TRAFFIC ANALYSIS REPORT

CITY OF LONDON

PROJECT NO.: 16M-01395-01
AUGUST 2018

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1 INTRODUCTION

The City of London (the City) has initiated a Class Environmental Assessment (Class EA) Study for a segment of Adelaide Street North between Oxford Street and Queens Avenue, including Canadian Pacific Railway (CP) Grade Separation. The City's 2030 Transportation Master Plan (TMP): *SmartMoves* identified a need for traffic capacity optimization and transit priority, as well as providing opportunities for pedestrian-scale, street-oriented land use development, enhanced landscaping, bicycle lanes and sidewalks.

Adelaide Street is a north-south arterial corridor, operates with a four-lane cross-section within the study area. It carries approximately 26,000 vehicles per day in both the directions. A CP crossing on Adelaide Street North is located between Pall Mall Street and Central Avenue. There are two train tracks at the Adelaide/CP crossing, and a railway yard (CP London Yard) is located east of Adelaide Street North. Trains crossing interrupt traffic flows at various times throughout the day, and resulting in delays up to 6 minutes per closure, and up to 2 hours of a total gate closure on a typical day. Due to gate closures at the rail crossing, a queue length for the southbound traffic generally extends past the Oxford Street intersection, and the northbound queue past the King Street intersection. These higher delays also result in traffic infiltration through the adjacent neighbourhood.

The introduction of a grade-separation crossing will eliminate the vehicular delays. Moreover, transportation network improvements are identified to provide improve accessibilities for other road users such as pedestrian and cyclists. This project will provide an opportunity to improve a major transportation corridor to carry high volumes of pedestrian/vehicular traffic in a safe and efficient manner and provide an attractive and memorable experience for those entering this heritage area of the City. The corridor can also be used as a relief line, as the new rapid transit has proposed to replace two lanes of general purpose traffic on Richmond Street with dedicated transit lanes. Adelaide Street could be seen as an alternate route, being a close major north-south corridor.

The 2030 TMP also recommends higher targets for transit and active transportation in 2030 – 20% of peak period trips on transit and 15% walking or cycling, compared with 12.5% and 9% respectively today. The transit system is approaching the point during certain periods and routes where it is at capacity and its competitiveness is going to decline if improvements are not made. This study offers an opportunity to introduce measures to improve the speed and reliability of transit services in the area, resulting in a more attractive transit system to the existing and potential passengers.

As part of the Class EA Study, a detailed Traffic Operational Analysis was undertaken to assess the Existing (2016) and Future (2036) weekday peak hour traffic conditions. This report documents traffic analyses and findings, as following tasks were conducted:

- Collected and summarized existing traffic volumes in the study area (presented in Section 3.1 and 3.2);
- Analyzed the existing roadway capacity (presented in Section 3.3);

- Conducted the existing intersection operational analysis (using a Vissim based micro-simulation model) for the study area intersections (presented in Section 3.4);
- Discussed a blockage study conducted by the City to estimate an average blockage time during gate closure (presented in Section 4).
- Analyzed the collision data to identify any safety-related concerns (presented in Section 5);
- Estimated future traffic volumes for both peak hour conditions using historical traffic growth (presented in Section 6.1);
- Analyzed the future roadway capacity (presented in Section 6.2);
- Conducted the future intersection operational analysis for the study area intersections (presented in Section 6.3), and;
- Study findings and recommendations are presented in Section 7.

2 STUDY AREA

The study area encompasses a section of Adelaide Street North between Oxford Street East intersection (in the north) and Queens Avenue intersection (in the south) and includes fourteen intersections. Currently, three intersections are operating with traffic signals (at the Oxford Street East, Central Avenue (west-leg), and Queens Avenue), and two intersections operating with Intersection Pedestrian Signal (IPS) at the Pall Mall Street and at the Lorne Avenue. All the other intersections are unsignalized and operate with 'Stop' control. Additionally, many property accesses and drive-ways are directly connected to Adelaide Street North. The study area is presented in Figure 1.

Within the study area, Adelaide Street North is an arterial road with a 4-lane cross-section (two lanes in each direction). The posted speed limit is 50 km/h within the study area. London Transit Route 16 provides service on Adelaide Street North through the study area.

Oxford Street East is an east-west arterial road with a 4-lane cross-section (two lanes in each direction) within the study area. Dedicated turning lanes are available for: eastbound left and right turns, westbound left turns and northbound and southbound left turns. The posted speed limit on Oxford Street is 50 km/h.

Central Avenue (the west approach) is a primary collector road with a traffic signal and dedicated left and right turn lanes at Adelaide Street North. Central Avenue, east of Adelaide Street North (the east approach), is a secondary collector operating with 'Stop' sign controlled for a 'right-out' movement (i.e. the westbound left turn is prohibited). The posted speed limit on Central Avenue is 50 km/h within the study area.

Queens Avenue is a one-way westbound arterial road. Within the study area, the westbound traffic operates with 2 lanes (shared left / through and shared through / right lanes at the intersection). The posted speed limit on Queens Avenue is 50 km/h.

All the other roadways connecting to Adelaide Street North are minor local roads providing access to the adjacent residential areas.

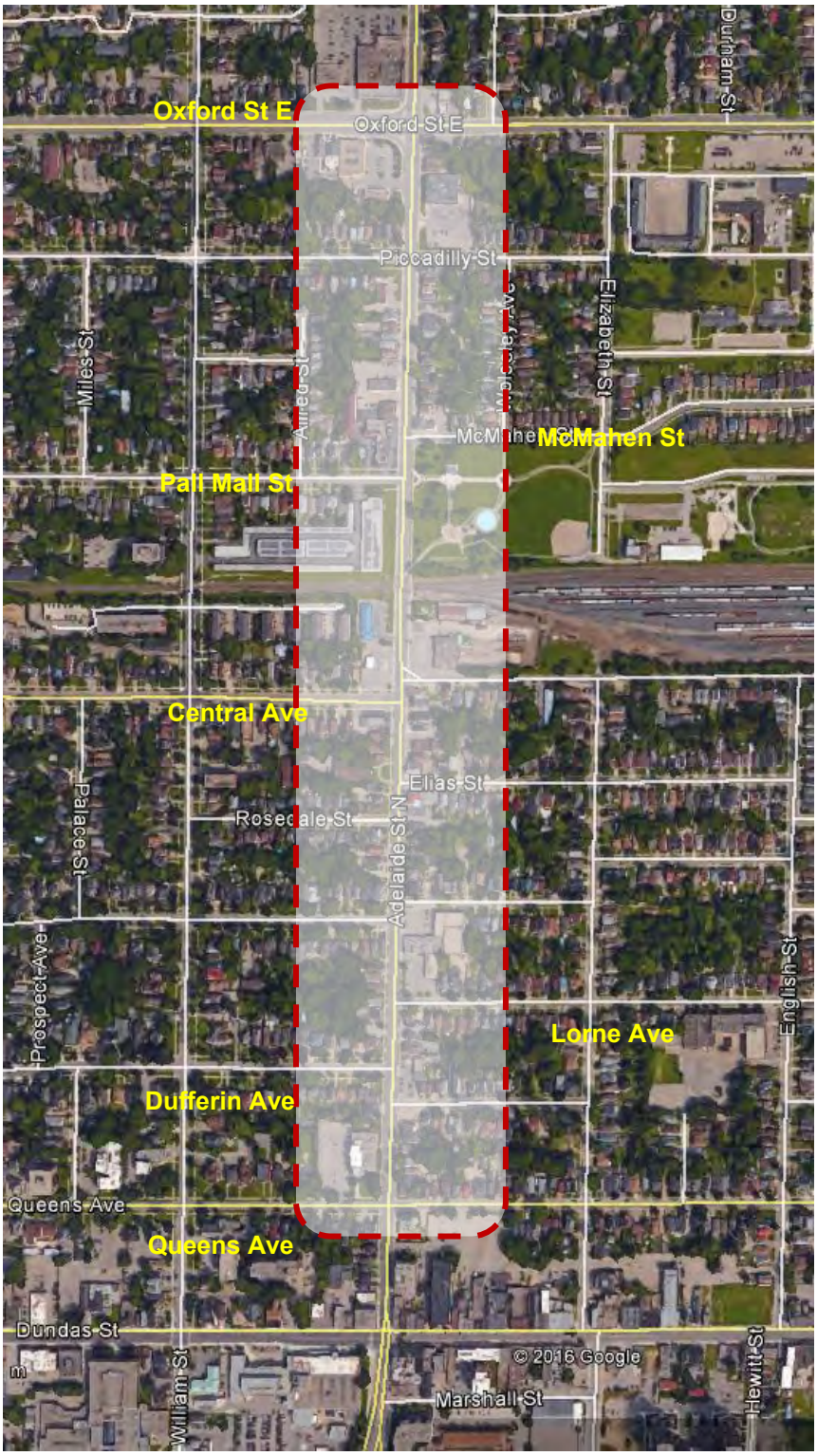


Figure 1: Study Area

3 EXISTING (2016) TRAFFIC CONDITIONS

3.1 EXISTING INTERSECTION LANE CONFIGURATIONS

The existing intersection lane configurations and control types are presented in Figure 2.

Seven major intersections within the study area were included for the traffic operational analysis, includes: Oxford Street East, McMahen Street, Pall Mall Street, Central Avenue (both the east- and west-leg), Lorne Avenue, Dufferin Avenue (west-leg only), and Queens Avenue.

Additionally, Dundas Street intersection is also included in the traffic simulation model due to the close proximity to the Queens Avenue (which is located approximately 120 meters south of Queens Avenue), allowing us to assess the upstream / downstream traffic operations.

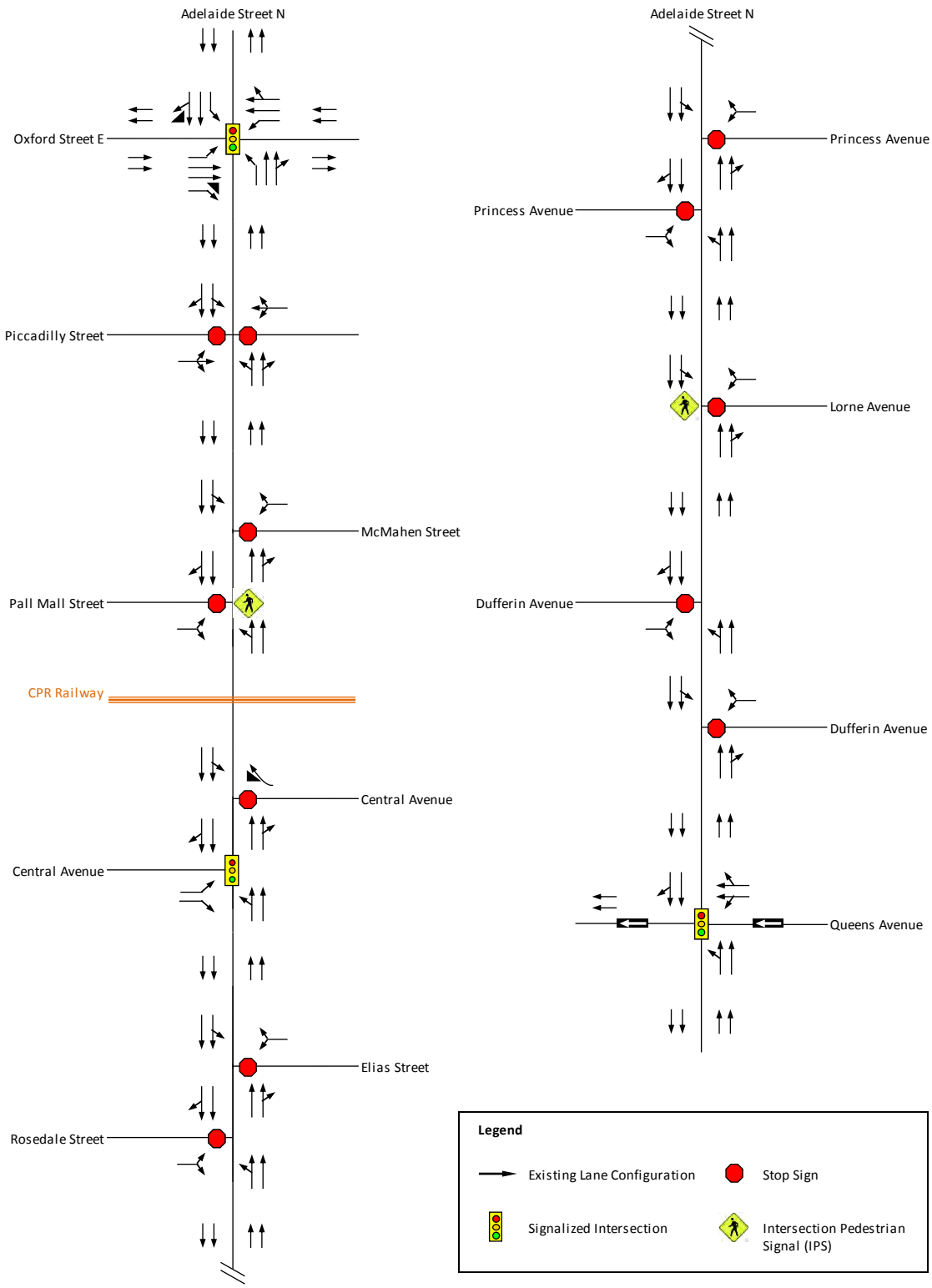


Figure 2: Existing (2016) Intersection Lane Configurations

3.2 EXISTING TRAFFIC VOLUMES

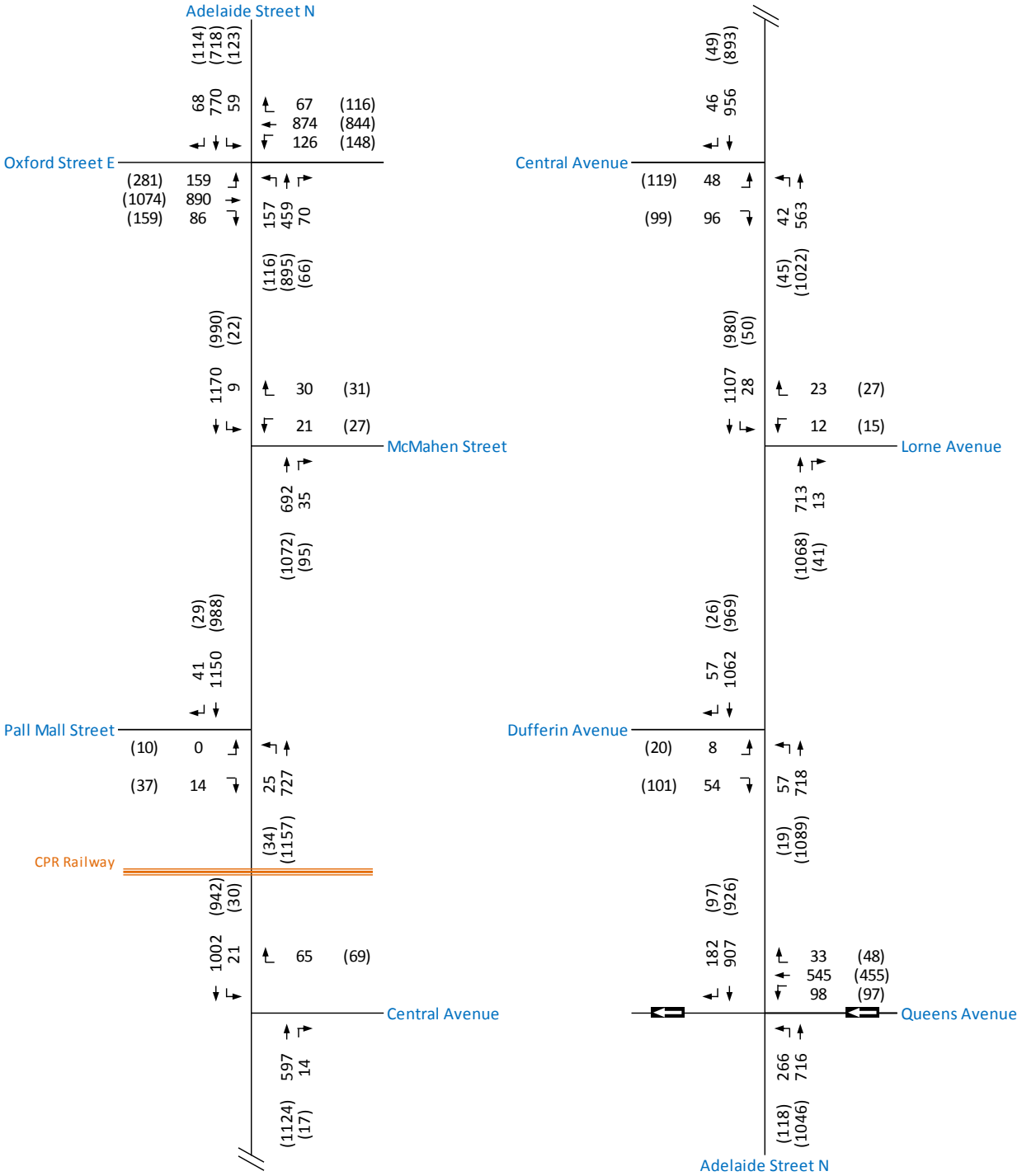
The turning movement counts (TMCs) for the study area intersections were provided by the City. These counts were collected by the City during 2013 to 2016. The survey dates for the study area intersections are presented in Table 1.

The traffic counts were reviewed and necessary growth rates were applied to reflect the current conditions. The signal timing plans for the signalized intersections were also collected from the City and included in the traffic models for the morning and afternoon peak hour conditions.

Table 1: Data Collection Dates for Turning Movement Counts

Intersection	Data Collection Dates
Oxford Street East	Wednesday, 30 September, 2015
McMahen Street	Tuesday, 12 April, 2016
Pall Mall Street	Wednesday, 30 September, 2015
Central Avenue	east-leg Tuesday, September 10, 2013 west-leg Monday, 16 November, 2015
Lorne Avenue	Thursday, 15 October, 2015
Dufferin Avenue	west-leg Tuesday, 12 April, 2016
Queens Avenue	Thursday, 15 October, 2015

The existing (2016) traffic volumes used for traffic operational analysis are presented in Figure 3, for both the morning and afternoon peak hours.



Legend

XX (YY): Morning (Afternoon) Peak Hour Volumes

Figure 3: Existing (2016) Weekday Peak Hour Turning Movement Volumes

3.3 EXISTING ROADWAY CAPACITY ANALYSIS

The roadway (link-level) capacity analysis for the existing (2016) condition was conducted by calculating the volume to capacity (v/c) ratios. The v/c ratio for each corridor segment of Adelaide Street North was calculated using traffic counts and planning level roadway capacity. Based on the roadway configuration and adjacent land use, planning level capacity was assumed at 800 vehicles per hour (vph) per lane.

The v/c ratios for Adelaide Street North segments for the morning and afternoon peak hour conditions are presented in Figure 4 and Figure 5, respectively. The v/c ratios show that southbound is the peak direction during the morning peak hour and northbound is the peak direction during afternoon peak hour.

For both peak hour conditions, traffic on the Adelaide Street is generally operating at 'Good' condition (with v/c ratio less than 0.80) for all the segments, except for a segment north of Oxford Street, a northbound traffic is operating at an 'Unstable' condition with v/c ratios at 0.81 during afternoon peak hour.

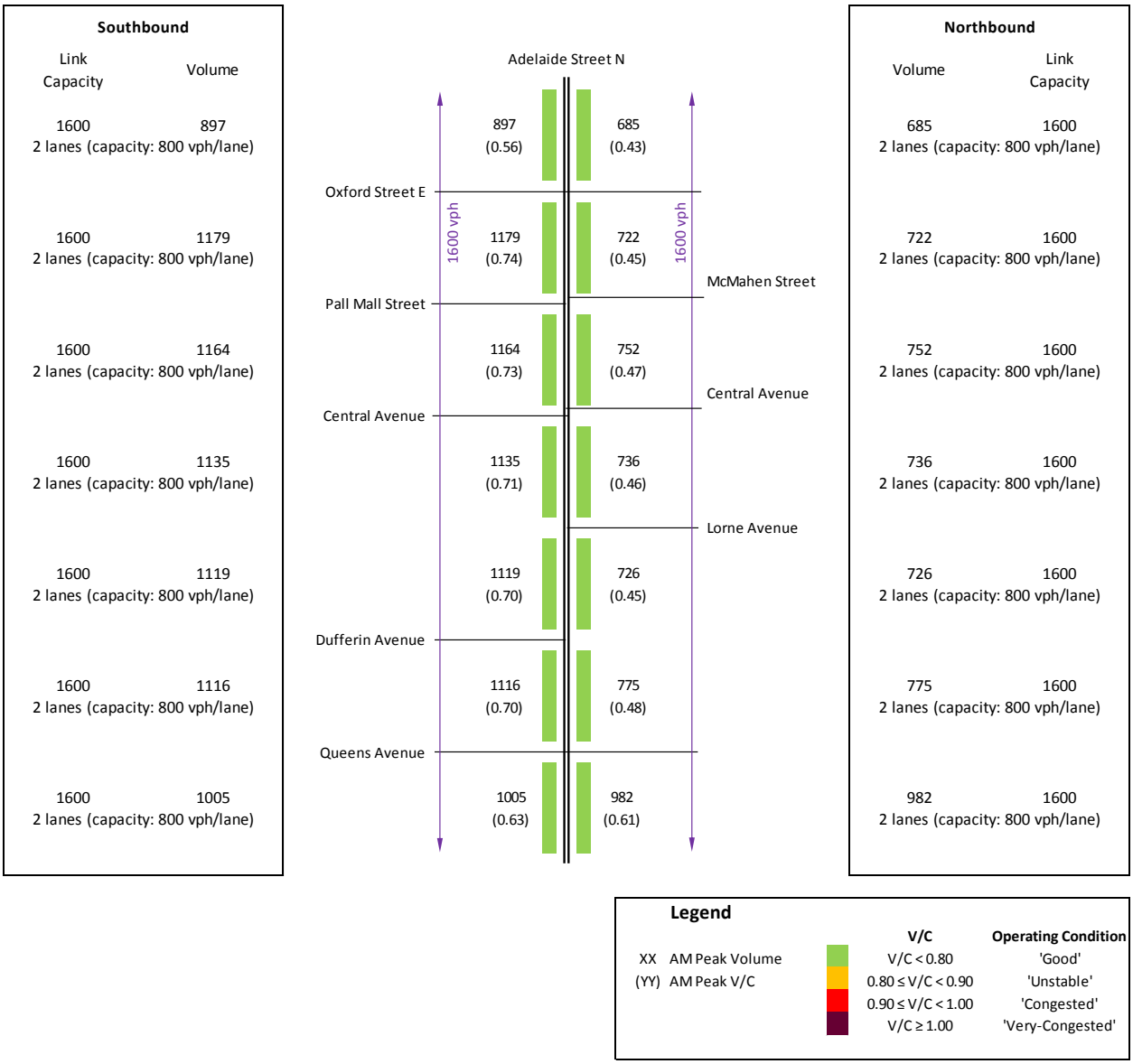


Figure 4: Roadway Capacity (V/C) Analysis for Existing (2016) Morning Peak Hour Condition

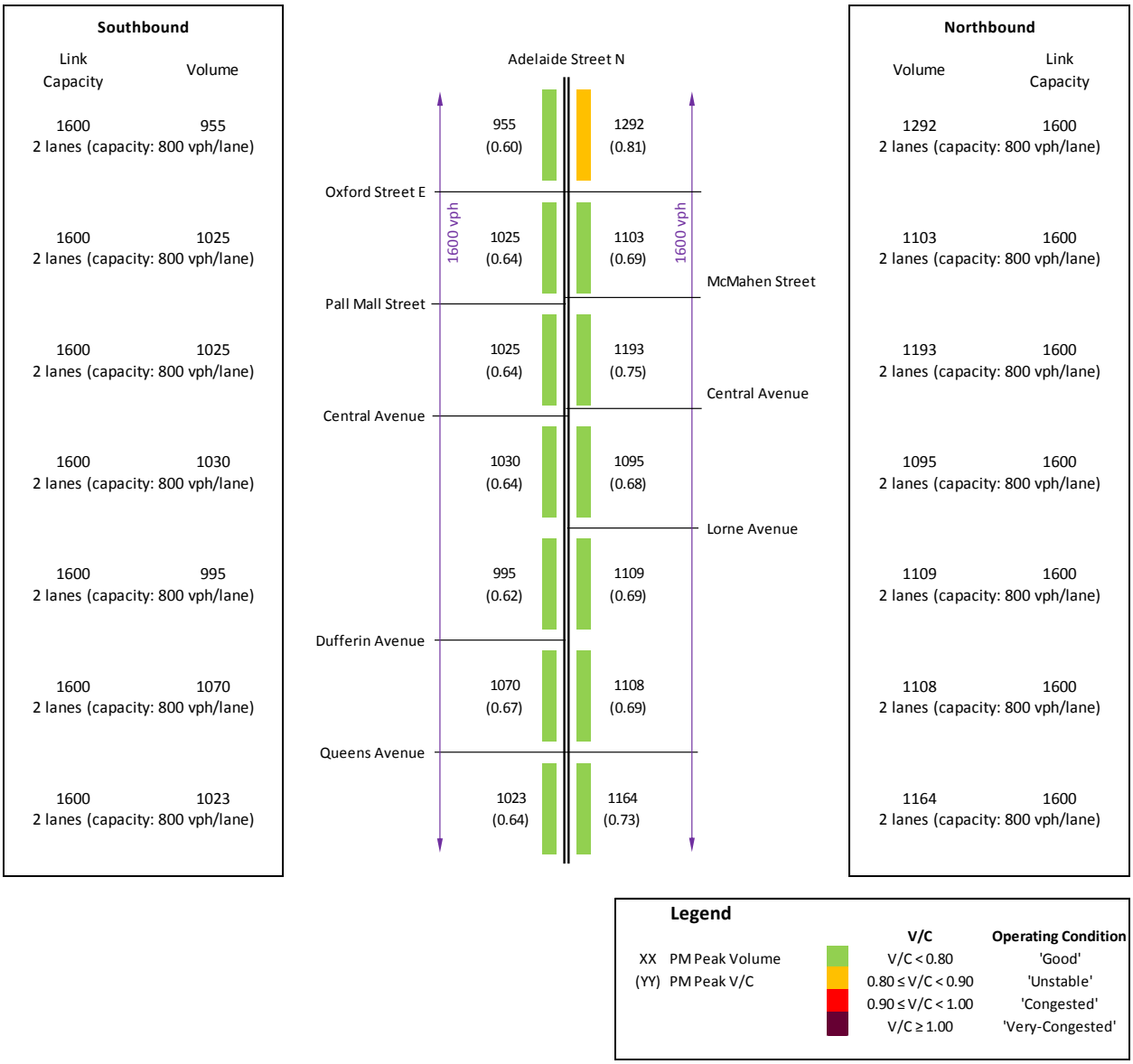


Figure 5: Roadway Capacity (V/C) Analysis for Existing (2016) Afternoon Peak Hour Condition

3.4 EXISTING (2016) INTERSECTION OPERATIONAL ANALYSIS

The existing (2016) intersection operational analysis was conducted for both the morning and afternoon peak hour conditions, using a *Vissim* based micro-simulation model. This model was developed considering the existing network configuration, traffic volumes and signal timing plans.

The *Vissim* model outputs were used to derive the 95th percentile queue length, average delay and the resulting level of service (LOS). The v/c ratios for signalized intersections were derived from a *Synchro* model.

The delay criteria for a signalized and un-signalized (e.g. 'stop' controlled) intersections are presented in Table 2.

Table 2: Intersection Level of Service Criteria

Level of Service	Intersection Delay Criteria (seconds per vehicle)	
	Signalized Intersection	Un-signalized Intersection
A	≤ 10	≤ 10
B	> 10.0 and ≤ 20.0	> 10.0 and ≤ 15.0
C	> 20.0 and ≤ 35.0	> 15.0 and ≤ 25.0
D	> 35.0 and ≤ 55.0	> 25.0 and ≤ 35.0
E	> 55.0 and ≤ 80.0	> 35.0 and ≤ 50.0
F	> 80.0	> 50.0

The highest possible rating is LOS 'A', under which the average delay (either on a movement, approach or intersection) is less than 10 seconds per vehicle. From LOS 'A' to 'D' presents the acceptable operating conditions, while LOS 'E' reflects congested conditions and LOS 'F' reflects failure (long delay).

Transit operations (northbound and southbound buses of London Transit Route 16 on Adelaide Street North) and pedestrian crossing activities at intersections were also coded in the model and their impacts to traffic operations were included in the analysis.

It is important to note that the traffic operational analysis does not consider the event of a train crossing and gate closure, as this would result in a complete gridlock of the microsimulation model.

The intersection operational analysis results for existing traffic conditions are presented in Table 3. Detailed *Synchro* reports for signalized intersections are presented in Appendix A.

Table 3: Existing (2016) Intersection Operational Analysis Results

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Adelaide St N and Oxford St E (Signalized)		***30***	***C***			***34***	***C***	
Eastbound Left	0.81	30	C	42	1.04	39	D	70
Eastbound Through	0.91	28	C	112	0.88	27	C	144
Eastbound Right	0.18	6	A	19	0.29	9	A	23
Westbound Left	0.69	41	D	125	0.75	45	D	126
Westbound Through/Right	1.01	35/32	C/C	140	0.92	36/33	D/C	143
Northbound Left	1.01	32	C	49	0.85	37	D	40
Northbound Through/Right	0.51	25/20	C/B	67	1.00	37/36	D/D	144
Southbound Left	0.24	31	C	84	0.90	57	E	103
Southbound Through/Right	0.85	32/20	C/B	100	0.89	36/23	D/C	112
Adelaide St N and McMahen St		***1***	***A***			***3***	***A***	
Westbound Left/Right	-	17/7	C/A	6	-	26/9	D/A	6
Northbound Through/Right	-	1/1	A/A	0	-	2/2	A/A	0
Southbound Left/Through	-	5/1	A/A	1	-	9/2	A/A	15
Adelaide St N and Pall Mall St[2]		***1***	***A***			***3***	***A***	
Eastbound Left/Right	-	0/7	A/A	5	-	20/7	C/A	6
Northbound Left/Through	-	9/1	A/A	5	-	11/2	B/A	16
Southbound Through/Right	-	1/2	A/A	2	-	3/3	A/A	17
Adelaide St N and Central Ave East-Leg		***5***	***A***			***7***	***A***	
Westbound Right ('stop' control)	-	7	A	0	-	7	A	7
Northbound Through/Right	-	1/0	A/A	-	-	3/2	A/A	-
Southbound Left/Through	-	5/4	A/A	76	-	9/5	A/A	67
Adelaide St N and Central Ave West-Leg (Signalized)		***5***	***A***			***7***	***A***	
Eastbound Left	0.36	40	D	25	0.61	46	D	48
Eastbound Right	0.47	6	A	13	0.39	6	A	14
Northbound Left/Through	0.33	9/1	A/A	18	0.52	12/3	B/A	30
Southbound Through/Right	0.43	4/5	A/A	76	0.38	5/5	A/A	67
Adelaide St N and Lorne Ave[2]		***4***	***A***			***2***	***A***	
Westbound Left/Right	-	18/9	C/A	6	-	22/13	C/B	9
Northbound Through/Right	-	4/3	A/A	28	-	2/3	A/A	35
Southbound Left/Through	-	8/4	A/A	38	-	11/2	B/A	22

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Adelaide St N and Dufferin Ave West-Leg		***1***	***A***			***1***	***A***	
Eastbound Left/Right	-	18/8	C/A	6	-	21/9	C/A	10
Northbound Left/Through	-	8/1	A/A	8	-	6/1	A/A	2
Southbound Through/Right	-	0/1	A/A	3	-	0/1	A/A	0
Adelaide St N and Queens Ave (Signalized)		***19***	***B***			***15***	***B***	
Westbound Left/Through/Right	0.91	34/33/23	C/C/C	77	0.83	41/39/27	D/D/C	81
Northbound Left/Through	1.71	21/5	C/A	82	0.90	8/3	A/A	49
Southbound Through/Right	0.59	20/21	B/C	110	0.49	14/15	B/B	103

Note: 1. Queue length reflects 95th percentile conditions
2. Intersections with IPS were treated as 'Stop' control intersections for LOS reporting

The intersection operational analysis results confirm that, in the absence of a gate closure at the rail crossing, all study area intersections have an overall operation of LOS 'C' or better, during both peak hours.

Some individual movements may operate at LOS 'D' or better during both peak hours, except for the southbound left-turn movement at the Oxford Street East intersection, which operates at LOS 'E' during the afternoon peak hour. The higher delay for this movement is mainly due to the short storage lane length (approximately 15 meters plus taper). At the Oxford Street intersection, the northbound left-turn lane, northbound through / right-turn lane, eastbound left-turn lane and westbound through / right-turn lane are all operating with v/c ratio of 1.00 or above, indicating the need for additional capacity.

The northbound shared through / left-turn movements at the Adelaide Street / Queens Avenue intersection is operating with high v/c ratio at 1.71 during the morning peak hour, indicating the need for a dedicated left turn lane. The northbound left turning traffic (266 vehicles during morning peak hour) occupies the shared through / left-turn lane and forces through traffic to change lanes at the intersection.

4 CP RAIL BLOCKAGE STUDY

CP is currently operating an at-grade crossing between Pall Mall Street and Central Avenue, controlled by crossing gates and signals. A recent study was conducted by the City (March 2017) to estimate an average blockage time. A total of 156 blockages were recorded during eight survey days, resulting in an average gate closure of 4 minutes and 46 seconds for each blockage, and over 92 minutes of a total blockage per day.

The average blockage time and the total blockage time during the data collection days are presented in Table 4.

Table 4: Blockage Time for CP Rail

Date	Average Blockage Time per train	Total Blockage Time per day
March 22, 2017	0:03:44	0:44:48
March 23, 2017	0:06:25	2:02:03
March 24, 2017	0:04:34	0:36:34
March 25, 2017	0:04:34	1:54:15
March 26, 2017	0:03:57	1:46:44
March 27, 2017	0:04:06	2:03:08
March 28, 2017	0:05:30	1:39:03
March 29, 2017	0:05:15	1:29:21
Average	**0:04:46**	**1:32:00**

5 COLLISION DATA ANALYSIS AND REVIEW

Collision data were received from the City for the study area intersections and mid-blocks for a five-year period from 2011 to 2015. The collision data identifies the total number of collisions, characteristics related to lighting and environmental conditions and initial impact types, types of collisions (i.e. 'property damage only' (PDO), 'injury', or 'fatal'). Within the data collection period, a total of 468 collisions were recorded on the study area corridor.

The distribution of collisions at/between intersections are presented in Figure 6.

Intersections on Adelaide St N	Number of Collisions
Oxford St E	173
	35
Piccadilly St	17
	10
McMahen St	10
	4
Pall Mall St	11
	30
Central Ave	26
	16
Elias Stt	4
	2
Rosedale St	1
	4
Princess Ave	12
	9
Lorne Ave	9
	6
Dufferin Ave	14
	3
Queens Ave	72

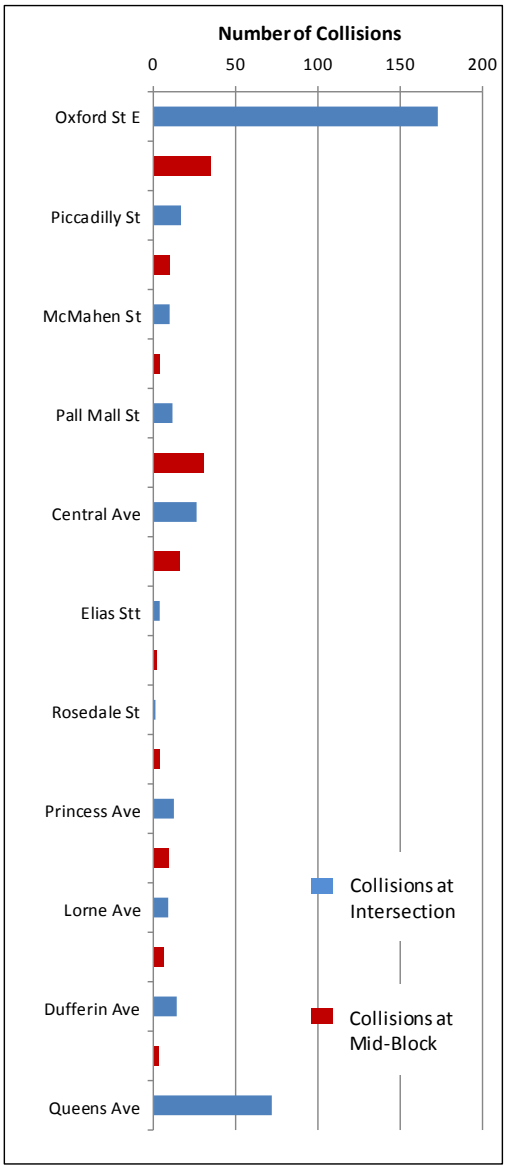


Figure 6: Collision Distributions within Study Area

5.1 COLLISIONS AT INTERSECTIONS

Within the five-year period (2011 to 2015), 349 out of the total 468 collisions (approximately 75%) were recorded at the intersections. The details of all collision data for the study area intersections are presented in Table 5.

Table 5: Collision Data Summary for Intersections (2011-2015)

Adelaide St N Intersections at	Total Collision	Collision Rate[1]	Lighting Conditions				Initial Impact Type							Collision Type			Environment Condition			
			Daylight	Dark	Dawn	Dusk	Rear End	Angle	SMV	Sideswipe	Turning Movement	Approaching	Other	PDO	Injury	Fatal	Clear	Rain	Snow	Other
Oxford St E	173	1.76	112	51	3	7	85	15	5	31	35	0	2	140	32	1	132	27	11	3
			65%	29%	2%	4%	49%	9%	3%	18%	20%	0%	1%	81%	18%	1%	76%	16%	6%	2%
Piccadilly St	17	-	14	2	0	1	6	7	2	2	0	0	0	11	6	0	12	2	3	0
			82%	12%	0%	6%	35%	41%	12%	12%	0%	0%	0%	65%	35%	0%	71%	12%	18%	0%
McMahen St	10	0.21	7	1	1	1	0	6	0	2	2	0	0	7	3	0	9	0	1	0
			70%	10%	10%	10%	0%	60%	0%	20%	20%	0%	0%	70%	30%	0%	90%	0%	10%	0%
Pall Mall St	11	0.22	8	2	0	1	3	4	1	2	0	1	0	8	3	0	9	1	1	0
			73%	18%	0%	9%	27%	36%	9%	18%	0%	9%	0%	73%	27%	0%	82%	9%	9%	0%
Central Ave	26	0.50	24	1	0	1	10	2	1	9	4	0	0	21	5	0	22	4	0	0
			92%	4%	0%	4%	38%	8%	4%	35%	15%	0%	0%	81%	19%	0%	85%	15%	0%	0%
Elias St	4	-	2	0	0	2	1	0	0	0	3	0	0	2	2	0	3	1	0	0
			50%	0%	0%	50%	25%	0%	0%	0%	75%	0%	0%	50%	50%	0%	75%	25%	0%	0%
Rosedale St	1	-	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0
			100%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%	0%
Princess Ave	12	-	10	2	0	0	2	2	3	5	0	0	0	9	3	0	7	3	2	0
			83%	17%	0%	0%	17%	17%	25%	42%	0%	0%	0%	75%	25%	0%	58%	25%	17%	0%
Lorne Ave	9	0.19	7	2	0	0	4	2	0	2	0	1	0	8	1	0	7	2	0	0
			78%	22%	0%	0%	44%	22%	0%	22%	0%	11%	0%	89%	11%	0%	78%	22%	0%	0%
Dufferin Ave	14	0.29	14	0	0	0	4	5	1	3	1	0	0	9	5	0	12	2	0	0
			100%	0%	0%	0%	29%	36%	7%	21%	7%	0%	0%	64%	36%	0%	86%	14%	0%	0%
Queens Ave	72	1.12	54	14	1	3	25	31	2	12	1	0	1	43	29	0	61	6	4	1
			75%	19%	1%	4%	35%	43%	3%	17%	1%	0%	1%	60%	40%	0%	85%	8%	6%	1%
Total	**349**	-	**253**	**75**	**5**	**16**	**141**	**74**	**15**	**68**	**46**	**2**	**3**	**259**	**89**	**1**	**275**	**48**	**22**	**4**
			72%	**21%**	**1%**	**5%**	**40%**	**21%**	**4%**	**19%**	**13%**	**1%**	**1%**	**74%**	**26%**	**0%**	**79%**	**14%**	**6%**	**1%**

Note 1: Collision rates are not available for the intersections at which the existing traffic volumes were not provided.

Many of the intersection collisions occurred under 'clear' weather (79%) and 'daylight' conditions (72%). The primary impact type was 'rear end' (40%), followed by the 'angle' and 'sideswipe' at 21% and 19%, respectively. Approximately 74% of the collisions resulted in PDO; remaining 26% of the collisions resulted in 'injury'. One fatal collision

(collision type of 'angle') occurred at the Adelaide Street North and Oxford Street East intersection in April 2013.

Approximately 50% of all intersection collisions occurred at Adelaide Street North and Oxford Street East intersection. Based on the number of collisions and the number of vehicles entering the intersection, collision rates were calculated to reflect the annual collision number per million vehicles approaching the intersection. The Oxford Street East intersection has experienced 173 collisions during the five-year period, which resulted in the highest collision rate of 1.76. This high collision rate could be attributed to potential sight-line issues and insufficient storage lane lengths for westbound and southbound left-turn movements.

The City has conducted a detailed safety review study (*Development of Safety Performance Function and Network Screening for Intersections*) in November 2014, which provides the result of the network screening and ranking for the top 20 intersections within the City of London on the basis of their Potential for Safety Improvement (PSI) for 'Severe' and 'PDO' (property damage only) combined. This study ranked the Adelaide Street North and Oxford Street intersection as 9th for PSI.

The Queens Avenue intersection experienced 72 collisions in the five-year period, resulting in a collision rate of 1.12. Most of the collisions occurred at this intersection were classified under the 'angle' or 'rear end' type (43% and 35%, respectively).

The collision rates for all the other intersections are less than 0.60 during the five-year period.

5.2 COLLISIONS AT MID-BLOCKS

Within the five-year period (2011 to 2015), a total of 119 collisions within the study area were recorded at mid-block locations. Most of these collisions occurred under 'clear' weather (85%) and 'daylight' conditions (80%). The primary impact types were 'rear-end' (34%) and 'sideswipe' (32%). Approximately 87% of the collisions resulted in PDO, the remaining 13% of the collisions resulted in 'injury'.

The collision data summary for the mid-blocks is presented in Table 6.

Thirty-five collisions occurred on the mid-block between Oxford Street East and Piccadilly Street, resulting in the highest collision rate of 0.78 for all the mid-block locations within the study area. The mid-block between Pall Mall Street and Central Avenue has experienced 30 collisions with a collision rate of 0.62. Potential contributing factors for mid-block collisions include: driver frustration due to delays at the CP rail crossing, substandard lane widths, absence of dedicated turn lanes and the high density of accesses / drive-ways along the corridor which increase the number of potential conflict points for turning and through traffic.

Table 6: Collision Data Summary for Mid-Blocks (2011-2015)

Mavis Intersections at	Total Collision	Collision Rate	Lighting Conditions				Initial Impact Type							Collision Type			Environment Condition			
			Daylight	Dark	Dawn	Dusk	Rear End	Angle	SMV Other	Sideswipe	Turning Movement	Approaching	Other	PDO	Non-Fatal	Fatal	Clear	Rain	Snow	Other
Oxford St E																				
	35	0.78	28	6	0	1	9	8	2	11	3	1	1	33	2	0	31	2	1	1
Piccadilly St			80%	17%	0%	3%	26%	23%	6%	31%	9%	3%	3%	94%	6%	0%	89%	6%	3%	3%
	10	0.21	9	1	0	0	6	1	1	2	0	0	0	9	1	0	8	1	1	0
McMahen St			90%	10%	0%	0%	60%	10%	10%	20%	0%	0%	0%	90%	10%	0%	80%	10%	10%	0%
	4	0.08	2	2	0	0	0	0	1	3	0	0	0	4	0	0	3	1	0	0
Pall Mall St			50%	50%	0%	0%	0%	0%	25%	75%	0%	0%	0%	100%	0%	0%	75%	25%	0%	0%
	30	0.62	25	5	0	0	10	5	3	9	2	1	0	23	7	0	26	1	3	0
Central Ave			83%	17%	0%	0%	33%	17%	10%	30%	7%	3%	0%	77%	23%	0%	87%	3%	10%	0%
	16	0.36	12	2	0	2	6	1	0	7	1	1	0	15	1	0	15	1	0	0
Elias St			75%	13%	0%	13%	38%	6%	0%	44%	6%	6%	0%	94%	6%	0%	94%	6%	0%	0%
	2	0.04	2	0	0	0	0	1	0	1	0	0	0	2	0	0	1	1	0	0
Rosedale St			100%	0%	0%	0%	0%	50%	0%	50%	0%	0%	0%	100%	0%	0%	50%	50%	0%	0%
	4	0.08	2	1	0	1	3	0	0	0	0	0	1	2	2	0	2	1	1	0
Princess Ave			50%	25%	0%	25%	75%	0%	0%	0%	0%	0%	25%	50%	50%	0%	50%	25%	25%	0%
	9	0.19	7	1	0	1	3	2	0	2	0	2	0	7	2	0	8	0	0	1
Lorne Ave			78%	11%	0%	11%	33%	22%	0%	22%	0%	22%	0%	78%	22%	0%	89%	0%	0%	11%
	6	0.13	5	0	0	1	3	1	0	1	0	1	0	6	0	0	4	1	1	0
Dufferin Ave			83%	0%	0%	17%	50%	17%	0%	17%	0%	17%	0%	100%	0%	0%	67%	17%	17%	0%
	3	0.06	3	0	0	0	1	0	0	2	0	0	0	3	0	0	3	0	0	0
Queens Ave			100%	0%	0%	0%	33%	0%	0%	67%	0%	0%	0%	100%	0%	0%	100%	0%	0%	0%
Total	**119**	**-**	**95**	**18**	**0**	**6**	**41**	**19**	**7**	**38**	**6**	**6**	**2**	**104**	**15**	**0**	**101**	**9**	**7**	**2**
			80%	**15%**	**0%**	**5%**	**34%**	**16%**	**6%**	**32%**	**5%**	**5%**	**2%**	**87%**	**13%**	**0%**	**85%**	**8%**	**6%**	**2%**

6 FUTURE (2036) TRAFFIC ANALYSIS

6.1 TRAFFIC GROWTH AND FUTURE VOLUME ESTIMATE

The historical traffic volumes (Annual Average Daily Traffic-AADT) on Adelaide Street North at Pall Mall Street and at Central Avenue were reviewed to identify were reviewed to identify growth trends. The results are presented in Figure 7.

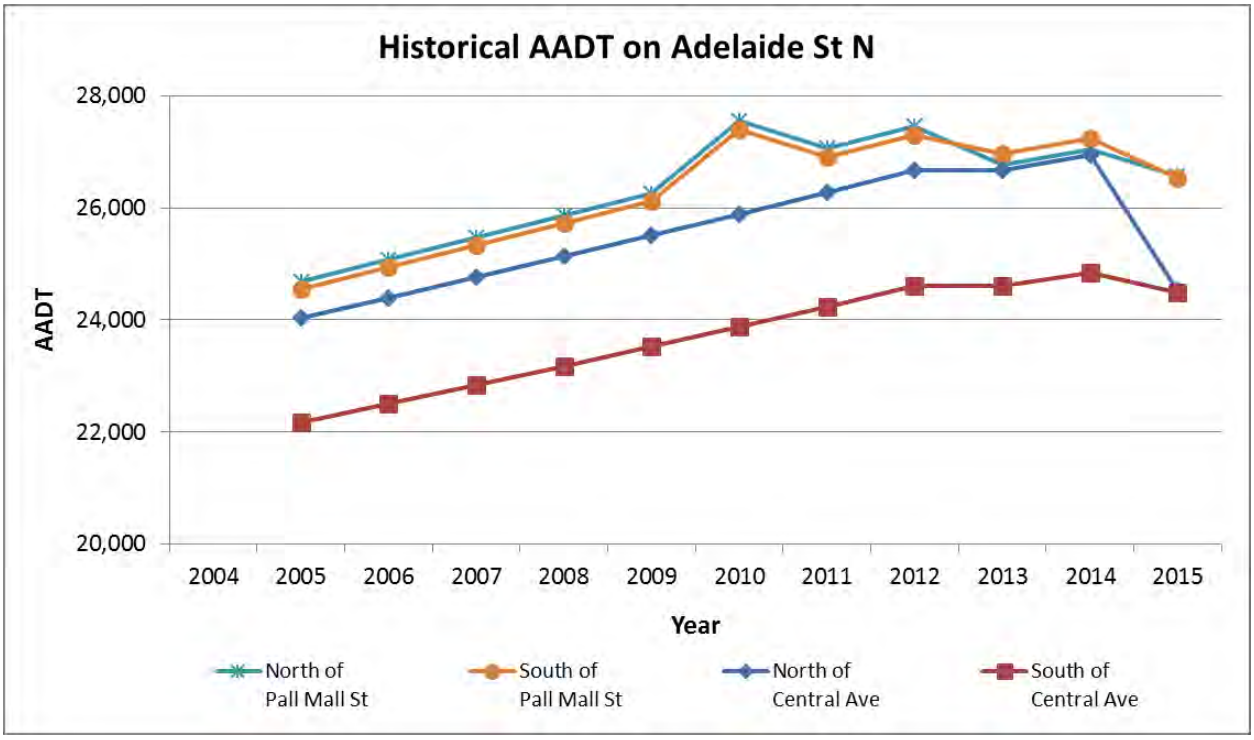


Figure 7: Historical Traffic Volumes (AADT) on Adelaide Street North

The traffic volumes on Adelaide Street North have experienced an average annual growth rate of 1% between 2005 and 2015. This growth rate was also utilized to estimate the future (2036) traffic demands, presented in Figure 8.

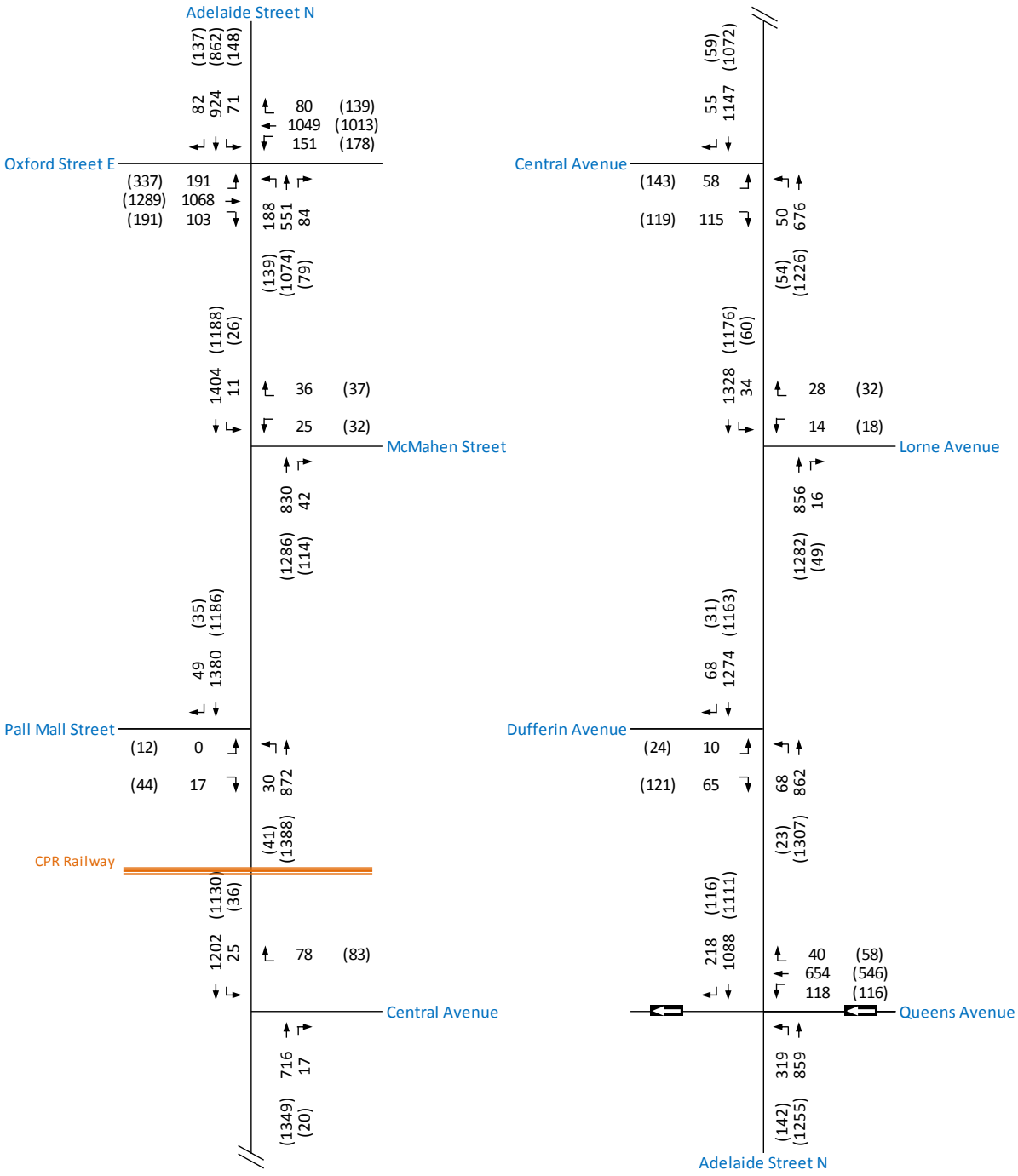


Figure 8: Future (2036) Traffic Demand Forecast - Weekday Peak Hours

6.2 FUTURE ROADWAY CAPACITY ANALYSIS

Similar to the existing condition, the roadway (link-level) capacity analysis for the future (2036) condition was conducted by calculating the v/c ratios. The v/c ratio for each corridor segment of Adelaide Street North was calculated using the estimated future traffic volumes and a roadway capacity of 800 vehicles per lane. The v/c ratios show that future traffic is expected to approach capacity for the peak-hour-peak-direction, which is the southbound direction during morning peak hour and the northbound direction during afternoon peak hour.

The v/c ratios for the morning and afternoon peak hour conditions are presented in Figure 9 and Figure 10, respectively. During morning peak hour (presented in Figure 9), the southbound traffic between Oxford Street and Queens Avenue is expected to operate at '*Unstable'* conditions with v/c ratio between 0.80 and 0.90.

During afternoon peak hour conditions, the northbound traffic demand is expected to approach near the planning level capacity of 1600 vehicles per hour. However, the projected traffic demand does not identify a need for an additional through lane on Adelaide Street.

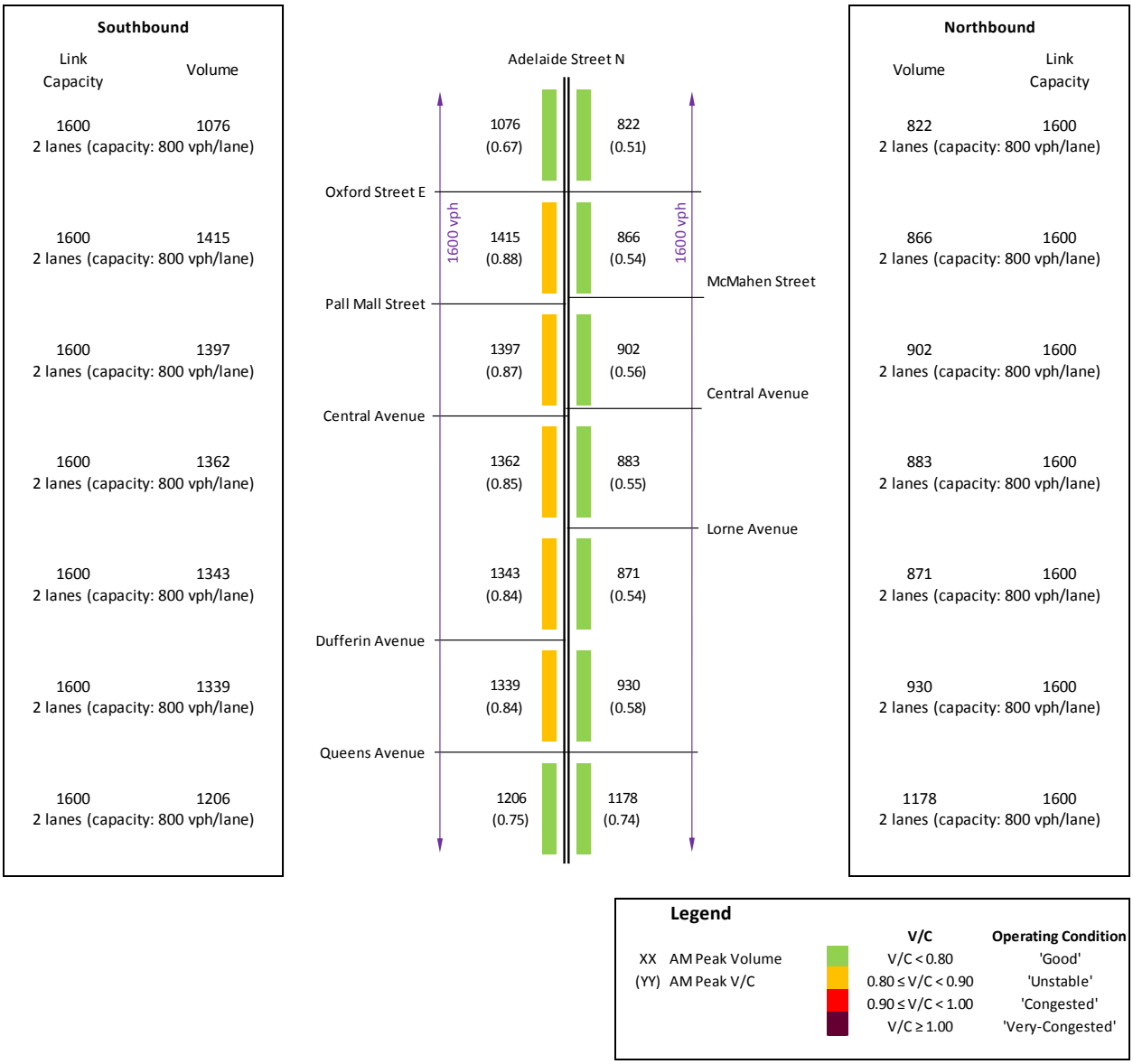


Figure 9: Roadway Capacity (V/C) Analysis for Future (2036) AM Peak Hour Condition

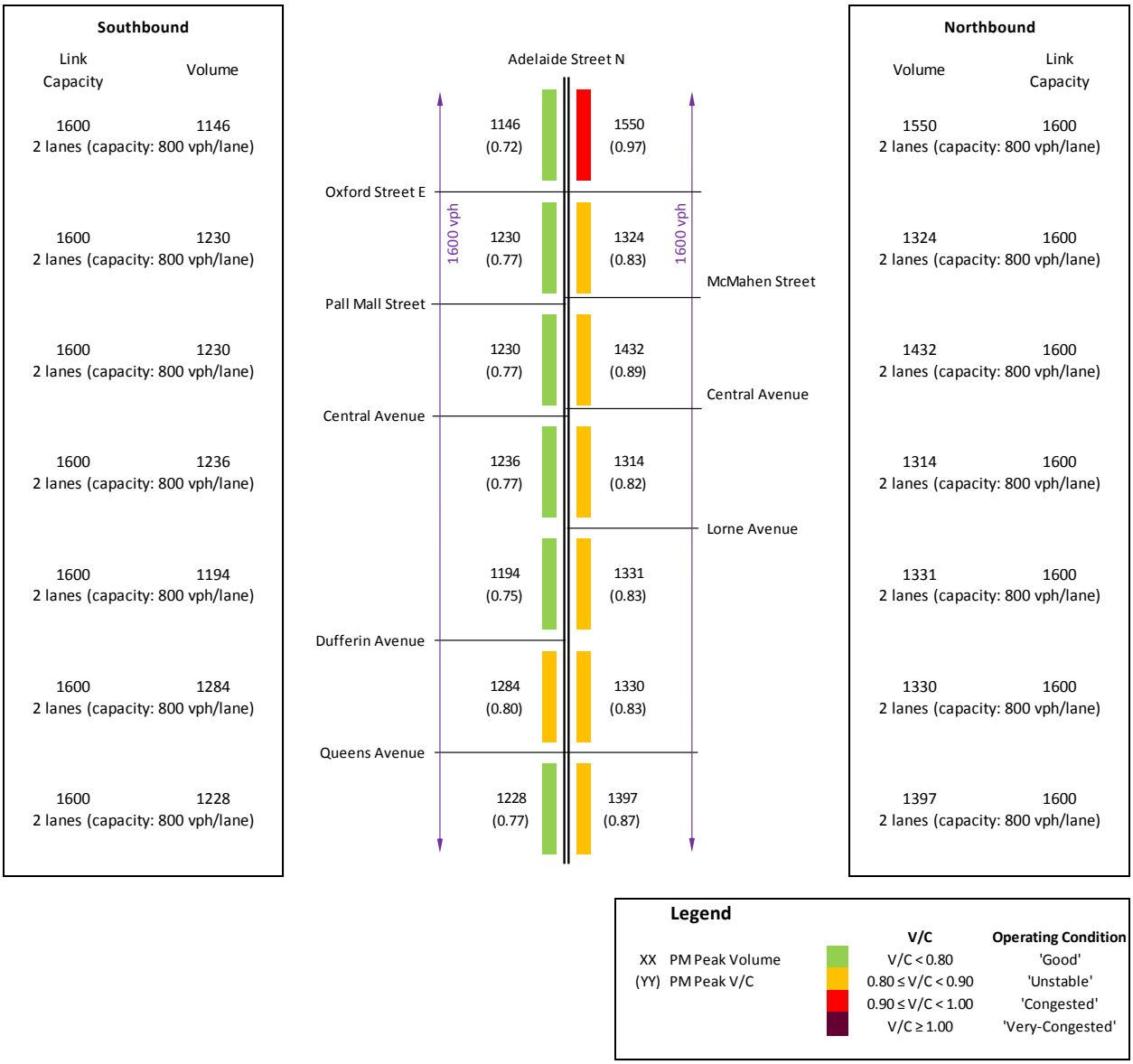


Figure 10: Roadway Capacity (V/C) Analysis for Future (2036) PM Peak Hour Condition

6.3 FUTURE INTERSECTION OPERATIONAL ANALYSIS

The future intersection operational analysis was conducted for the following two scenarios, for the forecasted traffic volumes for the future (2036) conditions:

- Scenario 1: 'Do-Nothing', and
- Scenario 2: Recommended intersection improvements.

The intersection operational analysis was conducted using *Vissim* based micro-simulation model. The *Vissim* model outputs were used to derive the 95th percentile queue length, average delay and the resulting level of service (LOS). The v/c ratios for signalized intersections were derived from a *Synchro* model.

6.3.1 ANALYSIS FOR SCENARIO 1: 'DO-NOTHING'

The intersection operational analysis for the 'Do-Nothing' scenario was conducted using the existing lane configurations and optimized signal timing plans derived from the Synchro model. The intersection operational analysis results are presented in Table 7. Detailed *Synchro* reports are presented in Appendix B.

Table 7: Future (2036) Intersection Operational Analysis Results for Scenario 1

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Adelaide St N and Oxford St E (Signalized)		***45***	***D***			***74***	***E***	
Eastbound Left	1.24	44	D	57	1.19	105	F	386
Eastbound Through	0.94	33	C	157	0.99	53	D	377
Eastbound Right	0.19	11	B	21	0.32	32	C	31
Westbound Left	1.01	93	F	315	1.09	154	F	391
Westbound Through/Right	1.02	72/72	E/E	310	1.10	121/117	F/F	401
Northbound Left	1.37	53	D	74	1.12	67	E	73
Northbound Through/Right	0.70	26/22	C/C	84	1.19	52/49	D/D	146
Southbound Left	0.42	37	D	109	1.19	118	F	224
Southbound Through/Right	1.16	34/24	C/C	125	1.07	58/46	E/D	222
Adelaide St N and McMahen St		***2***	***A***			***4***	***A***	
Westbound Left/Right	-	28/8	D/A	7	-	37/11	E/B	8
Northbound Through/Right	-	1/2	A/A	0	-	3/3	A/A	0
Southbound Left/Through	-	7/2	A/A	7	-	14/3	B/A	33

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Adelaide St N and Pall Mall St [2]		***2***	***A***			***3***	***A***	
Eastbound Left/Right	-	0/7	A/A	6	-	26/8	D/A	7
Northbound Left/Through	-	12/1	B/A	11	-	13/3	B/A	29
Southbound Through/Right	-	2/2	A/A	7	-	3/4	A/A	24
Adelaide St N and Central Ave East-Leg		***7***	***A***			***8***	***A***	
Westbound Right ('stop' control)	-	7	A	8	-	8	A	8
Northbound Through/Right	-	2/0	A/A	-	-	5/1	A/A	-
Southbound Left/Through	-	8/5	A/A	92	-	15/9	B/A	103
Adelaide St N and Central Ave West-Leg (Signalized)		***6***	***A***			***10***	***A***	
Eastbound Left	0.38	39	D	26	0.65	44	D	52
Eastbound Right	0.60	7	A	16	0.44	11	B	25
Northbound Left/Through	0.44	16/2	B/A	34	0.67	19/5	B/A	57
Southbound Through/Right	0.52	5/6	A/A	92	0.48	9/8	A/A	103
Adelaide St N and Lorne Ave[2]		***5***	***A***			***4***	***A***	
Westbound Left/Right	-	19/11	C/B	8	-	34/18	D/C	23
Northbound Through/Right	-	4/4	A/A	40	-	3/3	A/A	48
Southbound Left/Through	-	11/4	B/A	50	-	14/4	B/A	37
Adelaide St N and Dufferin Ave West-Leg		***1***	***A***			***3***	***A***	
Eastbound Left/Right	-	34/12	D/B	8	-	31/12	D/B	14
Northbound Left/Through	-	13/2	B/A	20	-	11/4	B/A	28
Southbound Through/Right	-	1/1	A/A	30	-	0/1	A/A	5
Adelaide St N and Queens Ave (Signalized)		***27***	***C***			***17***	***B***	
Westbound Left/Through/Right	1.07	38/36/30	D/D/C	91	1.06	45/42/36	D/D/D	97
Northbound Left/Through	3.19	47/13	D/B	143	1.15	14/5	B/A	82
Southbound Through/Right	0.71	26/27	C/C	112	0.57	15/17	B/B	109

Note: 1. Queue length reflects 95th percentile conditions

2. Intersections with IPS were treated as 'Stop' control intersections for LOS reporting

The intersection operational analysis results indicate that all the intersections are expected to operate at overall LOS 'C' or better, during both the morning and afternoon peak hours, except the Oxford Street East intersection. Many turning movements at this intersection are expected to operate with higher delays (at LOS 'E'/'F') and long queues. The queue lengths for all the left turning movements are expected to exceed available storage and block the through traffic movements, which would contribute to heavy congestion at this intersection.

For the intersection at Central Avenue (west-leg), the queue for the southbound left-turn movement is expected to extend upstream to the railway crossing during afternoon peak hour, which could be a potential safety issue.

The traffic operations under 'Do-Nothing' scenario will not provide adequate performance for the future traffic demands.

6.3.2 RECOMMENDED IMPROVEMENTS

Road blockages on Adelaide Street North created by CP operations through the at-grade rail crossing, result in significant delays for all the road users and creates long queues and gridlock in the area. To address this issue, a grade separation is essential.

In addition to the proposed grade separation, and based on the intersection operational analysis results, improvements were identified for many of the intersections:

- At Oxford Street East Intersection: extend storage length for eastbound, westbound and southbound left turn movements;
- At Pall Mall Street Intersection: convert the existing intersection configuration into a right-in / right-out, and relocate the signalized pedestrian crossing to McMahen Street (this relocation is required to address the geometric constraints with the proposed grade separation);
- At Central Avenue Intersection: realign the east and west legs of Central Avenue to eliminate the 'jog', and provide dedicated turning lanes for all the left turn movements; and
- At Queens Avenue: provide a dedicated northbound left turn lane.

With the recommended right-in / right-out intersection at Pall Mall Street (i.e. eliminating existing northbound left and eastbound left movements), the traffic demands for these left turn movements were assumed to be accommodated at the Central Avenue intersection. The traffic volumes for the Central Avenue were also revised to address the proposed realignment. The adjusted traffic demands for the future (2036) conditions for these two

intersections are presented in Figure 11. The recommended intersection lane configurations based on technical analysis are presented in Figure 12.

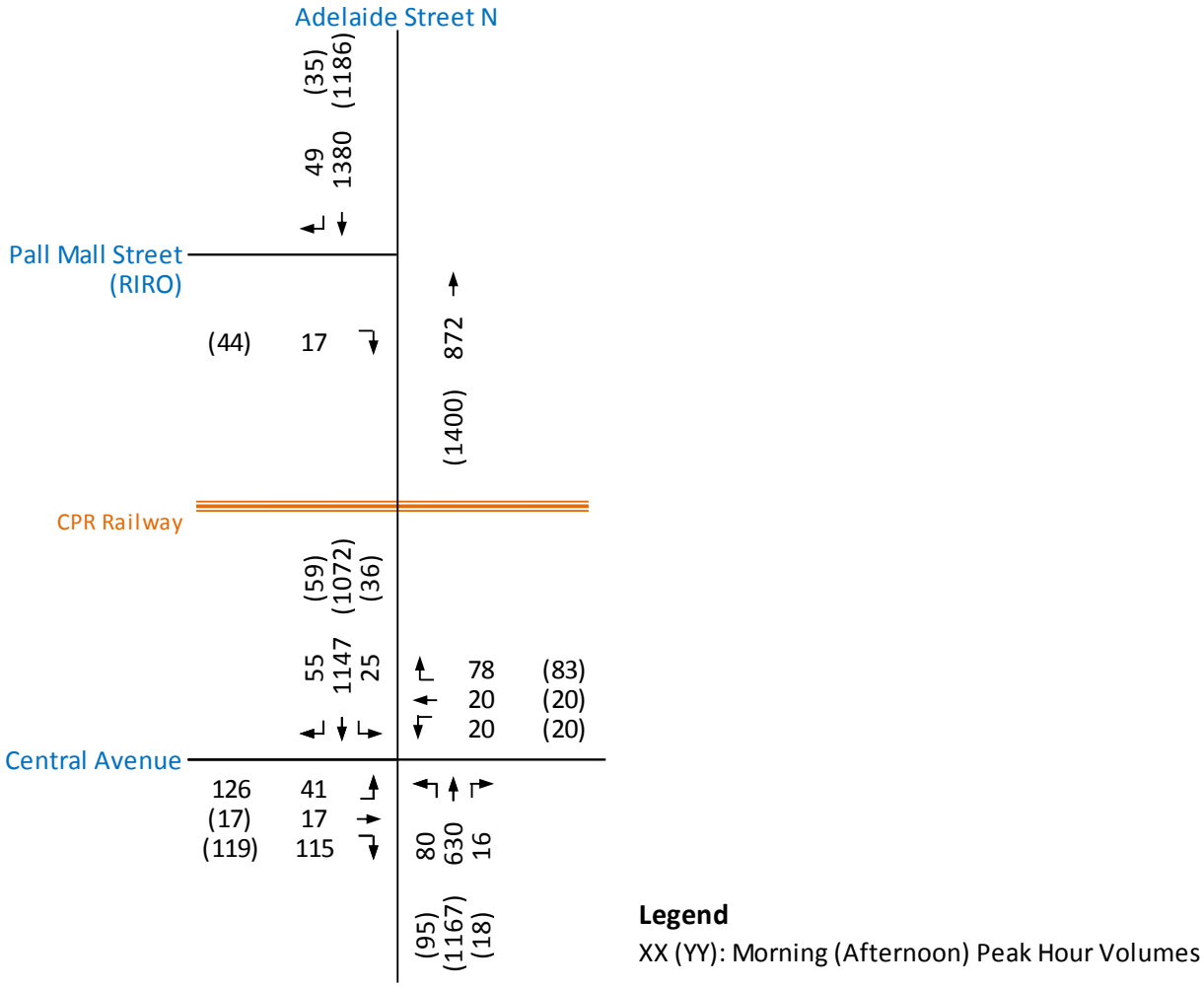


Figure 11: Future (2036) Adjusted Peak Hour Volumes at Central Avenue and at Pall Mall Street

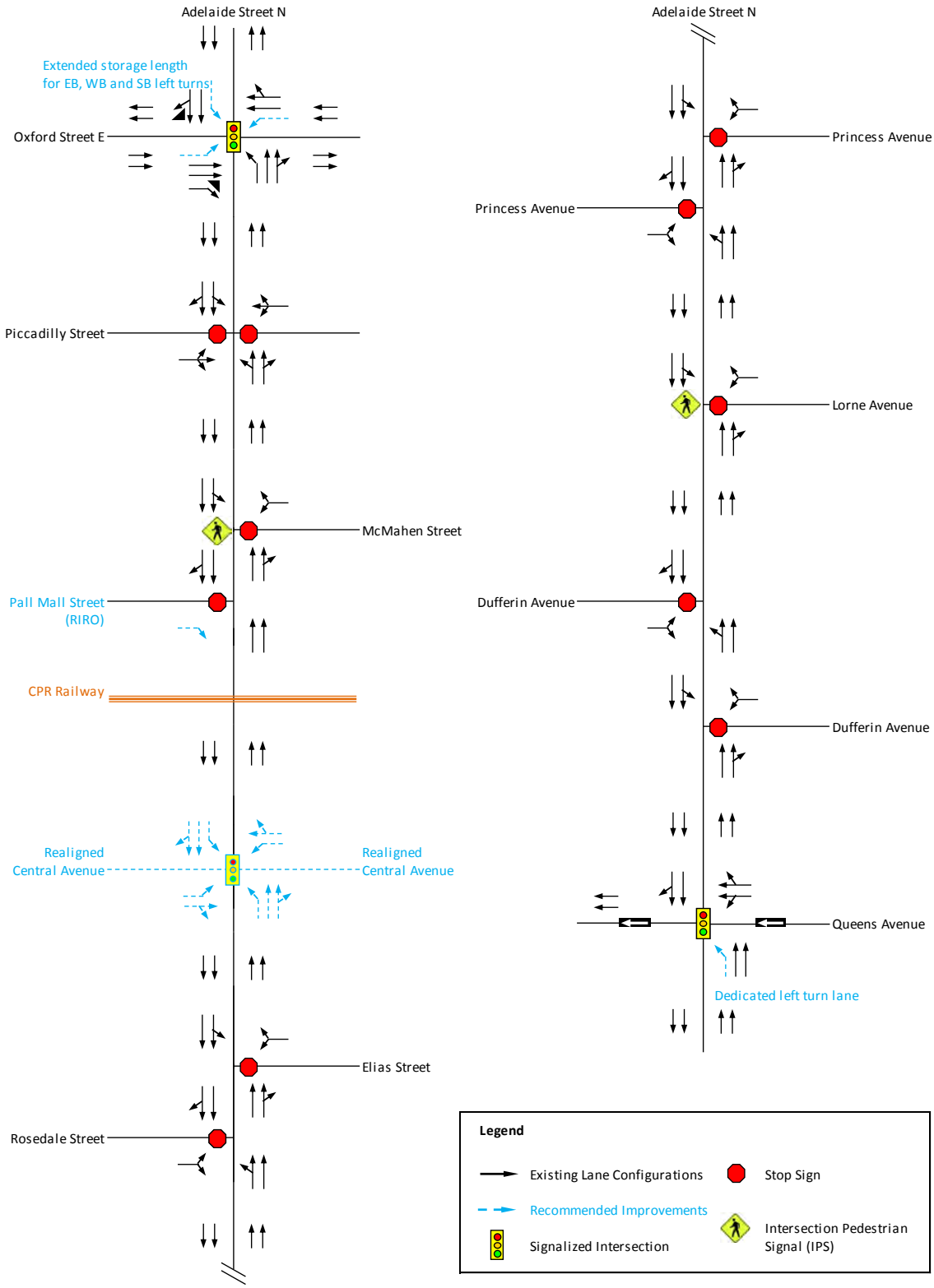


Figure 12: Future (2036) Recommended Intersection Improvements

6.3.3 ANALYSIS FOR SCENARIO 2: WITH RECOMMENDED IMPROVEMENTS

The intersection operational analysis results summarizing average vehicular delays, resulting LOS and 95th percentile queue length for the Scenario 2 (with recommended intersection lane configurations and optimized signal timing plans) are presented in Table 8. Detailed *Synchro* reports are presented in Appendix C.

Table 8: Future (2036) Intersection Operational Analysis Results for Scenario 2

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Adelaide St N and Oxford St E (Signalized)		***32***	***C***			***48***	***D***	
Eastbound Left	1.25	47	D	69	1.19	65	E	130
Eastbound Through	0.93	29	C	129	0.99	31	D	190
Eastbound Right	0.19	8	A	12	0.32	13	B	24
Westbound Left	1.02	30	C	43	1.09	49	D	66
Westbound Through/Right	1.02	31/31	C/C	149	1.10	51/54	D/D	206
Northbound Left	1.26	49	D	64	1.12	77	E	72
Northbound Through/Right	0.65	30/26	C/C	83	1.19	61/61	E/E	241
Southbound Left	0.40	27	C	27	1.19	116	F	85
Southbound Through/Right	1.13	37/26	D/C	129	1.07	37/25	D/C	123
Adelaide St N and McMahen St		***2***	***A***			***3***	***A***	
Westbound Left/Right	-	23/7	C/A	7	-	28/9	D/A	10
Northbound Through/Right	-	1/2	A/A	0	-	2/3	A/A	0
Southbound Left/Through	-	6/2	A/A	8	-	12/3	B/A	29
Adelaide St N and Pall Mall St [2] **(RIRO)**		***2***	***A***			***3***	***A***	
Eastbound Right	-	7	A	6	-	8	A	7
Northbound Through	-	1	A	4	-	1	A	10
Southbound Through/Right	-	3/3	A/A	16	-	4/4	A/A	34
Adelaide St N and Central Ave (Signalized)		*9*	*A*			*14*	*B*	
Eastbound Left	0.34	40	D	20	0.68	40	D	46
Eastbound Through/Right	0.64	38/11	D/A	36	0.48	37/11	D/B	34
Westbound Left	0.21	36	D	15	0.12	36	D	14
Westbound Through/Right	0.43	40/11	D/B	29	0.36	31/12	C/B	28
Northbound Left	0.42	22	C	19	0.43	25	C	22

Location/Movement	Levels of Service							
	Weekday Morning Peak Hour				Weekday Afternoon Peak Hour			
	V/C	Delay (s)	LOS	Queue (m)	V/C	Delay (s)	LOS	Queue[1] (m)
Northbound Through/Right	0.30	6/5	A/A	45	0.53	12/14	B/B	115
Southbound Left	0.06	12	B	8	0.18	17	B	11
Southbound Through/Right	0.54	7/7	A/A	111	0.50	9/9	A/A	101
Adelaide St N and Lorne Ave[2]		***7***	***A***			***5***	***A***	
Westbound Left/Right	-	23/12	C/B	10	-	26/13	D/B	11
Northbound Through/Right	-	8/7	A/A	56	-	6/7	A/A	58
Southbound Left/Through	-	12/6	B/A	52	-	12/3	B/A	30
Adelaide St N and Dufferin Ave West-Leg		***6***	***A***			***3***	***A***	
Eastbound Left/Right	-	32/12	D/B	8	-	25/11	C/B	13
Northbound Left/Through	-	15/4	B/A	46	-	10/2	A/A	26
Southbound Through/Right	-	7/7	A/A	0	-	4/4	A/A	0
Adelaide St N and Queens Ave (Signalized)		***28***	***C***			***19***	***B***	
Westbound Left/Through/Right	1.00	43/40/33	D/D/C	105	0.75	32/29/21	C/C/C	77
Northbound Left	1.06	37	D	99	0.70	27	C	56
Northbound Through	0.47	11	B	92	0.68	16	B	117
Southbound Through/Right	1.05	29/30	C/C	179	0.86	15/16	B/B	124

Note: 1. Queue length reflects 95th percentile conditions

2. Intersections with IPS were treated as 'Stop' control intersections for LOS reporting

The intersection operational analysis results indicate that all the intersections are expected to operate at an overall LOS 'C' or better during both peak hours. All the individual turning movements are expected to operate at an overall LOS 'D' or better during both peak hours, except for the Oxford Street East intersection. The eastbound left, northbound left, though, and right, and southbound left movements at this intersection are expected to operate at LOS 'E'/'F' during the afternoon peak hour. However, with the recommended storage length extension for left turn lanes, vehicular delays and resulting queue lengths are expected to reduce significantly compared to the 'Do-Nothing' scenario. Overall, the traffic operations with recommended intersection configurations could improve the future traffic conditions. The recommended storage lengths for the recommended improvements are presented in Table 9, which are identified based on the 95th percentile queue lengths.

While left-turn storage lengths were recommended in the context of the traffic analysis, adjustments were made based on local conditions and the effort to minimize property impacts. The final design is provided in Chapter 9 of the Environmental Study Report.

Table 9: Recommended Storage Length Requirements

Intersection / Movements	Recommended Storage Lengths (m)
At Oxford Street East - Eastbound Left	130
At Oxford Street East - Westbound Left	70
At Oxford Street East - Southbound Left	85
At Central Avenue - Eastbound Left	50
At Central Avenue - Westbound Left	15
At Central Avenue - Northbound Left	25
At Central Avenue - Southbound Left	15
At Queens Avenue - Northbound Left	100

6.3.4 PROPOSED INTERSECTION LANE CONFIGURATIONS

Based on comprehensive consideration of property requirements for intersection improvements, and potential impacts to other road users (e.g. pedestrians and cyclists), the recommended improvements are limited only for a segment between McMahen Street and Central Avenue. The proposed intersection lane configurations are presented in Figure 13.

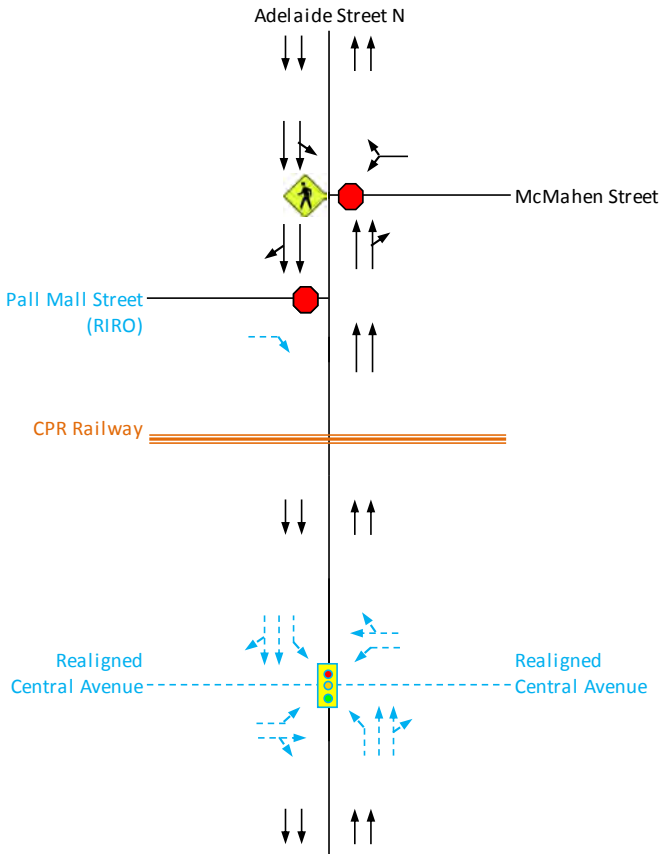


Figure 13: Proposed Intersection Lane Configurations

7 STUDY FINDINGS AND RECOMMENDATIONS

7.1 EXISTING TRAFFIC CONDITIONS

The following notes summarize the study findings in regard to existing (2016) traffic conditions:

- Adelaide Street North is four-lane north-south arterial corridor that carries approximately 26,000 vehicles per day. The southbound traffic peaks during the morning peak hour, and the northbound traffic peaks during the afternoon peak hour.
- There are two train tracks at the Adelaide - CP crossing, and a railway yard (CP London Yard) is located on the east side of Adelaide Street North. Trains crossing interrupt traffic flows at various times throughout the day, and resulting in delays up to 6 minutes per closure, and up to 2 hours of a total gate closure on a typical day. Due to gate closures at the rail crossing, a queue length for the southbound traffic generally extends past the Oxford Street intersection, and the northbound queue past the King Street intersection. These higher delays also result in traffic infiltration through the adjacent neighbourhood.
- The existing (2016) roadway capacity analysis results indicate that traffic on the Adelaide Street is generally operating at '*Good'* condition (with v/c ratio less than 0.80) for all the segments, except for a segment north of Oxford Street, a northbound traffic is operating at an 'Unstable' condition with v/c ratios at 0.81 during afternoon peak hour.
- The existing (2016) intersection analysis results indicate that all the intersections are operating at overall LOS 'C' or better; all the individual movements are operating at LOS 'D' or better for both peak hour conditions, except for the southbound left movement at Adelaide Street North and Oxford Street East intersection. This movement is operating at LOS 'E' during the afternoon peak hour. The high delay for this movement is mainly due to the short storage lane length (approximately 15 meters plus taper). At the Oxford Street intersection, various movements such as northbound left lane, northbound through / right lane, eastbound left turn lane and westbound through/right lanes are operating with v/c ratio of 1.00 or above, indicates the need for additional capacity.
- The northbound shared left / through movements at Adelaide Street and Queens Avenue intersection is operating with high v/c ratio at 1.71 during the morning peak hour indicates a need for a dedicated left turn lane.
- During the five-year period from 2011 to 2015, a total of 468 collisions were recorded on the study area corridor, including 349 collisions at intersections (75%) and 119 collisions on mid-blocks (25%).
- Approximately 50% of the intersection collisions occurred at the Oxford Street East intersection. This intersection has experienced 173 collisions, which resulted in a high collision rate of 1.76. This intersection has also experienced one 'fatal' collision in the

five-year period. The higher collision rate at this interaction could be contributed by the poor sightline and insufficient storage lane lengths for left turn movements. The City has conducted a detailed safety review study (*Development of Safety Performance Function and Network Screening for Intersections*) in November 2014. This study ranked the Adelaide Street North and Oxford Street intersection as 9th for PSI.

- The Queens Avenue intersection experienced 72 collisions in the five-year period, resulting in a collision rate of 1.12. Most of the collisions occurred at this intersection were classified under the 'angle' or 'rear end' type (43% and 35%, respectively).
- Thirty-five mid-block collisions occurred between Oxford Street East and Piccadilly Street during the five-year period, resulting in the highest collision rate of 0.78 for mid-blocks. The mid-block between Pall Mall Street and Central Avenue has experienced 30 collisions from 2011 to 2015. The potential contributing factors for mid-block collisions could be the substandard lane widths (3 meters), the absence of dedicated turning lanes, and high density of accesses/drive-ways along the corridor.

7.2 FUTURE TRAFFIC ANALYSIS AND RECOMMENDATIONS

The following notes summarize the findings for the future (2036) conditions and study recommendations:

- The roadway capacity analysis for the future (2036) conditions shows that during morning peak hour, the southbound traffic between Oxford Street and Queens Avenue is expected to operate at '*Unstable'* conditions with v/c ratio between 0.80 and 0.90. During afternoon peak hour conditions, the northbound traffic demand is expected to approach near the planning level capacity of 1600 vehicles per hour. However, the projected traffic demand does not identify a need for an additional through lane on Adelaide Street.
- The intersection operational analysis for the 'Do-Nothing' scenario indicate all the study area intersections are expected to operate at overall LOS 'C' or better, during both the morning and afternoon peak hours, except for the Oxford Street East intersection. Many turning movements at this intersection are expected to operate with higher delays (at LOS 'E'/'F') and long queues. The queue lengths for all the left turning movements at major signalized intersections are expected to exceed available storage and block the through traffic movements, which could create heavy congestions at this intersection. For the intersection at Central Avenue (west-leg), the 95th percentile queue for the southbound movement is expected to extend up to the upstream railway crossing during afternoon peak hour, which could be a potential safety issue.
- Based on intersection operational analysis results for the 'Do-Nothing' scenario, the following improvements were identified for the study area intersections:
  - At Oxford Street East Intersection: providing extended storage length for eastbound left turn, westbound left turn, and southbound left turn movements;

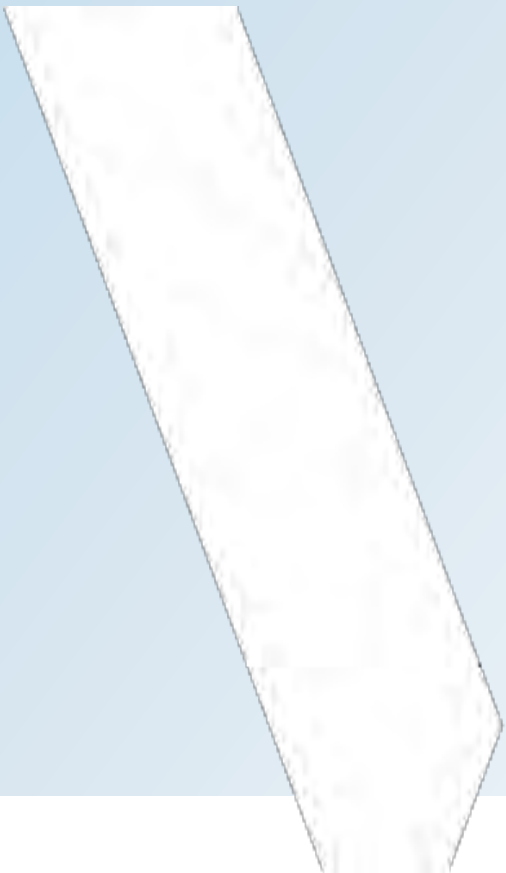
- At Pall Mall Street Intersection: converting existing intersection configuration into a Right-In-Right-Out (RIRO), and relocating the IPS to McMahen Street (this relocation is required to address the geometric constraints with the proposed grade separation);
- At Central Avenue Intersection: realigning the east and west legs of Central Avenue to eliminate the off-set, and providing dedicated turning lane for all the left turn movements; and,
- At Queens Avenue: providing a dedicated northbound left turn lane.

- The recommended intersection lane configurations based on technical analysis are presented in Figure 12, and storage length requirements for the left turn lanes are presented in Table 9.

Based on comprehensive consideration of property requirements for intersection improvements, and potential impacts to other road users (e.g. pedestrians and cyclists), the recommended improvements are limited only for a segment between McMahen Street and Central Avenue for this EA Study.

APPENDIX

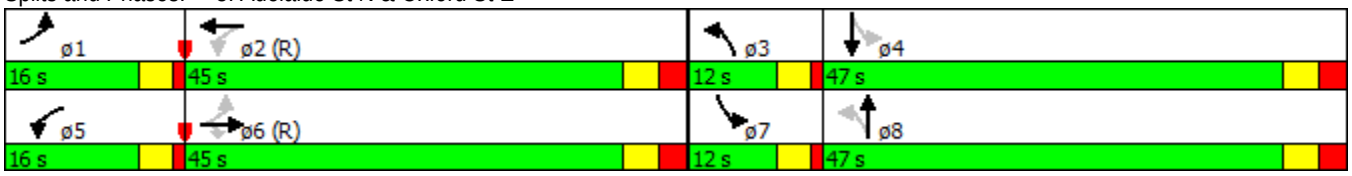
A: Existing (2016) Synchro Reports



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	159	890	86	126	874	157	459	59	770
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	1	6		5	2	3	8	7	4
Permitted Phases	6		6	2		8		4	
Detector Phase	1	6	6	5	2	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	7.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
Minimum Split (s)	9.0	28.9	28.9	9.0	28.9	9.0	26.9	9.0	26.9
Total Split (s)	16.0	45.0	45.0	16.0	45.0	12.0	47.0	12.0	47.0
Total Split (%)	13.3%	37.5%	37.5%	13.3%	37.5%	10.0%	39.2%	10.0%	39.2%
Yellow Time (s)	3.0	3.3	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.6	2.6	1.0	2.6	1.0	2.6	1.0	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.9	5.9	4.0	5.9	4.0	5.9	4.0	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	53.8	40.4	40.4	52.2	39.5	51.9	43.6	50.4	41.1
Actuated g/C Ratio	0.45	0.34	0.34	0.44	0.33	0.43	0.36	0.42	0.34
v/c Ratio	0.81	0.91	0.18	0.69	1.01	1.01	0.51	0.24	0.85
Control Delay	51.9	50.6	6.8	39.9	69.1	95.2	31.6	20.6	44.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.9	50.6	6.8	39.9	69.1	95.2	31.6	20.6	44.6
LOS	D	D	A	D	E	F	C	C	D
Approach Delay		47.5			65.6		46.2		43.0
Approach LOS		D			E		D		D

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 116 (97%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.01	
Intersection Signal Delay: 51.3	Intersection LOS: D
Intersection Capacity Utilization 84.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 3: Adelaide St N & Oxford St E



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Volume (vph)	48	96	42	563	956
Turn Type	Prot	Perm	Perm	NA	NA
Protected Phases	4			2	6
Permitted Phases		4	2		
Detector Phase	4	4	2	2	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	20.9	20.9	25.0	25.0	25.0
Total Split (s)	25.0	25.0	75.0	75.0	75.0
Total Split (%)	25.0%	25.0%	75.0%	75.0%	75.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	1.6	1.6	2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.9	4.9		6.0	6.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	8.8	8.8		80.3	80.3
Actuated g/C Ratio	0.09	0.09		0.80	0.80
v/c Ratio	0.36	0.47		0.33	0.43
Control Delay	48.7	15.0		3.3	3.6
Queue Delay	0.0	0.0		0.0	0.0
Total Delay	48.7	15.0		3.3	3.6
LOS	D	B		A	A
Approach Delay	26.2			3.3	3.6
Approach LOS	C			A	A

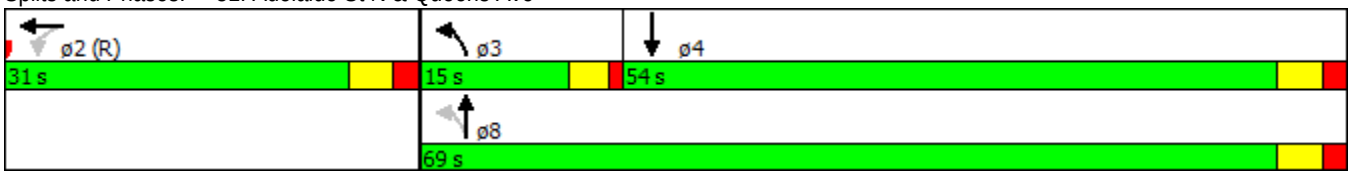
Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 6 (6%), Referenced to phase 2:NBTL and 6:SBT, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.47	
Intersection Signal Delay: 5.3	Intersection LOS: A
Intersection Capacity Utilization 64.1%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 13: Adelaide St N & Central Ave

Lane Group	WBT	NBL	NBT	SBT
Lane Configurations				
Volume (vph)	545	266	716	907
Turn Type	NA	pm+pt	NA	NA
Protected Phases	2	3	8	4
Permitted Phases		8		
Detector Phase	2	3	8	4
Switch Phase				
Minimum Initial (s)	7.0	5.0	7.0	7.0
Minimum Split (s)	21.4	9.0	18.3	18.3
Total Split (s)	31.0	15.0	69.0	54.0
Total Split (%)	31.0%	15.0%	69.0%	54.0%
Yellow Time (s)	3.3	3.0	3.3	3.3
All-Red Time (s)	2.1	1.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.4		5.3	5.3
Lead/Lag		Lead		Lag
Lead-Lag Optimize?				
Recall Mode	C-Max	None	Max	Max
Act Effct Green (s)	25.6		63.7	63.7
Actuated g/C Ratio	0.26		0.64	0.64
v/c Ratio	0.91		1.71dl	0.59
Control Delay	51.3		55.6	11.7
Queue Delay	0.0		15.0	0.0
Total Delay	51.3		70.5	11.7
LOS	D		E	B
Approach Delay	51.3		70.5	11.7
Approach LOS	D		E	B

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 44 (44%), Referenced to phase 2:WBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 42.5	Intersection LOS: D
Intersection Capacity Utilization 91.1%	ICU Level of Service F
Analysis Period (min) 15	
dl Defacto Left Lane. Recode with 1 though lane as a left lane.	

Splits and Phases: 31: Adelaide St N & Queens Ave

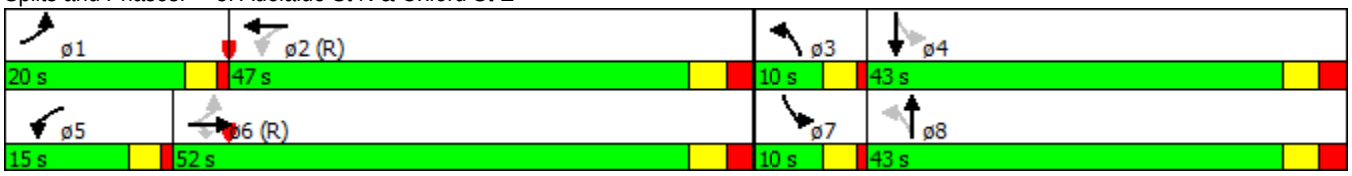


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	281	1074	159	148	844	116	895	123	718
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	1	6		5	2	3	8	7	4
Permitted Phases	6		6	2		8		4	
Detector Phase	1	6	6	5	2	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	7.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
Minimum Split (s)	9.0	28.9	28.9	9.0	28.9	9.0	26.9	9.0	26.9
Total Split (s)	20.0	52.0	52.0	15.0	47.0	10.0	43.0	10.0	43.0
Total Split (%)	16.7%	43.3%	43.3%	12.5%	39.2%	8.3%	35.8%	8.3%	35.8%
Yellow Time (s)	3.0	3.3	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.6	2.6	1.0	2.6	1.0	2.6	1.0	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.9	5.9	4.0	5.9	4.0	5.9	4.0	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	63.0	46.7	46.7	53.4	41.1	45.0	37.1	45.0	37.1
Actuated g/C Ratio	0.52	0.39	0.39	0.44	0.34	0.38	0.31	0.38	0.31
v/c Ratio	1.04	0.88	0.29	0.75	0.92	0.85	1.00	0.90	0.89
Control Delay	96.2	43.4	10.7	46.1	50.7	68.9	67.6	78.8	50.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	96.2	43.4	10.7	46.1	50.7	68.9	67.6	78.8	50.8
LOS	F	D	B	D	D	E	E	E	D
Approach Delay		49.8			50.1		67.7		54.4
Approach LOS		D			D		E		D

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 113 (94%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 55.0 Intersection LOS: D
Intersection Capacity Utilization 93.4% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 3: Adelaide St N & Oxford St E



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Volume (vph)	119	99	45	1022	893
Turn Type	Prot	Perm	Perm	NA	NA
Protected Phases	4			2	6
Permitted Phases		4	2		
Detector Phase	4	4	2	2	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	20.9	20.9	25.0	25.0	25.0
Total Split (s)	29.0	29.0	81.0	81.0	81.0
Total Split (%)	26.4%	26.4%	73.6%	73.6%	73.6%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	1.6	1.6	2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.9	4.9		6.0	6.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	13.5	13.5		85.6	85.6
Actuated g/C Ratio	0.12	0.12		0.78	0.78
v/c Ratio	0.61	0.39		0.52	0.38
Control Delay	56.8	12.0		5.9	4.6
Queue Delay	0.0	0.0		0.0	0.0
Total Delay	56.8	12.0		5.9	4.6
LOS	E	B		A	A
Approach Delay	36.5			5.9	4.6
Approach LOS	D			A	A

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 60 (55%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 8.3 Intersection LOS: A
Intersection Capacity Utilization 79.1% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 13: Adelaide St N & Central Ave

Lane Group	WBT	NBL	NBT	SBT
Lane Configurations				
Volume (vph)	455	118	1046	926
Turn Type	NA	pm+pt	NA	NA
Protected Phases	2	3	8	4
Permitted Phases		8		
Detector Phase	2	3	8	4
Switch Phase				
Minimum Initial (s)	7.0	5.0	7.0	7.0
Minimum Split (s)	21.4	9.0	18.3	18.3
Total Split (s)	31.0	10.0	79.0	69.0
Total Split (%)	28.2%	9.1%	71.8%	62.7%
Yellow Time (s)	3.3	3.0	3.3	3.3
All-Red Time (s)	2.1	1.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.4		5.3	5.3
Lead/Lag		Lead		Lag
Lead-Lag Optimize?				
Recall Mode	C-Max	None	Max	Max
Act Effct Green (s)	25.6		73.7	73.7
Actuated g/C Ratio	0.23		0.67	0.67
v/c Ratio	0.83		0.90	0.49
Control Delay	49.7		20.0	9.7
Queue Delay	0.0		0.1	0.0
Total Delay	49.7		20.2	9.7
LOS	D		C	A
Approach Delay	49.7		20.2	9.7
Approach LOS	D		C	A

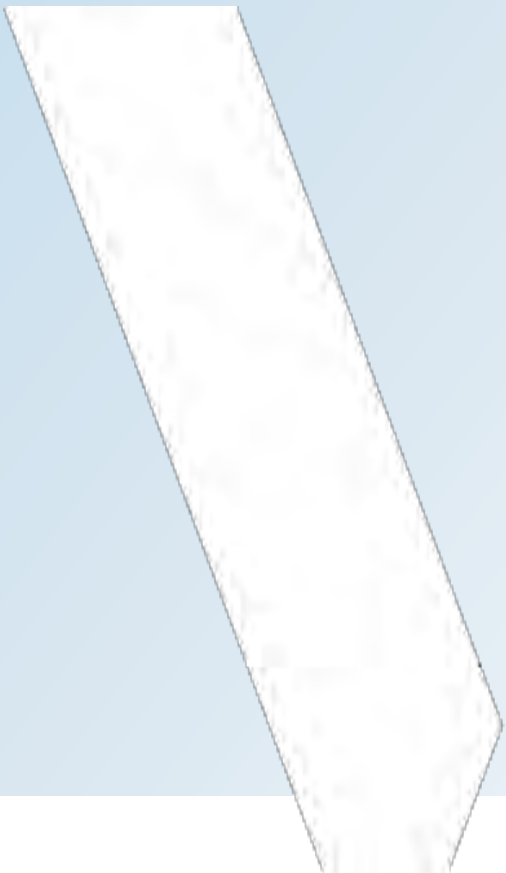
Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 110	
Offset: 109 (99%), Referenced to phase 2:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.90	
Intersection Signal Delay: 22.7	Intersection LOS: C
Intersection Capacity Utilization 91.7%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 31: Adelaide St N & Queens Ave

APPENDIX

B: Future (2036) Synchro Reports

Scenario 1: ‘Do-Nothing’

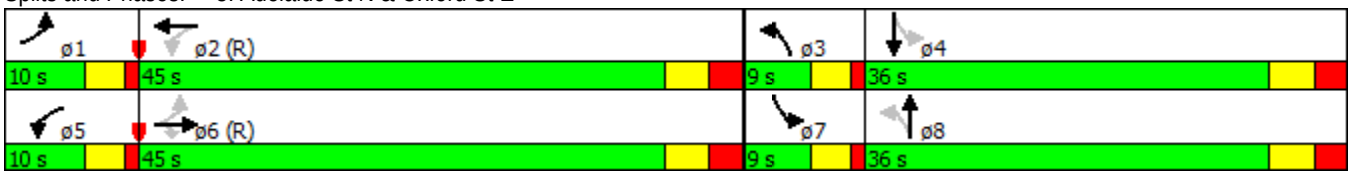


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	159	890	86	126	874	157	459	59	770
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	1	6		5	2	3	8	7	4
Permitted Phases	6		6	2		8		4	
Detector Phase	1	6	6	5	2	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	7.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
Minimum Split (s)	9.0	28.9	28.9	9.0	28.9	9.0	26.9	9.0	26.9
Total Split (s)	10.0	45.0	45.0	10.0	45.0	9.0	36.0	9.0	36.0
Total Split (%)	10.0%	45.0%	45.0%	10.0%	45.0%	9.0%	36.0%	9.0%	36.0%
Yellow Time (s)	3.0	3.3	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.6	2.6	1.0	2.6	1.0	2.6	1.0	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.9	5.9	4.0	5.9	4.0	5.9	4.0	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	47.0	39.1	39.1	47.0	39.1	37.8	31.9	37.0	30.1
Actuated g/C Ratio	0.47	0.39	0.39	0.47	0.39	0.38	0.32	0.37	0.30
v/c Ratio	1.24	0.94	0.19	1.01	1.02	1.37	0.70	0.42	1.16
Control Delay	167.5	43.4	4.8	92.8	60.8	227.6	33.8	25.4	115.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	167.5	43.4	4.8	92.8	60.8	227.6	33.8	25.4	115.1
LOS	F	D	A	F	E	F	C	C	F
Approach Delay		57.8			64.6		78.1		109.2
Approach LOS		E			E		E		F

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.37
Intersection Signal Delay: 75.6 Intersection LOS: E
Intersection Capacity Utilization 97.8% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 3: Adelaide St N & Oxford St E



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Volume (vph)	48	96	42	563	956
Turn Type	Prot	Perm	Perm	NA	NA
Protected Phases	4			2	6
Permitted Phases		4	2		
Detector Phase	4	4	2	2	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	20.9	20.9	25.0	25.0	25.0
Total Split (s)	24.0	24.0	76.0	76.0	76.0
Total Split (%)	24.0%	24.0%	76.0%	76.0%	76.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	1.6	1.6	2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.9	4.9		6.0	6.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	10.2	10.2		78.9	78.9
Actuated g/C Ratio	0.10	0.10		0.79	0.79
v/c Ratio	0.38	0.60		0.44	0.52
Control Delay	46.7	30.3		4.5	4.9
Queue Delay	0.0	0.0		0.0	0.0
Total Delay	46.7	30.3		4.5	4.9
LOS	D	C		A	A
Approach Delay	35.8			4.5	4.9
Approach LOS	D			A	A

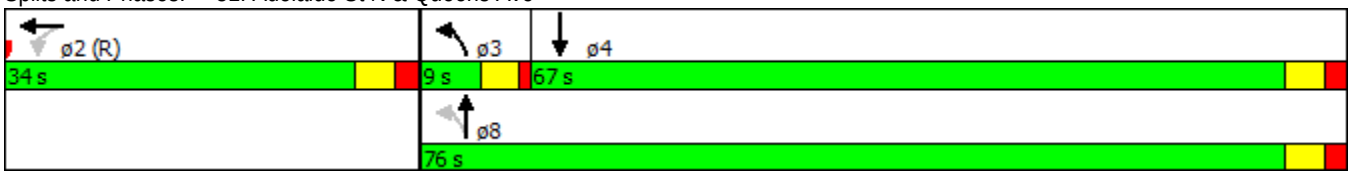
Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 7.3	Intersection LOS: A
Intersection Capacity Utilization 73.6%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 13: Adelaide St N & Central Ave

Lane Group	WBT	NBL	NBT	SBT
Lane Configurations				
Volume (vph)	545	266	716	907
Turn Type	NA	pm+pt	NA	NA
Protected Phases	2	3	8	4
Permitted Phases		8		
Detector Phase	2	3	8	4
Switch Phase				
Minimum Initial (s)	7.0	5.0	7.0	7.0
Minimum Split (s)	21.4	9.0	18.3	18.3
Total Split (s)	34.0	9.0	76.0	67.0
Total Split (%)	30.9%	8.2%	69.1%	60.9%
Yellow Time (s)	3.3	3.0	3.3	3.3
All-Red Time (s)	2.1	1.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.4		5.3	5.3
Lead/Lag		Lead		Lag
Lead-Lag Optimize?				
Recall Mode	C-Max	None	Max	Max
Act Effct Green (s)	28.6		70.7	70.7
Actuated g/C Ratio	0.26		0.64	0.64
v/c Ratio	1.07		3.19dl	0.71
Control Delay	90.9		147.8	14.8
Queue Delay	0.0		0.1	0.0
Total Delay	90.9		147.9	14.8
LOS	F		F	B
Approach Delay	90.9		147.9	14.8
Approach LOS	F		F	B

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 110	
Offset: 0 (0%), Referenced to phase 2:WBTL, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.26	
Intersection Signal Delay: 81.1	Intersection LOS: F
Intersection Capacity Utilization 106.6%	ICU Level of Service G
Analysis Period (min) 15	
dl Defacto Left Lane. Recode with 1 though lane as a left lane.	

Splits and Phases: 31: Adelaide St N & Queens Ave

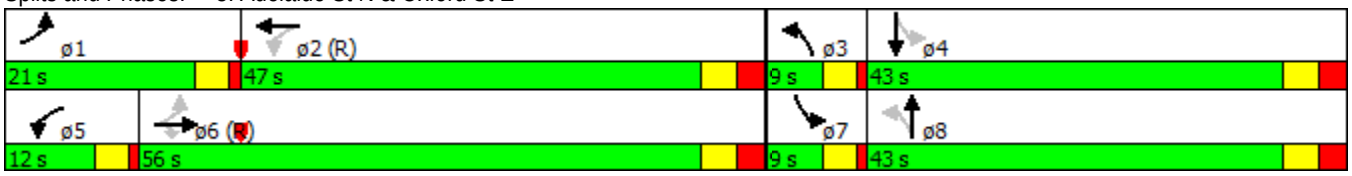


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	281	1074	159	148	844	116	895	123	718
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	1	6		5	2	3	8	7	4
Permitted Phases	6		6	2		8		4	
Detector Phase	1	6	6	5	2	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	7.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
Minimum Split (s)	9.0	28.9	28.9	9.0	28.9	9.0	26.9	9.0	26.9
Total Split (s)	21.0	56.0	56.0	12.0	47.0	9.0	43.0	9.0	43.0
Total Split (%)	17.5%	46.7%	46.7%	10.0%	39.2%	7.5%	35.8%	7.5%	35.8%
Yellow Time (s)	3.0	3.3	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.6	2.6	1.0	2.6	1.0	2.6	1.0	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.9	5.9	4.0	5.9	4.0	5.9	4.0	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	64.0	50.1	50.1	51.0	41.1	44.0	37.1	44.0	37.1
Actuated g/C Ratio	0.53	0.42	0.42	0.42	0.34	0.37	0.31	0.37	0.31
v/c Ratio	1.19	0.99	0.32	1.09	1.10	1.12	1.19	1.19	1.07
Control Delay	144.8	56.2	11.3	120.2	96.8	142.6	133.8	166.7	88.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	144.8	56.2	11.3	120.2	96.8	142.6	133.8	166.7	88.2
LOS	F	E	B	F	F	F	F	F	F
Approach Delay		68.0			99.9		134.7		98.3
Approach LOS		E			F		F		F

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 113 (94%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.19
Intersection Signal Delay: 97.2 — Intersection LOS: F
Intersection Capacity Utilization 108.7% — ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 3: Adelaide St N & Oxford St E



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Configurations					
Volume (vph)	119	99	45	1022	893
Turn Type	Prot	Perm	Perm	NA	NA
Protected Phases	4			2	6
Permitted Phases		4	2		
Detector Phase	4	4	2	2	6
Switch Phase					
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	20.9	20.9	25.0	25.0	25.0
Total Split (s)	22.0	22.0	78.0	78.0	78.0
Total Split (%)	22.0%	22.0%	78.0%	78.0%	78.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	1.6	1.6	2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.9	4.9		6.0	6.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	13.6	13.6		75.5	75.5
Actuated g/C Ratio	0.14	0.14		0.76	0.76
v/c Ratio	0.65	0.44		0.67	0.48
Control Delay	53.2	15.0		8.5	5.6
Queue Delay	0.0	0.0		0.0	0.0
Total Delay	53.2	15.0		8.5	5.6
LOS	D	B		A	A
Approach Delay	35.9			8.5	5.6
Approach LOS	D			A	A

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 10.0 Intersection LOS: A
Intersection Capacity Utilization 91.1% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 13: Adelaide St N & Central Ave

Lane Group	WBT	NBL	NBT	SBT
Lane Configurations				
Volume (vph)	455	118	1046	926
Turn Type	NA	pm+pt	NA	NA
Protected Phases	2	3	8	4
Permitted Phases		8		
Detector Phase	2	3	8	4
Switch Phase				
Minimum Initial (s)	7.0	5.0	7.0	7.0
Minimum Split (s)	21.4	9.0	18.3	18.3
Total Split (s)	36.0	9.0	104.0	95.0
Total Split (%)	25.7%	6.4%	74.3%	67.9%
Yellow Time (s)	3.3	3.0	3.3	3.3
All-Red Time (s)	2.1	1.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0
Total Lost Time (s)	5.4		5.3	5.3
Lead/Lag		Lead		Lag
Lead-Lag Optimize?				
Recall Mode	C-Max	None	Max	Max
Act Effct Green (s)	30.6		98.7	98.7
Actuated g/C Ratio	0.22		0.70	0.70
v/c Ratio	1.06		1.15	0.57
Control Delay	102.2		98.2	11.1
Queue Delay	0.0		0.3	0.0
Total Delay	102.2		98.5	11.1
LOS	F		F	B
Approach Delay	102.2		98.5	11.1
Approach LOS	F		F	B

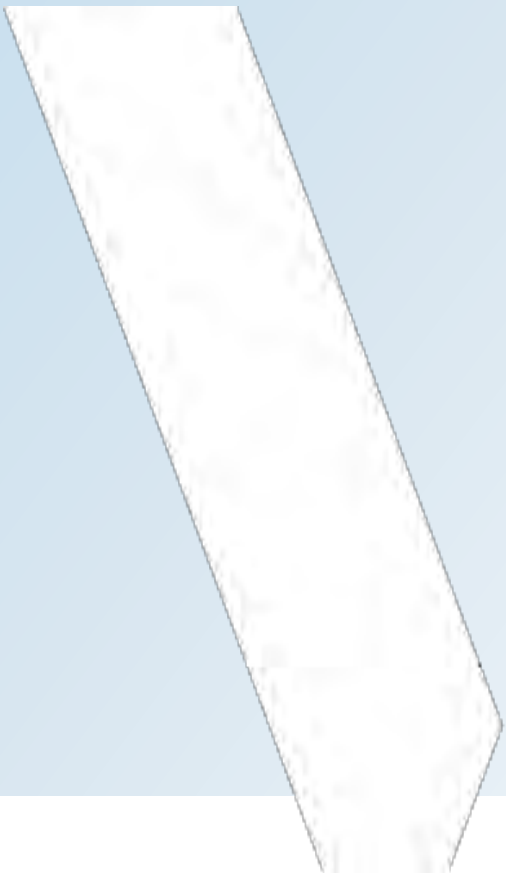
Intersection Summary	
Cycle Length: 140	
Actuated Cycle Length: 140	
Offset: 0 (0%), Referenced to phase 2:WBTL, Start of Green	
Natural Cycle: 140	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.15	
Intersection Signal Delay: 67.2	Intersection LOS: E
Intersection Capacity Utilization 107.2%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 31: Adelaide St N & Queens Ave

APPENDIX

C: Future (2036) Synchro Reports

Scenario 2: with Intersection Improvements

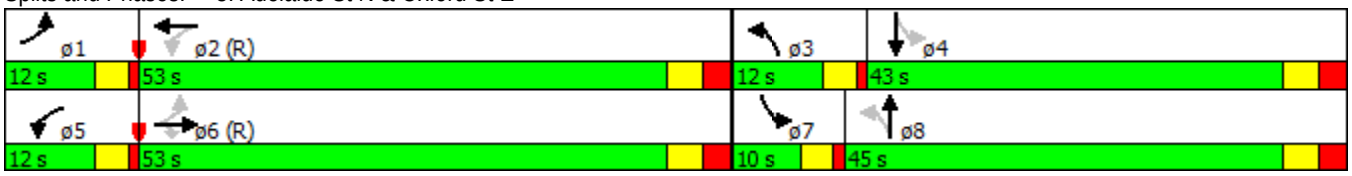


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	191	1068	103	151	1049	188	551	71	924
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	1	6		5	2	3	8	7	4
Permitted Phases	6		6	2		8		4	
Detector Phase	1	6	6	5	2	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	7.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
Minimum Split (s)	9.0	32.9	32.9	9.0	32.9	9.0	29.9	9.0	29.9
Total Split (s)	12.0	53.0	53.0	12.0	53.0	12.0	45.0	10.0	43.0
Total Split (%)	10.0%	44.2%	44.2%	10.0%	44.2%	10.0%	37.5%	8.3%	35.8%
Yellow Time (s)	3.0	3.3	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.6	2.6	1.0	2.6	1.0	2.6	1.0	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.9	5.9	4.0	5.9	4.0	5.9	4.0	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	57.0	47.1	47.1	57.0	47.1	49.4	41.1	45.0	37.1
Actuated g/C Ratio	0.48	0.39	0.39	0.48	0.39	0.41	0.34	0.38	0.31
v/c Ratio	1.25	0.93	0.19	1.02	1.02	1.26	0.65	0.40	1.13
Control Delay	177.5	48.3	7.6	101.5	65.0	180.8	36.5	27.2	108.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	177.5	48.3	7.6	101.5	65.0	180.8	36.5	27.2	108.7
LOS	F	D	A	F	E	F	D	C	F
Approach Delay		63.3			69.3		69.5		103.3
Approach LOS		E			E		E		F

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.26
Intersection Signal Delay: 75.6 Intersection LOS: E
Intersection Capacity Utilization 97.8% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 3: Adelaide St N & Oxford St E



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	41	17	20	20	80	630	25	1147
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	28.0	28.0	28.0	28.0	25.0	25.0	25.0	25.0
Total Split (s)	28.0	28.0	28.0	28.0	72.0	72.0	72.0	72.0
Total Split (%)	28.0%	28.0%	28.0%	28.0%	72.0%	72.0%	72.0%	72.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	11.6	11.6	11.6	11.6	76.4	76.4	76.4	76.4
Actuated g/C Ratio	0.12	0.12	0.12	0.12	0.76	0.76	0.76	0.76
v/c Ratio	0.34	0.64	0.21	0.43	0.42	0.30	0.06	0.54
Control Delay	45.2	35.8	42.6	17.1	12.1	4.3	4.1	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.2	35.8	42.6	17.1	12.1	4.3	4.1	6.0
LOS	D	D	D	B	B	A	A	A
Approach Delay		38.1		21.4		5.1		6.0
Approach LOS		D		C		A		A

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 9.0 — Intersection LOS: A
Intersection Capacity Utilization 70.9% — ICU Level of Service C
Analysis Period (min) 15

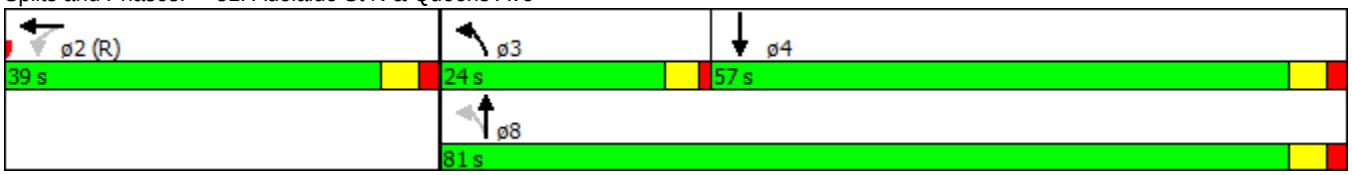
Splits and Phases: 13: Adelaide St N & Central Ave

Lane Group	WBT	NBL	NBT	SBT
Lane Configurations				
Volume (vph)	654	319	859	1088
Turn Type	NA	pm+pt	NA	NA
Protected Phases	2	3	8	4
Permitted Phases		8		
Detector Phase	2	3	8	4
Switch Phase				
Minimum Initial (s)	7.0	5.0	7.0	7.0
Minimum Split (s)	27.4	9.0	22.3	22.3
Total Split (s)	39.0	24.0	81.0	57.0
Total Split (%)	32.5%	20.0%	67.5%	47.5%
Yellow Time (s)	3.3	3.0	3.3	3.3
All-Red Time (s)	2.1	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.4	4.0	5.3	5.3
Lead/Lag		Lead		Lag
Lead-Lag Optimize?				
Recall Mode	C-Max	None	Max	Max
Act Effct Green (s)	33.6	77.0	75.7	51.7
Actuated g/C Ratio	0.28	0.64	0.63	0.43
v/c Ratio	1.00	1.06	0.47	1.05
Control Delay	71.4	99.8	12.5	70.3
Queue Delay	0.0	0.0	1.6	0.0
Total Delay	71.4	99.8	14.1	70.3
LOS	E	F	B	E
Approach Delay	71.4		37.3	70.3
Approach LOS	E		D	E

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 58.8 — Intersection LOS: E
Intersection Capacity Utilization 90.2% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 31: Adelaide St N & Queens Ave

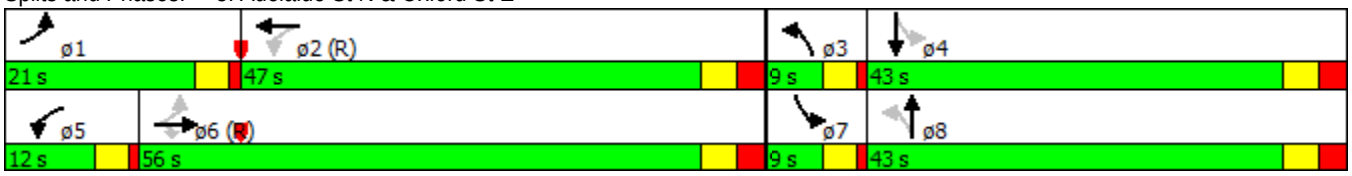


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	337	1289	191	178	1013	139	1074	148	862
Turn Type	pm+pt	NA	Perm	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	1	6		5	2	3	8	7	4
Permitted Phases	6		6	2		8		4	
Detector Phase	1	6	6	5	2	3	8	7	4
Switch Phase									
Minimum Initial (s)	5.0	7.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
Minimum Split (s)	9.0	32.9	32.9	9.0	32.9	9.0	29.9	9.0	29.9
Total Split (s)	21.0	56.0	56.0	12.0	47.0	9.0	43.0	9.0	43.0
Total Split (%)	17.5%	46.7%	46.7%	10.0%	39.2%	7.5%	35.8%	7.5%	35.8%
Yellow Time (s)	3.0	3.3	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.6	2.6	1.0	2.6	1.0	2.6	1.0	2.6
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.9	5.9	4.0	5.9	4.0	5.9	4.0	5.9
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	Max	None	Max
Act Effct Green (s)	64.0	50.1	50.1	51.0	41.1	44.0	37.1	44.0	37.1
Actuated g/C Ratio	0.53	0.42	0.42	0.42	0.34	0.37	0.31	0.37	0.31
v/c Ratio	1.19	0.99	0.32	1.09	1.10	1.12	1.19	1.19	1.07
Control Delay	144.8	56.2	11.2	120.2	96.1	142.6	133.8	166.7	87.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	144.8	56.2	11.2	120.2	96.1	142.6	133.8	166.7	87.5
LOS	F	E	B	F	F	F	F	F	F
Approach Delay		67.9			99.3		134.7		97.7
Approach LOS		E			F		F		F

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.19
Intersection Signal Delay: 97.0 Intersection LOS: F
Intersection Capacity Utilization 108.7% ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 3: Adelaide St N & Oxford St E



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	126	17	20	20	95	1167	36	1072
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Minimum Split (s)	28.0	28.0	28.0	28.0	25.0	25.0	25.0	25.0
Total Split (s)	33.0	33.0	33.0	33.0	67.0	67.0	67.0	67.0
Total Split (%)	33.0%	33.0%	33.0%	33.0%	67.0%	67.0%	67.0%	67.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	16.5	16.5	16.5	16.5	71.5	71.5	71.5	71.5
Actuated g/C Ratio	0.16	0.16	0.16	0.16	0.72	0.72	0.72	0.72
v/c Ratio	0.68	0.48	0.12	0.36	0.43	0.53	0.18	0.50
Control Delay	54.9	24.2	34.2	20.4	13.9	8.1	8.4	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.9	24.2	34.2	20.4	13.9	8.1	8.4	7.8
LOS	D	C	C	C	B	A	A	A
Approach Delay		39.0		22.6		8.6		7.8
Approach LOS		D		C		A		A

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 11.7 Intersection LOS: B
Intersection Capacity Utilization 70.3% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 13: Adelaide St N & Central Ave

Lane Group	WBT	NBL	NBT	SBT
Lane Configurations				
Volume (vph)	546	142	1255	1111
Turn Type	NA	pm+pt	NA	NA
Protected Phases	2	3	8	4
Permitted Phases		8		
Detector Phase	2	3	8	4
Switch Phase				
Minimum Initial (s)	7.0	5.0	7.0	7.0
Minimum Split (s)	27.4	9.0	22.3	22.3
Total Split (s)	36.0	13.0	64.0	51.0
Total Split (%)	36.0%	13.0%	64.0%	51.0%
Yellow Time (s)	3.3	3.0	3.3	3.3
All-Red Time (s)	2.1	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.4	4.0	5.3	5.3
Lead/Lag		Lead		Lag
Lead-Lag Optimize?				
Recall Mode	C-Max	None	Max	Max
Act Effct Green (s)	30.6	60.0	58.7	46.1
Actuated g/C Ratio	0.31	0.60	0.59	0.46
v/c Ratio	0.75	0.70	0.68	0.86
Control Delay	36.3	24.6	22.7	30.5
Queue Delay	43.7	0.0	49.3	11.5
Total Delay	80.0	24.6	72.1	42.0
LOS	E	C	E	D
Approach Delay	80.0		67.2	42.0
Approach LOS	E		E	D

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:WBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 60.7	Intersection LOS: E
Intersection Capacity Utilization 75.2%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 31: Adelaide St N & Queens Ave