			Ø8	
50 s			65 s	